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G1 – SECTION 404(B)(1) EVALUATION

I. Project Description

   a. Location

The DuPage River Flood Risk Management study identified two locations for flood control measures: Lisle Levee and Lacey Creek. Lisle Levee is located on the East Branch of the DuPage River between I-88 and Burlington Avenue in Lisle, Illinois. Lacey Creek is located southeast of Hidden Lake Forest Preserve in Downers Grove, Illinois. The creek is nestled in between DuPage County Forest Preserve property to the north and Morton Arboretum to the south. The majority of the creek falls within a ComEd utility easement. In addition, a total of 38 structures were identified for potential non-structural alternatives were identified throughout the watershed.
Levee Improvements
- Removal of vegetation and encroachments within 15 feet of the levee
- Increase height of levee to provide additional protection
- Flatten side slopes
- Install Erosion Control Features
- Install Closure Structure on Rt-53 South of BNSF Railroad

Closure structure to be operated during flood conditions
b. Authority and Purpose

This study is authorized by Section 206 of the Flood Control Act of 1958:

“SEC. 206. The Secretary of the Army is hereby authorized and directed to cause surveys for flood control and allied purposes, including channel and major drainage improvements, and floods aggravated by or due to wind or tidal effects, to be made under the direction of the Chief of
Engineers, in drainage areas of the United States and its Territorial possessions, which include the following-named localities: Provided, that after the regular or formal reports made on any survey are submitted to Congress, no supplemental or additional report or estimate shall be made unless authorized by law except that the Secretary of the Army may cause a review of any examination or survey to be made and a report thereon submitted to Congress if such review is required by the national defense or by changed physical or economic conditions: Provided further, that the Government shall not be deemed to have entered upon any project for the improvement of any waterway or harbor mentioned in this title until the project for the proposed work shall have been adopted by law:

Watersheds of the Illinois River, at and in the vicinity of Chicago, Illinois, the Chicago River, Illinois, the Calumet River; Illinois and Indiana, and their tributaries, and any areas in northeast Illinois and northwest Indiana which drain directly into Lake Michigan with respect to flood control and major drainage problems.

This study investigates overbank and backwater flooding along the DuPage River and its major tributaries, prioritizing high risk areas and developing a range of possible structural and non-structural alternatives to address flood risks. The study area has experienced rapid development over the past several decades, and currently includes 40 communities and approximately 900,000 residents. Major storm events resulting in overbank flooding in the basin occurred in 1996, 2008, 2010, and most recently in April 2013. The April 2013 flood impacted at least 20 communities and caused significant damage to residential and non-residential structures, critical infrastructure. Overbank flooding has also caused the closure of a major interstate highway (I-55) in multiple locations, as well as the closure of multiple U.S., State, and County highways.

In order to minimize any ecological effects, certain environmental measures to improve habitat are proposed in the feasibility study to ensure minimal to no impacts are realized while ensuring flood risk is addressed.

c. General Description

The Recommended Plan consists of repairing Lisle Levee and placing a restriction point on Lacey Creek to impound flood water. Lisle Levee is already degraded and will require fill of clay and topsoil to repair and elevate the levee cross section. Trees will need to be removed from the levee, along with animal burrows. Native vegetation including grasses and prairie plants will be used to prevent and control erosion. Overall, minimal impacts are anticipated from this portion of the recommended plan. General construction activities and sequencing would include:

(1) Site Preparation: The first task would be to install safety fencing, signage and other safety features in order to keep the public out of the site during heavy construction. Staging areas and access roads would be demarcated. Instructive signage for workers would be set up as well to signify off limit work areas and site restrictions.

(2) Levee Repairs: The existing slopes will be repaired to 2.5:1, and repaired to the 100 year flood. Numerous structures and woody brush that have been allowed on the levee will be cleared. Given the proximity of the existing levee to numerous existing homes, some waivers of the 15’ clearance rule will likely need to be reviewed. Native plantings will also be incorporated where feasible to support erosion protection. No fill will be placed below the ordinary high water mark.
Repair and improvement activities would include removal of existing levee encroachments such as trees and placing compacted fill where roots, animal burrows, unmaintained concrete structures, or other encroachments have compromised the integrity of the levee.

(3) BMPs: Soil erosion and sediment control measures would be incorporated into the design documents and will comply with local and federal environmental requirements. BMPs and erosion prevention would be implemented by the contractor. The minimum measures required at the project site may include:

- Installation of silt fences around graded slopes and stockpile areas
- Protection of the waterway where fill occurs with silt fencing to prevent sediments from traveling into the waterway
- Stabilizing construction entrances to limit soil disturbance at the ingress/egress from the site
- Installing erosion blanket over unprotected finished grades that are to be unplanted for at least two weeks

(4) Recreational Features: Specific components of recreation are not specified for this project.

The Lacey Creek Restriction will consist of placing a 72” x 44” box culvert with an additional dewatering culvert within the creek and a berm will be created on each side of the creek to the ground elevation of 680.5”. The stream bed within the culvert will be constructed with glacial cobbles and a low flow channel will allow fish to move through under normal conditions. The berm would consist of clay and top soil placed to the aforementioned height. The placement of fill will impact approximately 0.4 acres of highly degraded wetland consisting of primarily Reed Canary Grass. This impact will require mitigation, which is discussed in the mitigation plan. In order to prevent major upstream changes in flood elevation profiles, a spillway will be constructed to allow water to move past the berm under extremely high flow conditions. This spillway would consist of concrete with stone splash pad. General construction activities and sequencing would be similar to Lisle Levee and include:

(1) Site Preparation: The first task would be to install safety fencing, signage and other safety features in order to keep the public out of the site during heavy construction. Staging areas and access roads would be demarcated. Instructive signage for workers would be set up as well to signify off limit work areas and site restrictions.

(2) Culvert placement and berm construction: The culverts will be placed within the creek channel and secured with the necessary fill. Cobbles will be placed to create a low to moderate flow channel within the creek to promote fish passage. Once the culvert is placed, fill would be brought in to construct the berm. The berm would primarily consist of clay with some topsoil.

(3) BMPs: Soil erosion and sediment control measures would be incorporated into the design documents and will comply with local and federal environmental requirements. BMPs and erosion prevention would be implemented by the contractor. The minimum measures required at the project site may include:

- Installation of silt fences around graded slopes and stockpile areas
- Protection of the waterway where fill occurs with silt fencing to prevent sediments from traveling into the waterway
- Stabilizing construction entrances to limit soil disturbance at the ingress/egress from the site
- Installing erosion blanket over unprotected finished grades that are to be unplanted for at least two weeks

After construction, native grasses and plants will be used to seed the berm for erosion control.
(4) Recreational Features: Specific components of recreation are not specified for this project.

d. General Description of Fill Material

1) General Characteristics and Purpose of Material

All materials used on levee construction would be clays free of foreign debris and contamination. Material from off-site sources will be tested to ensure the material is clean and suitable. This material is primarily inert and clean.

2) Quantity of Material

Permanent Fill Needed Lacey Creek Restriction
- 2,250 cyd
Permanent Fill Needed for Levee tow protection above the ordinary high water mark
- 6,000 cyd

3) Source of Material

All fill materials (i.e. top soil, clay, fluvial stone, glacial stone, or dolomitic stone) will be purchased from a licensed dealer.

4) Material Quality

All stone and fill material will be clean, inert materials.

e. Description of Proposed Discharge Site

1) Location

There would be no discharge of aqueous materials.

2) Size, Type, Habitat and Wetland Delineation

Existing Condition

The levee is approximately 5.4 acres and is predominately mowed lawns with occasional non-native/weedy tree species. The lack of maintenance of the levee has allowed mature trees and smaller shrubs to grow, causing unstable levee conditions. This growth would have occurred after the project was originally disturbed during initial construction of the levee.

The conditions at Lacey Creek have resulted in a degraded wetland. The majority of the restriction point and therefore impacted area falls within a ComEd utility easement. The habitat currently has an access road through the project area that has likely caused some of the impacts resulting in degraded habitat. The wetland habitat within the project vicinity is predominantly vegetated by invasive species such as Reed Canary Grass. Nonetheless, the impacted wetland does provide some habitat for native fauna.
Future With-Project Condition

The condition of habitat at Lisle Levee may slightly improve through construction. After construction, nature based features which includes the planting of native prairie grass, may provide localized benefits to native and resident flora and fauna.

Lacey Creek will see a loss of degraded wetland habitat that may impact localized flora and fauna. However, planned in-kind mitigation within the project area would improve local habitat resulting a no overall significant impact to existing habitat. The inundation of flood waters behind the restriction point may also result in the change of vegetation communities upstream. The use of dewatering culverts and other site features will be designed to minimize or eliminate upstream impacts to the adjacent significant natural resources.

Net Gains/Losses

Lisle Levee will have no net loss in wetland habitat quantity. Lacey Creek would result in the loss of 0.4 acres of degraded wetland. This impact will require mitigation which is outlined in the mitigation plan.

3) Timing and Duration of Discharge

All work will be completed within the first year.

f. Description of Placement Method

Small bobcat/skit-steer/backhoe like vehicles and handwork would be the primary means of placing and contouring materials. All materials would be placed and not dropped from distance to elevations specified in the contract documents.

II. Factual Determinations

a. Physical Substrate Determinations

1) Substrate Elevation and Slope

The levee side slopes will be 2.5:1. The crest width varies, but is at least 10 feet wide in most areas and is 15 to 20 feet wide across most of the levee. The Lacey Creek Restriction point will consist of a berm that will have similar dimensions to the Lisle Levee.

2) Sediment Type

The predominant soil types and sediment within the project area are outlined in the Detailed Project Report. The impact of the fill material will be minor because the majority of the project area has been altered by human disturbance.

3) Fill Material Movement

Stone materials would be sized appropriately to remain where placed in the channel. The substrates will achieve equilibrium within the reach and then stop moving. Native vegetation will be used to help with erosion control and minimize fill movement.
4) **Physical Effects on Benthos**

No fill will be placed below the water line at Lisle Levee.

The physical effects on the benthos within Lacey Creek will be minor and some invertebrates could get smothered from the placement of the culverts and subsequent fill. After construction, the existing tolerant macroinvertebrate groups would recolonize quickly. It is anticipated that the recommended plan would have no long term effects to existing macroinvertebrate communities.

5) **Other Effects**

No other effects are expected.

6) **Actions Taken to Minimize Impacts**

Special measures would be taken to minimize the temporary impacts on physical substrates associated with the proposed activity. These include the timing of particular restoration measures, silt control, biodegradable erosion control fabric and native plants.

**b. Water Circulation, Fluctuation, and Salinity Determinations**

1) **Water**

(a) **Salinity**

Not applicable, although the waterway ecosystems within the study area are adversely affected by unnatural salinity inputs.

(b) **Water Chemistry**

Since inert substrates indicative of the ecoregion are being used, no adverse water chemistry changes are expected.

(c) **Clarity**

Minor temporary effects may occur during storms causing run-off. These effects are expected to be minor due to the small nature of the project. Best management practices will be used to ensure the impact is controlled.

(d) **Color**

No impacts on the color of water are anticipated from the project.

(e) **Odor**

No impacts to odor are anticipated from the project.

(f) **Taste**

No effects are expected.
(g) Dissolver Gas Levels
No effects are expected.

(h) Nutrients
No impacts or benefits are anticipated from this project.

(i) Eutrophication
No impacts or benefits are anticipated from this project.

(j) Other
No other impacts or benefits are anticipated.

2) Current Patterns and Circulation
See Section 2.1.3 of Detailed Project Report for description of Site Hydrology.

(a) Current Patterns and Flow
No changes are anticipated at Lisle Levee. During larger storm events, changes to Lacey Creek are anticipated to occur. The water will pool up behind the restriction point, slowing the water patterns and flow.

(b) Velocity
No changes are anticipated at Lisle Levee. Velocities may increase after large storms and during the release of water from the Lacey Creek Restriction. The impacts downstream will be minor overall.

(c) Stratification
There are no expected effects to limnic or lotic stratification due the project area occurring within a shallow waterway.

(d) Hydrologic Regime
No changes are anticipated at Lisle Levee.

3) Normal Water Level Fluctuations
Water levels in the project areas of are primarily driven by precipitation. While levels will increase naturally from precipitation, the Lisle Levee will have no effect on normal water levels. Due to the nature of Lacey Creek, the pooling of storage waters behind the project area will cause some changes in the water elevation up to a 100 year storm. These increases may potentially impact a variety of resources on the Morton Arboretum property. Impacts will be investigated in further detail during design and specifications and all attempts will be made to minimize and avoid any impacts.
4) **Salinity Gradients**

Not applicable to freshwater environments, although the system is adversely affected via the use of road salts.

5) **Actions that will be Taken to Minimize Impacts**

Best management practices will be used to minimize the temporary impacts on water circulation and fluctuation since there are no predicted adverse effects.

c. **Suspended Particulate/Turbidity Determinations**

1) **Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Fill Site**

There would be negligible to minor increases in suspended particulates and turbidity levels in the immediate area of the proposed fill activity during construction.

2) **Effects on Chemical and Physical Properties of the Water Column**

(a) **Light Penetration**

No effects are expected.

(b) **Dissolved Oxygen**

No effects are expected.

(c) **Toxic Metals and Organics**

No effects are expected.

(d) **Pathogens**

No effects are expected.

(e) **Aesthetics**

Minor effects to aesthetics may occur from the placement of the berm in a wetland system. In addition, the impacts to higher value resources on the Morton Arboretum could also be impacted, resulting in a decrease of localize aesthetics. In order to minimize impacts to these existing significant resources and address increased inundation times for adjacent natural resources, an additional culvert was included in the Lacey Creek Restriction design. The additional culvert would be gated, and operated to dewater the restriction after the flood peak on the East Branch had passed. Impacts will be investigated in further detail during design and specifications and all attempts will be made to minimize, avoid, and limit any impacts.

(f) **Other**

No effects are expected.
3) **Effects on Biota**

(a) **Primary Production, Photosynthesis**
No effects are expected to primary production.

(b) **Suspension/Filter Feeders**
No effects are expected to primary production

(c) **Sight Feeders**
No effects are expected to primary production

4) **Actions Taken to Minimize Impacts**

Timing and methods of fill placement, use of biodegradable erosion control fabric, silt fencing and native plantings would be implemented to minimize the temporary turbidity impacts associated with the proposed activity. All proposed activities would be well under the turbidity threshold caused by a moderate rain storm.

d. **Contaminant Determinations**

The proposed fill material would not introduce contaminants to the DuPage River.

e. **Aquatic Ecosystem and Organism Determinations**

1) **Effects on Plankton**
No effects are expected to primary production

2) **Effects on Benthos**

Impacts on existing benthos may be impacted as material is placed. However, the area impacted is very small and would overall be insignificant.

3) **Effects on Nekton**

Fish eggs and larvae would not be smothered by the proposed fill activity since the anticipated construction activities will occur during non-reproductive or rearing seasons.

4) **Effects on Aquatic Food Web**
No effects are expected.

5) **Effects on Special Aquatic Sites**

a) Sanctuaries and Refuges – NA
b) Wetlands – Approximately 0.4 acres of degraded wetland will be impacted from the implementation of the Lacey Creek Restriction point.
   c) Mud Flats – none present; no significant impact
d) Vegetated Shallows – Vegetation is limited and impacts are not expected

c) Freshwater Reefs – None present, no significant impact

f) Riffle and Pool Complexes – no impacts are expected

6) Threatened and Endangered Species

Federal T&E Species

Federally-listed Threatened, Endangered, Proposed and Candidate Species were reviewed for the project area by the Chicago District (http://www.fws.gov/midwest/endangered/section7/index.html). The following federally listed species, status and their critical habitats are identified by the USFWS as occurring within DuPage County:

- Leafy-prairie clover (*Dalea foliosa*) – Endangered – Prairie remnants on thin soil over limestone
- Prairie bush-clover (*Lespedeza leptostachya*) – Threatened – Dry to mesic prairies with gravelly soil
- Mead’s milkweed (*Asclepias meadii*) – Threatened – Late successional tallgrass prairie, tallgrass prairie converted to hay meadow, and glades or barrens with thin soil
- Eastern prairie fringed orchid (*Platanthera leucophaea*) – Threatened – Moderate to high quality wetlands, sedge meadow, marsh, and mesic to wet prairie
- Hine’s emerald dragonfly (*Somatochlora hineana*) – Endangered – Spring fed wetlands, wet meadows, and marshes
- Eastern massasauga (*Sistrurus catenatus*) – Candidate – Graminoid dominated plant communities (fens, sedge meadows, peatlands, wet prairies, and shrublands)
- Northern Long-Eared Bat (*Myotis septentrionalis*) – Threatened – Hibernates in caves and mines - swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests and woods

Based on the information listed above and site assessments, federally endangered and threatened species or their critical habitats are unlikely to occur within the study area. However, due to the general habitat use by Northern Long-Eared Bats, a 4(D) streamlined online form was used to account for tree cutting that may occur at Lisle Levee. The form resulted in a may affect, but unlikely to affect the Northern Long-Eared Bat. Species list of local remnant prairie were reviewed for the Eastern Prairie Fringed Orchid and is unlikely to be present. Finally, the recommended plan locations are all located in the dispersal zones of the Rusty Patched Bumble Bee and are likely to not be present.

State T&E Species

The only state listed species located within the Lisle Levee project area according to EcoCat is the Black-Crowned Night Heron (*Nycticorax nycticorax*). Observations of the species or potential nesting sites were not observed during site visits by USACE biologists. No direct or indirect impacts are anticipated to the Black-Crowned Night Heron from the implementation of this project.
According to coordination with ILDNR via EcoCat, the Lacey Creek project area has records of 5 State listed species. These include the Blanding’s Turtle, Marsh Speedwell, Spotted Coral-Root Orchid, Black-Crowned Night Heron, and Least Bittern. Recommendations for the impacts to the Blanding’s Turtle are outlined above in Section 2.4.2.5. A letter received from ILDNR (Dated 3 May 2018) states that both bird species (Black Crowned Night Heron and Least Bittern) are unlikely to be adversely affected. The state threatened Marsh Speedwell and the state endangered Spotted Coral-Root Orchid occur just south of the project area. The coordination letter continues with the following:

“Pursuant to the Illinois Endangered Species Protection Act [520 ILCS 10/], state-listed plants belong to the landowner and their fate resides with the landowner’s conservation decisions. However, express written permission from the landowner should be obtained from construction companies/crews to “take” listed plants to comply with the Illinois Endangered Species Protection Act. Regardless, the department recommends the area be surveyed by a qualified biologist for these species and conservation measures be employed to mitigate impacts if found. Such measures may include seed collection and/or translocation to appropriate habitat, as well as surface soil conservation, which may contain the seed bank.”

7) Other Wildlife

Larger mammals may move away from the area during construction, but the impacts will only be temporary.

8) Actions to Minimize Impacts

General construction scheduling and sequencing would minimize impacts to reproducing macroinvertebrates and fishes. Erosion control fabric, silt fencing, silt curtains and native plantings would be implemented to minimize the temporary turbidity impacts associated with the proposed activity.

f. Proposed Disposal/Discharge Site Determinations

1) Mixing Zone Determination

A mixing zone is not applicable to this project as no violation of applicable water quality standards is expected during construction.

2) Determination of Compliance with Applicable Water Quality Standards

The proposed activity would not cause significant or long-term degradation of water quality.

3) Potential Effects on Human use Characteristics

(a) Municipal and Private Water Supply

No effects expected.

(b) Recreational and Commercial Fisheries

No effects expected.

(c) Water Related Recreation

No effects expected.
(d) Aesthetics

No effects expected.

(e) Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves

The Morton Arboretum may potentially see some impacts from the Lacey Creek Restriction. The back-up of flood waters may inundate portions of the arboretum for longer periods of time and at a greater frequency. While the Arboretum is impacted already by flood waters, the proposed action will increase the impact by raising the 100 year flood levels within the area. Site layout as well as the design and operation of a dewatering culvert will be optimized during the Design & Implementation Phase to minimize or eliminate impacts to Morton Arboretum resources.

(f) All protected historical and cultural resources would not be affected by this project since there are none within the affected study area.

  g. Determination of Cumulative Effects on the Aquatic Ecosystem

Overall, the project will cause minor impacts from the construction of the Lacey Creek Restriction. Operation of the Lacey Creek Restriction will result in the impoundment of water upstream of the restriction. A second gated culvert is included in the restriction that will facilitate drawdown of the impoundment. During detailed design analyses will be completed to optimize the design and operation of the dewatering features will be considered to minimize or eliminate impacts to significant upstream resources of the Morton Arboretum. Reconfiguration of site features may also be considered to minimize or eliminate impacts. Overall, the recommended plan is expected to have minor impacts to the existing natural resources within the project areas.

  h. Determination of Secondary Effects on the Aquatic Ecosystem

No adverse significant secondary impacts to the ecosystem are expected as a result of the proposed activities.

III. Findings of Compliance or Non-Compliance with Restrictions on Discharge

a. No adaptation of the Section 404(b)(1) guidelines was made for this evaluation.

b. No practical alternatives are available that produce fewer adverse aquatic impacts than the proposed plan.

c. The proposed project would comply with applicable water quality standards.

d. The project is in compliance with applicable Toxic Effluent Standards under Section 307 of the Clean Water Act; with the Endangered Species Act of 1973; with the National Historic Preservation Act of 1966; and with the Marine Protection, Research, and Sanctuaries Act of 1972.

e. The proposed fill activity would have no significant adverse impact on human health or welfare, including municipal and private water supplies, recreational and commercial fisheries, plankton, fish,
shellfish, or wildlife communities (including community diversity, productivity, and stability), special aquatic sites, or recreational, aesthetic, and economic values.

f. Typical erosion control measures would be taken to minimize construction impacts other than selection of the least environmentally damaging construction alternative.

a. Conclusions

Based on all of the above, the proposed action is determined to be in compliance with the Section 404(b)(1) Guidelines, subject to appropriate and reasonable conditions, to be determined on a case-by-case basis, to protect the public interest.
G2 –Summary of Public Comments
Public Comment Summary Report

July 2019
DUPAGE RIVER, ILLINOIS
DRAFT FEASIBILITY REPORT AND INTEGRATED ENVIRONMENTAL ASSESSMENT
PUBLIC COMMENT SUMMARY REPORT

1 Introduction

This report summarizes the public comment process implemented and public comments received for the U.S. Army Corps of Engineers (USACE) DuPage River, Illinois Feasibility Report and Integrated Environmental Assessment in DuPage and Will Counties, Illinois conducted by USACE, Chicago District (LRC) in cooperation with the non-Federal sponsors, DuPage and Will Counties. In addition, this report includes USACE responses to comments on the Draft Report.

2 Public Comment Process

2.1 Public Outreach

2.1.1 Initial Public Comment Period
On July 25, 2018, USACE announced the DuPage River, Illinois Feasibility Report and Integrated Environmental Assessment, was available for public review starting a 30-day public review period. The public was invited to comment on the draft report via e-mail; by postal mail or hand delivery to the Chicago District Office; and in person at public meetings by testifying or submitting written comments. In response to feedback from the public, an unredacted version of the report and corresponding appendices was released and the deadline for submitting comments was extended to September 22, 2018. This allowed the public additional time to review the updated information in the report.

USACE coordinated public meetings in conjunction with the non-Federal sponsors, DuPage and Will Counties, to discuss the draft report and receive oral and written comments from the public. The public was able to register to speak upon check-in. Meeting participants could also register to speak and submit written comments at the meetings. USACE staffed each meeting with agency representatives who facilitated the meeting and gave a presentation summarizing the Draft Report. Court reporters recorded the proceedings of each meeting.

Prior to each public meeting, a press release was distributed to the local media outlets. Opportunities for public input were also publicized through notices posted via county and municipal websites, subscription e-mail notices, and mailings.

Information on locations and dates for the two public meetings was posted on the LRC website on July 25, 2018.

Meetings dates and locations were as follows:

- August 15, 2018             Wheaton, IL
- August 16, 2018             Plainfield, IL

As part of its ongoing public outreach activities, USACE maintains a public project website (located at https://www.lrc.usace.army.mil/Missions/Civil-Works-Projects/DuPage-River/) that provides background information about the study; technical information; public involvement opportunities; project-related documents; and news and events specific to the DuPage River.
2.1.1 Secondary Public Comment Period
Following the initial public, state and agency, and USACE and independent review of the TSP, more detailed engineering and economic analysis was completed to refine the recommendations for this study. Based on completion of this more detailed analysis, the refined results indicated that the Lacey Creek Restriction was economically justified and supportable and therefore it was determined that the Lacey Creek Restriction could be included in the Recommended Plan. Due to the addition of this feature in the recommendation, USACE determined that conducting a second review period was warranted.

Comments were accepted for 15 days from May 2, 2019 through May 17, 2019.

2.2 Public Comments

2.2.1 Initial Public Comment Period
USACE received nearly 70 comment submittals, both written and oral, on the draft DuPage River, Illinois Feasibility Report and Integrated Environmental Assessment. A few individuals submitted more than one letter or used more than one method to submit comments. Table 1 provides information on the methods used to submit comments and the percent for each method.

