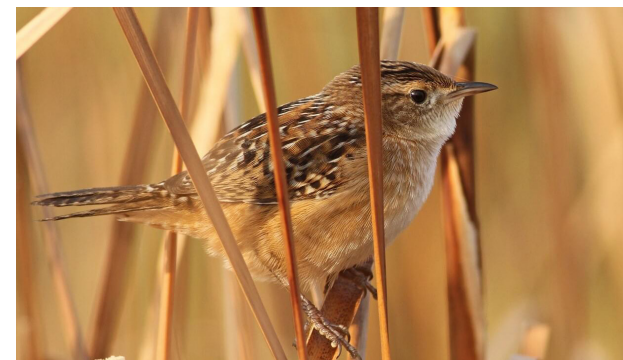


# PRIORITY CONCERN: WETLAND BIRDS

To ensure the resilience of wetland bird populations, we must restore the structural diversity and connectivity of wetland complexes within the St. Louis River Estuary. By securing these critical habitat mosaics, we support stable breeding grounds and high-energy migratory corridors.



## PRIORITY ACTIONS



### DESIGN

- Optimize wetland projects for priority birds by aligning project hydrology and vegetation structure with species-specific habitat recommendations during the initial design phase.

## BEST PRACTICES

### PLAN

- Restore a hemi-marsh mosaic designed to support breeding marsh-obligate species—such as rails, bitterns, and wrens—while providing critical stopover habitat for migratory waterfowl.
- Implement an adaptive management framework to refine conservation strategies in response to shifting wetland dynamics and population trends of target species.

### MAINTAIN

- Maintain an optimal mosaic of emergent vegetation and open water to maximize wetland edge complexity.



### RESTORE

- Prioritize restoration of hemi-marsh wetlands to support diverse wetland bird communities.
- Restore critical, limited-extent wetland habitats in the St. Louis River Estuary by aligning site hydrology and structure with the specific requirements of priority bird species.
- Create complex habitat by establishing and maintaining hemi-marsh conditions, including shallow water, exposed mudflats, and gradual vegetation transitions to provide essential roosting and foraging habitat.



## INFORMATION GAPS



### STUDY

- Implement standardized monitoring protocols to establish ecological baselines, quantifying the value of wetland sites for breeding birds and migratory stopover occupancy.
- Quantify the conservation value of wetland sites by utilizing multi-metric assessments of bird productivity, habitat quality, and focal indicator species to serve as metrics for ecosystem health.

## CONSIDERATIONS

### COLLABORATE

- Collaborate with partners to maximize benefits to wetland ecosystem function and resilience by coordinating hydrologic restoration, vegetation management, and bird habitat objectives across projects.
- Engage private landowners to protect and restore critical wetland functions, ensuring a connected mosaic of diverse vegetation and hydrologic regimes for priority bird populations.

### PLAN

- Integrate climate-resilient design into wetland projects, using long-term monitoring to track species range shifts and adaptive management to ensure habitat connectivity remains functional despite changing environmental regimes.
- Promote landscape resilience by integrating successional modeling into wetland design and employing adaptive management to ensure habitats remain productive for wetland-dependent birds over time.

#### Photo Credits:

- Natural Resources Research Institute
- Emmons & Olivier Resources, Inc.

# PRIORITY CONCERN: SHORELINE BIRDS

Identify essential shoreline and island habitats necessary for promoting waterbird productivity and shorebird migration. Conservation efforts must emphasize habitat connectivity and disturbance-free zones that remain viable under projected sea-level rise and climatic transitions.



## BEST PRACTICES

### PLAN

- Preserve and optimize beach and nearshore mosaics—including islands and mudflats—to provide critical nesting and migratory stopover sites for diverse bird populations.

### MAINTAIN

- Systematically update shoreline management plans to mitigate erosion, manage shifting vegetation, and balance recreational demands with ecological needs of local bird species.



## INFORMATION GAPS



### STUDY

- Establish ecological baselines by conducting standardized avian surveys during peak migration and breeding seasons. This data will quantify how shorebirds and waterbirds utilize specific beaches, mudflats, and nearshore habitats.
- Assess the significance of shoreline and island sites by monitoring nesting productivity, evaluating habitat integrity, and documenting species composition. This includes identifying indicator species to serve as benchmarks for habitat quality.

## CONSIDERATIONS

### COLLABORATE

- Partner with stakeholders to optimize shoreline resilience by integrating stabilization and recreation management with the specific ecological requirements of shorebird and waterbird species.
- Cultivate partnerships with private landowners to promote shoreline stewardship that balances effective erosion control and recreation with the protection of vital bird habitats.

### PLAN

- Design climate-ready shorelines that mitigate erosion and storm impacts while facilitating habitat transitions. Incorporating adaptive management strategies will ensure continued connectivity and support for species as they respond to shifting environmental conditions.

#### Photo Credits:

- Natural Resources Research Institute
- Emmons & Olivier Resources, Inc.

## PRIORITY ACTIONS



### RESTORE

- Prioritize creation, enhancement, and restoration of natural shoreline and nearshore habitats within the St. Louis River Estuary in areas with the highest potential to recover rare or absent habitats—such as mudflats, sandy beaches, and essential vegetation gradients—to support diverse shorebird and waterbird populations.

### DESIGN

- Integrate bird conservation into the design phase of shoreline projects by providing site-specific guidance on infrastructure, vegetation, and disturbance management to better support shorebird and waterbird species.



# PRIORITY CONCERN: FOREST BIRDS

Support diverse, self-sustaining populations of forest-dependent birds by enhancing forest structure and understory density. Identifying native plant communities that foster biodiversity while remaining resilient to climate change will be critical. Maintaining high-quality riparian and upland corridors is essential to facilitate movement and provide high-energy stopover habitat.



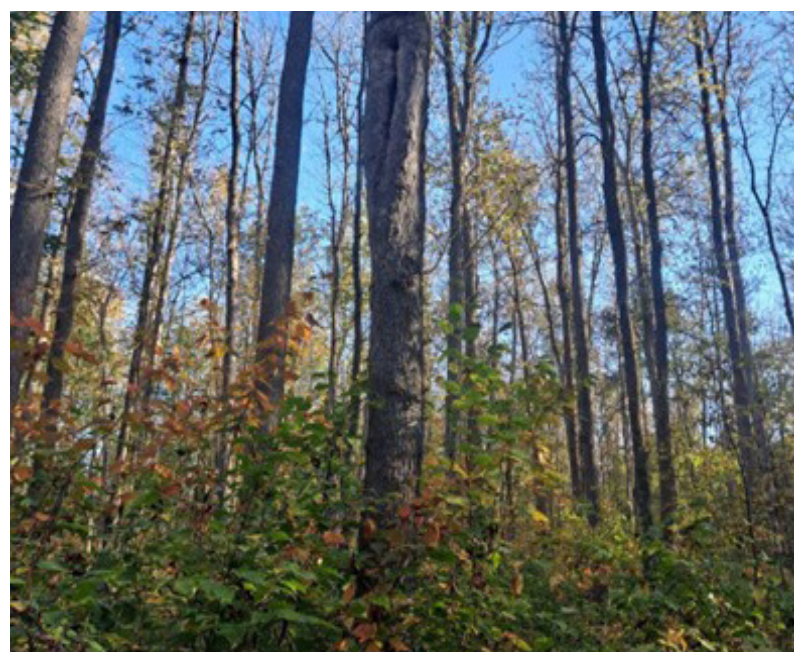
## BEST PRACTICES

### PLAN

- Promote a diverse mosaic of forest age classes and structural complexity to provide high-quality habitat for riparian and forest-dwelling birds throughout their breeding and migratory cycles.
- Systematically update forest management plans every ten years to ensure that forest succession, disturbance impacts, and wildlife goals remain aligned with a changing climate.

### MAINTAIN

- Prioritize the retention of structural features—including snags, coarse woody debris, and multi-layered canopies—alongside patches of mature forest to maintain complex habitat architecture.



## INFORMATION GAPS



### STUDY

- Establish ecological baselines to quantify the conservation value of forested sites for breeding and migratory bird populations. By integrating standardized point counts with autonomous acoustic monitoring, we can utilize long-term monitoring data to evaluate restoration efficacy and inform adaptive management.

## PRIORITY ACTIONS



### RESTORE

- Prioritize the restoration of structurally complex forests—incorporating varied age classes and canopy gaps—to sustain high-priority bird communities throughout their breeding and migratory cycles.
- Prioritize restoration within the St. Louis River Estuary for sites with the highest potential to recover scarce forest types. Efforts will focus on re-establishing structural diversity and landscape connectivity to meet the specialized needs of priority avian species.
- Enhance habitat heterogeneity within forested wetlands by maintaining a mosaic of open water and early-successional gaps which provide essential foraging and roosting opportunities.

### DESIGN

- Integrate bird conservation into the design phase of forest projects by providing site-specific guidance on silvicultural treatments, structural complexity, and landscape connectivity to support priority species throughout their life cycles.



## CONSIDERATIONS

### COLLABORATE

- Partner across agencies to build resilient forest landscapes where sustainable management and recreation coexist with thriving habitats for breeding and migratory birds.
- Cultivate long-term partnerships with private landowners to promote forest stewardship that preserves structural complexity and habitat connectivity for forest-dependent bird species.

### PLAN

- Incorporate climate resilience into forest planning by addressing shifts in species composition, shifting disturbance regimes and habitat transitions. Use adaptive management to maintain resilient ecosystems that support the life-cycle needs of forest bird communities.

#### Photo Credits:

- Natural Resources Research Institute
- Emmons & Olivier Resources, Inc.



# PRIORITY CONCERN: BROOK TROUT STREAMS

Maintain, enhance, and rehabilitate self-sustaining, Brook Trout populations within resilient watersheds.