<table>
<thead>
<tr>
<th>Submittal Method</th>
<th>Number of Comment Submissions</th>
<th>Percent of Comment Submissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-mail</td>
<td>34</td>
<td>50.0 %</td>
</tr>
<tr>
<td>Oral testimony at a public meeting</td>
<td>28</td>
<td>41.18 %</td>
</tr>
<tr>
<td>Postal mail</td>
<td>5</td>
<td>7.35 %</td>
</tr>
<tr>
<td>Written at a public meeting</td>
<td>1</td>
<td>1.47 %</td>
</tr>
</tbody>
</table>

Comment submittals were received from 11 municipalities in DuPage and Will Counties. Table 2 shows the percentages, by location, of individuals and organizations that submitted comments on their own or provided oral comments at one or more of the public meetings. Some written comments included an address, but not a zip code, in which the address was cross referenced with local postal information to determine a zip code and municipality. Some oral commenters did not provide a zip code, but later submitted a written comment which was cross referenced to assign a zip code to the oral comment. The top two municipalities, Lisle and Plainfield, represented over half of the total commenters.
Table 2: Percent of Commenters by Municipality

<table>
<thead>
<tr>
<th>State</th>
<th>Number of Comment Submissions</th>
<th>Percent of Comment Submissions</th>
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<tbody>
<tr>
<td>Lisle</td>
<td>24</td>
<td>35.29 %</td>
</tr>
<tr>
<td>Plainfield</td>
<td>14</td>
<td>20.59 %</td>
</tr>
<tr>
<td>Glen Ellyn</td>
<td>9</td>
<td>13.24 %</td>
</tr>
<tr>
<td>Channahon</td>
<td>3</td>
<td>4.41 %</td>
</tr>
<tr>
<td>Plainfield/Bolingbrook</td>
<td>2</td>
<td>2.94 %</td>
</tr>
<tr>
<td>Warrenville</td>
<td>2</td>
<td>2.94 %</td>
</tr>
<tr>
<td>Joliet</td>
<td>1</td>
<td>1.47 %</td>
</tr>
<tr>
<td>Lockport</td>
<td>1</td>
<td>1.47 %</td>
</tr>
<tr>
<td>Lombard</td>
<td>1</td>
<td>1.47 %</td>
</tr>
<tr>
<td>Minooka</td>
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<td>1.47 %</td>
</tr>
<tr>
<td>Shorewood</td>
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<td>1.47 %</td>
</tr>
<tr>
<td>No Location Info</td>
<td>9</td>
<td>13.24 %</td>
</tr>
</tbody>
</table>

Table 3: Percent of Commenters by County

<table>
<thead>
<tr>
<th>County</th>
<th>Number of Comment Submissions</th>
<th>Percent of Comment Submissions</th>
</tr>
</thead>
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<tr>
<td>DuPage</td>
<td>34</td>
<td>50.0 %</td>
</tr>
<tr>
<td>Will</td>
<td>24</td>
<td>36.76 %</td>
</tr>
<tr>
<td>No Location Info</td>
<td>9</td>
<td>13.24 %</td>
</tr>
</tbody>
</table>

Federal, State, Tribal, local government entities, and community groups that provided comments in the NEPA scoping in 2016 or the public comment period in 2018 include:

Federal
- U.S. Department of the Interior, Fish and Wildlife Service Region 3
- U.S. Environmental Protection Agency, Region 5

Tribal
- Miami Tribe of Oklahoma

State
- Illinois Historic Preservation Agency
- Illinois Department of Natural Resources

Local
- City of Warrenville
- DuPage County, Illinois, Stormwater Management Planning Committee
- Village of Lisle
- Village of Woodridge
- Will County, Illinois, Executive Office

Community Groups
2.2.2 Secondary Public Comment Period

USACE received 19 comments in response to the secondary public comment period. All but one comment was received via email, one was sent via first class mail. In total, 12 comments were received from residents or their legal representatives and 7 were received from organizations.

Federal, State, Tribal, local government entities, and community groups that provided comments include:

Federal
- U.S. Environmental Protection Agency, Region 5
- Forest County Potawatomi Community

Local
- Village of Lisle, Village Board Member
- DuPage River Salt Creek Workgroup
- Forest Preserve District of Cook County
- Morton Arboretum

Community Groups
- St. Joseph Creek Condo Association
- Valley View – Arboretum Civic Association

In conjunction with the second public comment period, letter to individual property owners that were included in the nonstructural plan were directly sent letters, via certified mail, informing them that their property was included in the plan. A copy of this letter is included as ATTACHMENT 1 to this summary report.

2.3 Public Meetings

Over 130 individuals attended the DuPage River public meetings; some people attended more than one meeting. Meeting attendees included representatives from federal and state agencies, elected officials or their representatives, private industry, representatives from environmental groups, local news media, and other interested parties. Thirty-seven oral comment submittals were provided over the course of the two meetings (See Table 4).

<table>
<thead>
<tr>
<th>Meeting Location</th>
<th>Number of People Attending</th>
<th>Number of People Providing Oral/Written Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheaton</td>
<td>87</td>
<td>17 / 0</td>
</tr>
<tr>
<td>Plainfield</td>
<td>46</td>
<td>20 / 1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>136</strong></td>
<td><strong>37 / 1</strong></td>
</tr>
</tbody>
</table>
3 Comment Summary

This section summarizes the comments received on the DuPage River, Illinois Feasibility Report and Integrated Environmental Assessment Report and USACE responses to those comments. Comment submittals were reviewed by the project team. Based upon that review, comment categories were developed that encompassed the range of comments received. Further reviews of comment submissions were conducted to assign comments contained within each comment submittal to appropriate comment category. It should be noted that some comment submissions (i.e., letter, e-mail, submitted document, etc.) could contain specific comments falling within multiple categories or subcategories. USACE then developed responses for each of the comment categories. Summaries and comment responses for each of the comment categories are provided in the following sections.

For the first comment period, overall the comments received covered a variety of issues including: requests for additional flood protection measures, individual property questions, whether or not a property is included in the non-structural plan, if the Lisle Levee will create impacts upstream or downstream of the proposed project, if St. Joseph’s Creek was investigated during the study, why the height of the Lisle Levee south of the BNSF railroad is not being increased, and if the DuPage can be modified (such as dredge, straighten, or channelize).

For the second public comment period, comments included flood reports, support of the addition of the Lacey Creek restriction project or flood risk reduction projects in general, technical questions, comments and concerns related to potential impacts due of the Lacey Creek project, and a question about nonstructural features.

Figure 1 below shows the locations of public comments received for both comment periods for comments which had a specific location. Many of these comments identified areas of flooding concerns that guided the project team in developing additional analysis. A “fact sheet” was placed on website addressing comments the comments summarized below. Comments that were not site-specific in nature, such as comments from state or regional organizations, do not have locations identified in the figure. Comments which indicated a neighborhood but not specific address were placed generally within the neighborhood for the purposes of representation on the map.
Figure 1: Location of Public Comments Received
3.1 Frequently Asked Questions

**Lisle Levee**

1. Will the levees affect the floodplain designation of the current properties?

Floodplain designation is defined by mapping products created by the Federal Emergency Management Agency (FEMA) called Flood Insurance Rate Maps (FIRMs). Changes to these maps can be requested through a “Letter of Map Revision” (LOMR) request, submitted to FEMA. LOMR requests must be submitted by the community.

In the case of a map change associated with a levee, the levee must qualify for FEMA levee accreditation. The requirements for levee accreditation are described in Title 44, Chapter 1, Section 65.10 of the Code of Federal Regulations (44 CFR Section 65.10). FEMA levee accreditation design requirements include meeting minimum freeboard criteria above the designated 1% annual chance exceedance flood profile (also referred to as the Base Flood Elevation or BFE) and appropriate closure structures and embankment protection measures being included in the design. A summary of the FEMA levee accreditation requirements can be found here: https://www.fema.gov/media-library-data/20130726-1600-20490-4180/lv_accred_checklist_nov08.pdf

According to FEMA, “Freeboard is a factor of safety usually expressed in feet above a flood level for purposes of floodplain management. Freeboard tends to compensate for the many unknown factors that could contribute to flood heights greater than the height calculated for a selected size flood and floodway conditions, such as wave action, bridge openings, and the hydrological effect of urbanization of the watershed.”

The elevation of the currently proposed Lisle Levee project does not meet the freeboard requirements to qualify for FEMA levee accreditation and therefore the floodplain designation behind the current levee are not anticipated to change. There are several reasons that the levee that is proposed does not meet these requirements for levee accreditation.

USACE is required to evaluate potential projects based on net benefits of each project. Net benefits are defined as the difference between the estimated project cost and the anticipated project benefits over the period of analysis, which is 50 years for the DuPage River Feasibility Study. Benefits can be defined in various ways, including economic benefits, environmental benefits, and other types of benefits such as social effects. In the case of this study, benefits were quantified based on economic benefits which include the reduction of damages that would have occurred over the period of analysis if the project was not implemented.

Various elevations were considered for the top of the Lisle Levee including an elevation which could provide enough freeboard to qualify for FEMA levee accreditation. Preliminary designs were completed for these various elevations to estimate the cost that would be required to construct, operate, and maintain the various configurations of levee considered. These cost estimates were compared to estimates of economic benefits which were estimated by an economist on the project team. The difference between the cost and the benefits was reviewed for each alternative considered and the project which provided the highest benefits when compared to the cost (net benefits) was selected for recommendation. For the Lisle Levee project, the proposed elevation is approximately 0.5 feet above the 1% annual chance flood profile elevation calculated by the hydraulic engineers on the team. Various factors went into not being able to recommend a taller levee which could provide the required amount of freeboard to qualify for FEMA levee accreditation:
• The local topography in the area is very flat. If a taller levee was to be constructed, the length of the levee would have to be significantly longer in order to meet with ground high enough to form a complete line or protection for the levee. Therefore, to increase the levee height higher than the recommended height would require significantly more cost associated with the additional real estate and construction quantities which would be required. The proposed levee height capitalizes on localized high points to tie the levee into.

2. My house is outlined in a red box in the Lisle Levee formulation figure, what does that mean? The figure is simply outlining the properties within the adjacent area of the project. The red boxes do not necessarily represent houses that experience flooding or will impacted either positively or negatively to project implementation.

3. Why is the 1% annual chance event (ACE) selected to determine the proposed levee height versus the 0.2% ACE? The height of the recommended levee is based on maximizing net benefits rather than targeting a specific elevation. Description of the levee heights considered were described in relationship to the 1% ACE only for the purpose of providing context of the elevations considered.

4. What is being done at the Lisle Levee? The existing levee slopes will be repaired to 3Horizontal:1Vertical, and the existing crest repaired to a 10’ minimum. The crest of the levee will be raised to the 1% ACE. Numerous structures and woody vegetation that are on the levee will be cleared. Given the proximity of the existing levee to numerous existing homes, some waivers of the 15’ clearance rule will likely need to be reviewed. Along with slope repair and levee clearance, native plantings will also be incorporated where feasible to support erosion protection.

5. Solution to acquire property for levee did not work in the past, what’s different this time? The USACE will require the non-federal sponsor to work out the land easements needed with private homeowners. The non-federal sponsor is required to pay 35% of the total project cost. Within this portion of the total cost, the fees associated with acquiring the necessary easements to build the levee will be the sponsor’s responsibility. Refer to the response to FAQ #38 for a comment about the possibility for use of eminent domain if necessary.

6. What material will the levee be constructed from? The levee will be raised using clay. Once the clay is used to increase the height of the levee, a 6” layer of topsoil will be placed on top of the clay layer. Native grasses and plants will be seeded along the levee to assist with any erosion control and to serve as final levee vegetation. In addition, some areas will have stone placed at the base of the levee where the river meets it to also assist with erosion control.

7. Will this revised levee allow cut/ fill improvement in the future? Any modifications to the levee would need to be submitted to USACE for approval. These modifications can be new structures within the easement, pipes that extend underneath the levee, recreational features, etc. Before constructing, the modification must be reviewed and approved under the USACE 408 process to make sure it isn’t harmful to the public and still meets the project's intended purposes. The 408 process includes an engineering, environmental, real estate, and legal review.
8. **Will the revised levees allow raised structures to be filled to a new elevation so it appears to be at grade?**

No raised structures are proposed as a part of the current Lisle Levee alternative. Structures currently on the levee would either be removed, or if deemed acceptable to be placed on the levee would be removed and replaced in kind.

9. **What is being done about the disrepair of drains on the neighborhood side of the levee?**

The County is aware of the issues associated with the valves and are currently working to ensure the appropriate maintenance is conducted.

10. **How will the benefits be achieved for Lisle Levee without Comprehensive storage?**

Currently the hydraulic modeling shows no impacts upstream of downstream of the lisle levee project. During the more detailed design phase, additional site specific hydraulic analysis will be completed. If it’s determined that there are impacts, compensatory storage will be required to meet state and/or local requirements.

**St. Joseph Creek Area**

11. **What impacts will St. Joseph Creek Storage #2 have on my property?**

St. Joseph Creek Storage #2, outlined in Figure 3-20 in the Feasibility Report, was not selected as part of the tentatively selected plan and will not have any impacts to surrounding and adjacent property owners. The project was initially investigated for potential flood water storage, but was determined to not be cost effective project.

12. **Why is the levee on St. Joseph Creek not being repaired as well?**

The tentatively selected plan labeled as Lisle Levee includes the repair and inclusion of the tie back levees on St. Joseph Creek. The tie back will extend to IL Route 53.

13. **Can the curb along St. Josephs Creek be raised to prevent flood damage to local condominiums?**

Nonstructural floodproofing alternatives were considered for these properties and included in the recommend plan.

**Non-Structural Projects**

14. **Will my house and or property be bought out and/or flood proofed as part of the non-structural plan outlined in the Feasibility Report?**

Due to privacy concerns, we cannot publicly release the addresses of individual properties eligible for these measures. However, based on your feedback we have further detailed the process which eligible property owners can expect between now and the completion of the feasibility study next July:

- Notice will be provided to eligible property owners that their property may be included in our recommended plan in May 2019.

- Input will be solicited from notified individuals regarding interest and the type of non-structural measure considered (floodproofing, elevation, or buyout/ relocation).

- Based on input a final economic cost benefit analysis will be completed to confirm the final recommended plan.

- Once the project is approved and funded, notice will be given to eligible property owners and a land owners meeting will be held to discuss the process to expect as the project is implemented.
Valley View Area

15. Why did no alternative to address the flooding impacts at the Valley View subdivision make the tentatively selected Plan?
In terms of a direct structural option, the Valley View area had been studied in depth prior to this report. Prior analyses determined that groundwater was coming from both the uphill side (west) and river (east). Therefore, the design team determined that an underground slurry wall would have to be constructed around the entire subdivision to effectively mitigate the groundwater impacts. This resulted in an estimated project costs that exceeded the available benefits. Consequently, this plan did not meet the criteria for federal funding.

The Lacey Creek Restriction, however, may result in decreased flows and flood elevations on the East Branch of the DuPage River downstream of the confluence of Lacey Creek and the East Branch, which could help to reduce flood depths for that area.

16. Please clarify why Lacey Creek Restriction, one of the only structural alternatives mitigating highway closures and Valley View flooding, was not included?
Following review of the initial draft report, the design and construction of the Lacey Creek Restriction was developed in greater site-specific detail. This resulted in a cost estimate that was significantly less than the estimate developed for the TSP. This resulted in the last added analysis for Lacey Creek and Lisle Levee indicating that each was incrementally justified, and the combination of the two was also justified. The Lacey Creek Restriction has been included in the Recommended Plan.

17. Will the proposed increase of the Lisle Levee cause water to pool north of the levee and increase the flooding impacts in Valley View?
As part of the USACE regulations, as well as IDNR floodway regulations, any implemented structure cannot have negative impacts to upstream or downstream communities. A computer based model call the Full Equations Model (FEQ) was used to determine any impacts from the implementation each potential project. Analysis of the model did not show any changes in the flood impacts to the Valley View area from the increased height of the Lisle Levee.

Riverview Area

18. Why was the Riverview Drive levee not considered in the tentatively selected plan?
The levee south of the BSNF railroad was investigated for improvement. While it did provided some reduction in water surface elevations it didn’t meet the criteria for federal funding.

19. Will raising the levees north of my property impact the base flood elevation on my property since increased storage that once occurred upstream will be lost due to the increased levee height?
A model called Full Equation Model (FEQ) was used to determine the impacts both upstream and downstream of all potential projects. The FEQ is a computer based model that simulates flows within a river system and can be used to predict impacts from specific storm events. Results from the FEQ modeling show no changes to flooding upstream or downstream of the proposed project.

20. Why is the levee not being increased in height south of the BNSF railroad? In previous floods the Police Station was impacted and inaccessible.
The levee south of the BSNF railroad was investigated for improvement. While it did provided some benefits, it didn’t meet the criteria for federal funding.
Habitat and River Manipulation

21. Why the DuPage River and/or its tributaries can’t be dredged, dammed, or modified significantly to allow for flood waters to move through quicker or store more water?

The DuPage River is a significant environmental resource to Northeast Illinois and the region. The watershed is home to 11 federally threatened and endangered species and an additional 106 species are listed as State threatened and endangered. The watershed is an important resource for migrating birds, reptiles, amphibians, fish, insects, and mammals. In addition, the watershed is an important economic driver for the surrounding communities. The environmental recreation provided within the watershed brings people from around the region which adds to the local economy. An estimated total of $25.8 billion dollars is spent in Illinois annually on outdoor recreation (https://outdoorindustry.org/state/illinois/). Natural spaces also help maintain property values. Local parks and open space can have benefits up to 33% of the residential real estate value (https://cdn.ymaws.com/www.ilparks.org/resource/resmgr/research_documents/research_era_real_estate.pdf). Dredging or modifying the stream channel will cause significant environmental damage that would require extensive and expensive mitigation. The cost of benefits ratio for such a project would not be supported by the Federal government. The placement of a dam within the system, in most instances, would not be feasible. Placement of a dam would likely have significant impacts to upstream reaches of the river and by law the USACE cannot implement a project that will impact areas upstream or downstream of the project area.

22. Should more plans consider removal of trees and shrubs to help increase the movement of water?

Trees and natural areas have been shown to decrease the impacts of flooding. These areas slow water down temporarily to allow the ground to store water and prevent greater impacts downstream. In addition, trees and shrubs provide important erosion control along rivers. Without the establishment the roots, sediment would be washed away and property would be lost through time. Issues from the loss of trees along rivers can result in expensive erosion control methods that can have serious impacts to local infrastructure such as streets, sewer lines, etc. These forest and shrub features are also significant habitat for many species of animals that important for the surround ecology.

23. What can I do about erosion on my property?

One of the best ways to minimize erosion along your property line is to minimize mowing right to the river and plant native deep rooted plants and trees. The roots help hold the sediment in place and therefore preventing the loss through erosion. For information on plant and tree suggestions, we recommend reaching out to the Illinois Native Plant Society (https://ill-inps.org/contact-us/). If erosion issues are severe, you must work with local and state government agencies to follow appropriate measures and permitting requirements for erosion control.

24. Will any of the projects consider removal of invasive buckthorn as erosion control?

Removal of invasive Common Buckthorn will occur in areas where the levee will be raised. It is important to remove woody shrubs and larger trees to ensure the roots of these structures do not compromise the integrity of the levee. In areas outside of the project area, Common Buckthorn will not be removed.

25. Why were improvements near Eagle Lake not considered (i.e. river channel improvements, reconnecting Eagle Lake and removing the upstream bridge)? The reach is listed as wetlands but it is manmade?

Channel improvements in this area of Eagle Lake would provide very little benefits to the surrounding area as the channel is limited by the location of Morton Arboretum infrastructure and Route 53. The
connection of Eagle Lake would also provide little benefits in storage as the river already overtops into Eagle Lake under smaller storms. USACE considered a measure that would restrict water upstream of Eagle Lake to minimize impacts to the Valley View area. Analysis demonstrated that the project to further restrict flows at the bridge near Hidden Lake was not cost effective (costs greater than benefits). In addition, removal of the existing restriction point at the bridge would result in increased impacts downstream. Therefore removing the current restriction point near the bridge would have negative impacts downstream, which is not permissible based on USACE policy.

The USACE does not mention Eagle Lake in any detail in regards to wetland classification. However, the USFWS wetland mapper indicates several wetland habitats within the area. Just southwest and adjacent to Eagle Lake sits an approximately 1.8 acre forested/shrub wetland. In addition, the river and the lake itself are by definition wetlands as well.

The USACE also acknowledges the historic changes to the landscape within the areas of Eagle Lake. While the wetland habitats have been modified, previously disturbed areas can still be considered wetlands or transition back to wetland habitat through time. The amount of impact and length of time between the disturbances plays a role in how the habitat may transition back to a functioning wetland. Therefore, any area that may have been severely modified by humans can revert back.

**Flood Insurance and Mapping**

26. *Why do I pay for flood insurance when my property does not experience flooding?*

As noted in FAQ#13, regulatory floodplain designation is defined by mapping products created by the Federal Emergency Management Agency (FEMA) called Flood Insurance Rate Maps (FIRMs). USACE does not have the authority to change the regulatory flood maps or control the insurance rates. Flood plain map designations are determined through the Federal Emergency Management Agency (FEMA) which are then used by insurance companies to determine the cost of flood insurance.

The FEMA regulatory floodplain is based on an estimation of the probability and risk of flooding. The regulatory floodplain includes areas which are considered to have a 1% chance of flooding in any given year. Therefore, just because a property is not known to have flooded in the past does not mean that it will not flood in the future. FEMA has an option online to request a change in flood zone designation located here: https://www.fema.gov/change-flood-zone-designation-online-letter-map-change.

27. *How will the tentatively selected plan impact the flows and elevations in Woodridge?*

USACE cannot impact water elevation upstream or downstream of an implemented project. Therefore the tentatively selected plan will not have any impacts to the Woodridge areas. Flows and flood elevation will remain the same.

28. *When will the new flood maps be finalized for the DuPage River?*

FEMA and their partners are responsible for producing new regulatory floodplain maps. In DuPage County, the preliminary maps are anticipated to become effective ____. In Will County, updated regulatory maps are pending and anticipated to become effective in 2019: http://www.illinoisfloodmaps.org/dfirm.aspx?county=will

**Operation and Maintenance**

29. *Who has the responsibility of maintaining and clearing debris from the floodplain?*

USACE does not have authority to maintain channels in the DuPage watershed. Please contact your local government or county office for information in regards to log jam removal.
Other Structural Options

30. *Can the USACE implement a project to fill in the weir at the Lakelands homeowners association to minimize any impacts to houses surrounding Walloon Lake?*
If the HOA is interested in this project they should coordinate appropriately with local and state regulatory officials about implementing the project on their own.

31. *With water coming in quickly near the 135th Street boat ramp in Plainfield, can something be done to prevent this?*
Based on analysis conducted by USACE, the area in question near the 135th street boat ramp was part of our analysis but did not meet the federal requirements for funding. Please reach out to your local government to express your concerns as this ramp was not placed by USACE.

32. *Can we build small retention ponds in open areas to help store water?*
Yes, retention ponds can be built for flood water storage. The potential to build both small and large retention ponds were analyzed during this study. However, retention ponds and other small local storage opportunities were not considered cost beneficial and therefore did not meet the Federal requirements for funding. These projects may be carried by local governments if they choose.

33. *Why does the government not apply eminent domain to the quarry? Will it be used for buyouts associated with the non-structural plan?*
The quarry project considered at the existing Elmhurst Stone Quarry facility was not economically justified based on hydraulic and economic analysis and therefore is not part of the recommended plan. This plan is defined as plan EBBQ in the feasibility report.

Eminent domain will be avoided where possible. However, eminent domain may need to be utilized for the Lisle Levee or the non-structural plan if the real estate is not able to be acquired through a voluntary negotiation process. Additionally, costs for permanent relocation measures include the provision of relocation assistance under Public Law (P.L) 91-646.

34. *Can a person construct their own levee around their house?*
Please contact your local municipality for more information about permitting requirements that would be required for any water management projects. Note that any placement of material within the regulatory floodplain or floodway may require a permit. It is important to make sure that any improvements made within the floodplain do not adversely impact other areas adjacent to or near the project.

Additionally note that constructing individual levees would create a risk to life safety. When levees hold back water, they are at risk of failing or overtopping. When levees fail, water rushed behind them into the previously protected area. This rush of water creates a significant safety risk. Even if an individual levee does not overtop, if adequate interior drainage is not provided, induced flooding can occur due to the accumulation of rainfall and runoff from adjacent properties.

35. *Where are the potential storage areas located?*
The study started with over 90 sites for potential storage. After parametric cost analysis, several options were further investigated in greater detail. After gathering additional data and running more models, it was determined that no storage options met the criteria to receive federal funding based on a comparison of project costs to project benefits. As a result, no storage options were retained in the recommended plan. These are shown on Figures 3-7 and 3-8 in the Main Report.
36. Table 7 in Appendix H eliminates a slurry wall for Indian Trails but retains one for "Will County: Channahon." Where is that location?

Thank you for catching our typo. The area in question is MS08, while the one on the west side of the river is MS07. These MS##’s are considered ‘damage areas’ which calculate the expected annual damages that were identified first. Refer to Table 3-3 to see the numbers of structures affected and expected annual damages. The subsurface in these 2 areas consist of sand and gravel which allows water to flow from the river and throughout the area. So to reduce this seepage, an underground slurry wall would be constructed, which needs to extend all the way to bedrock to be effective. This remedy is designated as SSMS01 for the area to the east of the river, and SSMS02 west of the river. So SSMS01 would be the plan to mitigate the MS08 issue; which is the Indian Trails neighborhood. Then SSMS02 = MS07 = Bonita Vista = Channahon Slurry Wall in 3.8.4.7. SSMS02 is mislabeled in the report as being in Channahon, so that will be changed to Minooka.

37. How will the tentatively selected plan impact my property?

The increased height of Lisle Levee will provide beneficial impacts to properties in the immediate area. By law, the USACE cannot implement a project that will cause impacts upstream or downstream of a constructed project. Therefore, property owners outside of the project area will not be impacted. The non-structural portion of the project provide additional benefits to select home owners in the project vicinity. Please see FAQ #14 for more information about when property owners may be contacted.

38. How is current and future development taken into consideration for the feasibility study? Who’s responsible for allowing these activities?

The hydrology model includes land use types and percentage of total watershed area which is impervious to groundwater infiltration to estimate rainfall runoff volumes contributing to riverine flows. With regards to future development, USACE coordinated with both DuPage and Will Counties to estimate anticipated development within the watershed which could contribute to increased future riverine flow rates.

In DuPage County, since that portion of the watershed is highly urbanized, minimal changes were made with respect to future development land use in the hydrology model. In Will County, land use and population projections as developed by the Chicago Metropolitan Agency for Planning (CMAP) for the year 2040 were used with input from the Will County Land Use Department. Changes were then made in the hydrology model to reflect the effects future development would have on the watershed. All future developments within the floodplain are approved and regulated by local governments. If wetland impacts occur, The USACE is involved with permitting and appropriate mitigation.

Future land use assumptions are discussed in Section 2.4.1 in the Main Report.

39. Do any solutions require participation of third parties (i.e. IDOT, etc.) at their own expense in order to succeed?

None of the proposed projects require third parties to contribute at their own expense. All project costs will be covered by the nonfederal sponsor(s) and USACE. Implementation of the projects will require coordination with third parties, however. For example. The Lisle Levee project will require the installation of several closure structures across Route 53 in the event of a flood. These closure structures will act to prevent floodwaters from inundating the area behind the levee. Coordination with IDOT will be required to construct and operate these structures. Coordination with utility companies may also be required if the construction of any of the proposed projects require utility relocation. That work will be done at the expense of the project team (USACE and the sponsor).
40. **Can the Illinois and Michigan Canal be used as flood relief for DuPage?**
The portion of the I&M Canal upstream of the Channahon dam was included as part of the feasibility study. Unfortunately no projects, including modification of the Channahon Dam, met the criteria for federal funding.

41. **Why weren’t preventative measures taken after 2013 flood?**
Local governments within the watershed have initiated several studies and smaller projects to help alleviate flooding. However, the extent of flooding is expansive within the DuPage River Watershed which led to the initiation of this study.

42. **Does the USACE manage and regulate private structures on the DuPage River and its connecting tributaries?**
The USACE does have regulatory requirements and issues permits for structures and fill placement into the waters of the US. Fill is defined as any material used for the primary purpose of replacing an aquatic area with dry land or changing the bottom elevation of the waterbody. Section 404 of the Clean Water Act (https://www.epa.gov/cwa-404) allows USACE to administer the program and enforce permit provisions. If structures span the waterway and have no structures or footings into the stream USACE does not have authority.

43. **Where did USACE study groundwater impacts and what abatement actions will be taken?**
The DuPage River study included several different sites that reported flooding due to groundwater impact. These sites were Valley View in Lisle and two subdivisions in Channahon and Minooka. The Valley View area had been studied in depth prior to this report, which found that groundwater was coming from both the uphill side (west) and river (east). Therefore, the design team determined that an underground slurry wall would have to be constructed around the entire subdivision to effectively mitigate the groundwater impacts. USACE conducted a similar investigation for Channahon and Minooka and a slurry wall was also reviewed. However, for each subdivision this solution was determined to not meet the criteria for federal funding and therefore not included in the recommended plan.

44. **Is the TSP sufficiently protective given weather and precipitation trends in the upper Midwest?**
In cooperation with the Illinois State Water Survey, an extensive effort was completed to determine all existing and future impacts increasing precipitation trends will have on the TSP. Increasing precipitation trends due climate change were considered as an input into the hydraulic and economic analysis.

45. **How will any Archeological items and/or remains be handled?**
If any artifacts or remains are found during construction, all activities will be halted. Any tribes with ties back to the DuPage River region will be contacted immediately and activities will be coordinated with the necessary parties. If required, an in depth archeological survey will be conducted.

46. **Does the project take into consideration of run-off from Interstate 88?**
Yes, the hydraulic and hydrology models used to predict flooding takes into consideration the amount of run-off from impervious surfaces such as I-88.

47. **How is sewer back-up being addressed by the study?**
Unfortunately, this project does not address issues in relation to sewer back-up, as this is outside the authority of USACE.

48. **What is the drop dead date for the project?**
The final report is scheduled to be approved by July 2019. Once the report is approved the funding would have to be provided through Congress and we cannot predict that timeframe.

49. **What role does the USACE play in the construction of bridges and how they impact water flows?**
The USACE does not participate in permitting the construction of bridges unless fill is required and wetlands are impacted from the construction of the project. Illinois Department of Transportation (IDOT) and the Illinois Department of Natural Resources (IDNR) are the responsible parties for permitting those construction activities. In DuPage County, the IDNR’s permitting authority for construction in the floodplain is delegated to the County.

50. **Figure 3-20 (St. Joseph Storage option #2) shows a line going through various properties to create additional flood water storage. What will happen to the properties that have a line going through them and why would a project in this area alleviate flooding when the majority of nearby residence do not have flooding issues?**
Figure 3-20 outlines a potential location to construct a storage option to help hold floodwater and then slowly release flood water. Even though the area surrounding the potential project may not have severe flooding impacts, storing water at strategic locations can alleviate impacts further downstream. While this location was investigated as a potential storage option during the feasibility phase, the cost-benefit did not meet the federal criteria and will not be constructed as part of this study.

51. **What has happened in the river over the last decade to cause the increased flooding that occurs on an annual basis?**
Several factors are likely attributed to increased flooding within the DuPage River over the last decade. Increased development within and adjacent to the floodplain can increase flooding impacts. As green space and other natural habitat are converted into infrastructure, the area of impervious surfaces increases. As a result, water is quickly moved to the river and can cause increased flood stages. In addition, future forecast for the Midwest suggest an increase in the number of powerful storms and total rainfall. As these storms become more frequent and more rain falls, flooding will continue to increase. These issues are occurring within urban watersheds throughout the country.

52. **Will current floodplain homes continue to require floodproofing?**
Any structures that remain within the limits of the FEMA designated floodplain will still be subject to FEMA regulations for structure, Lisle (or any municipality) will be required to enforce this to remain in good standing with the National Flood Insurance Program (NFIP) failure to enforce compliance could impact a community’s CRS rating.

53. **What effects will the reconstruction of Route 53 have on flood impacts?**
This study did not evaluate raising Illinois Route 53 (Rt 53). The Illinois Department of Transportation (IDOT) has evaluated or is currently evaluating making improvements to various segments of Rt 53.

More information about the study evaluating improvements of Rt 53 and Rt 56 near Glen Ellyn can be found here: [http://www.idot.illinois.gov/projects/il53-at-il56](http://www.idot.illinois.gov/projects/il53-at-il56)

More information about the ongoing study for improvements of Rt. 53 in the City of Joliet and the Village of Elwood, in Will County can be found here: [http://www.idot.illinois.gov/projects/IL-route-53-study](http://www.idot.illinois.gov/projects/IL-route-53-study)

54. **Please revisit costs of closing the State Highway 53 for more hours than 12 per year.**
Several unrealistic assumptions make this cost estimate unreliable for decision-making:
Rte 53 closings during recent flood events have been of 24-96 hours duration and this information was used by IDOT in planning Rte 53 elevations. Why base closings on hydrographs when historic closing data is known? Road closings at Rte 53 occur yearly and sometimes more frequently.

The delay cost of $125,700 appears to result from multiplying the following:
Annual average Daily Traffic 36,400 trips/day
Detour Duration 0.31 hours/trip
Value of Time Saved $22.32 hour driven
Duration of Closure 12 hours/event
Delay annual cost $125,873

Recalculating this cost using 48 hours per year yields an annual cost 4 times higher, about $500,000 per year. This is a material amount for the cost analyses. Road closure costs are understated because they do not include substantial labor and overtime costs for municipal staff. Nor do they consider increased risk of vehicle accidents.

We appreciate your review and perspective on our attempt at communicating the complexities in annualizing impacts. We developed the estimates documented in the report based on the best available information.

Estimating the annualized damages or benefits using the methods outlined in this report require defining three primary relationships, the exceedance-probability function, the stage-discharge function, and the stage-damage function (each with uncertainty). The exceedance-probability function defines the frequency at which different flows are anticipated within a waterway. The stage-discharge function defines a relationship between the amount of flow in the waterway and how high the water surface will rise for a given event. The stage-damage relationship defines the estimated damages anticipated for various depths of flooding. The Hydrologic Engineering Center’s Flood Damage Analysis software (HEC-FDA) automates the application of these relationships using Monte Carlo Analysis, defining a range of estimates and sampling the results thousands of times to develop an estimated expected annual damage. Additional details regarding these relationships and development are available in the economic appendix.

The first two relationships discussed above (exceedance-probability and stage-discharge) are defined by the hydrologic and hydraulic engineer using available data and model results. The third relationship, the stage-damage function, is what is described in more detail in the economic appendix. Table 25 in the economic appendix is intended to provide a basis for estimating closure impacts and putting the potential delay costs into a common increment, an estimate of delay values if a closure of 12 hours occurred at any of the displayed locations. This is not indicative of the site specific closure durations anticipated at any given location.

The step that is not documented in detail is the marrying of closure durations with the hydrograph to define the stage-damage function. Using your example of S053F, we were able to estimate the frequency and duration of closures as a result of flooding from the East Branch of the DuPage River. This particular closure was represented by the low point in the road, approximately at river station 69,305.8 on the right descending bank, within the EB06R Valley View reach.

The modeled 2020 precipitation condition estimates that the road is to be overtopped and closed starting with a 0.04 ACE event (25 year recurrence interval). A relationship was developed using estimated closure durations to develop a stage-damage curve for the without project condition. For example, if the road were to be inundated by an event similar to 2013 (approximately a 0.01 ACE event/100 year
recurrence interval), it was estimated that the traffic delays would be approximately $440,000. This is a similar order of magnitude to which you provided in your comment ($500,000). Furthermore, the $440,000 is only the most likely estimate. Uncertainty around this value was included using a triangle distribution with the minimum estimated to be $330,000 and the maximum estimated to be $880,000. These uncertain estimates are also sampled throughout the Monte Carlo process.

However, an additional step remains to develop the annualized values. The $440,000 is an event based estimate. It is not an annualized value. Annualizing the estimated damage requires multiplying the various event based damages by the estimated likelihood or frequency each event is anticipated to be realized in any given year. In this case, the $440,000 in estimated event damages equals $4,400 in annualized damages (frequency x consequence = 0.01 x $440,000). Less frequent events are weighted less heavily, while more frequent events are weighted more heavily. This process is followed for all eight of the modeled frequencies using the three relationships discussed above. In this example, the expected annual damage for the 2020 condition is estimated to be approximately $28,000.

55. Please share all communication with local stakeholders regarding potential structural alternatives involving their property and how USACE has responded to such comments and developed structural alternatives to respond to their concerns.

Your request is being considered as part of the National Environmental Protection Act (NEPA) process. If you wish to file a FOIA request you can do so by email at foia-lrc@usace.army.mil, by fax to 312-353-8710, or mail to:

Freedom of Information Act Request
Office of Counsel
U.S. Army Corps of Engineers, Chicago District
231 LaSalle Street, Suite 1500
Chicago, Illinois 60604
4. Table of Comments

The following table provides the last name of the commenter, their zip code and the corresponding Frequently Asked Question (FAQ) Number that answers the questions received.

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May 2, 2019

Dear Property Owner:

As you may be aware, in partnership with the DuPage County Stormwater Management and the Will County Executive Office, the U.S. Army Corps of Engineers (USACE), Chicago District is conducting a feasibility study to address flood risk in DuPage and Will counties.

The study investigated structural and nonstructural measures to reduce flood risk associated with the DuPage River and its major tributaries.

- Structural measures include civil works projects such as levees, floodwalls, channel modifications, and diversions.
- Nonstructural measures modify the potential damages to structures from flooding through acquisitions (buy-out), floodproofing, or elevation or structures identified to be at risk of flooding.

Potential structural and nonstructural measures were evaluated for their cost-effectiveness, technical feasibility, and environmental acceptability to identify a Recommended Plan.

A draft Feasibility report and Integrated Environmental Assessment was released for public review and comment on July 31, 2018. This report presented the status of the study and the Tentatively Selected Plan for implementation of flood risk reduction projects. During public meetings held in August 2018, USACE committed to inform property owners of properties included in the nonstructural components of the Recommended Plan prior to finalization of the study. This letter is to inform you that your property is included as one of the nonstructural features included in the Recommended Plan. This means that your property may be eligible for acquisition, floodproofing, or elevation through which would be funded through a cost-sharing agreement between USACE and a local nonfederal sponsor.

An updated report was released for comment on May 2, 2019 and made available online at: https://www.lrc.usace.army.mil/Missions/Civil-Works-Projects/DuPage-River

Note that the current Recommended Plan is undergoing USACE policy review as well as public review and is subject to change. If approved, the project would be implemented after it receives federal funding and after a cost-sharing agreement with a nonfederal sponsor is finalized.
Once the funding agreements are in place, you (and any tenants) can expect to receive official notice of the project's initiation with additional details about the anticipated timeline. An in-person initial meeting will be held to discuss the next steps and answer any questions. All improvements will be implemented with input from owners and sponsors of the project.

The Army Corps of Engineers is accepting comments on the report from May 2, 2019, through May 17, 2019. Comments may be submitted by e-mail to dupageriver@usace.army.mil or mailed to: U.S. Army Corps of Engineers, Chicago District, 231 S. LaSalle Street, Ste. 1500, Chicago, IL 60604, ATTN: DuPage River. Mailed comments must be postmarked by May 17, 2019.

Please direct any comments on the report through the submittal options listed above and any questions related to your property's inclusion in the recommended plan to Imad Samara, Project Manager, at Imad.N.Samara@usace.army.mil or (312) 846-5560.

Sincerely,

[Signature]

Susanne J. Davis, P.E.
Chief, Planning Branch
G3 – Mitigation Planning
DuPage River, Illinois

Detailed Project Report and Integrated Environmental Assessment

1. Introduction

The Lacey Creek Restriction project will result in the placement of fill on approximately 0.4 acres of wetland habitat. The habitat within the wetland is of low quality and dominated by invasive species; most prominently Reed Canary Grass. The location of the wetland is between Morton Arboretum and the Hidden Lake Forest Preserve near ComEd utility easements. The area has several access roads for utility maintenance and inspections, which have likely exacerbated the degraded state. Despite the low ecological quality of the wetland habitat, the habitat is still an important component to the surrounding environment and will require mitigation. The features for the project do not fall under any regional or national permit based on coordination Chicago based regulators and environmental engineers. Several alternatives are being considered. Variation of wetland restoration and creation within the site footprint is one alternative and a second alternative consists of acquiring bank credits to offset project related wetland impacts.

2. Authority and Guidance

§ 2283. Fish and wildlife mitigation, 33 USCA § 2283

United States Code Annotated
Title 33. Navigation and Navigable Waters (Refs & Annos)
Chapter 36. Water Resources Development
Subchapter V. General Provisions

33 U.S.C.A. § 2283

§ 2283. Fish and wildlife mitigation

Effective: June 10, 2014

Applicable USACE Guidance

- Compensatory Mitigation for Losses of Aquatic Resources; Final Rule; Federal Register, Volume 73, No.70, April 10, 2008.
3. Mitigation Determination

The following mitigation planning analysis adheres to the guidelines presented in ER 1105-2-100, Appendix C, Section e., parts 1 through 15 and the amended authority. The typical USACE planning process is followed once a determination is made that compensatory mitigation is required for a certain alternative or portion of a project. The study team used the following five steps to determine that compensatory mitigation is required to prevent or compensate for resource loss:

a) Avoiding the impact altogether by not taking a certain action or part of an action

The DPR identifies wide range of various alternatives for flood risk management throughout the DuPage River watershed. The alternatives consist of a matrix of structural and non-structural combinations to determine the accumulative benefits for the project. The alternative breakdown can be found in table 3-11 in the Detailed Project Report. The recommended plan selected includes three components: Lisle Levee, Lacey Creek Restriction, and Non-structural.

Lacey Creek Restriction: This alternative is located on Lacey Creek, a tributary to the East Branch DuPage River. A new culvert near the confluence with the East Branch DuPage River is proposed that would restrict flows in large events, while normal flow and lower flow events pass through unimpeded. This new culvert will restrict any flow larger than a low flow event, causing raised water elevations on the surrounding Forest Preserve and Morton Arboretum lands. The new path over the culvert will be at elevation 680.5’, allowing water to overflow if it reaches that level. By restricting flow from large storms, flood flows and elevations are reduced on the East Branch. Water surface elevations in larger storm events are increased upstream of the proposed restriction, however, this area is forested and open space and results in no damage to structures. There is no excavation associated with this alternative, but nearly 283 acre-feet of new flood storage is realized due to the increased water surface profile. This alternative would provide significant reductions in water surface elevation in the downtown Lisle area.

Since the restriction will be holding back water, it will likely be classified as a dam. Per USACE ER 1110-2-1156, “Safety of Dams – Policy and Procedures” dated March 31, 2014. Based on this classification, non-breach and breach analyses would need to be conducted to estimate incremental consequences to quantify risks associated with this structure. This analysis will be conducted during detailed design.

Lisle Levee: A central portion of the Village of Lisle is protected by an existing, non-accredited levee system along the East Branch of the DuPage River and St. Joseph Creek.
Figure 1: Aerial of the Lacey Creek Restriction point.

The original construction of the levee system occurred in 1961, with the levee crests at the approximate level of the 50 year flood event. Deterioration of the levee has occurred over time, lowering the crest elevation in some areas and eroding the side slopes and levee toe. The project will consist of repairing the levee and restoring it to its 1961 elevation (elevating less than a foot in most areas). The existing slopes will be repaired to approximately 3:1 and the existing crest repaired to a 10’ minimum top-width. Numerous structures, such as stairs and decking, and woody brush and roots that have been allowed on the levee or within 15-feet of the base of the levee on both the river and the land sides will be removed,
per levee safety standards. Given the proximity of the existing levee to numerous existing homes, some waivers of the 15-foot clearance rule will likely need to be reviewed. Native plantings will also be incorporated where feasible to support erosion protection.

The existing levee extends some distance along St. Joseph Creek, and ties back at Maple Ave. on the DuPage River east bank. Based on the hydraulic modeling performed in this study, not all of the areas included in the current levee system require levee improvement for protection. The proposed project will tie into high ground along St. Joseph’s Creek. On the south end, the levee ties into the existing Burlington Northern Santa Fe (BNSF) Railroad embankment 0.06 miles south of Burlington Avenue. The east bank levee will also tie into Ogden Ave about 400 feet south of the St Joseph Creek outlet. Only one structure exists behind the levee north of Ogden Ave and it is located above the 1% ACE flood elevations.

There are four small existing pump stations that provide interior drainage for the levee system that were installed in 2006. Two pump stations are installed on the east bank and two on the west bank. Each pump station has a 5 cfs design capacity. During further design the team will inspect the existing pump stations and verify their capacity and maintenance levels are sufficient for the improved levee. DuPage County maintains these pump stations and reports no issues with their operation or with providing adequate interior drainage. Any necessary upgrades will be included the project features and designed as minimal facilities, meaning they will convey the necessary flows as a result of the levee, not designed to address other local flooding needs if such needs exist. Operation and maintenance for the pump stations is currently performed by DCSM and any incremental costs required for additional O&M will be included in the USACE project.

Non-structural Plan: Implementation of the nonstructural measures includes the possibility of both voluntary and non-voluntary participation. Consistent with USACE Planning Bulletin 2016-01, Clarification of Existing Policy for USACE Participation in Nonstructural Flood Risk Management and Coastal Storm Damage Reduction Measures, acquisitions/relocations/permanent evacuations are required to include the option to use eminent domain, where warranted. Additionally, costs for permanent relocation measures should include the provision of relocation assistance under P.L 91-646. Measures such as dry floodproofing and elevations can be included as voluntary participation.
Several other options to account for flood water storage and benefits were considered and screened out during the alternative analysis. Lacey Creek was the only location in conjunction with Lisle Levee that provided cumulative benefits to the area. As a result, it was determined that we cannot avoid the impacts.

b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation

During the planning process, the PDT looked at a variety of designs and locations to not only limit costs, but also minimize any impacts to natural resources. Many sites were screened out based on environmental concerns and cost analysis. However, via this process and the addition of new data, updated cost estimates, and additional public comments, Lacey Creek was investigated further to determine if it’s a viable project. In addition, the location of the restriction was moved to initially to decrease costs, but it also allows a smaller impact to wetland habitat. In order to minimize impacts to existing significant resources and address increased inundation times for adjacent natural resources, an additional culvert was included in the Lacey Creek Restriction design. The additional dewatering culvert will reduce the length of time that floodwater would be detained and potentially alleviate impacts to significant natural resources. Detailed design is required to optimize the size and operational requirements for the dewatering culvert. Additional design could also include a final configuration of the upstream storage area to protect the existing resources from large changes in the
hydrologic regime. Reconfiguration could also include additional dewatering culverts, or the installation of low protective berms adjacent to these important resources."

c) **Rectifying the impact by repairing, rehabilitating or restoring the affected environment**

The impact associated with the construction of Lacey Creek will include the placement of fill on approximately 0.4 acres of degraded wetland and creek channel habitat. The footprint of the impact will be completely covered with fill and therefore the project footprint will never be able to be repaired, rehabilitated, or restored.

d) **Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action**

With the placement of fill on an approximate footprint of 0.4 acres, the reduction or elimination of the impact over time is not feasible as the habitat will be smothered.

e) **Compensating for the impact by replacing or providing substitute resources or environments.**

"Replacing" means the replacement of fish and wildlife resources in-kind

The impacts to the degraded wetland at the location of the berm for Lacey Creek would be considered moderate. With so much degraded wetland habitat and other impacts associated with the utility easement, typically the small amount of required mitigation at a degraded site proposed a significant risk. Such small mitigation areas can frequently be ignored, especially during periods of budget constraints, due to management inefficiencies. Fixed mobilization, demobilization and labor costs are simply better expended on larger, more easily accessible tracts. As the effort to manage these labor-intensive sites decreases, management needs increase because the small mitigation sites, particularly when surrounded by substantial areas of low quality habitat, are inherently unstable, requiring excessive management effort to sustain them. However, potential nearby locations near the fringes of already restored areas could be utilized and to improve the size and quality of the overall area. This method has the risk associated with the non-federal sponsor and/or local partnering agency who would be responsible for the maintenance of the mitigation area. This will be investigated further from a cost benefit perspective with coordination from the non-federal sponsor and local stakeholders.

f) "Substitute" means the replacement of fish and wildlife resources out-of-kind. Substitute resources, on balance, shall be at least equal in value and significance as the resources lost.

Substitution, or the replacement of fish and wildlife resources out-of-kind, is also being considered as a potential alternative. Typically, this methodology would require mitigation banking at a location outside of the project area. Mitigation banking is typically not ideal since the project area where habitat is lost does not directly benefit from the mitigation. However, this will be considered as an option and considered with the cost benefit analysis.

This mitigation plan ensures that adverse impacts to wetland resources are fully mitigated. Mitigation will be accomplished through appropriate actions taken to avoid, minimize and compensate for unavoidable losses as required to clearly demonstrate efforts made to meet the administration's goal of no net loss of wetlands. Measures that would replace or substitute for the affected resource will be considered in the mitigation planning.
4. Mitigation Planning

4.1 General

Through this analysis, USACE has ensured that project-caused adverse impacts to ecological resources have been avoided or minimized to the extent practicable and that remaining, unavoidable impacts have been compensated to the extent justified. The proposed project includes sufficient mitigation to ensure that the selected plan will not have more than negligible adverse impacts on ecological resources (Section 906(d), WRDA86). These mitigation measures are fully justified, as described in this analysis.

4.2 Justification

Justification of mitigation features recommended for inclusion in this project is based on analyses that demonstrate that the combined monetary and non-monetary values of the last increment of losses prevented, reduced, or replaced is at least equal to the combined monetary and non-monetary costs of the last added increment so as to reasonably maximize overall project benefits. In addition, an incremental cost analysis, to the level of detail appropriate, was used to demonstrate that the most cost effective mitigation plan has been selected.

4.3 Separable Features

Beneficial effects that the impacted habitat would have on the ecology of the project area as well as the quantity and quality of habitat lost were considered for determining separable mitigation features. Placing fill in the impacted area is integral to ensuring the effectiveness and acceptability of the proposed levee project. The impacted area was identified as a regulatory wetland. As indicted in Section 4.7, any adverse impacts to wetland resources require mitigation.

4.4 Range of Alternative

To properly evaluate and compare mitigation plans and determine remaining unmitigated losses, if any, this analysis considers a range of alternatives including full compensation of significant ecological resource losses. Appropriate units of measure are used aid in this evaluation. Examples of units of measure include habitat units, or other habitat quality indicators, numbers of animals, pounds of fish, user-days, etc. The units of measure used in this mitigation plan are habitat units, which is quality times quantity; Mean C x Acres = Habitat Units.

4.5 Land Requirements

USACE has considered the use of both public and private lands, and selected the lands that represent the best balance of costs, effectiveness, and acceptability consistent with cost guidance. For this analysis, land required for an on-site mitigation project is expected to be in the public ownership as there are large Forest Preserve properties in and around the project area. Public lands used for comparable projects in the region have been valued at approximately $5,000 per acre. If a mitigation bank is used, the land costs would be included in the cost-per-acre of mitigation.
4.6 **Special Requirements**

The alternative mitigation plans ensure that adverse impacts to the degraded wetland are mitigated in-kind to the extent possible. In this instance "to the extent possible" takes into consideration the availability of manageable units of existing or restorable wetland habitats and the practicability and feasibility of implementing management measures to accomplish in-kind mitigation. In-kind does not necessarily mean acre-for-acre, but may be restoration or the increased management of local wetlands to compensate for the loss of biological productivity (habitat quality). The degraded wetland in this instance does not require any special requirements based on the availability of local and regional opportunities to restore, create, or purchase banking credits.