## BEST PRACTICES

### PLAN

- Develop stormwater management plans and implement projects that reduce the negative impacts of stormwater discharged to Brook Trout watersheds.

### EDUCATE

- Develop outreach materials that highlight the importance of headwater wetlands and stormwater management for the long-term health of Brook Trout watersheds.
- Develop concept plans for specific high-priority watersheds to promote advancement of actions that preserve, enhance and restore their ecological functions.

### PRESERVE

- Mitigate the negative impacts of development to the greatest degree possible.

### MONITOR

- Assess and characterize high quality wetland complexes within priority Brook Trout watersheds.

### STEWARD

- Ensure existing regulations are being implemented to protect habitat.
- Improve recreational access to brook trout watersheds to enhance public support for their restoration and preservation.

### MAINTAIN

- Maintain the quality of areas that have already undergone restoration efforts.
- Advance currently funded projects to completion.

## PRIORITY ACTIONS

### RESTORE

- Prioritize and sequence future stream restoration efforts in a way that will enhance previously completed projects to maximize the ecological uplift of the entire system.
- Manage erosion from heavily incised tributaries.
- Remove connectivity barriers within high-priority Brook Trout watersheds to restore the migration of fish and other aquatic organisms, and improve natural transport of sediment and connection of the stream to its floodplain.

### PLAN

- Develop roadmaps to resilience for quality Minnesota Brook Trout watersheds with sources of stress that are considered high.



### STEWARD

- Improve recreational access to brook trout watersheds to enhance public support for their restoration and preservation.
- Identify and establish government units responsible for long term maintenance of past, present and future projects.

### PRESERVE

- Preserve existing high quality springs and headwaters habitats, including elevated woody wetlands.
- Preserve coldwater tributaries that offer thermal refugia and spawning habitat.

## INFORMATION GAPS

### STUDY

- Understand what factors could be addressed to make difficult projects more feasible.
- Identify connectivity barriers to critical habitat areas.

### ASSESS

- Gather baseline data such as water temperature, sediment loading, habitat quality, and hydrology to determine the feasibility of future projects and to aid in the prioritization of projects for Brook Trout watersheds.

### PLAN

- Work through how to restore a challenging site with available resources.



## CONSIDERATIONS

### COLLABORATE

- Work with appropriate natural resource management agencies to prioritize restoration and monitoring needs.
- Work to acquire easements to preserve or restore high quality habitat and maintain connectivity.
- Work with the City of Duluth on city managed land and projects.
- Establish partnerships with landowners and community to implement actions that improve the ecological function of watersheds.
- Work with municipal authorities to develop processes and protocols for preserving priority habitats.



Photo Credits:  
• South St. Louis SWCD  
• Emmons & Olivier Resources, Inc.

# PRIORITY CONCERN: COASTAL WETLANDS

**Restore and protect** resilient coastal wetland habitats, so that water quality and substrate conditions support healthy native fish and wildlife populations, healthy native plant communities, ecosystem services, recreational uses, and commercial activities in the St. Louis River and Estuary.

## BEST PRACTICES

### PLAN

- Continue to control invasive species (e.g. cattails, purple loosestrife, phragmites, and Eurasian watermilfoil) using a combination of mechanical, biological, and chemical control based on size of infestation and land governance guidelines.
- Implement Early Detection Rapid Response (EDRR) principles to identify the establishment of new invasive species that have a high probability of negatively impacting native plant communities or the spread of existing invasive species populations to new areas.
- Pro-actively plant trees and shrubs in forested wetlands where they are at risk of forest conversion due to emerald ash borer (EAB), browse pressure, or climate change disturbance.
- Manage dredge spoils to prevent the spread of aquatic invasive species (AIS,) especially to new or high quality areas.
- Use high quality reference sites within the St Louis River estuary or a similar functioning Great Lakes coastal wetlands to inform future restoration designs and derive species planting lists.
- Plant native species in restored coastal wetlands selecting suitable species derived from an ecologically functioning reference community within the SLRE or a similar system, like Wisconsin's South Shore coastal wetlands. Emphasize culturally significant species such as wild rice and northern white cedar when appropriate.
- Conduct baseline surveys before restoration and follow-up monitoring focusing on vegetation and other potentially impacted fauna species. and Set realistic reference goals to determine success.

## INFORMATION GAPS

### STUDY & ASSESS

- Identify and learn more about wetlands not included in the Great Lakes Coast Wetland Monitoring Program.
- Identify areas where shorelines can be softened, the emergent plant zone can be expanded, or islands can be created to slow wave intensity, buffer high quality areas, and re-connect or expand existing wetlands.
- Conducting monitoring to prevent the spread of invasive species into existing high quality habitats.
- Understand the importance of high quality wetlands to other priority concerns such as birds.
- Identify areas where large scale factors (shoreline change, fetch) impact the existing or potential plant community.



## PRIORITY ACTIONS

### PRESERVE:

- Preserve and protect high quality reference wetlands, and use these locations as references for restoration design.
- Protect and improve small and limited wetlands that are creating a habitat corridor between larger wetlands for birds, fish and other wildlife.

### EDUCATE

- Develop public demonstration areas for public education on the control and restoration of an area impacted by invasive species.
- Improve recreation and education infrastructure such as boat launches and wildlife viewing area.



### RESTORE:

- Promote dynamic native plant communities that are able to respond to fluctuating estuary water levels by reducing monocultures of cattail and other invasive species.
- Restore specific wetland types or habitat conditions such as hemi-marsh, sheltered floating mat, and incorporate wild rice where conditions are appropriate.
- Develop wetland restoration goals that stress ecological function rather than goals focused on quantities of habitat created.
- Address shoreline erosion due to fetch through barrier island creation and shoreline softening.

## CONSIDERATIONS

### PRESERVE

- Control invasive species in high quality reference native plant community locations.
- Prevent invasive species from becoming re-established in newly restored areas or where previous worked has occurred to prevent loss of potential ecological gains.
- Prioritize shoreline softening and new coastal wetland creation in areas that might connect existing wetlands or create a habitat corridor.
- Identify overlapping objectives with other priority concern teams to enhance benefits of projects.
- Confirm that proposed restoration will enhance existing wetland habitat, and, for example, that the location is not already a high-quality area.



Photo Credits: Kelly Beaster / Emmons & Olivier Resources, Inc.

# PRIORITY CONCERN: COMMUNITY ENGAGEMENT

**Prioritized and valued** as essential to support a thriving landscape and community in the lower St. Louis River. Communities generate, inform, co-develop, contribute to, and evaluate the actions of the Headwaters Partnership, with reciprocal responsiveness, resources, and support from the Partnership.



## BEST PRACTICES

### PLAN

- Plan for equitable community engagement before, during, and after project development. Seek adequate funding to implement your plan.
- Learn about the community where work is being done. Consider community uses values and needs. Use the Community Atlas as a first step.
- Seek to learn about the history and culture of a place, including communities that have been excluded or harmed.



Headwaters Partnership Community Council 2025/2026

- Use simple, clear language in communications with the public. Avoid technical words or acronyms and explain things in ways that anyone can understand.
- Honor traditions and cultural practices in your engagement. Strive to understand and follow cultural protocols as appropriate. Work alongside Indigenous and local community leaders.
- Build-in evaluation and feedback loops to assess and learn from engagement efforts. Share learning gained from evaluation with the broader Headwaters partners.

- Recognize the importance of building relationships for lasting community engagement using the Headwaters Partnership Community Engagement Framework as a guide for learning. Plan for the time, funding, and capacity that this takes.
- Use a step by step approach for engaging with communities at any point in project development using the Headwaters Partnership Community Engagement Toolkit.
- Approach engagement with genuine curiosity, humility, openness, and flexibility rather than predetermined goals or agendas.



## PRIORITY ACTIONS

### DESIGN



- Meet people at community events, parks, libraries, and community centers, where people have easy access and feel comfortable, rather than asking them to come to you. Build authentic connections through consistency, rather than single events.
- Design informal, unstructured activities such as simple, shared meals and intergenerational activities in outdoor spaces to create an environment where people are comfortable and feel they belong. Engage with community members in these spaces to understand concerns, input, and priority areas.

### COLLABORATE

- Collaborate with partners to create opportunities for stewardship in action - citizen science, event hosting, volunteer activities, and youth leadership. Honor and celebrate the commitment of volunteers.
- Create a cross-departmental team to help with engagement in your organization. Utilize internal resources and staff, such as volunteer programs, outreach, and education.
- Support local community groups, to help build capacity for partnership and engagement, through funding; and stipends to community members for their time and expertise.
- Collaborate with community organizations, schools, tribal, and partner networks already creating programming for community members where interest align.

- Create opportunities to share stories of disconnection and reconnection to land, water, and place. Recognize that reconnection is emotional, political, and cultural, as well as informational. Consider inviting Ojibwe story tellers to share aadizookaan or other important stories in the winter months.
- Use open-ended questions that invite community-defined visions and values such as "What do you want out of the resources in your backyard?" or "How do you like to connect with this place?" Share how their experiences and input connects with your efforts. Share back how it shapes project outcomes.
- Offer engagement in multiple forms - interactive, digital, visual, oral, artistic. Partner with other community organizations that have skills to lead in non-traditional ways.
- Design intergenerational engagement opportunities to reach youth, families, and elders and to hear their stories, concerns, and interests.
- Capture feedback and learn from conversations during informal, unstructured activities to connect future engagement efforts to what people already care about.
- Share information learned and communicate next steps in a timely manner to build trust and transparency within project teams, across the partnership for collective learning, and back with participants for accountability.