4.7 **Mitigation of Wetland Impacts**

This mitigation plan ensures that adverse impacts to wetland resources are fully mitigated. The mitigation plan would accomplish this through appropriate actions taken to avoid, minimize, and compensate for unavoidable losses as required to clearly demonstrate efforts made to meet the administration's goal of no net loss of wetlands.

4.8 **Incremental Cost Analysis**

An incremental cost analysis was performed for all identified mitigation plans. The purpose of incremental cost analysis is to discover and display variation in cost and to identify and describe the least cost plan. The mitigation analysis is presented in an analytical framework commensurate with other project benefits and costs so that rational decisions regarding mitigation can be made. The least cost mitigation plan that provides full mitigation of losses specified in mitigation planning objectives, and which is unconstrained except for required legal and technical constraints, is identified and displayed. The recommended plan, if different, will be compared to it. Planning methods and data were used which yield cost estimate accuracy and reliability commensurate with that of other cost analysis components of the overall study. The sources of data and information used in performing incremental cost analysis are included in the discussion below.

4.8.1 **Inventory and Categorize Ecological Resources**

The degraded wetland still provides hydrologic functions for Lacey Creek and the larger DuPage River Watershed. In addition it provides habitat for species of insects, amphibians, reptiles, birds and mammals. As indicative of the DuPage County wetland map, Reed Canary Grass (*Phalaris arundinacea*) is the predominant species within the project footprint of the berm. The edges are dominated by weedy tree and shrub species such as Box elder (*Acer negundo*), silver maple (*Acer saccharinum*), and buckthorn (*Rhamnus cathartica*). The current floristic quality based upon the Floristic Quality Index (FQI) and the native coefficient of conservatism (mean C) averages are 6.5 and 1.6 respectively. A FQI below 19 and a native mean C below 3.0 are considered to be low quality with no natural area attributes, a ruderal habitat.
Table 1: List of species common in the Lacey Creek area.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>COMMON NAME</th>
<th>C VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambrosia trifida</td>
<td>Great Ragweed</td>
<td>0</td>
</tr>
<tr>
<td>Impatiens capensis</td>
<td>Spotted Touch-Me-Not</td>
<td>3</td>
</tr>
<tr>
<td>Lycopus americanus</td>
<td>Cut-Leaf Water-Horehound</td>
<td>4</td>
</tr>
<tr>
<td>Lythrum salicaria</td>
<td>Purple Loosestrife</td>
<td>0</td>
</tr>
<tr>
<td>Mimulus ringens</td>
<td>Allegheny Monkey-Flower</td>
<td>4</td>
</tr>
<tr>
<td>Persicaria lapathifolia</td>
<td>Dock-Leaf Smartweed</td>
<td>0</td>
</tr>
<tr>
<td>Phalaris arundinacea</td>
<td>Reed Canary Grass</td>
<td>0</td>
</tr>
<tr>
<td>Phragmites australis ssp. australis</td>
<td>Common Reed</td>
<td>0</td>
</tr>
<tr>
<td>Pilea pumila</td>
<td>Canadian Clearweed</td>
<td>2</td>
</tr>
<tr>
<td>Salix interior</td>
<td>Sandbar Willow</td>
<td>2</td>
</tr>
<tr>
<td>Scirpus atrovirens</td>
<td>Dark-Green Bulrush</td>
<td>4</td>
</tr>
<tr>
<td>Solidago sempervirens</td>
<td>Seaside Goldenrod</td>
<td>0</td>
</tr>
<tr>
<td>Symphyotrichum lanceolatum</td>
<td>White Panicled American-Aster</td>
<td>3</td>
</tr>
<tr>
<td>Urtica dioica ssp. gracilis</td>
<td>Tall Nettle</td>
<td>1</td>
</tr>
</tbody>
</table>

4.8.2 Determine Significant Net Losses

Impacts to wetlands will occur with the placement of the fill material at the location of the berm at the Lacey Creek project site. Approximately 0.4 acres of degraded wetland, predominately vegetated by Reed Canary Grass, will be smothered by the placement of fill material. The positive flood protection effects of the Lacey Creek Restriction outweigh the minor loss of habitat resulting from project construction.

Current habitat units for the wetland that would be impacted by the project are:

\[
\text{Average Annual Wetland Mean C} \times \text{Forestied Wetland Acres} = \text{Average Annual Habitat Units}
\]

\[
1.64 \times 0.6 = 0.98 \text{ Average Annual Habitat Units (AAHU)}
\]

Therefore, the net loss of resources is 0.98 AAHU.
Figure 3: Location of the restriction point on Lacy Creek and the surrounding wetland habitat as marked by DuPage County Wetland Maps. Green indicates regulatory wetlands and red indicates critical wetlands. Note: no critical wetlands were identified in the project area.

4.8.3 Define Mitigation Planning Objectives

The mitigation objectives are based on the minimum action of replacing the impacted wetland complex either in-kind or with substitute (out-of-kind) habitats of equal value. But based on USACE invasive species policies and due diligence, however, the habitat quality would ultimately be higher since invasive plant species would not be planted but removed from any new mitigation site, and maintenance and enhancements by the land owners would retain or improve the site’s quality over time. The following objective is in agreement with the Study Objectives:

Replace habitat that would be removed by construction of the Lacey Creek Restriction with either in-kind habitat or habitat of equal value (0.4 acres of wetland)
4.8.4 Potential Mitigation Strategies, Cost & Benefits

In addition to no action, two potential mitigation measures were identified: in-kind mitigation at a location at or near the project area or substituting fish and wildlife resources out of kind at a certified mitigation bank. In-kind mitigation could be accomplished at the project site and could occur through the construction of a new wetland or the restoration of a current wetland. The project area has several locations of previously restored habitat and on-site restoration adjacent to these areas would be the most suitable. On-site mitigation does come with some risk in that the area has several known weedy and invasive species that could infiltrate the project area. Mitigation through the purchase of credits would result in out-of-kind mitigation.

The period of analysis for this planning is 50 years. Over that 50 years, it is assumed that the quality of the wetland would not change and the impacted wetland would provide 0.98 AAHU per acre if no project were implemented.

To consider a range of alternatives, these measures were considered at a range of scales: no action, purchasing mitigation bank credits, restoration of 0.6 acres of wetland near the project site, and the creation of 0.6 acres of new wetland habitat.

Benefits of Alternative Plans

For the in-kind mitigation near the project area, there would be a period of establishment of approximately 5 years until the habitat has reached the target quality (mean C = 4.72). Assuming that the initial mean C is 1.64, the restoration or creation of a wetland would both result in an AAHU of 2.7.

For out-of-kind mitigation through the purchase of mitigation banks, the mitigation bank would be required to maintain a Mean C = 3.5 with an AAHU of 2.1.

The AAHU per acre, total acres, and total AAHU for each alternative plan are shown in Table 2. As shown in the table, each of the alternatives except for the no action alternative would provide sufficient acres and habitat units to mitigate for the project impacts.

<table>
<thead>
<tr>
<th>Alternative</th>
<th>AAHU/acre</th>
<th>Acres</th>
<th>Total AAHU</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Action</td>
<td>1.0</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>On-Site Restoration</td>
<td>2.7</td>
<td>0.6</td>
<td>1.62</td>
</tr>
<tr>
<td>On-Site Wetland Creation</td>
<td>2.7</td>
<td>0.6</td>
<td>1.62</td>
</tr>
<tr>
<td>Mitigation Bank Credits</td>
<td>3.5</td>
<td>0.6</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Costs of Alternative Plans

For the on-site mitigation alternatives, the following cost assumptions were used:

- **Real Estate**: Public lands used for comparable projects in the region have been valued at approximately $5,000 per acre. These costs would be incurred in Year 0 of the period of analysis and acquired as a part of the recommended plan.
- **Engineering and Design**: Location of the restored and created wetland assume that an area near or adjacent to the study foot print is available for implementation.
• **Monitoring:** A total of $1,000 per year for a period of 5 years was assumed for monitoring for both in-kind options of mitigation.

• **Construction Costs:** Costs assume plugs, invasive species removal, and prescribed burns for the restoration of 0.6 acres. Creation of a new 0.6 acre wetland assumes the additional costs of soil amendments and minor earthwork.

• **Maintenance:** Costs also assume that a local stakeholder or Non-federal sponsor will the mitigation area for the project life span.

• **Establishment:** Costs provided include the cost of a 5 year establishment period.

<table>
<thead>
<tr>
<th>Table 3: Construction Activity Costs for In-kind Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity</td>
</tr>
<tr>
<td>Invasive Plant Removal</td>
</tr>
<tr>
<td>Native Plant Plugs</td>
</tr>
<tr>
<td>Soil Amendment</td>
</tr>
<tr>
<td>Minor earthwork</td>
</tr>
<tr>
<td>Prescribed Burns</td>
</tr>
<tr>
<td>Monitoring</td>
</tr>
<tr>
<td>Total Construction Cost</td>
</tr>
</tbody>
</table>

• **Operation and Maintenance (O&M):** Based on similar projects completed in the area, operation and maintenance activities would include burning and mowing, control of herbaceous and woody invasive species, and additional seeding to build species richness. These costs would be incurred each year after construction is completed and are built into the costs shown above.

For the out-of-kind mitigation via the purchase of mitigation bank credits, the cost per acre is currently listed at $175,000/acre. At 0.6 acres, the total cost for out-of-kind mitigation would be $105,000.

### 4.8.5 Cost Effectiveness and Incremental Costs

The cost effective (CE) and incremental cost analysis (ICA) are two distinct analyses that are conducted to evaluate the effects of alternative plans, and for this mitigation plan, is simplistic. First, it must be shown through a cost effective analysis that a mitigation plan’s output cannot be produced more cost effectively by another means. Cost effective means that, for a given level of non-monetary output, no other plan costs less and no other plan yields more output at a lower cost. Best buy plans are the most efficient of the cost effective plans, providing the greatest increases in output for the lowest increases in cost.

Table 4 shows that two plans, Purchasing wetland bank credits and creation of a new 0.6 acre wetland on site, are both listed as non-cost effective. Conversely the no action alternative and the restoration of 0.6 acres of wetland on site are listed as Best Buy.
Table 4: Average annual cost and habitat units.

<table>
<thead>
<tr>
<th>Name</th>
<th>Average Annual Cost</th>
<th>Average Annual Habitat Units</th>
<th>Cost Effective</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Action</td>
<td>$0</td>
<td>1.0</td>
<td>Yes (Best Buy)</td>
</tr>
<tr>
<td>On-Site Restoration</td>
<td>$1,076</td>
<td>2.7</td>
<td>Yes (Best Buy)</td>
</tr>
<tr>
<td>On-Site Wetland Creation</td>
<td>$1,383</td>
<td>2.7</td>
<td>No</td>
</tr>
<tr>
<td>Mitigation Bank Credits</td>
<td>$2,100</td>
<td>2.1</td>
<td>No</td>
</tr>
</tbody>
</table>

**4.9 Timing of Implementation**

For all water resources development projects on which construction has not commenced as of November 17, 1986, authorized ecological resource mitigation features, including the acquisition of lands or interest in lands to mitigate losses to ecological resources, will be undertaken or acquired before any construction of the project (other than such mitigation land acquisition) commences, or concurrently with the acquisition of lands and interests in lands for project purposes (other than mitigation of fish and wildlife losses); whichever the Secretary, determines is appropriate except that any physical construction required for the purpose of mitigation may be undertaken concurrently with the physical construction of such project.

Mitigation measures will generally be scheduled for accomplishment concurrently with other project features in the most efficient way. Circumstances warranting the accomplishment of mitigation as the first or last elements of project construction will require prior approval by HQUSACE.

**4.10 Monitoring**

Monitoring is appropriate for all mitigation actions to insure that those actions have achieved the objective. The level of monitoring should be consistent with the magnitude of the project and the degree of risk and uncertainty associated with the probable success of the mitigation. USACE will include the cost of a monitoring program in the estimate of O&M cost for mitigation measures, if such a program has been adopted in accordance with 40 CFR part 1505.2(c) and 1505.3.

The non-federal sponsor or stakeholder is responsible for monitoring the mitigation project in accordance with monitoring objectives and identify problems requiring remedial action. Monitoring provisions should be based on scientifically sound performance standards as provided by USACE. Monitoring should be conducted at time intervals appropriate for the project and until such time that the authorizing agency, in consultation with the non-federal sponsor and/or stakeholder are confident that success is being achieved (i.e., performance standards are attained). The period for monitoring will typically be five years; however, it may be necessary to extend this period for projects requiring more time to reach a stable condition or where remedial activities were undertaken. Annual monitoring reports should be submitted to the authorizing agency.

The current cost used for the mitigation includes 5 years of monitoring during the establishment period. Once the establishment period is completed, the non-federal sponsor will ensure the performance criteria is maintained. The details associated with the mitigation monitoring are still in development. Additional analyses in Detailed Design and Specifications will help guide the performance criteria for monitoring.
addition, coordination with local stakeholders and the non-federal sponsors is ongoing to determine the exact location and responsibilities for the mitigation monitoring. A comprehensive monitoring plan will be developed in Detailed Design and Specifications

4.11 Allocation and Apportionment of Mitigation Costs

Ecological resources mitigation costs incurred after November 17, 1986 are allocated among the authorized purposes which caused the requirement for mitigation, and are cost shared to the same extent as project costs allocated to these purposes.

Allocation: The impact analysis identifies the project purposes which cause losses to be mitigated. If practicable, the analysis identifies the extent of losses separable or specific to each purpose. Mitigation costs not associated with specific purposes will be included with other joint project costs.

Apportionment: Once the proportionate amounts of losses and corresponding amounts of mitigation and costs are assigned to the appropriate purposes, joint costs of mitigation should be allocated among the causative purposes on the same basis as other joint costs.

4.12 Mitigation Cost Sharing

(a) LERRD. Non-Federal interests will provide lands, easements, rights-of-way, relocations and disposal areas (LERRD) where this is a requirement of the purpose that necessitates the mitigation except where otherwise agreed for the Corps to accomplish with non-Federal funds. As Title I of Public Law 99-662 contains a generic requirement that non-Federal interests provide LERRD, all future mitigation features will require non-Federal interests to provide LERRD, if required, unless the project authorization after 17 November 1986 provides differently for mitigation.

(b) Construction. Construction costs for mitigation will be treated the same as other project construction costs for cost sharing purposes.

(c) OMRR&R. Non-Federal interests will be responsible for all costs of operation, maintenance, repair, rehabilitation, and replacement of mitigation features except for:

(d) Exception. No cost sharing will be imposed without the consent of the non-Federal interests where contracts have previously been signed for repayment of costs or until such contracts are complied with or renegotiated.

4.13 Preconstruction Environmental Protection and Mitigation Fund

This fund was established by Section 908 of WRDA '86. Implementation of the fund has not been sought since timing of implementation of mitigation features will assure that mitigation features will be available to mitigate for unavoidable adverse project impacts as they occur.

4.14 OMRR&R of Mitigation Features

Federal Responsibility: Execution and performance of Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) of ecological mitigation features of a project is a Corps responsibility whenever the project authorization, or recommendation for authorization, provides for the Corps to operate, maintain, repair, rehabilitate or replace other project features. The manner in which the District
Commander exercises this authority and responsibility will vary widely, depending on the location of the fish and wildlife mitigation features and the type of ecological management and administration required. Plans recommended for authorization in this category will identify the Corps OMRR&R responsibility. OMRR&R of ecological resources features included in an alternative plan to mitigate losses associated with an existing Federal program (e.g., National Migratory Bird Management Program) will be the responsibility of the Federal agency that administers that program.

Non-Federal Responsibility: OMRR&R of fish and wildlife mitigation features is a non-Federal responsibility whenever the project authorization or recommendation for authorization provides for non-Federal interests to operate and maintain other project features, and in some cases where there is a Federal OMRR&R responsibility but no Federal (Corps) presence, e.g., no Corps project management office located on site. Assignment of such responsibility will be a part of the items of local cooperation for the project, to be fulfilled by either a local sponsor or another agency which will provide the necessary assurances to the Corps.

5. Total Mitigation Costs

As discussed in the preceding sections, the mitigation cost would be $53,843. This cost for the restoration of a current wetland within the project area and would include all associated real estate, design, construction, monitoring, and operation and maintenance costs.
G4 – Agency Coordination
Planning Branch
Environmental Formulation Section

Kenneth Westlake, Chief
Environmental Review Branch
U.S. EPA ME-19J
77 West Jackson
Chicago, IL 60604

Dear Mr. Westlake:

The Chicago District is preparing a National Environmental Policy Act (NEPA) document to evaluate the potential effects of a range of alternatives to manage risks associated with flooding within the DuPage River watershed. The DuPage River watershed is located primarily within DuPage and Will Counties, Illinois. As part of the NEPA scoping process, the Chicago District would appreciate any comments or concerns you might have associated with DuPage River flooding and the potential impacts to wetlands, riverine habitat, rare and unique habitat, threatened and endangered species or cultural and social resources that could result from alternatives to reduce flood risk. Attached is a list of State and Federal Agencies and Tribal Nations that are also receiving this request (enclosure 1). A map of the study area is attached (enclosure 2).

The study will investigate overbank and backwater flooding along the DuPage River and its major tributaries, focusing on prioritizing high risk areas and developing a range of possible structural and non-structural alternatives to reduce flood risk. Alternatives to that could be evaluated to reduce flood risk include: floodwater storage, levees or floodwalls, diversion channels, channel modifications, flow control structures, flood proofing, structure elevations and buyouts. Communities within DuPage County where flooding will be evaluated include, but are not limited to: Bloomingdale, Lombard, Lisle, Winfield, Warrenville, Naperville, Milton Township, and Lisle Township. Communities within Will County include Bolingbrook, Joliet, Romeoville, Crest Hill, Plainfield, Minooka, Channahon, Plainfield Township, and Wheatland Township.

The Chicago District, in collaboration with representatives of DuPage and Will Counties, the study’s non-federal sponsors, will host two public meetings on the subject study. We will provide information on those upcoming meetings on the District’s webpage.

www.lrc.usace.army.mil (look under Hot Info)
The Chicago District values your input to the DuPage River Feasibility Study. We request that comments be provided no later than December 4, 2015 to Mr. Peter Bullock, U.S. Army Corps of Engineers, 231 South La Salle Street Suite 1500, Chicago, Illinois 60604, or by email at peter.y.bullock@usace.army.mil. Questions should be directed to Mr. Bullock at (312) 846-5587.

Sincerely,

Susanne J. Davis, P. E.
Chief, Planning Branch
Scoping List-Agencies

Kenneth Westlake, Chief
Environmental Review Branch
U.S. EPA ME-19J
77 West Jackson
Chicago, IL 60604

Louise Clemency
US Fish and Wildlife Service
Chicago Illinois Field Office
1250 South Grove, Suite 103
Barrington, Illinois 60010

Andrew Velasquez III
Federal Emergency Management Agency Region 5
536 South Clark Street, 6th Floor
Chicago, IL 60605

Erin Gasiel
IEMA
1035 Outer Park Drive
Springfield, IL 62704-4462

Director Wayne Rosenthal
Illinois DNR
One Natural Resource Way
Springfield, IL 62702-1271

Keith Shank, Acting Division Manager
Office of Resource Review
Illinois DNR
One Natural Resource Way
Springfield, IL 62702-1271

Nathan, Grider
IDNR, Office of Realty and Environmental Planning
1 Natural Resource Way
Springfield, IL 62702

Director Daniel Injerd
Illinois DNR/OWR
160 N. LaSalle St,
Suite S-700
Chicago, Illinois 60601

Dan Heacock
Illinois EPA
Water Pollution Division
1001 N. Grand
Springfield, IL 62794
Pat Malone
Illinois DNR – Realty/Planning
One Natural Resource Way
Springfield, IL 62702-1271

Rachel Leibowitz
Illinois Hist. Pres. Agency
1 Old State Capitol Plaza
Springfield, IL 62701

Ann Hanson
Federal Aviation Administration
Chicago Airports District Office, CHI-ADO-600
2300 East Devon Avenue
Des Plaines, Illinois 60018

Barry Cooper
Federal Aviation Administration
Chicago Airports District Office, CHI-ADO-600
2300 East Devon Avenue
Des Plaines, Illinois 60018

Scott Beckerman, State Director
TWS-Certified Wildlife Biologist(r)
USDA APHIS Wildlife Services
3430 Constitution Drive, Suite 121
Springfield, Illinois 62711

Suzanne Hart
President, Board of Commissioners
Forest Preserve District of Will County
17540 West Laraway Road
Joliet, IL 60433

Joseph Cantore
President Board of Commissioners
Forest Preserve District of DuPage County
P.O.Box 5000
Wheaton, IL 60189-5000

DuPage County Airport
2700 International Dr #200,
West Chicago, IL 60185

Stephen McCracken
DuPage River Salt Creek Workgroup
10S404 Knoch Knolls Rd # B,
Naperville, IL 60565
Brook McDonald, Executive Director
The Conservation Foundation
10S404 Knoch Knolls Rd # B,
Naperville, IL 60565

Communities

Village President Al Larsen
Village of Schaumburg
Robert O. Atcher Municipal Center
101 Schaumburg Court
Schaumburg, IL 60193-1899

Village President Kevin Wallace
Village of Bartlett
228 S. Main Street
Bartlett, IL 60103

Village President Rodney S. Craig
Village of Hanover Park
2121 West Lake Street
Hanover Park, IL 60133

Mayor Gayle A. Smolinski
Village of Roselle
31 S. Prospect Street
Roselle, IL 60172

Village President Eileen Phipps
Village of Wayne
5N430 Railroad Street
P.O. Box 532
Wayne, IL 60184

Village President Franco Coladipietro
Village of Bloomingdale
201 S. Bloomingdale road
Bloomingdale, IL 60108

Mayor Frank Saverino
Village of Carol Stream
500 N. Gary Avenue
Carol Stream, IL 60188

Village President Linda Jackson
Village of Glendale Heights
300 Civic Center Plaza
Glendale Heights, IL 60139
Mayor Ruben Pineda  
City of West Chicago  
475 Main Street  
West Chicago, IL 60185

Village President Eric Spanke  
Village of Winfield  
27West 265 Jewell Road  
Winfield, IL  60190

Mayor Michael J. Gresk  
City of Wheaton  
303 West Wesley Street  
Wheaton, IL  60187-0727

Village President Alexander W. Demos  
Village of Glen Ellyn  
Glen Ellyn Civic Center  
535 Duane Street  
Glen Ellyn, IL  60137

Village President Keith T. Giagnorio  
Village of Lombard  
255 East Wilson Avenue  
Lombard, IL  60148-3969

Mayor David Brummel  
City of Warrenville  
28W701 Stafford Place  
Warrenville, IL  60555

Mayor Joseph Broda  
Village of Lisle  
925 Burlington Avenue  
Lisle, IL 60532

Mayor Martin T. Tully  
Village of Downers Grove  
801 Burlington Avenue  
Downers Grove, IL  60515

Mayor Ron Gunter  
Village of Westmont  
31 West Quincy Street  
Westmont, IL  60559

Mayor George Pradel  
City of Naperville  
400 S. Eagle Street  
Naperville, IL  60540
Mayor Gina Cunningham-Picek  
Village of Woodridge  
5 Plaza Drive  
Woodridge, IL 60517

Mayor Roger A. Claar  
Village of Bolingbrook  
375 West Briarcliff Road  
Bolingbrook, IL 60440

Village President Michael P. Collins  
Village of Plainfield  
24401 Lockport Street  
Plainfield, IL 60544

Mayor John D. Noak  
Village of Romeoville  
1050 west Romeo Road  
Romeoville, IL 60446

Mayor Ray Soliman  
City of Crest Hill  
1610 Plainfield Road  
Crest Hill, IL 60403

Mayor Bob O’Dekirk  
City of Joliet  
150 West Jefferson Street  
Joliet, IL 60432

Mayor Richard Chapman  
Village of Shorewood  
One Towne Center Blvd  
Shorewood, IL 60404

Village President Kimberly Zuelsdorf  
Village of Rockdale  
79 Moen Avenue  
Rockdale, IL 60436-2626

Village President Pat Brennan  
Village of Minooka  
121 East McEvilly Road  
Minooka, IL 60447

Mayor Missey Moorman Schumacker  
Village of Channahon  
244555 S. Navajo Drive  
Channahon, IL 60410
Libraries

Schaumberg Township District Library
130 S Roselle Rd
Schaumburg, IL 60193

Bartlett Public Library
800 S Bartlett Rd
Bartlett, IL 60103

Hanover Park Branch Library
1266 Irving Park Rd
Hanover Park, IL 60133

Roselle Public Library
40 S Park St,
Roselle, IL 60172

Bloomingdale Public Library
101 Fairfield Way
Bloomingdale, IL 60108

Carol Stream Public Library
616 Hiawatha Dr
Carol Stream, IL 60188

Glenside Public Library
25 E Fullerton Ave
Glendale Heights, IL 60139

West Chicago Public Library
118 W Washington St
West Chicago, IL 60185

Winfield Public Library
0S291 Winfield Rd
Winfield, IL 60190

Wheaton Public Library
225 N Cross St
Wheaton, IL 60187

Glen Ellyn Public Library
400 Duane St
Glen Ellyn, IL 60137

Helen Plum Memorial Library
110 W Maple St
Lombard, IL 60148
Warrenville Public Library
28W751 Stafford Place
Warrenville, IL 60555

Lisle Library
777 Front St
Lisle, IL 60532

Downers Grove Library
1050 Curtiss St.
Downers Grove, IL 60515

Westmont Public Library
428 N Cass Ave.
Westmont, IL 60559

Naperville Public Library
2035 S Naper Blvd
Naperville, IL 60565

Woodridge Public Library
3 Plaza Dr.
Woodridge, IL 60517

Fountaindale Public Library
300 W Briarcliff Rd.
Bolingbrook, IL 60440

Plainfield Public Library
15025 S Illinois St,
Plainfield, IL 60544

White Oak Library-Romeoville Branch
201 Normantown Rd.
Romeoville, IL 60446

Crest Hill Branch Library
20670 Len Kubinski Dr.
Crest Hill, IL 60403

Joliet Public Library
150 N Ottawa St.
Joliet, IL 60432

Shorewood-Troy Public Library
650 Deerwood Dr
Shorewood, IL 60404

Minooka-Three Rivers Public library
109 N Wabena Ave.
Minooka, IL 60447
Tribes

Kickapoo Tribe of Oklahoma
P.O. Box 70
McCloud, OK 74851

Kickapoo Of Kansas
1107 Goldfinch Rd.
Horton, KS 66434

Kickapoo Tribe of Texas
Box HC 1 9700
Eagle Pass, TX 78853

Miami Nation in Indiana
P.O. Box 41
Peru, IN 46970

Miami Tribe of Oklahoma
P.O. Box 1326
Miami, OK 74355
Attn: Mr. George Strack

Citizen Potawatomi Nation
1901 S. Gordon Cooper Dr.
Shawnee, OK 74801

Forest County Potawatomi Exec. Council
P. O. Box 340
Crandon, WI 54520

Nottawaseppi Huron Potawatomi Tribal Office
2221 One-and-a-half Mile Rd.
Fulton, MI 49052

Hannahville Potawatomi Comm., Council
N 14911 Hannahville Road
Wilson, MI 49896-9728

Prairie Band Potawatomi Tribal Council
16281 Q RD
Mayetta, KS 66509

Pokagon Band of Potawatomi Indians
P.O. Box 180
Dowagiac, MI 49047
Various Counties
Various Locations
  Initiating Section 106 Consultation, DuPage River Feasibility Study
  DuPage County - Bloomingdale, Lombard, Lisle, Winfield, Warrenville, Naperville, Milton Township and
  Lisle Township; Will County - Bolingbrook, Joliet, Romeoville, Crest Hill, Plainfield, Minooka, Channahon,
  Plainfield Township and Wheatland Township
IHPPA Log #019110215

November 12, 2015

Peter Bullock
U.S. Army Corps of Engineers, Chicago District
231 S. LaSalle St., Suite 1500
Chicago, IL 60604

Dear Mr. Bullock:

Thank you for soliciting our comments and areas of concern about the above referenced undertaking. We are concerned about the effects of flood control measures on any prehistoric and historic archaeological sites and the built environment within the area of potential effect.