Photo Credits:

- St. Louis River Alliance
- Minnesota Land Trust

# PRIORITY CONCERN: DREDGE MATERIAL MGMT.

Increase public awareness of the dredging process for maintaining the Great Lakes navigation system and identify opportunities to more effectively manage material that benefits both the environment and economic interests.

## BEST PRACTICES

### PLAN

- Align proposed dredging operations with environmental exclusions to limit impacts on habitat and the aquatic community.
- Consider seasonal timing and placement locations to avoid negatively impacting the St. Louis River fishery.
- Use the EPA dredge material decision support tool to help prioritize beneficial use opportunities.
- Examine current regulatory standards to determine fit with Clean Water Act requirements as they relate to dredging and material management (e.g. Section 401, Section 404, NPDES permit conditions.)

### MAINTAIN

- Protect the areas identified in the Harbor Study that have high quality vegetation, macro-invertebrates and sediment chemistry from negative impacts to due dredge materials management.



## PRIORITY ACTIONS

### DESIGN

- Provide general guidance on preferred material characterization used for beneficial use based on intended use.
- Seek and maintain a list of opportunities for beneficial use for both in-water and land-based opportunities.
- Determine natural resource management priorities that align with the City's of Duluth and Superior comprehensive plans and Duluth Seaway Port Authority land use plans.

### EDUCATE

- Promote and facilitate the use of dredged material for beneficial uses, both in-water and land-based applications.
- Use results from the public perception survey on dredge material management to target future outreach efforts to improve public awareness and understanding.
- Promote the importance of accessing a federal navigation system on the regional economy.



## INFORMATION GAPS



### STUDY

- Examine nutrient loading and bio-accumulative compounds in sediment horizons to determine potential inputs from wastewater and runoff sources. Reference or establish specific cutoff values for which constituents are likely to manifest in sheltered bays, interacting with warming water temperatures, that increase exposure risks to human health and the environment.
- Assess the performance or results where dredge material is beneficially used.

### ASSESS

- Characterize sediment adequately based on proposed use.
- Document concerns or negative impacts due to dredge material management.
- Document turbidity baseline values and determine what rates result in detrimental biochemical impacts and/or increase nutrient availability.

## CONSIDERATIONS



### CONNECT

- Connect with Dredged Material Management Team members during initial restoration planning stages.

### COLLABORATE

- Collaborate with other Priority Concern teams on shared goals and objectives.

#### Photo Credits:

- Duluth Seaway Port Authority
- Emmons & Olivier Resources, Inc.

# PRIORITY CONCERN: HYDROLOGIC INTEGRITY

For the streams, lakes, and wetlands within the estuary landscape to be resilient and function as close as possible to their range of natural variation, which includes a natural flow regime and healthy water quality.

## BEST PRACTICES

### PLAN

- Develop and adopt a climate resilient stormwater management focused development code.
- Combine sub-watershed and stormwater management planning with regional transportation planning to maximize efficiency of funding resources and align schedules.

### STEWARD

- Prioritize green infrastructure opportunities and areas to be restored/protected.
- Implement an infrastructure upgrade plan for climate resiliency.

### MAINTAIN

- Develop priorities for protection – forests, wetlands, streams, riparian areas, shoreline setbacks, and watershed storage.



## PRIORITY ACTIONS

### RESTORE

- Restore longitudinal connectivity by replacing priority stream crossings to ensure natural stream flows, sediment transport, and aquatic organism passage.
- Restore streams by addressing channel pattern and form, and establishing floodplain connection to reduce sediment input, decrease water temperatures, provide groundwater recharge, and improve habitat.
- Remove water bodies from the Clean Water Act 303(d) impaired waters list.

### PRESERVE

- Preserve coldwater tributaries, wetlands, springs, forested greenspaces, and designated natural areas to maintain baseflow conditions, and coldwater refugia for aquatic organisms and reduce sediment input.
- Prioritize lands to be sold or developed that should be protected in headwaters, wetlands, and other vulnerable areas.

### DESIGN

- Develop implementation focused sub-watershed management plans at HUC 10-12 scale that comprehensively identify and address ecological and physical stressors.



### MAINTAIN

- Pursue funding to support ongoing monitoring to help identify stressors and track improvements.

### COLLABORATE

- Facilitate communication via a contact list of practitioners focused on watershed health (or other more specific topic).
- Support the local natural resource groups that provide technical knowledge and collaboration as well as public engagement.

### EDUCATE

- Support citizen science opportunities and participatory science (e.g. school and community engagement, updated Lake Superior Streams website, public service announcements, one on one contact with landowners, site stewardship by recreation and community groups).

## INFORMATION GAPS

### STUDY

- Conduct baseline monitoring as we move post-Area of Concern.
- Inventory natural storage and retention opportunities (wetlands, glacial till deposits, native plant community retention).
- Improve the understanding of groundwater inputs, flows, recharge rates (efforts are currently underway in MN & WI).
- Understand how climate change impacts, including storms, droughts, rising temperatures, and reduced ice cover, affect estuarine processes.
- Understand patterns and drivers of change in lake levels, seiche impacts, and implications for Lake Superior near shore areas and the estuary.

### ASSESS

- Conduct baseline inventories to inform sub-watershed planning, which may include an inventory of water storage opportunities, wetlands, cold water inputs, biological community health, storm sewer system mapping, road-stream crossings, habitat, or stream health.
- Enhance monitoring of streams and wetlands (e.g., flows, temperature, and water quality). Also included as Water Quality Objective 3.
- Implement an urban stormwater management strategy (see Brook Trout Objective 2).
- Create and maintain an inventory of green/grey infrastructure.
- Evaluate if stream crossings are limiting stream functions such as passage barrier and wetland connections. A focus on railroad crossings or causeways and culverts; including the railroad causeway along the St. Louis River.

## CONSIDERATIONS

### COLLABORATE

- Increase availability of monitoring data to the public and partners.
- Emphasize green infrastructure solutions, especially to capture excess sediment before it reaches downstream water bodies.
- Restore, protect, and enhance watershed functionality in relation to stormwater management goals.
- Incorporate updated design standards for infrastructure that include climate change considerations.
- Coordinate stormwater management planning with other jurisdictions, state, county and municipal, township.

### PRESERVE

- Protect and restore the resiliency of water bodies against physical and ecological changes throughout time.



Photo Credits:  
• Lake Superior National Estuarine Research Reserve  
• South St. Louis SWCD  
• Emmons & Olivier Resources, Inc.

# PRIORITY CONCERN: INVASIVE SPECIES

**Protect and maintain** diverse native plant communities and resilient habitats within the Headwaters Partnership region so resilient ecosystem services are provided for plants, animals, and people with minimal impact from invasive species. Conduct invasive species prevention, education, and population management activities in a biologically sound and culturally appropriate manner.

## BEST PRACTICES

### PLAN

- Consider prioritization criteria from partners managing invasive species within and outside of the St. Louis River estuary, such as the Great Lakes Indian Fish and Wildlife Commission.
- Identify target invasive species on a site-specific basis based on management goals, public health risk, habitat quality, potential for spread or range expansion, state-listed noxious weeds, and risk to culturally significant and sensitive species.

### MAINTAIN

- Conduct regular Early Detection Rapid Response monitoring and notify agencies of new species finds and response plan.

### STEWARD

- Prioritize areas where previous restoration work or invasive treatments have occurred to help ensure previous achievements are not degraded and investments are not wasted.



## INFORMATION GAPS



### STUDY

- Monitor public access areas (e.g. boat launch, trail head) or other locations where invasive species may likely be spread or establish.
- Meet with partners to design and implement invasive species population management strategies (Integrated Pest Management) and include a strategy with guidance for carefully targeted herbicide use.

### CONNECT

- Reach out to technical and local knowledge stakeholders on invasive species presence and management efforts, especially in areas that appear to lack information, before prioritizing actions to better identify and address local management objectives.
- Acknowledge the indigenous traditional ecological knowledge perspective when developing management actions and seek opportunities for appropriate engagement to help inform actions.

## PRIORITY ACTIONS

### COLLABORATE

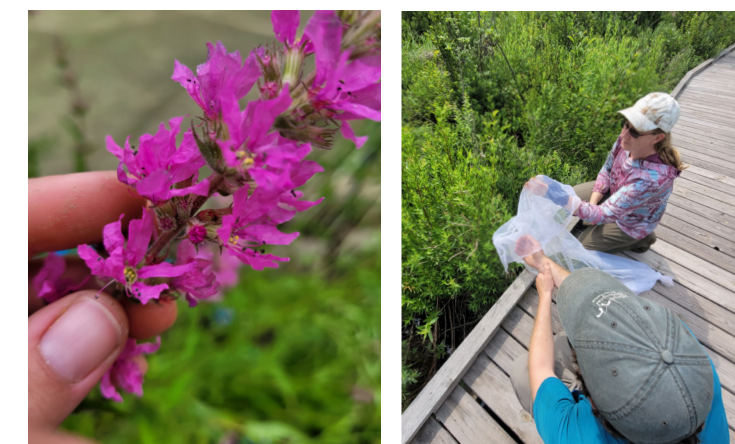
- Engage with decision makers, stakeholders, citizens, resource managers and partners to communicate threats posed by invasive species and encourage participation in prevention and management activities.

### EDUCATE

- Develop consistent messaging for invasive species outreach & education utilizing well established campaigns such as Stop Aquatic Hitchhikers and Play Clean Go.

### RESTORE

- Prioritize areas for invasive species control where critical habitat or species are present, such as native plant communities, manoomin, or walleye and sturgeon spawning habitat.
- Continue to control invasive species (cattails, purple loosestrife, phragmites, and Eurasian watermilfoil) using a combination of mechanical, biological, and chemical control based on size of infestation and land governance guidelines.