We look forward to further consultation as plans are developed for this important project.

Sincerely,

Rachel Leibowitz, Ph.D.
Deputy State Historic
Preservation Officer
RL:djh
November 30, 2015

Mr. Peter Bullock  
U.S. Army Corps of Engineers  
231 La Salle Street, Suite 1500  
Chicago, IL 60604

RE: CITY OF WARRENVILLE COMMENTS  
DUPAGE RIVER FEASIBILITY STUDY

Dear Mr. Bullock:

The City of Warrenville appreciates the United States Army Corps of Engineers' investment of time and resources to evaluate the flooding along the DuPage River. As you are likely aware, DuPage County and the City of Warrenville have invested significant money and time to alleviate flooding in the West Branch DuPage River watershed in recent years.

The County adopted the Addendum to the West Branch DuPage Watershed Plan in January 2011. The Addendum evaluated flooding and identified a group of projects as the Preferred Alternative to alleviate flooding. The following projects have been or are in the process of being implemented:

1. Construction of a levee to protect Bower Elementary School (County) - complete
2. Main Street Storm Sewer System Drainage Control Structure Project (City) - complete
3. Excavation to create additional floodplain storage and construction of a flood protection berm along River Road, between Bower Elementary School and Warrenville Road (County) - complete
4. Reconstruction of Williams Road bridge to raise it and the approaching roadway above the regulatory 100-year floodplain (City) - complete
5. Reconstruction of Warrenville Road bridge (County) - nearly complete
6. Re-meander of West Branch DuPage River at Warrenville Road (County) - nearly complete

One major project that was not included in the Preferred Alternative projects identified in the Addendum was the reconstruction of the Illinois Route 56 / Butterfield Road bridge over the West Branch DuPage River. That project began in 2011 and was completed in 2012 by the Illinois Department of Transportation.
Some projects were not implemented due to lack of funding and/or consensus between the property owners in the affected neighborhoods. Those projects include:

1. Emerald Green flood protection berm
2. Iroquois Court flood walls
3. Forestview Drive North / Riverside Parkway flood protection berm
4. Flood protection and commercial property buy-out north of Warrenville Road bridge

Please note that three residential property owners in the Forestview Drive North / Riverside Parkway neighborhood have invested a significant amount of money to reconstruct, raise or partially demolish and reconstruct their homes to remove them from the regulatory floodplain. They were able to do this as a result of receiving an allocation of excess compensatory storage volume created as part of DuPage County’s projects.

Of the three neighborhoods identified above, Iroquois Court flooding is the most severe. While the City’s nearby Williams Road bridge project is expected to improve access to this neighborhood during a 100-year storm, it did not reduce the flood elevations for this neighborhood. DuPage County proposed flood walls to protect homes in this neighborhood, which some of the residents viewed as intrusive because they would cut through their rear yards. This neighborhood remains in need of flood mitigation assistance.

The commercial property referenced in item 4 above was identified as a property buy-out in the County’s Addendum. The property was not acquired and flood protection was not completed for this property. There is still a desire to further evaluate and implement actions designed to address the remaining private property issues north of the bridge.

Finally, DuPage County recently obtained approval from the Illinois Department of Natural Resources for a minor modification to the operating plan for Fawell Dam. While this change is not expected to have a significant impact on the flood elevations of the river, it is something that should be included while evaluating flooding along the river.

Please feel free to contact Senior Civil Engineer Phil Kuchler at (630) 836-3033 if you require any additional clarification of any of our comments or questions. Thank you in advance for your efforts on this important project.

Sincerely,

[Signature]

David Brummel
Mayor, City of Warrenville

Cc: City Council
    John Coakley, City Administrator
    Ron Mentzer, Community Development Director
    Phil Kuchler, Senior Civil Engineer
December 2, 2015

Col. Christopher T. Drew
District Engineer
U.S. Army Corps of Engineers
Chicago District
231 S. LaSalle Street, Suite 1500
Chicago, Illinois 60604

Attention: Peter Bullock

Dear Col. Drew:

This letter responds to your request for scoping comments on the DuPage River, Illinois Feasibility Study in DuPage and Will Counties, Illinois. The U.S. Army Corps of Engineers (Corps) is preparing a National Environmental Policy Act (NEPA) document to evaluate the potential effects of a range of alternatives to manage risks associated with flooding within the DuPage River watershed.

We provide general comments as they relate to U.S. Fish and Wildlife Service (Service) trust resources (e.g., Federally listed species and migratory birds) that may be affected by the project. We recommend that the NEPA document fully address the concerns identified in this letter.

General comments

The draft NEPA document should fully disclose potential impacts to Service trust resources and aquatic resources found in the project vicinity. The potential range of alternatives that could be used to manage risks associated with flooding in the DuPage River watershed include actions which could adversely impact Service trust resources and the habitats that they depend on. There is the possibility that habitat for Federally listed species could be found within the proposed action area(s). For example, habitat for the Federally threatened eastern prairie fringed orchid (Platanthera leucophaea) or northern long-eared bat (Myotis septentrionalis) could be present within the action area(s) for the possible range of alternatives. Other aquatic resources (e.g., wetlands) could be impacted by the range of alternatives as well.
The Corps has identified that it would prioritize high risk areas and develop a range of possible structural and non-structural alternatives to reduce flood risks. The list of possible alternatives should include incorporating infiltration best management practices (BMPs) in suitable areas to assist in reducing flood risks.

The non-Federal sponsors for the project, DuPage and Will Counties, should explore options to minimize development in high risk flood areas. During the two day charrette, held on November 9 and 10, 2005, the Corps identified that flooding in the watershed is due to: 1) landuse changes (resulting in increased imperviousness due to development), 2) population increases (resulting in increased development), and 3) climate change (i.e., increases in average precipitation and “heavy” precipitation). This assessment is supported by numerous studies (Schuler 1987; Wright et al. 2006) that have shown that construction of developments and roads, with the associated high amounts of impervious cover, results in onsite and offsite hydrologic changes including an increase in the volume of stormwater runoff. The results of the increased volume of runoff include increased ponding and water level fluctuations (“bounce”) in wetlands located downstream. Increased ponding and water level fluctuations reduce biodiversity and favor the spread of invasive plant and animal species (Wright et al. 2006). Urban runoff associated with commercial developments often contains contaminants (such as oil and grease, sediments, metals, nutrients, and chlorides) which also reduce biodiversity and favor the spread of invasive plant and animal species (Wright et al. 2006).

Wetlands and uplands located on forest preserves and other open space areas (e.g., Illinois Natural Area Inventory sites, critical wetlands, Federal mitigation banks, Audubon designated Important Bird Areas, etc.) throughout the study area provide home to Service trust resources and we recommend that the Corps consider alternatives that do not adversely impact habitat for Service trust resources (e.g., conversion of grassland and sedge meadow habitats to storage reservoirs). We also recommend that the Corps consider non-traditional flood control alternatives, including infiltration BMPs in high risk/flood prone areas and areas upstream of the West Branch, East Branch, and mainstem of the DuPage River. In these areas applicable buyout areas could be retrofitted with infiltration BMPs.

The Service will also coordinate with the Corps to address impacts to wildlife resources and their habitats in accordance with the Fish & Wildlife Coordination Act. Additionally, we recommend that the Illinois Department of Natural Resources (Impact Assessment Section) and the Forest Preserve Districts of DuPage County and Will County be involved as stakeholders in this feasibility study, as these state and local agencies are the most knowledgeable about the resources on their land.

If you have any questions, please contact Mr. Shawn Cirton at 847/381-2253, ext. 19.

Sincerely,

Louise Clemency
Field Supervisor

cc: USEPA, Pelloso
IDNR, Grider
FPDDC, Meister
FPDWC, Robson

Literature Cited


December 3, 2015

US Army Corps of Engineers, Chicago District  
ATTN: Planning Branch (Bullock)  
231 S. LaSalle Street, Suite 1500  
Chicago, IL 60604

Re: DuPage River Feasibility Study – Comment Form  
Sent via email- peter.y.bullock@usace.army.mil / chicagodistrict.pao@usace.army.mil

Dear Mr. Bullock,

This correspondence is in regards to the scoping effort by the US Army Corps of Engineers, Chicago District for the evaluation of alternatives to manage risks associated with flooding within the DuPage River watershed. This is an important effort and the Village is appreciative of the investigate work being conducted by the ACOE and DuPage County.

The Village has significant flow that comes from its major tributaries in the watershed that ultimately drains into the DuPage River. As the study evaluates non-structural alternatives to reduce flood risk, the Village has an interest in exploring opportunities for expansion or creation of detention to reduce overbank flooding that incorporates channel modification that would address streambank stabilization concerns that are interwoven with the storm water flow through the tributaries.

The Village would welcome the opportunity to discuss the issues and study further and to help determine opportunities to improve storm water management in the DuPage River watershed. Please do not hesitate to contact me directly at 630-719-4767.

Respectfully,

Christopher Bethel  
Director of Public Works
Col. Christopher T. Drew  
District Engineer  
U.S. Army Corps of Engineers  
Chicago District  
231 S. LaSalle Street, Suite 1500  
Chicago, Illinois 60604  

Attention: Sara Brodzinsky

Dear Colonel Drew:

This constitutes our Planning Aid Letter (PAL) on your DuPage River Feasibility Study. It was prepared under the authority of, and in accordance with, the provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), but does not constitute the final report required by Section 2(b) of the Fish and Wildlife Coordination Act. Your scoping letter was submitted to our office in November 2015.

**Introduction**

This PAL transmits the results of our preliminary evaluation of alternatives for the DuPage River Feasibility Study by the U.S. Army Corps of Engineers (Corps). This PAL is based on documentation provided by the Corps, which included the project fact sheet, project maps, a scoping letter, a report synopsis that describes the project, and summary of sites identified for initial array of alternatives. Information was also provided by the Corps during your planning charrette on November 9-10, 2015. The non-Federal sponsors for the study are the DuPage County, Illinois, Stormwater Management Planning Committee and the Will County, Illinois, Executive Office. The DuPage River Feasibility Study is a new study investigating flood risk management alternatives along the DuPage River and its major tributaries. The study is currently in the Scoping Phase, focused on the major tasks of identifying problems and opportunities, inventorizing and forecasting conditions, and formulating alternative plans. The DuPage River Feasibility Study will investigate overbank and backwater flooding along the DuPage River and its major tributaries, prioritizing high risk areas and developing a range of possible structural and non-structural alternatives to address flood risks. The study area has experienced rapid development over the past several decades, and currently includes 40 communities and
approximately 900,000 residents. This is a single-purpose study investigating flood risk management opportunities in the DuPage River watershed. Recreation opportunities may also be investigated where compatible with flood risk management alternatives.

Alternatives Considered
The Corps has not yet finalized the alternatives to be devised for evaluation in environmental studies.

Description of the Study Area
The study area includes the DuPage River and its tributaries which drain approximately 353 square miles, primarily in DuPage and Will Counties in Illinois. The East and West Branches of the DuPage River lie primarily in DuPage County and flow south towards Will County where they meet to form the DuPage River mainstem. The mainstem flows south through Will County to its confluence with the Des Plaines River in Channahon, Illinois.

Description of Fish and Wildlife Resource Conditions

Existing Conditions
The Corps report synopsis indicates that several areas along the DuPage River experience extensive damages from overbank flooding, as do isolated structures and infrastructure in the floodplain of the DuPage River and its tributaries. As the Upper DuPage River Watershed Plan (2007) notes, the Upper DuPage River Watershed supports a range of habitats from river to oak woodland and wetland to dry prairie.

Most of the open space/natural areas in the DuPage River Watershed are in public ownership, either owned by the Forest Preserve District of DuPage County the Forest Preserve District of Will County, local park districts, or private ownership. The Illinois Department of Natural Resources’ (IDNR) The DuPage River Basin – An Inventory of the Region’s Resources (2001) provides a detailed summary of natural resources in the DuPage River Watershed.

The watershed is located in an urbanized and developed landscape; however, the remaining open space/natural areas provide habitat for terrestrial and aquatic resources within the watershed. For example, The Lower DuPage River Watershed Plan (2011) notes that pre-settlement data shows that the vegetation within the watershed was forested in pockets along the main stem of the river, but otherwise was comprised mostly of prairie. The Lower DuPage River Watershed Plan indicates that based on CMAP 2005 data, agriculture and residential land uses were nearly equally dominant in the lower part of the watershed, 26.72% and 32.44%, respectively. In contrast, open space and water accounted for 8.14% and 3.39%, respectively. Only 6.28% were considered protected land for conservation or recreation purposes. It should also be noted that there are several nature preserves and Illinois Natural Area Inventory (INAI) sites within the watershed, which are high quality natural areas that often serve as habitat for threatened and endangered species. These sites are assessed and designated by the IDNR and can be located on private or public land.
The IDNR’s Status of Fish Communities and Stream Quality in the Des Plaines and DuPage Rivers: 2003 Basin Survey summarized the findings of the fish surveys conducted in the DuPage River. The report noted that stream quality based on fish Indices of Biotic Integrity on the DuPage mainstem ranged from moderate to limited and dams appear to be one of the limiting factors. For example, site GB-01, in that report, is below the Channahon Dam and is directly connected with the lower Des Plaines River, near the confluence with the Illinois and Kankakee Rivers. The report noted that the location of the survey site accounted for the site being the most species diverse location in the entire DuPage River Basin (including the East and West Branches in the upper DuPage River watershed). Although additional species were collected in that study, it was noted that the dam prevents further migration of fish upstream, regardless of whether or not the habitat would support the fish.

These open space/natural areas provide suitable habitat for the U.S. Fish and Wildlife Service’s trust resources (migratory birds and Federally listed species). It has been noted that, while we had farsighted conservation leaders that established our preserve systems and open space, as the Chicago metropolitan area expands our natural areas continue to decline (Chicago Wilderness Biodiversity Recovery Plan, 1999). The Chicago Wilderness consortium’s The State of Our Chicago Wilderness: A Report Card on the Ecological Health of the Region (2006) identified that urban expansion and the loss of natural processes are two of the major stressors to our natural communities and these stressors contribute to the Chicago Wilderness Report Card determination that overall, the region’s natural communities and animal assemblages remain in a declining or threatened state of health. For example, The State of Our Chicago Wilderness: A Report Card on the Ecological Health of the Region (2006) shows that the principal threat to the remaining floodplain forests in our forest preserves is altered hydrology—more frequent floods of longer duration.

Natural areas serve as the last remaining stopover, breeding, and resident areas for migratory birds within the watershed. For example, grassland birds are one of the most imperiled groups of birds in the world and they utilize some of the natural areas within the watershed. The State of the Birds 2011 Report on Public Lands and Waters lists grassland birds among our fastest declining species and notes that the percentage of grassland birds on public lands is low because such a small amount of United States grassland (less than 2%) is both publicly owned and managed for conservation. Forest preserves and other natural areas provide terrestrial and aquatic habitat for various groups of organisms that remain in the Chicago metropolitan area. This includes aquatic organisms (e.g., fish, aquatic macroinvertebrates, etc.) that utilize the DuPage River and its tributaries as habitat.

For example, based on information provided by the Forest Preserve District of DuPage County (FPDDC), the FPDDC possesses:

- 15,262 acres of land
  - 2,365 wetland acres
- 391 vertebrate wildlife species recorded since 2005
  - 31 endangered or threatened
- 1,219 invertebrate species recorded since 2005
3 endangered or threatened

• 1,457 native plant species (959 vascular + 498 non-vascular)
  o 27 endangered or threatened

within the DuPage River watershed.

Federally listed species such as the threatened eastern prairie fringed orchid are located within the watershed. The threatened northern long-eared bat has been captured within the Des Plaines watershed, and just outside of the DuPage watershed boundary, and is very likely to occur within the DuPage watershed.

Based on information provided by the Corps and data from literature we consulted, we determined resource categories for the study area. Resource category determinations are made in order to help determine mitigation needs for fish and wildlife habitats directly and indirectly affected by Federal water resources projects. Resource category classifications (Table 1) are made in accordance with the Service’s Mitigation Policy (501 FW 2), which was established pursuant to the Fish and Wildlife Coordination Act of 1956 (16 U.S.C. 742(a)-754), the Fish and Wildlife Coordination Act (16 U.S.C. 661-667(e)), the Watershed Protection and Flood Prevention Act (16 U.S.C. 1001-1009), and the National Environmental Policy Act (42 U.S.C. 4321-4347).

Fish and Wildlife Resources Without the Project
The natural areas within the study area are all providing suitable habitat for fish and wildlife resources in a developed landscape. Without implementation of any of the project alternatives, fish and wildlife resources would utilize the same natural areas that are currently providing habitat and the habitat condition would likely remain the same.

Fish and Wildlife Resources With the Project
Based on the documentation provided by the Corps, the Corps has not yet finalized the alternatives to be devised for the study. The study would result in a range of possible structural and non-structural alternatives to address flood risks. However, the Corps does provide the five following general categories/plans, with associated measures, as part of the Corps site screening process.

1) Levee - Levees/Floodwalls
2) Storage - New storage or modifications to existing storage
3) Other Structural Alternatives - Bridge Modifications, Channel Improvements, Diversions, Dam Modifications, or Below grade cut-off walls
4) Non-structural Alternatives - Physical Measures or Non-physical Measures
5) Nature-based Alternatives- Restore hydrology on open lands or Integration with other measures

Based on the potential alternatives that are currently being screened by the Corps, there is the possibility that habitat used by fish and wildlife resources could be impacted (i.e., habitat could be lost) by the incorporation of certain alternatives. The nature of the impacts on habitat cannot be determined until site specific alternatives have been chosen from the site screening process.
Evaluation and Comparisons of Alternatives

Value of Individual Alternatives

The Corps has not yet finalized the alternatives for the study. We will instead evaluate the potential benefits or impacts of the five general flood risk management categories that are being considered by the Corps.

1) *Levee.* Construction of levees/floodwalls can adversely impact fish and wildlife resources in areas where there are existing natural areas/open space. Impacts could range from the loss of habitat (from flooding and increased water depths) to degradation of habitat (due to poor water quality from contaminants and sedimentation). Benefits from levee construction could result from the acquisition of land prone to flooding that was in private ownership, but is now being converted to public open space. Most fish and wildlife resources could benefit from newly acquired open space when the open space is not flooded and wildlife can naturally utilize the area.

2) *Storage.* Construction of new storage areas can adversely impact fish and wildlife resources in areas where there are existing natural areas/open space. Impacts would primarily occur from the loss of habitat. Modifications to existing storage areas would likely have negligible impacts to fish and wildlife resources unless the storage area is increased in size, which would result in the loss of habitat, or unless modifications are made that would result in poor water quality. Benefits that would result from the construction of new storage areas would likely be limited to fish and resources that can survive in a lacustrine environment.

3) *Other Structural Alternatives.* Construction or modification of the other structural alternatives being considered can result in a range of impacts to fish and wildlife resources and their habitats. For example, bridge construction, modifications, or bridge alternatives (i.e., culverts) could cause flow constrictions at the bridge/culvert which can impact the hydrology of both upstream and downstream wetlands. Channel improvements could result in hydrologic impacts and habitat loss due to the straightening of creeks within the watershed. Dam modifications would continue to keep the existing dams in place which has been documented to fragment habitat, degrade habitat, and limit fish recruitment within the watershed. Benefits in this category could include bridges/culverts that are properly constructed and maintained to eliminate flow constrictions, channel improvements that would not result in hydrologic impacts or the loss of habitat, and fish passage for dams that cannot be removed.

4) *Non-structural Alternatives.* Construction or the incorporation of non-structural alternatives also can adversely impact fish and wildlife resources in areas where these features replace existing natural areas/open space. Benefits to fish and wildlife resources could result from the construction or incorporation of non-structural alternatives. For example, the Corps could incorporate non-traditional flood control alternatives, such as infiltration best management practices (BMPs), in buyout areas that are in high risk/flood prone areas. Incorporation of infiltration BMPs could help offset increased stormwater runoff from development in the watershed.
Early in the process, the Corps identified that: The non-Federal sponsors for the project, DuPage and Will Counties, should explore options to minimize development in high risk flood areas. During the charrette, the Corps identified that flooding in the watershed is due to: 1) landuse changes (resulting in increased imperviousness due to development), 2) population increases (resulting in increased development), and 3) climate change (i.e., increases in average precipitation and “heavy” precipitation). This assessment is supported by numerous studies (Schuler 1987; Wright et al. 2006) that have shown that construction of developments and roads, with the associated high amounts of impervious cover, results in onsite and offsite hydrologic changes to wetlands including: increases in stormwater runoff volumes, decreased groundwater recharge, and flow constrictions. Wetlands within the watershed provide habitat for numerous fish and wildlife resources. The results of the increased volume of runoff include increased ponding and water level fluctuations (“bounce”) in wetlands located downstream. Increased ponding and water level fluctuations reduce biodiversity and favor the spread of invasive plant and animal species (Wright et al. 2006). Urban runoff associated with developments often contains contaminants (such as oil and grease, sediments, metals, nutrients, and chlorides) which also reduce biodiversity and favor the spread of invasive plant and animal species (Wright et al. 2006).

5) Nature-based Alternatives. Restoring the hydrology on open lands, including wetlands, would result in overall benefits to fish and wildlife resources. This alternative would increase the amount of fish and wildlife habitat within the watershed.

Mitigation
Mitigation and mitigation area ratios for federal projects affecting water resources are based on direct and indirect impacts to the water resources (Table 1). Until the proposed alternatives are identified we cannot determine if the proposed alternatives may serve as mitigation for prior alterations within the watershed or if additional mitigation is needed.

TABLE 1. Criteria for resource category classifications and mitigation goals established by the United States Fish and Wildlife Service’s Mitigation Policy (501 FW 2).

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
<th>Mitigation Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource Category 1*</td>
<td>Habitat to be impacted is of high value for evaluation species and is unique and irreplaceable on a national basis or in the ecoregion section.</td>
<td>No loss of existing habitat value.</td>
</tr>
<tr>
<td>Resource Category 2</td>
<td>Habitat to be impacted is of high quality for evaluation species and is relatively scarce or becoming scarce on a national basis or in the ecoregion section.</td>
<td>No net loss of in-kind habitat value.</td>
</tr>
<tr>
<td>Resource Category 3</td>
<td>Habitat to be impacted is of high to medium value for evaluation species.</td>
<td>No net loss of habitat value while minimizing loss of habitat value.</td>
</tr>
<tr>
<td>Resource Category 4</td>
<td>Habitat to be impacted is of medium to low value for evaluation species.</td>
<td>Minimize loss of habitat value.</td>
</tr>
</tbody>
</table>

*This classification requires concurrence from USFWS Regional Director.
The study area currently includes habitat that we classify as Resource Category 2, Resource Category 3, and Resource Category 4 status. Due to the range of Resource Categories, there is a range of Service recommended mitigation goals (i.e., no net loss of in-kind habitat value, no net loss of habitat value while minimizing loss of habitat value and to minimize loss of habitat values).

**Recommendations**

1) We recommend that the Corps develop a National Environmental Policy Act document that provides an array of alternatives that follows the Service’s Mitigation Policy (e.g., avoids, minimizes, and mitigates for impacts to fish and wildlife resources within the watershed).

2) We recommend that priority be placed on buyout alternatives, where infiltration BMPs can be incorporated, to offset the increased runoff from imperviousness (due to development) in the watershed. Secondary emphasis should be placed on nature-based alternatives that restore hydrology on open lands (e.g., wetland restoration that could serve to offset flooding and serve as habitat for fish and wildlife resources).

3) If nature-based alternatives are used, the Corps or local sponsors should incorporate monitoring plans. These monitoring activities would help to determine use of the study site by migratory birds and fish species before and after an alternative is implemented in order to determine if the project is successful. The monitoring activities should also determine extent of use by, and or project effects on fish and wildlife resources for a period of seven years after project completion. Results of the monitoring should be shared with this office on an annual basis.

4) The Corps should work with the local sponsors to incorporate policy in their landuse planning to ensure that the post-development infiltration volumes are equal to or as close to the pre-development infiltration volumes as possible (e.g., that the post-development infiltration volume be at least 90% of the pre-development infiltration volume). We recommend that no exceptions be allowed to this policy to ensure that new development (i.e., residential, commercial, or industrial) does not contribute to the existing flooding problems within the watershed.

**Summary of Findings and U.S. Fish and Wildlife Service Position**

The U.S. Fish and Wildlife Service cannot provide recommendations on any proposed alternatives until the alternatives have been identified. We recommend that the Corps choose an array of alternatives and identify the potential benefits and impacts to fish and wildlife resources. We recommend that non-structural alternatives, such as infiltration BMPs in buyout areas, be prioritized in the alternative selection process.

Based on the information provided by the Corps, there is the possibility that Federally listed species could be affected by alternatives chosen within the watershed. Information about Federally listed species can be found on the Service’s Region 3 Section 7 webpage,
and can assist the Corps in determining if the proposed alternatives could impact listed species in the watershed. The Corps should ensure that effect determinations are made for the species listed in DuPage County.


If you have any questions, please contact Mr. Shawn Cirton at (312) 216-4728.

Sincerely,

Louise Clemency
Field Supervisor

cc: USEPA, Liz Pelloso
IDNR, Nathan Grider
FPDWC, Dave Robson
FPDWC, Scott Miester
Literature Cited


February 25, 2019

Col. Aaron W. Reisinger
District Engineer
U.S. Army Corps of Engineers
Chicago District
231 S. LaSalle Street, Suite 1500
Chicago, Illinois 60604

Attention: Imad Samara


Dear Colonel Reisinger:

This letter constitutes our Fish and Wildlife Coordination Act Report for the DuPage River Integrated Feasibility Report and Environmental Assessment (EA). It has been prepared under the authority of and in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat.401, as amended; 16 U.S.C. 661 et seq.); the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 703 et seq.); and in accordance with the U.S. Fish and Wildlife Service's Mitigation Policy. This report, when final, will constitute the report of the Secretary of Interior as required by Section 2(b) of the Fish and Wildlife Coordination Act (FWCA).

The DuPage River Feasibility Study was conducted under the Congressional Authority known as the Chicago – South End of Lake Michigan (C-SELM) Urban Water Damage Study Authority. This authority is contained in section 206 of the 1958 Flood Control Act (PL-85-500). The Feasibility Study was completed to investigate overbank and backwater flooding along the DuPage River and its major tributaries, to prioritize high-risk areas, and to develop a range of possible structural and nonstructural alternatives to address flood risks. Descriptions of the project area and plan components are posted by the U.S. Army Corps of Engineers (Corps) at the following URL: https://www.lrc.usace.army.mil/Missions/Civil-Works-Projects/DuPage-River/

The Chicago Field Office of the U.S. Fish and Wildlife Service (USFWS) has been involved in early project planning since attending the Corps’ planning charrette on November 9 and 10,
We have consistently recommended that infiltration best management practices (BMPs) be incorporated in the preferred plan. The draft feasibility report provided a recommended plan to address flood risk on the DuPage River and its tributaries in DuPage County and Will County, in Illinois. The draft report indicated that the District’s Tentatively Selected Plan (TSP) included the repair and elevation of the Lisle Levee in DuPage County, as well as the implementation of nonstructural risk reduction measures at approximately 42 individual structures within the watershed. The nonstructural components of the plan provide flood risk reduction through proposed modifications of 42 structures including likely acquisition of 4 structures, elevation of 23 structures, and floodproofing of 15 structures. The draft report stated that the features of the nonstructural plan would be further detailed and evaluated following the public comment period and the number of structures and potentially recommended nonstructural features would likely change prior to the finalization of the selected plan. Our past comments recommended that green infrastructure practices (e.g., infiltration BMPs) and low impact development practices be incorporated into the preferred plan to help alleviate flooding and benefit listed species such as the Hine’s emerald dragonfly. We recommended that the array of nonstructural features be broadened, that the broadened array of nonstructural features include large scale infiltration BMPs, that the broadened array of nonstructural features be placed throughout the watershed (i.e., not just areas that have experienced flooding), and that these infiltration BMPs be incorporated prior to the finalization of the selected plan.

Based on recent email correspondence from your office, we understand that the final Feasibility Report is being updated based on public and agency comments and is scheduled to be complete in April 2019. In emailed correspondence your staff have indicated that they do not anticipate significant changes in the final plan. Possible changes include additional levee tie-back areas, and determining which non-structural option will be used for each location. As noted above, we encourage the use of infiltration BMPs in strategic areas, where flooding has occurred and also in areas where flooding has not occurred.

To our knowledge, coordination with the Illinois Department of Natural Resources has not yet occurred, and so this report does not represent the report of the State on this project. State of Illinois threatened and endangered species may occur in the project area.

FISH AND WILDLIFE RESOURCES AND RECOMMENDATIONS

We continue to provide the following recommendations:

1) Exact locations of nonstructural measures from the Tentatively Selected Plan (TSP) should be identified in the final report and EA. The final report and EA should consider adverse impacts to listed species from the proposed nonstructural measures. For example, nonstructural measures such as evacuations (buyouts), elevations, and floodproofing could adversely impact the endangered rusty patched bumble bee (Bombus affinis) if suitable habitat and nectar resources are present and impacted by project activities. Based on Figure 3-25 “Location of nonstructural plans” in the Draft Feasibility Report, at least one nonstructural measure (an EBNS2 measure)
occurs within a High Potential Zone for the endangered bumble bee. Details were not provided about the nonstructural measure; therefore, we are not certain whether acquisition, elevation, or floodproofing of structures are proposed for EBNS2. If earthmoving, the placement of fill, or other construction activities are proposed for this measure, these activities could impact rusty patched bumble bee habitat (e.g., nectar resources or nesting areas). Conservation measures such as the planting of impacted nectar resources could be used to offset potential impacts to suitable habitat for the species. The document should evaluate the potential impacts to the endangered rusty patched bumble bee (Bombus affinis) which is found in several locations in the DuPage watershed. Additional information about High Potential Zones and locations of the rusty patched bumble bee can be found at:
https://www.fws.gov/midwest/endangered/insects/rpbb/rpbbmap.html

2) The Corps should maximize planning to incorporate infiltration BMPs in the recharge areas for the Hine’s emerald dragonfly. Parts of the DuPage River watershed (in southeastern DuPage and Will Counties) overlay recharge areas and recharge area buffers for designated critical habitat units for the endangered Hine’s emerald dragonfly (Somatochlora hineana). Recharge areas are areas in which infiltrating precipitation has the greatest potential for supplying water to each critical habitat unit. Recharge area buffers are the widest estimated areas delineated that may influence the recharge areas for the critical habitat units. Critical habitat units in Illinois can be found at:

Infiltration BMPs in the parts of the DuPage River watershed that overlay recharge areas and recharge area buffers would provide benefits not just in flood reduction but also in aquifer protection. Further, increased infiltration BMPs throughout the watershed would benefit aquifers that may provide drinking water for communities that may otherwise seek to divert groundwater from recharge areas that supply water to Hine’s emerald dragonfly habitat. The endangered Hine’s emerald dragonfly requires spring-fed seeps and rivulets for reproduction, and the continued presence of this habitat is dependent upon aquifer protection. Lockport Prairie Nature Preserve (critical habitat unit 1 of seven in Illinois) is the most productive site for the HED, providing 54-56% of the reproduction in Illinois. The River South parcel is critical habitat unit 2 and is the second most productive site for the HED, providing 30-35% of the reproduction in Illinois. Incorporating infiltration BMPs into the recharge areas and recharge area buffers for these critical habitat units could benefit the first and the second most productive breeding sites for the Hine’s emerald dragonfly in Illinois. The final report and EA should consider potential impacts, including beneficial effects, to the Hine’s emerald dragonfly.

3) The Corps should develop a final report and EA that provides an array of alternatives that follow the Service’s Mitigation Policy (e.g., avoids, minimizes, and mitigates for impacts to fish and wildlife resources within the watershed).

4) The Corps should prioritize buyout alternatives where infiltration BMPs can be incorporated to offset the increased runoff from imperviousness (due to development) in the watershed. Secondary emphasis should be placed on nature-based alternatives that restore hydrology on open lands (e.g., wetland restoration that could serve to offset flooding and serve as habitat for fish and wildlife resources).
5) The Corps should work with the local sponsors to incorporate policy in their landuse planning to ensure that the post-development infiltration volumes are equal to or as close to the pre-development infiltration volumes as possible (e.g., that the post-development infiltration volume be at least 90% of the pre-development infiltration volume). We recommend that no exceptions be allowed to this policy to ensure that new development (i.e., residential, commercial, or industrial) does not contribute to the existing flooding problems within the watershed.

SUMMARY OF FINDINGS

The District has eliminated structural alternatives (such as the Lacey Creek Restriction) that could have adversely affected existing natural areas/open space (e.g., forest preserve district land). Elimination of structural alternatives in areas where there are existing natural areas preserves habitat for Service trust resources.

Green infrastructure practices (e.g., infiltration BMPs) and low impact development practices should be incorporated into the preferred plan to help alleviate flooding and benefit listed species (e.g., in recharge areas for the Hine’s emerald dragonfly). We continue to recommend that the proposed nonstructural features be expanded to include a broader array of BMPs, including large scale infiltration BMPs. Siting of BMPs should also be expanded to include areas not currently prone to flooding but within the watershed. The project components carried over by the District for the preferred plan are currently limited to only areas that have been flooded in the past. The District should also consider areas that are proposed to be developed, both for buyout or to incorporate green infrastructure practices. This recommendation is in line with numerous studies and literature that have shown that high amounts of impervious cover have adverse impacts on the downstream landscape. Actions should be prioritized to avoid areas where infiltration is already occurring and minimize development in areas where development is expected to occur (by identifying the best locations on site to promote infiltration). These approaches should be feasible because landuse plans are available showing where development is proposed in the watershed. The local sponsors, the DuPage County Stormwater Management Planning Committee and the Will County Executive Office, should be fully involved in this planning. Additionally, the counties have information about sites that currently provide infiltration. Incorporation of the recommendations that we have provided would be a benefit to not only Service trust resources, but to the human environment as well.

For the purposes of this study, green infrastructure and low impact development practices were also considered as potential nature-based features. The draft report notes that, “Green infrastructure reduces or offsets the impacts of development on runoff volumes by planning sites and stormwater infrastructure to capture runoff at or close to its source. These measures seek to maximize infiltration through measures such as bioswales or rain gardens with plants that promote infiltration, or minimizing impervious surfaces through measures such as installation of permeable pavement or green roofs. Low impact development is an application of green infrastructure concepts through the application of practices that use or mimic natural processes that result in the infiltration, evapotranspiration or use of stormwater.” However, the draft report notes that, “While widespread implementation of green infrastructure or low impact development practices can result in some reduction of river flow volumes and peak flow rates, since the
identified flood damage areas are so disperse, retaining water in the headwater wetlands and constructed green infrastructure areas was not identified as being economically justified based on USACE (Corps) criteria” and therefore, these practices were not retained as part of the TSP. The issue of flooding is a long standing issue that continues to be problematic in our area and across the country. It is a reoccurring and critical issue that needs to be addressed in District’s program. The District should consider making changes to its economic analysis framework to account for all costs (e.g., indirect and long-term costs) so that nonstructural alternatives such as infiltration BMPs score better and are incorporated into project plans.

Thank you for the opportunity to provide comments. This letter provides comment under the authority of, and in accordance with, the provisions of the National Environmental Policy Act of 1969 (83 Stat. 852, as amended P.L. 91-190, 42 U.S.C. 4321 et seq.), the Fish and Wildlife Coordination Act of 1956 (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.). If you have any questions, please contact Mr. Shawn Cirton at (312) 216-4728.

Sincerely,

Louise Clemency
Field Supervisor

Cc: USACOE, Nicholas Barkowski
USEPA, Elizabeth Pelloso
IDNR, Nathan Grider
FPDWC, Dave Robson
FPDDC, Scott Miester
Planning Branch  
Environmental Formulation and Analysis Section

Louise Clemency  
Field Supervisor  
U.S. Fish and Wildlife Service  
230 South Dearborn Street, Suite 2938  
Chicago, IL 60604

Dear Mrs. Clemency,

The U.S. Army Corps of Engineers has received and reviewed your comments from the public review period for the DuPage River Flood Risk Management Feasibility Report and Integrated Environmental Assessment. Thank you very much for your time during this review and for the well thought out comments. Members of the Product Delivery Team for the project have provided the below responses to the comments and recommendations listed in your letter.

*The final report and EA should consider adverse impacts to listed species from the proposed nonstructural measures. For example, the document should evaluate the potential impacts to the endangered rusty patched bumble bee (Bombus affinis) which is found in several locations in the DuPage watershed.*

The locations of the nonstructural measures were compared against the shapefiles of high and low potential zones located here:  
https://www.fws.gov/midwest/endangered/insects/rpbb/rpbbmap.html. All of the nonstructural locations fall within the low potential zone of the Rusty Patched Bumble Bee. These zones are listed as potential dispersal zones for the species and are unlikely to be present. However, we will continue to work with USFWS during detailed design to ensure all potential impacts are fully documented.

*The final report and EA should consider potential impacts, including beneficial effects, to the Hine’s emerald drongonfly.*

Upon a review of: https://www.fws.gov/midwest/endangered/insects/hed/index.html it does not appear that the proposed projects will either beneficially or adversely affected the Hine’s Emerald Dragonfly. The final EA will confirm this determination.

*We recommend that the Corps develop a National Environmental Policy Act document that provides an array of alternatives that follows the Service’s Mitigation Policy (e.g., avoids, minimizes, and mitigates for impacts to fish and wildlife resources within the watershed).*

Concur. It is USACE Policy to avoid impacts to significant natural resources. If impacts cannot be avoided, USACE policy directs that we identify opportunities to minimize impacts. If impacts to resources cannot be minimized, then USACE identifies appropriate mitigation. The current recommended plan includes a small impact to existing wetlands on Lacey Creek, as well as in-kind mitigation within the watershed of 0.6 acres. The integrated NEPA document also identifies project compliance with Section 7.
We recommend that priority be placed on buyout alternatives, where infiltration BMPs can be incorporated, to offset the increased runoff from imperviousness (due to development) in the watershed. Secondary emphasis should be placed on nature-based alternatives that restore hydrology on open lands (e.g., wetland restoration that could serve to offset flooding and serve as habitat for fish and wildlife resources).

Justification for USACE involvement in flood risk management projects such as this, depend on cost-benefit analyses to justify projects. Typical flood risk measures can facilitate some natural features, where affordable, but the predominant features are optimized to reduce flood and life-safety risk. USACE understands the importance of infiltration, especially in areas of increased urbanization. BMP such as infiltration trenches/porous pavements, etc. are best implemented at a local level, as they are most effective for local drainage issues and require regular maintenance to maintain functionality. Stormwater agencies and other public entities are best suited for this type of effort.

A total of 6 structures are listed within the recommended plan for buy-outs. USACE does plan to utilize nature-based features such as native plants which may promote infiltration and improve local fish and wildlife resources where possible and affordable to enhance the project features.

*If nature based alternatives are used, the Corps or local sponsors should incorporate monitoring plans. These monitoring activities would help to determine use of the study site by migratory birds and fish species before and after an alternative is implemented in order to determine if the project is successful. The monitoring activities should also determine extent of use by, and or project effects on fish and wildlife resources for a period of seven years after project completion. Results of the monitoring should be shared with this office on an annual basis.*

USACE understands the importance of monitoring plans to determine the usage of habitats by various organisms. For the objective of this project, the focus is primarily on minimizing impacts from flood waters and ecosystem monitoring is not typically included for flood risk management projects. Any nature based features, including the 0.4 acres of wetland mitigation will be installed and establishment verified. Monitoring and adaptive management will be appropriate to the scale of the habitat. Long term maintenance is the responsibility of the non-federal sponsor, who will be provided an O&M manual for all elements of the project.

*The Corps should work with the local sponsors to incorporate policy in their landuse planning to ensure that the post-development infiltration volumes are equal to or as close to the pre-development infiltration volumes as possible (e.g., that the post-development infiltration volume be at least 90% of the pre-development infiltration volume). We recommend that no exceptions be allowed to this policy to ensure that new development (i.e., residential, commercial, or industrial) does not contribute to the existing flooding problems within the watershed.*

USACE does not have authority to regulate and change policy in terms of land use and development planning at the local level. Each county participating in the study maintains and manages their own regulations and processes in terms of development and both counties administer stormwater ordinances which restrict additional runoff due to development. Discussion about the importance of floodplain management and stormwater ordinances is included in the updated detailed project report.
The District should also consider areas that are proposed to be developed to buyout or incorporate green infrastructure practices. These actions would avoid suitable areas where infiltration is already occurring or minimize development in areas where development is expected to occur (by identifying the best locations on site to promote infiltration). These approaches should be feasible because land use plans are available showing where development is proposed in the watershed. Additionally, the counties have information about sites that currently provide infiltration.

USACE has no jurisdiction over changes to local and county ordinances related to development or the inclusion of green infrastructure. However, please note that both DuPage and Will County have stormwater ordinances. For this study, sites were investigated for potential storage options that would have allowed some infiltration capacity. Through our detailed analysis, it was determined that storage options were not feasible based on cost-benefit ratios. As a result, those projects could not be recommended.

For the non-structural plan, those locations where a structure will be removed, the vacant lot would be seeded with native prairie plants, which may assist with infiltration on a small, localized scale. Maintenance of those new greenspaces will be the responsibility of the non-federal sponsor.

We strongly suggest that the recommended nonstructural features be expanded and incorporated prior to the finalization of the selected plan. Large scale infiltration BMPs should be a part of the selected plan. This should include green infrastructure and low impact development practices that should be incorporated in strategic areas where flooding has occurred and in areas where flooding has not occurred, but where infiltration BMPs could help alleviate flooding throughout the watershed.

USACE understands the importance of Best Management Practices for stormwater, especially in areas of increased urbanization. BMP such as infiltration trenches/porous pavements, etc. are best implemented at a local level, as they are most effective for local drainage issues and require regular maintenance to maintain functionality. Stormwater agencies and other public entities are best suited for this type of effort. USACE encourages the USFWS to work directly with local counties to further promote these

Once again, thank you very much for your review of the DuPage River, Illinois Feasibility Report and Integrated Environmental Assessment. If you have any questions please feel free to contact me at 312-846-5580 or via email at susanne.j.davis@usace.army.mil.

Sincerely,

Susanne J. Davis, (P. E)
Chief, Planning Branch

Dear Ms. Davis:

The U.S. Environmental Protection Agency has reviewed the above-mentioned feasibility report with integrated environmental assessment (hereafter, Draft EA) dated July 2018 regarding the proposed project. This letter provides EPA’s comments on the Draft EA, pursuant to our authorities under the National Environmental Policy Act (NEPA), the Council on Environmental Quality’s NEPA Implementing Regulations (40 CFR 1500-1508), and Section 309 of the Clean Air Act.

The Draft EA presents the results of the DuPage River, Illinois Feasibility Study conducted by the United States Army Corps of Engineers (USACE) in partnership with the DuPage County, Illinois Stormwater Management Planning Committee and the Will County, Illinois Executive Office, in coordination with the Illinois Department of Natural Resources. Identified measures, alternative plans, and evaluation criteria were also coordinated with U.S. Fish and Wildlife Service, Forest Preserve District of DuPage County, and Will County Forest Preserve District to ensure potential impacts to significant natural resources in the watershed were considered in the plan formulation process.

The study area is the DuPage River, including the East and West Branches, and its major tributaries, within DuPage County. The DuPage River is the largest tributary to the Des Plaines River. The East Branch DuPage River and the West Branch DuPage River flow primarily through DuPage County before flowing into the main stem of the DuPage River in Will County. The study was completed to investigate overbank and backwater flooding along the DuPage River and its major tributaries, prioritizing high-risk areas, and developing a range of possible structural and nonstructural alternatives to address flood risks. The study area has experienced rapid development during the past several decades and currently includes approximately 900,000 residents in 40 communities. The population and associated land use conditions impact the amount of rainfall-runoff and the population at risk, increasing the likelihood and severity of overbank flooding in the watershed.
Major storm events resulting in overbank flooding in the basin occurred in 1996, 2008, 2010, and most recently in April 2013. The April 2013 flood impacted at least 20 communities and caused significant damage to residential and non-residential structures and critical infrastructure. Overbank flooding resulted in the closure of a major interstate highway (I-55) in multiple locations as well as the closure of multiple U.S., State, and County highways. An assessment of existing and projected future without project conditions determined that a significant risk of overbank flooding exists across most of the watershed. Expected annualized flood damages are estimated at $5,102,000 over the 50-year period of analysis for this study.

The feasibility study evaluated a range of measures to address overbank and backwater flooding along the DuPage River and its major tributaries. Structural measures aimed to reduce the risk of flooding by altering the frequency, stage and duration of floodwaters (e.g., levees or floodwalls, floodwater storage reservoirs, channel improvements, and diversions) were evaluated. The optimization or rehabilitation of existing structures was also evaluated. Physical nonstructural measures such as acquisitioning, floodproofing, and elevation of structures were evaluated individually to determine whether they were economically justified. For measures in both categories, the Project Delivery Team (PDT) further evaluated opportunities to incorporate nature-based features and recreation features\(^1\) to optimize the function and utility of the proposed project.

Locations of potential flood risk management measures were identified across the watershed using two strategies:

- identifying damage areas where measures such as levees or channel improvements could be implemented; and
- identifying opportunities to modify existing areas where measures such as storage or diversions could be implemented.

A total of nine action alternatives were considered, as well as the No Action alternative. Action alternatives consisted of a variety of storage, levee and nonstructural features throughout the DuPage River Watershed. Through an economic cost-benefit analysis, several alternatives were screened and a tentative plan was selected.

The proposed structural component included in the Tentatively Selected Plan (TSP) provides flood risk reduction on the East Branch primarily within the Village of Lisle by improving and elevating the Lisle Levee. The existing Lisle Levee (Lisle Levee) was originally constructed in 1961, with the levee crest elevation at the approximate level of the 50-year flood event. Deterioration of the Lisle Levee has occurred over time, lowering the crest elevation in some areas and eroding the side slopes and levee toe. Based on the current condition and height of the Lisle Levee, it has been identified as at risk of overtopping or failure. Therefore, the TSP proposes repair of the Lisle Levee to USACE levee standards by removal of large woody debris, regrading of side slopes, repair of eroded areas, and riverside toe armoring. The TSP also proposes elevating the Lisle Levee to approximately 2 feet above the currently-identified

\(^1\) Nature-based features include native plantings in project vegetation designs, pairing ecosystem restoration with vacated floodplain properties, and setting back levees or floodwalls to allow for continued natural and beneficial floodplain functions. Recreation features include trails, picnic areas, or other facilities compatible with the flood risk management project purpose.
1% annual chance event (ACE) flood elevation. The project would provide flood risk reduction to approximately 175 structures located in the area protected by the Lisle Levee.

The proposed nonstructural components of the TSP provide flood risk reduction through acquisition, elevation, or floodproofing structures. Nonstructural features are included within the communities of Minooka, Shorewood, Joliet, Plainfield, Bolingbrook, Naperville, Warrenville, Lisle, and Glen Ellyn, as well as within unincorporated DuPage and Will Counties. The nonstructural proposal includes modifications of 42 structures including likely acquisition of 4 structures, elevation of 23 structures, and floodproofing of 15 structures.

Pursuant to a review of the Draft EA and appendices, EPA offers the following comments.

**STRUCTURAL MEASURES: LEVEES/ FLOODWALLS**
Section 3.8.3.2 of the Draft EA states: “Basic design assumptions were made for each levee location which was retained after the preliminary screening process. Approximate alignment was based on review of available topographic data, aerial photography and structure location data. Assessment of likely structure type (levee or floodwall) was based on the review of aerial photography. The levee height was approximated based on the 1% ACE flood profile available from FEMA. Both length and height assumptions were initially based on rough estimates to support a screening level analysis.”

Additionally, Table 3-3, Summary of Damage Reaches, included in Section 3.6.1, Damage Reach Summary, displays the number of impacted structures (1,585 clustered structures) that were shown in the preliminary model as damaged by flood events up to and including the 0.2% ACE (500-year flood).