## CONSIDERATIONS

### COLLABORATE

- Recommend inclusion of invasive species management as a component of projects completed by others when/where appropriate.



**Photo Credits:**

- St. Louis River Alliance and Community Action Duluth
- St. Louis River Alliance/Old Saw Media
- Wisconsin DNR

# PRIORITY CONCERN: LAKE STURGEON

Maintain, enhance, & rehabilitate self-sustaining Lake Sturgeon populations by providing a resilient watershed through the protection and rehabilitation of habitat and migration corridors important for all life stages.

## PRIORITY ACTIONS

### RESTORE

- Remove or mitigate both upstream and downstream migration barriers to Lake Sturgeon.
- Improve Lake Sturgeon juvenile rearing habitat and restore off channel deep hole habitat.

### EDUCATE

- Increase public awareness and education on the ecological and cultural importance of Lake Sturgeon.



## BEST PRACTICES

### MAINTAIN

- Continue to control sea lamprey and other invasive species to minimize negative impact on Lake Sturgeon.

### PLAN

- At the project-level scale, consult with state Department of Natural Resources (DNR) and Tribal natural resource staff on potential benefits and impacts to sturgeon habitat for potential projects.



## INFORMATION GAPS



### ASSESS

- The results of long-term spawning and larval/ juvenile surveys will enable the evaluation of species restoration and inform adaptive management into the future.
- Continue annual spawning surveys with goals of estimating sturgeon population size while also evaluating growth, survival, and spawning periodicities.
- Continue to index natural reproduction through annual larval drift netting and juvenile netting surveys.

## CONSIDERATIONS



### COLLABORATE

- Remove barriers such as undersized culverts and disconnected floodplains that limit the natural transport of sediment and natural hydrologic processes.

### PRESERVE

- Protect important habitat for all uses (rearing, overwintering, feeding, migrating) by various life stages of Lake Sturgeon.

#### Photo Credits:

- Dan Wilford
- Brian Rucker
- Minnesota Land Trust
- Emmons & Olivier Resources, Inc.

# PRIORITY CONCERN: TERRESTRIAL HABITAT CONNECTIVITY

**Terrestrial habitats** in the Headwaters Partnership region are resilient to the impacts of climate change and development, ecologically connected, and support thriving ecological communities that include humans and culturally significant plant and animal species.

## BEST PRACTICES

### PLAN

- Support and guide the protection and restoration of wetlands and forested habitat within the St. Louis River watershed to enhance terrestrial connectivity and climate resiliency.
- Develop an index of fragmentation and track over time to measure change and aid in prioritization of restoration and protection actions.



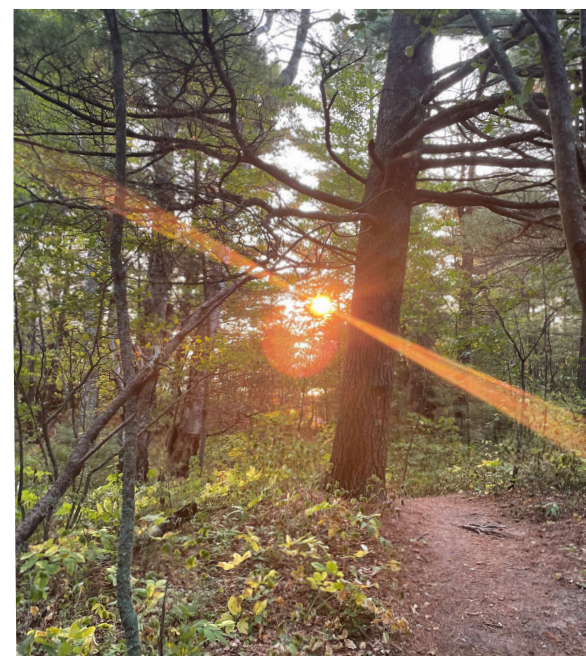
## INFORMATION GAPS



### ASSESS

- Compile wildlife movement and road mortality data to better understand existing barriers, identify connectivity opportunities, and collect additional data to fill data gaps that hinder our ability to identify safe road crossing locations and critical linkages between core habitat patches.

## CONSIDERATIONS



## PRIORITY ACTIONS

### RESTORE

- Restore or enhance habitat to create landscape corridors for increased connectivity.

### COLLABORATE

- Develop comprehensive forest management plans to protect core forest areas. Collaborate with partners and the community.

### PRESERVE

- Protect and enhance existing or newly restored landscape corridors, including aquatic organism passage and riparian/stream connectivity.



### COLLABORATE

- Support the implementation of priority management actions identified in existing plans - such as the Wisconsin and Minnesota State Wildlife Action Plans - that contribute to increased terrestrial connectivity within the St. Louis River watershed.

### PRESERVE

- Continue to protect and enhance current core areas of large intact terrestrial habitat.