**Recommendations:** The Draft EA is unclear as to why the TSP recommends levee repair to approximately 2 feet above the currently-identified 1% ACE flood elevation when Table 3-3 uses the 0.2 ACE flood elevation (500-year event) to model the number of impacted structures. EPA recommends the Final EA should:

a) indicate why the 1% ACE was selected to determine the proposed levee height versus the 0.2% ACE;

b) indicate whether the TSP is sufficiently protective given weather and precipitation trends in the upper Midwest during the past approximately 15-20 years (Section 1.2, Inventory of Historic Flooding);

c) describe how the residual risk factor\(^2\) was explained to residents and/or commercial property owners protected by the Lisle Levee;

d) indicate what percentage of structures impacted in the 2013 flood event would be protected by the TSP if implemented? What percentage of structures impacted in the 2013 precipitation event would remain without adequate risk reduction if the TSP is implemented?

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\(^2\) The EA indicates the proposed project would provide flood risk reduction to approximately 175 structures located in the Lisle Levee area.
NON-PHYSICAL NONSTRUCTURAL MEASURES: FLOOD PREPAREDNESS

Section 3.8.2.5, Non-physical Nonstructural Measures of the Draft EA states: “Both counties have prepared and regularly update county-wide hazards mitigation plans which analyze risks associated with flooding along with other potential hazards. The plans also identify actions such as flood hazard mapping, stormwater management planning, expanding and improving flood warning systems, and preserving open space and wetlands. In general, each County maintains preparedness for disasters including flooding. However, flood hazard mapping is a significant concern in Will County. Revised Preliminary floodplain maps for DuPage County were issued by FEMA in June of 2017, and are expected to become effective in early 2019. These maps are based on updated hydrology through 2008 for both the East Branch and West Branch DuPage River Watersheds. Hydraulic models in both of these watersheds were completed in 2013. Comprehensive updates to the hydrology and hydraulic modeling of the Mainstem DuPage River and the Lily Cache Creek in Will County has not been completed since the 1970s. Updated modeling prepared for this study can improve the understanding of flood risks in the Will County portion of the watershed and support ongoing preparedness planning.”

Recommendations: The Draft EA does not address whether flood hazard mapping in Will County is scheduled for revision. As stated above, because updated modelling can improve the understanding of flood risk and support ongoing preparedness planning in the Will County portion of the watershed and support ongoing preparedness planning, how is the TSP affected by the lack of current information for Will County? What constraints curtail Will County from updating the hydraulic and hydrology modeling (e.g., funding constraints that can be addressed by USACE, other federal or state agency, etc.)? EPA recommends the Final EA address these two issues.

CONSTRAINTS

One of the constraints identified in the Draft EA is the avoidance of inducing adverse hydraulic impacts relative to existing conditions. According to the Draft EA, “Most of the ground water is at or near the water table, which is controlled by the DuPage River. The proposed project will not disrupt groundwater recharge, discharge, or gradients. Therefore, Lisle Levee and nonstructural projects will have no direct or indirect adverse effect on groundwater volume or quality in the project area.” However, this the Draft EA does not indicate whether adverse hydraulic impacts of the proposed project, if any, will affect downstream communities.

Recommendations: The Draft EA should address hydraulic impacts resulting from proposed activities, if any, in relation to downstream communities, and discuss how coordination of floodway permits (if required) have addressed or mitigated the potential for adverse hydraulic impacts due to implementation of the TSP.

STRUCTURAL MEASURES – DIVERSIONS AND SUBSURFACE CUTOFF WALLS

Figure 3-10 and Section 3.8.2.4, Other Structural Measures, indicate that two categories of structural measures were identified for further investigation as part of the plan formulation: diversions and subsurface cutoff walls. The Draft EA and appendices are unclear on whether these structural measures will be considered as a future project.
**Recommendations:** The Final EA should clearly indicate when a conclusion concerning these structural measures (Winfield, Lily Cache Creek, and Bolingbrook Quarry Diversions; subsurface cutoff walls) be made. Additional considerations include: how these structural measures might dovetail or impact proposed structural measures; and how construction of these measures might impact other features (e.g., Lily Cache Creek).

**AIR QUALITY**

EPA acknowledges the air quality impacts analysis in the Draft EA. However, in an effort to reduce air impacts to the greatest extent feasible, we have enclosed a copy of EPA’s Construction Emission Control Checklist.

**Recommendations:** The Final EA should commit to employing all applicable construction emission reduction measures.

**TRANSPORTATION**

EPA recommends USACE consider developing a construction traffic management plan to ensure that trucks hauling materials and heavy machinery avoid areas with sensitive receptors to the greatest extent possible. For example, truck routes should avoid schools, day care facilities, and parks when possible, and crossing guards should be used when such areas cannot be avoided.

**NON-PHYSICAL NONSTRUCTURAL MEASURES – NATURE-BASED FEATURES**

The Draft EA states the following: “Nonstructural measures, unlike structural measures, modify the potential damages from flooding rather than modifying flood stages or durations. Although USACE may not implement plans that benefit individual homes or businesses, implementation of a nonstructural plan benefitting multiple owners collectively can be the best way to manage flood risk in a community. … Removal of structures would result in the addition of green space, with the potential for restoration in the future. … Buyouts and conversion to open space, if feasible, may provide positive impacts to surface water as it will allow increase absorption and lower the amount of impervious surfaces, improving water quality. … Lisle Levee Project, if implemented, could be planted with native grasses and plants that can withstand mowing and the necessary maintenance required to keep the levee in compliance with regulations. Native grasses and plants provide important habitat for local insect and other organisms that rely on this habitat for feeding and refuge. In addition, native grasses and plants provide higher aesthetic value.”

**Recommendations:** EPA strongly recommends USACE commit to the following in the Final EA and forthcoming decision document, if an action alternative is selected:

- using native vegetation on the Lisle Levee; and
- partnering with non-federal sponsors and local non-governmental organizations to restore/maintain native vegetation on evacuated properties.

Using native vegetation in evacuated properties, as well as the Lisle Levee, would provide the greatest degree of flood damage reduction to the project area. Additionally, restoration and
maintenance of native vegetation on the Lisle Levee and on evacuated properties in the project area would also serve to fulfill USACE’s Environmental Operating Principles.\(^3\)

**NON-NATIVE INVASIVE SPECIES CONTROL**

The Draft EA indicates many of the wetlands and river banks in the project area are infested with non-native, invasive species (NNIS), resulting in lower quality habitat. The Draft EA does not address NNIS control.

**Recommendations:** The Final EA should address whether any NNIS removal or control will be included in project activities. EPA strongly recommends USACE include NNIS removal or control of known NNIS populations in the list of proposed project activities for the TSP. Committing to cleaning equipment before it moves across the project area would help to reduce the possibility of moving aquatic or terrestrial NNIS seeds/plants within the project area.

**NONSTRUCTURAL MEASURES**

The Draft EA indicates that implementation of nonstructural measures would result in the modification or removal of existing structures. However, the Draft EA does not address material disposal. Safe debris management is an essential component of the proposed project. It is important that debris be properly managed in order to protect human health, comply with regulations, conserve disposal capacity, and minimize or prevent environmental impacts.

**Recommendations:** We recommend USACE refer to EPA’s debris management tool at https://www.epa.gov/large-scale-residential-demolition/disaster-debris-recovery-tool. EPA also encourages the use of this bid specification tool for any of the structures that will be completely removed: https://www.epa.gov/sites/production/files/2013-09/documents/road-to-reuse-residential-demolition-bid-specification-201309.pdf. We encourage USACE to commit to incorporating the above tools into project specifications for the TSP.

**LEVEE/ FLOODPLAIN**

Activities to occur at the Lisle Levee include tree removal due to the establishment of some trees through time which have diminished the integrity of the levee. A total of 5.39 acres of altered habitat will be impacted. Acknowledging the need to ensure structural integrity of the levee, the Draft EA does not address tree disposal.

**Recommendations:** The Draft EA should address whether trees will be mulched for residents to use or whether small branches can be used by residents to create brush habitat for small mammals and birds. EPA strongly recommends vegetation is not disposed of by burning, due to increased negative air impacts.

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\(^3\) The Environmental Operating Principles (EOPs) were developed to ensure USACE missions include totally integrated sustainable environmental practices. See Section 5.2.5 for additional information concerning EOPs.
The Draft EA indicates that animal burrows will be filled to maintain levee integrity.

**Recommendations:** The Draft EA should confirm that all animal burrows will be confirmed to be empty before any filling takes place. A program of levee inspection and repair should be included to address future levee damage due to burrowing animals.

EPA appreciates the opportunity to review and comment on this proposed project. Please send future NEPA documents concerning this proposed project to our office. If you have any questions about this letter, please contact Kathy Kowal (312-353-5206 or via email at kowal.kathleen@epa.gov) or my staff.

Sincerely,

\[Signature\]

Kenneth A. Westlake, Chief
NEPA Implementation Section
Office of Enforcement and Compliance Assurance

Enclosure: EPA’s Construction Emission Control Checklist

cc: (via email)
Louise Clemency, Chicago Field Office, U.S. Fish and Wildlife Service
Adam Rawe, Illinois Department of Natural Resources
Scott Meister, Forest Preserve District of DuPage County
Dave Robson, Forest Preserve District of Will County
Anthony Charlton, Floodplain Manager, DuPage County
Scott Killinger, Floodplain Manager, Will County
Diesel emissions and fugitive dust from project construction may pose environmental and human health risks and should be minimized. In 2002, EPA classified diesel emissions as a likely human carcinogen, and in 2012 the International Agency for Research on Cancer concluded that diesel exhaust is carcinogenic to humans. Acute exposures can lead to other health problems, such as eye and nose irritation, headaches, nausea, asthma, and other respiratory system issues. Longer term exposure may worsen heart and lung disease.\(^1\) We recommend USACE consider the following protective measures and commit to applicable measures in the EA and Finding of No Significant Impacts.

**Mobile and Stationary Source Diesel Controls**

Purchase or solicit bids that require the use of vehicles that are equipped with zero-emission technologies or the most advanced emission control systems available. Commit to the best available emissions control technologies for project equipment in order to meet the following standards.

- **On-Highway Vehicles:** On-highway vehicles should meet, or exceed, the EPA exhaust emissions standards for model year 2010 and newer heavy-duty, on-highway compression-ignition engines (e.g., long-haul trucks, refuse haulers, shuttle buses, etc.).\(^2\)
- **Non-road Vehicles and Equipment:** Non-road vehicles and equipment should meet, or exceed, the EPA Tier 4 exhaust emissions standards for heavy-duty, non-road compression-ignition engines (e.g., construction equipment, non-road trucks, etc.).\(^3\)
- **Low Emission Equipment Exemptions:** The equipment specifications outlined above should be met unless: 1) a piece of specialized equipment is not available for purchase or lease within the United States; or 2) the relevant project contractor has been awarded funds to retrofit existing equipment, or purchase/lease new equipment, but the funds are not yet available.

Consider requiring the following best practices through the construction contracting or oversight process:

- Establish and enforce a clear anti-idling policy for the construction site.
- Use onsite renewable electricity generation and/or grid-based electricity rather than diesel-powered generators or other equipment.
- Use electric starting aids such as block heaters with older vehicles to warm the engine.
- Regularly maintain diesel engines to keep exhaust emissions low. Follow the manufacturer’s recommended maintenance schedule and procedures. Smoke color can signal the need for maintenance (e.g., blue/black smoke indicates that an engine requires servicing or tuning).
- Retrofit engines with an exhaust filtration device to capture diesel particulate matter before it enters the construction site.
- Repower older vehicles and/or equipment with diesel- or alternatively-fueled engines certified to meet newer, more stringent emissions standards (e.g., plug-in hybrid-electric vehicles, battery-electric vehicles, fuel cell electric vehicles, advanced technology locomotives, etc.).
- Retire older vehicles, given the significant contribution of vehicle emissions to the poor air quality conditions. Implement programs to encourage the voluntary removal from use and the marketplace of pre-2010 model year on-highway vehicles (e.g., scrapage rebates) and replace them with newer vehicles that meet or exceed the latest EPA exhaust emissions standards.

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\(^1\) [https://www3.epa.gov/region1/eco/diesel/health_effects.html](https://www3.epa.gov/region1/eco/diesel/health_effects.html)

\(^2\) [http://www.epa.gov/otaq/standards/heavy-duty/ldci-exhaust.htm](http://www.epa.gov/otaq/standards/heavy-duty/ldci-exhaust.htm)

\(^3\) [http://www.epa.gov/otaq/standards/nonroad/nonroadci.htm](http://www.epa.gov/otaq/standards/nonroad/nonroadci.htm)
**Fugitive Dust Source Controls**
- Stabilize open storage piles and disturbed areas by covering and/or applying water or chemical/organic dust palliative, where appropriate. This applies to both inactive and active sites, during workdays, weekends, holidays, and windy conditions.
- Install wind fencing and phase grading operations where appropriate, and operate water trucks for stabilization of surfaces under windy conditions.
- When hauling material and operating non-earthmoving equipment, prevent spillage and limit speeds to 15 miles per hour (mph). Limit speed of earth-moving equipment to 10 mph.

**Occupational Health**
- Reduce exposure through work practices and training, such as maintaining filtration devices and training diesel-equipment operators to perform routine inspections.
- Position the exhaust pipe so that diesel fumes are directed away from the operator and nearby workers, reducing the fume concentration to which personnel are exposed.
- Use enclosed, climate-controlled cabs pressurized and equipped with high-efficiency particulate air (HEPA) filters to reduce the operators’ exposure to diesel fumes. Pressurization ensures that air moves from inside to outside. HEPA filters ensure that any incoming air is filtered first.
- Use respirators, which are only an interim measure to control exposure to diesel emissions. In most cases, an N95 respirator is adequate. Workers must be trained and fit-tested before they wear respirators. Depending on the type of work being conducted, and if oil is present, concentrations of particulates present will determine the efficiency and type of mask and respirator. Personnel familiar with the selection, care, and use of respirators must perform the fit testing. Respirators must bear a NIOSH approval number.

**Children’s Health**
- Per Executive Order 13045 on Children’s Health, EPA recommends the lead agency and project proponent pay particular attention to worksite proximity to places where children live, learn, and play, such as homes, schools, and playgrounds. Construction emission reduction measures should be strictly implemented near these locations in order to be protective of children’s health.

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4 Children may be more highly exposed to contaminants because they generally eat more food, drink more water, and have higher inhalation rates relative to their size. Also, children’s normal activities, such as putting their hands in their mouths or playing on the ground, can result in higher exposures to contaminants as compared with adults. Children may be more vulnerable to the toxic effects of contaminants because their bodies and systems are not fully developed and their growing organs are more easily harmed. EPA views childhood as a sequence of life stages, from conception through fetal development, infancy, and adolescence.
Planning Branch
Environmental Formulation and Analysis Section

Kenneth Westlake, Chief
Environmental Review Branch
United States EPA
77 West Jackson
Chicago, IL 60604

Dear Mr. Westlake,

The U.S. Army Corps of Engineers has received and reviewed your comments from the public review period for the DuPage River Flood Risk Management Feasibility Report and Integrated Environmental Assessment. Thank you very much for your time during this review and for the well thought out comments. Members of the Product Delivery Team for the project have provided the below responses to the comments and recommendations listed in your letter.

*Indicate why the 1% ACE was selected to determine the proposed levee height versus the 0.2% ACE.*

The height of the recommended levee is based on maximizing net benefits rather than targeting a specific elevation. Description of the levee heights considered were described in relationship to the 1% ACE only for the purpose of providing context of the elevations considered.

*Indicate whether the TSP is sufficiently protective given weather and precipitation trends in the upper Midwest during the past approximately 12-20 years.*

In cooperation with the Illinois State Water Survey, an extensive effort was completed to determine all existing and future impacts increasing precipitation trends will have on the TSP. The recommended plans are not formulated to provide a particular level of protection, but rather to maximize the net benefits of the investment. Future conditions precipitation trends were considered in the estimation of net benefits over the 50-year period of analysis for the study.

*Describe how the residual risk factor was explained to residents and or commercial property owners protected by the Listle levee.*

There is always risk associated with the implementation of any flood risk reduction project. Residual risk is the level of flood risk for people and assets located in a floodplain that remains after implementation of flood risk reduction actions. Residual risk includes transformed risk and is often defined as the risk beyond the level of protection provided by hazard reduction infrastructure. Residual risk is described in the feasibility report and will continue to be highlighted through future communication with residents and land owners as the proposed project proceeds through construction. The project report clearly defines the expected performance of the proposed project in terms of risk reduction. USACE will work with the non-federal sponsors to ensure that member
of the community are aware of residual risks, especially as climatic conditions change over time.

**Indicate what percentage of structures impacted in the 2013 flood event would be protected by the TSP if implemented? What percentage of structures impacted in the 2013 precipitation event would remain without adequate risk reduction if the TSP if Implemented?**

USACE did not compare the proposed projects to the structures impacted by the 2013 flood event specifically. The 2013 flood on the East and West Branches of the DuPage River was estimated to be between a 1% and 0.2% annual chance event. On the Mainstem DuPage River, the 2013 flood was estimated to be between a 2% and 1% annual chance flood event. Most of the structures of the nonstructural recommended plan are within these annual chance events and were likely impacted during the 2013 flood.

**How is the TSP affected by the lack of current information for Will County? What constraints curtail Will County from updating the hydraulic and hydrology modeling?**

Updated hydrologic and hydraulic models were developed for Will County as part of this study. Additional survey data was collected to aid in the development of the updated hydraulic models. These models are available for public and private use to evaluate the impacts of future proposed projects or for any future Flood Insurance Rate Map revision efforts that the County or any Municipalities would like to pursue.

**The Draft EA should address hydraulic impacts resulting from proposed activities, if any. In relation to downstream communities, and discuss how coordination of floodway permits have addressed or mitigate the potential for adverse hydraulic impacts due to implementation of the TSP.**

All proposed projects were evaluated using the updated hydraulic models to determine hydraulic impacts. A more detailed analysis was completed for the potential impacts of the recommended plan and provided in the Detailed Project Report. Some analyses are still needed and will be further evaluated during the detailed design.

It is not expected that a floodway permit will be required for this project. An Illinois consent decree entered in 1975 requires USACE to obtain relevant state permit for work completed on several Illinois waterways, however DuPage River is not included in this decree. Regardless, the planning process considered the requirements contained in the Illinois Department of Natural Resources’ (IDNR) Part 3708 ‘Floodway Construction in Northeastern Illinois’ permit requirements. The planned projects will be coordinated with the IDNR – Office of Water Resources as necessary.

**The final EA should clearly indicate when a conclusion concerning these structural measures (Winfield, Lilly Cache Creek, and Bolingbrook Quarry diversions” subsurface cutoff wall) be made. Additional considerations include: how these structural measures might dovetail of impact proposed structural measures; and how construction of these measures might impact other features (e.g., Lilly Cache Creek).**

None of the listed measures was determined to be justified. The final report documents those measures/plans included in the recommended plan.
The Final EA should commit to employing all applicable construction emission reduction measures.

All equipment operation, activities, or processes performed by USACE or its contractors comply with all federal, state, and local air emission and performance laws and standards. USACE follows EM 385-1-1 for worker health and safety and requires all construction activities to be completed in compliance with federal health and safety requirements. Many of the suggestions, though laudable, exceed USACE’s authority to implement. Because the project will be built by independent contractors, USACE cannot direct the means and method of construction, including the selection of equipment and mandating training of contractor employees. Moreover, considering the joint conclusion of USACE and USEPA that construction equipment emissions will not have a significant impact on the human environment, incorporation of such conditions into the FONSI would be inappropriate.

EPA recommends USACE consider developing a construction traffic management plan to ensure that trucks hauling materials and heavy machinery avoid area with sensitive receptors to the greatest extent possible. For example, truck routes should avoid schools, day care facilities, and parks when possible, and crossing guards should be used when such areas cannot be avoided.

USACE will require the contractor, if the project is implemented, to provide a construction traffic management plan. This plan will be reviewed and approved by USACE prior to the start of construction.

EPA strongly recommends USACE commit to the following in the Final EA and forthcoming decision document, if an action alternative is selected: using native vegetation on the Lisle Levee; and partnering with non-federal sponsors and local NGO’s to restore/maintain native vegetation on evacuated properties.

Seeding of the Lisle Levee and evacuated properties with native vegetation will occur as part of the recommended plan. These areas as well as the species lists will be developed during detailed design.

The Final EA should address whether any NNIS removal or control will included in project activities. EPA strongly recommends USACE include NNIS removal or control of non-natives population in the list of proposed project activities for the TSP.

Non-native and invasive species (NNIS) removal will occur on Lisle Levee if implemented. The removal of small shrubs and larger non-native trees is required to maintain the integrity of the levee. NNIS removal outside of the recommended plan will not occur as part of this study as it is outside of the study authority.

EPA recommends USACE commit to incorporating the use of the EPA’s debris management tool and bid specification tool for any structures removed as part of the TSP.

Thank you for the recommendation. USACE will look into the use of the debris management and bid specification tools for the removal of structures.

The Draft EA should address whether trees will be mulched for residents to use or whether small branch can be used by residents to create brush habitat for small mammals and birds. EPA recommends vegetation is not disposed of by burning, due to increased negative air impacts.
The disposition of woody debris, including trees and will be developed during detailed design. USACE will take the USEPA recommendation under consideration during our design and specifications phase. All necessary local, state, and federal laws and regulation will be followed.

_The Draft EA should confirm that all animal burrows will be confirmed to be empty before and filling takes place. A program of levee inspection and repair should be included to address future levee damage due to burrowing animals._

Visual inspections will be used to determine if animal burrows are empty prior to filling. This requirement will be added to the specifications to ensure the contractor is aware.

Once again, thank you very much for your review of the DuPage River, Illinois Feasibility Report and Integrated Environmental Assessment. If you have any questions please feel free call at 312-846-5580 or contact me via email at susanne.j.davis@usace.army.mil.

Sincerely,

\[Signature\]

Susanne J. Davis, P.E.
Chief of Planning Branch
From: Diane Hunter <dhunter@miamination.com>
Sent: Friday, August 17, 2018 2:12 PM
To: "Davis, Susanne J CIV USARMY CELRC (US)" <Susanne.J.Davis@usace.army.mil>
Subject: [Non-DoD Source] DuPage River Study - Comments of the Miami Tribe of Oklahoma

Dear Ms. Davis:
Attached you will find the response of the Miami Tribe of Oklahoma to the above-mentioned project.

Diane Hunter
Tribal Historic Preservation Officer
Miami Tribe of Oklahoma
dhunter@miamination.com <mailto:dhunter@miamination.com>
918-541-8966
August 17, 2018

Ms. Susanne Davis  
Planning Branch Chief  
U.S. Army Corps of Engineers  
231 South LaSalle Street, Suite 1500  
Chicago, IL 60604

Re: DuPage River Study – Comments of the Miami Tribe of Oklahoma

Dear Ms. Davis:

Aya, kikwehsitoole – I show you respect. My name is Diane Hunter, and I am the Tribal Historic Preservation Officer for the Federally Recognized Miami Tribe of Oklahoma. In this capacity, I am the Miami Tribe’s point of contact for all Section 106 issues.

The Miami Tribe offers no objection to the above-mentioned project at this time, as we are not currently aware of existing documentation directly linking a specific Miami cultural or historic site to the project site. However, as this site is within the aboriginal homelands of the Miami Tribe, if any human remains or Native American cultural items falling under the Native American Graves Protection and Repatriation Act (NAGPRA) or archaeological evidence is discovered during any phase of this project, the Miami Tribe requests immediate consultation with the entity of jurisdiction for the location of discovery. In such a case, please contact me at 918-541-8966 or by email at dhunter@miamination.com to initiate consultation.

The Miami Tribe accepts the invitation to serve as a consulting party to the proposed project. In my capacity as Tribal Historic Preservation Officer I am the point of contact for consultation.

Respectfully,

Diane Hunter  
Tribal Historic Preservation Officer
January 10, 2019

Susanne Davis
U.S. Army Corps of Engineers, Chicago District
231 S. LaSalle St., Suite 1500
Chicago, IL 60604

Dear Ms. Davis:

Thank you for requesting comments from the Illinois State Historic Preservation Office concerning the DuPage River Feasibility Report and Integrated Environmental Assessment that was submitted to our office. Our comments are required by Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations, 36 CFR 800: “Protection of Historic Properties.”

It is our opinion that archaeological and architectural surveys that identify and evaluate cultural resources located within defined Areas of Potential Effect need to be submitted to our office for review. We look forward to continued consultation with the U.S. Army Corps of Engineers for this important undertaking.

If you have any questions, please call 217/782-4836.

Sincerely,

Robert F. Appleman
Deputy State Historic Preservation Officer
Planning Branch
Environmental Formulation and Analysis Section

Robert F. Appleman
Deputy State Historic Preservation Officer
Illinois Department of Natural Resources
1 Old State Capitol Plaza
Springfield, IL 62701

Dear Mr. Appleman,

Thank you for your review of the DuPage River, Illinois Feasibility Report and Integrated Environmental Assessment (EA). In your letter dated 10 January, 2019 additional information on the surveys used to identify any potential impacts to cultural resources was requested for review. Since the last review an additional site at Lacey Creek was added to the recommended plan. The document has been updated to provide additional information on the potential Lacey Creek project. The Integrated EA was updated to clearly indicate the processes used to make our assessment for both Lisle Levee and Lacey Creek. The following summarizes the analysis and updates to the EA for clarification.