# PRIORITY CONCERN: WATER QUALITY

**Maintain** water quality in waterbodies within the Headwaters Partnership region that falls within current state and federal regulations, taking into account natural variation inherent in unique ecosystems within the estuary; supports healthy aquatic communities; and enhances cultural and environmental ecosystem services.

## BEST PRACTICES

### PLAN

- Assess phytoplankton community composition to assess ecosystem health.
- Communicate water quality issues identified via water quality monitoring programs for agencies and partners to address.
- Assess the site-specific potential for water quality contamination from nearby contaminated sites.
- Review land use plans, zoning, and development codes to determine adequacy for water quality protection now and in the future with consideration for climate change.



## INFORMATION GAPS

### ASSESS

- Identify gaps in existing monitoring programs to determine what information still needs to be collected, such as new and emerging contaminants.
- Characterize baseline phosphorus and turbidity conditions in Bear and Bluff Creeks and Allouez Bay to define natural variability and watershed influences on water quality.



### STUDY

- Characterize spatial and temporal patterns in water quality through all seasons.
- Determine acceptable water quality standards for shallow bays in the estuary that consider natural variation in water quality.
- Study how climate change impacts affect estuarine process and subsequent effects on water quality.
- Study patterns and drivers of lake level changes and implications for water quality in the St. Louis River estuary.
- Develop understanding of how limited hydrologic connection impacts water quality in wetlands.
- Identify opportunities for restoring historic land alterations and the negative water quality effects within the Estuary watershed.

## CONSIDERATIONS

### RESTORE

- Implement Invasive Species objectives for aquatic invasive species control.

### COLLABORATE

- Evaluate linkages between ambient water quality and completed restoration projects to determine whether observed water quality improvements can be attributed to project actions.
- Support restoration and protection projects in streams tributary to the St. Louis River Estuary.
- Improve hydrologic connectivity to sheltered bays and disconnected wetlands to address water quality issues.



## PRIORITY ACTIONS

### RESTORE

- Address pollutants and stressors from point and non-point sources that are causing water quality impairments (303-d listed waters).

### DESIGN

- Maintain and expand water quality monitoring programs in the estuary, streams, and wetlands.

### EDUCATE

- Increase availability of water quality monitoring data and interpretations of the data to the public.



### COLLABORATE

- Develop efficient collaborative monitoring strategies among partners.
- Improve collective understanding of hydrodynamics in the St. Louis River Estuary and near shore areas of Lake Superior.

#### Photo Credits:

- MPCA
- WDNR
- Lake Superior National Estuarine Research Reserve

# PRIORITY CONCERN: WILD RICE (MANOOMIN)

Increase the abundance and distribution of self-sustaining wild rice within the St. Louis River Estuary to increase opportunities for culturally important harvest, improve fish and wildlife habitat, and enhance Manoomin's resiliency for long-term persistence.

## BEST PRACTICES

### PLAN

- Identify hydrologic and geomorphic restoration and/or enhancement opportunities to benefit the creation of suitable manoomin habitat, where possible.
- Evaluate positive/negative impacts to manoomin and manoomin habitat during project development and implementation.

### MAINTAIN

- Implement the Manoomin Restoration Model at Core Restoration Sites as directed by the 2024 St. Louis River Estuary Manoomin Restoration and Stewardship Plan.
- Manage the impact of Canada goose herbivory as recommended in the 2024 St. Louis River Estuary Manoomin Restoration and Stewardship Plan.



## PRIORITY ACTIONS

### RESTORE

- Implement aquatic invasive species management strategies where conflicts with manoomin restoration objectives arise.

### EDUCATE

- Develop local education and outreach programs (e.g., signage, seminars, workshops, rice camps, etc.) to recruit future stewards and build community consensus for long-term stewardship.



## INFORMATION GAPS

### STUDY

- Develop research and monitoring programs to address Research Priorities identified in the Goals and Objectives for wild rice. For example:
  - Define the spatial dynamics of Canada geese relative to wild rice distribution and quantify the impact of goose removals on annual wild rice seed production.
- Quantify seed viability in St. Louis River Estuary sediments and define what it means to achieve a resilient manoomin seed bank.
- Investigate the prevalence of toxic metals in St. Louis River Estuary wild rice and potential human health impacts from dietary exposure.
- Determine the density at which wild rice is resilient to herbivory pressure from Canada geese in the St. Louis River Estuary.
- Develop and implement an estuary-wide study to identify the relationship between muskrat activity and factors influencing wild rice persistence (e.g., density, acreage, presence of competing vegetation) at restoration and control sites in the St. Louis River Estuary.
- Develop a strategy for implementing regular remote sensing data collection to define the extent of wild rice across the St. Louis River Estuary.
- Identify and evaluate methods for sustaining and enhancing community relationships with wild rice (e.g., recruiting harvesters, stewards, etc.).

#### Photo Credits:

- WDNR
- Minnesota Land Trust
- Emmons & Olivier Resources, Inc.

## CONSIDERATIONS