The proposed construction would have no known adverse effect on archaeological or historic properties, as defined by the National Historic Preservation Act of 1966. In order to determine the impacts to any historic properties, the National Register of Historic Places website was used to determine if any structures are near or adjacent to the recommended plan project sites. Based on review by USACE, no listed historic places will be impacted by the implementation of the recommended plan. The Lacey Creek Project has the potential to impact portions of the historic tree collections on the Morton Arboretum Property. While Morton Arboretum is not currently listed on National Register of Historic Places, it is likely eligible. The purpose and character of the property was developed as a museum of trees and as result should be conserved. The Lacey Creek Restriction has a potential to impact a portion of the Morton Arboretum historic tree collections. The area of potential impacts is along the northeastern edge of the property. This area may be impacted by the increased time and frequency of inundation caused by the restriction, but additional analysis is needed to effectively characterize these effects. During detailed design additional analysis and engineering solutions will be investigated to minimize and avoid any impacts to historic tree collections. Analyses and designs will be coordinated with the non-federal sponsor, Morton Arboretum staff, and State Historic Preservation Office to ensure that the project could be constructed and operated with no significant impact to these important resources.

It is recognized that that locations near rivers and other bodies of water have a higher likelihood of finding archaeological resources. However, the projects included in the Recommended Plan all take place in areas that have already been heavily disturbed and the projects do not require extensive excavation. To ensure minimal impacts, analysis was conducted for any potential archaeological resources. The Illinois Inventory of Archaeological Sites was reviewed to determine any impacts from the implementation of the recommended plan. Areas adjacent to the Lacey Creek Restriction project area have
been sampled in the past. A sawmill site northwest of the project area and a potential Mississippian site on the Forest Preserve property northeast of the project area were both identified as locations. Both sites however are a significant distance from the placement of the berm and minor earthwork and therefore will not be impacted. To further corroborate any potential impacts, aerial photography was used to assess the amount of ground disturbance. In 1939 Lacey Creek was more consistent with a wetland swale and only minor drainage channels can be viewed on aerials. Sometime after, the wetland was channelized and heavily modified for drainage purposes to the current straightened creek observed today. The drastic change is outlined in Figure 4-8 in Section 4.5.3.1 of the Feasibility Report and Integrated EA. Overall, major changes to the ground disturbances throughout the Lacey Creek project area in conjunction with minor ground disturbance to place a culvert is most likely not to adversely impact any archeological resources.

The Lisle Levee project area has not been sampled for archeological resources, but the project has little to no ground disturbance. The levees were built in the 1960s and the only earth work will be the removal of topsoil on the levee. Once the soil is removed down to the clay, additional clay would be brought in to be placed on top of the current levee to the new project height. The area was already disturbed during the original construction of the project and not likely to impact any archeological resources. In addition to the two structural projects, the nonstructural may require some excavation in and around house foundations. Once again these areas consist of pre-disturbed areas are not likely to impact any archeological resources.

Despite the unlikely possibility of finding any cultural resources during construction, the Chicago District understands that it is still possible. In the event that cultural remains are discovered during implementation of this project, all work with the potential to impact the resource(s) would be halted, the Chicago District’s cultural resources point-of-contact would be notified, and consultations would take place with the Illinois SHPO. In addition, should any unanticipated archeological discovery be made during the project design or construction period, Native American Tribes and the Illinois SHPO would be immediately consulted.

Once again, thank you very much for your review of the DuPage River, Illinois Feasibility Report and Integrated Environmental Assessment. If you have any questions please feel free call at 312-846-5580 or contact me via email at susanne.j.davis@usace.army.mil.

Sincerely,

[Signature]

Susanne J. Davis, P.E.
Chief of Planning Branch
August 22, 2018

US Army Corps of Engineers, Chicago District
ATTN: Planning Branch (Bullock)
231 S. LaSalle Street, Suite 1500
Chicago, IL 60604

Re: DuPage River Feasibility Study – Comment Form
Sent via email: dupageriver@usace.army.mil

Dear Army Corps of Engineers Staff,

This correspondence is in regards to the DuPage River Feasibility Report and Integrated Environmental Assessment (dated July 2018). Village staff were able to attend the presentation at DuPage County on August 15th and appreciate the time and effort that has been placed into the evaluation and report process. This is an important effort in order to help improve stormwater management throughout this geographic area.

The Village understands there was a complex evaluation process used to narrow the potential structural and non-structural solutions under consideration and to ultimately reach the recommendation of the tentatively selected structural plan of the Lisle Levee improvements. During Erin Maloney’s presentation she stated based on the computer modeling for the Lisle Levee “...the indicators are there are no negative impacts upstream or downstream of the tentatively selected project...”

The Village is interested in understanding and seeing the modeling results for the Woodridge area of the East Branch and how the tentatively selected plan changes flows and elevations in Woodridge. Specifically, what is the downstream impact? Can a map showing elevation changes in Woodridge be provided? Further, how are no negative impacts being achieved without constructing any compensatory storage in conjunction with the levee modifications?

The Village would welcome the opportunity to discuss the issues and study further. Please do not hesitate to contact me directly at 630-719-4767. Thank you in advance for the requested information.

Respectfully,

Christopher Bethel
Director of Public Works

cc: Mayor Cunningham and Board of Trustees
    Village Administrator Stonitsch
    Sarah Hunn, DuPage County Division of Stormwater Management
September 22, 2018

Colonel Aaron W. Reisinger
USACE, Chicago District
231 S. LaSalle St., Suite 1500
Chicago, IL 60604

Re: July 2018 Draft DuPage River Feasibility Report and Environmental Assessment

Dear Col. Reisinger,

Thank you and the DuPage County Stormwater Management group for undertaking this very important study. We are saddened and extremely disappointed with the findings. In its current form, there is nothing that will provide a substantial benefit to the Valley View subdivision.

Valley View was developed in unincorporated DuPage County in the late 1950's. Since then, we have suffered with chronic flooding problems related to the East Branch of the DuPage River and a high ground water table. Over the years, large scale projects on the West Branch and the Salt Creek have reduced problems in those areas. We have seen other river projects all around us and even the State Highway Department plans to use Federal money to widen, shift west, and raise Route 53 about 30 inches to solve the regular highway closure problems there (between us and the river). Also, despite all of the stormwater management ordinances all over the County, those highway closures and our flooding has become increasingly frequent and more severe. Note the significant percentage increases in average flows at Shorewood in Table 2-4. How do increases of 5%, 11%, and 23% occur in the 90's, 00's, and 10's respectively despite strict flood ordinances? This can’t all be due to climate change. So we have waited a long time. We are most hopeful that this first time ever, all-encompassing study of the DuPage River will finally provide some answers and solutions.

We are glad that the one structural project that was found to be cost effective so far will help our neighbors in downstream Lisle because they have flooding on an even larger scale than we do. However we do have some concerns about the Lisle Levee Raising and Repair Project. By your own operating procedures and by law, you basically will not propose a project that will make conditions worse for others or move a problem up or down-stream. The levee project will add substantial height to the berms and will protect for an additional river crest elevation range of from 2 to 5 feet. This will prevent huge
amounts of river water from spilling into Lisle during the 30 to 100 year plus storm
events. We think this will impede the river flow and aggravate flooding in upstream
areas, namely the Morton Arboretum and Valley View Subdivision. Your computer
models must say otherwise or the levee project would not be allowed. That project
effectively and substantially fills in the floodplain. Where is the compensatory storage?
Please explain.

Stormwater storage projects in our area are needed to reduce flooding here. While it is
true that many homes were removed a few decades ago, by our count, there are still 75
remaining in the floodplain, many of which are in constant threat of major flooding when
large storms come through. We believe that the Lacey Creek and Hidden Lake projects
and others have merit and need to be given a closer look. Bill Graham of Juniper Lane
is sending a letter requesting more about these.

We know we will receive a written response to these questions, but we also are
requesting a small meeting with you so that we can both fully understand the whole
picture.

It was said at the informational meeting on Aug. 15, 2018, that if projects beneficial to us
are not approved in this report we can always seek them on our own locally. Without
your endorsement, we think securing federal funds or any funds will be difficult or
doubtful. We think this is now or never.

Thank you for providing us with this opportunity to comment and pursue this further. We
may be reached at 630-469-1638.

Sincerely,

Mel and Ina Konsoer
Co-Presidents
VVACA

cc: Rep. Peter Breen, 48th District
    Mr. Grant Eckhoff, County Board District 4
    Mr. Tim Elliott, County Board District 4
    Ms. Amy L. Grant, County Board District 4
Ms. Susanne J. Davis, P.E.
Chief, Planning Branch
Department of the Army
Chicago District, U.S. Army Corps of Engineers
231 South LaSalle Street, Suite 1500
Chicago, IL 60604

Subject: DuPage River Study Secondary Public Review

May 15, 2019

Dear Ms. Davis,

The purpose of this letter is to provide public comment on behalf of The Morton Arboretum (Arboretum) to The U.S. Army Corps of Engineers (USACE), Chicago District, about the “DuPage River, Illinois Feasibility Report and Integrated Environmental Assessment”, dated April 2019, as notified by Ms. Susanne J. Davis, P.E., Chief - Planning Branch on May 2, 2019.

As noted within the Feasibility Report (Report) the National Economic Development Plan now includes the Lacey Creek Restriction (Restriction), an earthen berm which is proposed to be constructed near the confluence of Lacey Creek and the East Branch DuPage River.

While the Arboretum supports the USACE effort to resolve flooding concerns in the region and desires to take part in further discussions and analysis of those concerns, particularly as they relate to the Arboretum, there are questions and concerns the Arboretum has about the proposed Restriction and its impacts to the Arboretum. In general, constructing the Restriction does not appear to align with the mission of the Arboretum and appears to have a significant impact on the natural resources and daily operations of the Arboretum. The mission of the Arboretum is:

to collect and study trees, shrubs, and other plants from around the world, to display them across naturally beautiful landscapes for people to study and enjoy, and to learn how to grow them in ways that enhance our environment. Our goal is to encourage the planting and conservation of trees and other plants for a greener, healthier, and more beautiful world.
As noted in the Report, the Restriction would greatly alter the pattern of flooding upstream of it within the Arboretum, which includes increasing the extent, depth, and duration of flood waters. Increased acreage of land inundated with water, increased depth by several feet of water, and increased duration of flooding periods would likely have adverse impacts on the natural resources and daily operations of the Arboretum. The first impact would be on a historic tree collection which includes several accessioned trees remaining on site from when it was managed as a tree collection. Secondly, the largest and oldest trees found in the Arboretum are located within this area, including the Arboretum’s largest black walnut and old growth bur oaks, one of which dates back to the 1770s. Also found within this area are remnant natural ecosystems which the Arboretum has been actively managing for the past 15 years. A small remnant prairie with high species diversity is located directly within the impacted area as well as wetlands and woodlands found adjacent to the project site. Altered flood patterns would likely have deleterious effects on these ecosystems, and mitigation of damage to these remnant ecosystems is not advisable. The altered flood pattern would also facilitate inundation by the most common invasive species, such as purple loosestrife, common reed, and reed canary grass. Furthermore, the altered flood waters would impede access to a thoroughfare by Arboretum staff, impacting operations in a significant manner. The Arboretum believes that adverse impacts to the natural resources and operations would fall outside of the project’s constraints to preserve natural and beneficial floodplain values and to avoid adverse flood impacts.

The Arboretum is also currently engaged in a USACE agreement to restore the East Branch DuPage River immediately downstream of the proposed Restriction, which is funded through Section 206 of the the Water Resources Development Act of 1996. The Morton Arboretum Section 206 Aquatic Ecosystem Restoration Project is an example of a project which utilizes nature-based solutions which are complementary to goals and mission of both the Arboretum and USACE, and the Arboretum proposes to analyze the potential to utilize such applications with USACE and its project team to assist with the goals and objectives of this Report. Such applications to consider could include: stream meanders, creation and enhancement of new and existing wetlands, among other restorative activities that would assist the objectives of the proposed project and the Arboretum’s mission.

As mentioned above, the Arboretum requests to be involved in further dialogue about this Restriction and any other potential project that USACE considers which would have an impact on the Arboretum. We believe that solutions can be achieved for the greater good of the watershed and are less impactful to the Arboretum.

Sincerely,

Kris R. Bachtell
Vice President of Collections and Facilities
Planning Branch
Environmental Formulation and Analysis Section

Mr. Kris R. Bachtell
Vice President of Collections and Facilities
Morton Arboretum
4100 Illinois Route 53
Lisle, Illinois 60532

Dear Mr. Bachtell:

The U.S. Army Corps of Engineers (USACE) has received and reviewed your comments from the public review period for the DuPage River Flood Risk Management Feasibility Report and Integrated Environmental Assessment. Thank you very much for your time during this review.

USACE Chicago District understands the concerns of the Morton Arboretum as outlined in the letter dated May 15, 2019. The Chicago District wants to provide assurance that we plan to continue to collaborate with the Morton Arboretum to develop a project that will best meet the flood risk reduction goal while minimizing impacts to Morton Arboretum resources to the extent practicable. We expect the feasibility report will be approved next month, July, 2019. Following approval, the detailed design and engineering specifications phase will begin when we have received Federal funding and have a signed partnership agreement with a nonfederal sponsor. During the design phase, additional engineering analysis will be completed in collaboration with Morton Arboretum staff to find solutions to minimize impacts to the important resources on and adjacent to the Morton Arboretum property.

In order to assist USACE in best understanding the existing resources, it would be very helpful if the Morton Arboretum could provide additional information for the resources located within the vicinity of the Lacey Creek project. Collection of GPS coordinates for the Historic Tree collection and old growth bur oaks as well as detailed location of the remnant prairie will help facilitate potential designs and collaboration. If possible, please provide photographs of recent or past flooding near Lacey Creek with recognizable landmarks. This will help us to accurately determine existing conditions. While we realize these activities may be a bit of a hindrance, they will be very important to help minimize or prevent any impacts to these resources.
Once again, thank you very much for your review of the DuPage River, Illinois Feasibility Report and Integrated Environmental Assessment. If you have any questions, please feel free to call the Project Manager, Imad Samara, at 312-846-5560, or via email at imad.n.samara@usace.army.mil.

Sincerely,

Susanne J. Davis, P.E.
Chief, Planning Branch
May 17, 2019

U.S. Army Corps of Engineers, Chicago District
ATTN: Planning Branch (DuPage River)
231 S. LaSalle Street, Suite 1500
Chicago, IL  60604
Via email: dupageriver@usace.army.mil

Re: DuPage River Study Secondary Public Review

To Whom It May Concern:

The Forest Preserve District of DuPage County would like to offer the following comments regarding the above-referenced project.

We acknowledge that the proposed Lacey Creek Restriction will have benefits to downstream and nearby residents. At this time, the Forest Preserve District of DuPage County is interested in learning more information about the project, and actively engaging in the analyses process moving forward. In particular, it will be important for our organization to improve our understanding in the following areas:

- To paraphrase, our mission is to “preserve and protect flora and fauna for the education, pleasure, and recreation of our citizens.” As currently proposed, the Lacey Creek Restriction does not provide ecological benefits to the Hidden Lake Forest Preserve. Can the project evolve to include restoration of the adjacent acres and benefits that support our mission? Examples may include, constructed or restored creek meanders, wetlands, raising of the streambed and floodplain enhancements, etc.

- Construction and maintenance of the proposed restriction will require permanent access to the site. To our knowledge, an access route has not yet been determined as part of the proposed plan, and it is possible a route could be chosen through preserve property and ecosystems. As evaluation continues and access plans are addressed, we are interested in understanding the full potential environmental impact of this project.

- As with any project, we understand there will be long-term costs and maintenance. If the Lacey Creek Restriction moves forward, we would like to fully understand the long term maintenance need and we request that responsibility for maintenance remain with the local/non-federal sponsor.
Thank you for the opportunity to share comments on behalf of the Forest Preserve District of DuPage County.

Sincerely,

[Signature]

Daniel Hebreard
President
Planning Branch  
Environmental Formulation and Analysis Section

Hon. Daniel Hebreard  
President, Board of Commissioners  
Forest Preserve of DuPage County  
3S580 Naperville Road  
P.O. Box 5000  
Wheaton, Illinois 60189

Dear Mr. Hebreard:

The U.S Army Corps of Engineers has received and reviewed your comments from the public review period for the DuPage River Flood Risk Management Feasibility Report and Integrated Environmental Assessment. Thank you very much for your time during this review. We would like to provide direct responses to some of your comments and questions:

**Can the project evolve to include restoration of the adjacent acres and benefits that support our mission? Examples may include, constructed or restored creek meanders, wetlands, raising of the streambed and floodplain enhancements, etc.**

While USACE, Chicago District continues to strive to be a leader in the region for ecosystem restoration and environmental stewardship, we must comply with specific project authority and justification requirements. The DuPage River Feasibility study was conducted with a focus on Flood Risk Management. Recommended project justification is based on the cost to benefit ratio; consequently, we are limited in our ability to include additional ecosystem based features. However, the recommended plan does include nature based features that include native plantings and naturalized stream bottom for Lacey Creek. In addition, compliance with mitigation requirements documented in our report will be considered to be implemented on-site to minimize any impacts from the project.

During the detailed design phase of the project, we will conduct additional analysis and attempt to develop engineering solutions to maximize the benefit of the flood risk management project that is acceptable to the mission of the DuPage County Forest Preserve mission. Additional design details, including the location of access roads will be coordinated at that time. Once a tentative start
date is confirmed for the design, the Chicago District will begin coordination with the DuPage County Forest Preserve.

To our knowledge, an access route has not yet been determined as part of the proposed plan, and it is possible a route could be chosen through preserve property and ecosystems. As evaluation continues and access plans are addressed, we are interested in understanding the full potential environmental impact of this project.

At this point it is assumed that project construction would utilize the existing ComEd access road for maintenance roads therefore minimizing any additional environmental impacts. However, as previously mentioned The Chicago District will continue to collaborate with the DuPage County Forest Preserve as more details are developed in the detailed design and specifications phase.

As with any project, we understand there will be long-term costs and maintenance. If the Lacey Creek Restriction moves forward, we would like to fully understand the long term maintenance need and we request that responsibility for maintenance remain with the local/non-federal sponsor.

The non-federal sponsor is responsible for project Operation and Maintenance (O&M). O&M responsibilities for the project features will refined during detailed design and specifications phase. An O&M Manual will be provided to the non-federal sponsor once the project is complete.

Once again, thank you very much for your review of the DuPage River, Illinois Feasibility Report and Integrated Environmental Assessment. If you have any questions, please feel free to call the Project Manager, Imad Samara, at 312-846-5560, or via email at imad.n.samara@usace.army.mil.

Sincerely,

Susanne J. Davis, P.E.
Chief, Planning Branch
Susanne J. Davis, P.E.
Chief, Planning Branch
Department of the Army
U.S. Army Corps of Engineers – Chicago District
231 South La Salle Street, Suite 1500
Chicago, Illinois 60604


Dear Ms. Davis:

The U.S. Environmental Protection Agency has reviewed the above-mentioned revised feasibility report with integrated environmental assessment (EA) dated April 2019 regarding the proposed project. This letter provides EPA’s comments on the EA, pursuant to our authorities under the National Environmental Policy Act (NEPA), the Council on Environmental Quality’s NEPA Implementing Regulations (40 CFR 1500-1508), and Section 309 of the Clean Air Act.

The EA presents the results of the DuPage River, Illinois Feasibility Study conducted by the United States Army Corps of Engineers (USACE) in partnership with the DuPage County, Illinois Stormwater Management Planning Committee and the Will County, Illinois Executive Office, in coordination with the Illinois Department of Natural Resources. Identified measures, alternative plans, and evaluation criteria were also coordinated with U.S. Fish and Wildlife Service, Forest Preserve District of DuPage County, and Will County Forest Preserve District to ensure potential impacts to significant natural resources in the watershed were considered in the plan formulation process.

The study area is the DuPage River, including the East and West Branches, and its major tributaries, within DuPage County. The DuPage River is the largest tributary to the Des Plaines River. The East Branch DuPage River and the West Branch DuPage River flow primarily through DuPage County before flowing into the main stem of the DuPage River in Will County. The study was completed to investigate overbank and backwater flooding along the DuPage River and its major tributaries, prioritizing high-risk areas, and developing a range of possible structural and nonstructural alternatives to address flood risks. The study area has experienced rapid development during the past several decades and currently includes approximately 900,000 residents in 40 communities. The land use conditions impact the amount of rainfall-runoff and the population at risk, increasing the likelihood and severity of overbank flooding in the watershed.
Major storm events resulting in overbank flooding in the basin occurred in 1966, 2008, 2010, and most recently in April 2013. The April 2013 flood impacted at least 20 communities and caused significant damage to residential and non-residential structures and critical infrastructure. Overbank flooding resulted in the closure of a major interstate highway (I-55) in multiple locations as well as the closure of multiple U.S., State, and County highways. An assessment of existing and projected future without project conditions determined that a significant risk of overbank flooding exists across most of the watershed. Expected annualized flood damages are estimated at $5,102,000 over the 50-year period of analysis for this study.

The feasibility study evaluated a range of measures to address overbank and backwater flooding along the DuPage River and its major tributaries. Structural measures aimed to reduce the risk of flooding by altering the frequency, stage and duration of floodwaters (e.g., levees or floodwalls, floodwater storage reservoirs, channel improvements, and diversions) were evaluated. The optimization or rehabilitation of existing structures was also evaluated. Physical nonstructural measures such as acquiring, floodproofing, and elevating structures were evaluated individually to determine whether they were economically justified. For measures in both categories, the Project Delivery Team (PDT) further evaluated opportunities to incorporate nature-based features and recreation features to optimize the function and utility of the proposed project.

A total of three action alternatives were considered, as well as the no action alternative:

- **Lisle Levee Elevation (EBLL2):** The existing Lisle Levee was originally constructed in 1961, with the levee crest elevation at the approximate level of the 2% USACE (50-year) flood event. Deterioration of the levee has occurred over time, lowering the crest elevation in some areas and eroding the side slopes and levee toe. Based on the current condition and height of the Lisle Levee, it has been identified as at risk of overtopping or failure. This study recommends repair of the several segments of the existing structure to USACE levee standards by removal of large woody debris, re-grading of side slopes, repair of eroded areas, and riverside toe armoring. The project would also elevate the levee to approximately the currently identified 1% USACE (100-year) flood elevation to provide additional risk reduction. To complete the line or protection, an additional tie-back along the east bank of the East Branch just south of Ogden Avenue as well as a closure structure on Illinois Route-53, which will be operated during high water conditions, will be required. The project would provide flood risk reduction to approximately 175 structures located behind the existing levee.

- **Lacey Creek Restriction (EB6):** The Lacey Creek Restriction is proposed to limit outflow from the Lacey Creek Tributary to reduce the peak flow entering the East Branch from that tributary. The project will store approximately 283 acre-feet of floodwater, and slowly release it to the East Branch to reduce peak flows and stages on the East Branch downstream of the Lacey Creek. Project features include an earthen berm with a primary, restrictive outflow culvert in addition to an operable gate which could facilitate more rapid drawdown

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1 Nature-based features include native plantings in project vegetation designs, pairing ecosystem restoration with vacated floodplain properties, and setting back levees or floodwalls to allow for continued natural and beneficial floodplain functions. Recreation features include trails, picnic areas, or other facilities compatible with the flood risk management project purpose.
of the storage area after floodwaters have receded to reduce impacts to habitat upstream. Impacts to aquatic habitat will be mitigated as part of the project construction;

- **Nonstructural Measures (EBNS2, LCNS1, DUNS1, DUNS2, DUNS3, IMNS1, SJNS1):** The nonstructural components of the Recommended Plan provide flood risk reduction through property acquisition, elevation of structures, or floodproofing structures. Nonstructural features are included within the communities of Shorewood, Plainfield, Bolingbrook, Lisle, and Glen Ellyn. The nonstructural plans include modifications of 38 structures including likely acquisition of 6 structures, elevation of 9 structures, and floodproofing of 23 structures. Consistent with USACE Planning Bulletin 2016-01, Clarification of Existing Policy for USACE Participation in Nonstructural Flood Risk Management and Coastal Storm Damage Reduction Measures, acquisitions will be accomplished on a voluntary basis or eminent domain will be applied when needed. Additionally, costs for permanent relocation measures include the provision of relocation assistance under Public Law (P.L) 91-646. Measures such as dry floodproofing and elevations can be implemented with voluntary participation; and

- **No Action Alternative:** The proposed structural and non-structural measures would not be implemented.

EPA commented on an earlier version of this project on September 21, 2018. In that letter, we commented on structural measures for levees/floodwalls, flood preparedness, constraints, diversions and cutoff walls, nature-based features, air quality, transportation, nature-based features, non-native invasive species control, non-structural measures, and non-structural measures for levees/floodplains. We appreciate USACE addressing each of these comments in our September 21, 2018 comment letter. We have no additional comments.

We are available to discuss these comments at your convenience. Please feel free to contact the Lead NEPA Reviewer, Mike Sedlacek, at 312-886-1765, or by email at sedlacek.michael@epa.gov.

Sincerely,

[Signature]

Kenneth A. Westlake
Deputy Director, Office of Multi-Media Programs
Office of the Regional Administrator

cc: Louise Clemency, Chicago Field Office, U.S. Fish and Wildlife Service
    Adam Rawe, Illinois Department of Natural Resources
    Scott Meister, Forest Preserve District of DuPage County
    Dave Robson, Forest Preserve District of Will County
    Anthony Charlton, Floodplain Manager, DuPage County
    Scott Killinger, Floodplain Manager, Will County
Dear US Army Corps of Engineers:

Thank you for the opportunity to provide comment to the US Army Corps of Engineers (US ACOE) on the Draft DuPage River, Illinois Feasibility Report and Integrated Environmental Assessment dated April 2019 on behalf of the DuPage River Salt Creek Workgroup (DRSCW).

The DRSCW supports the US ACOE’s efforts to mitigate flooding in the East Branch DuPage River watershed, the structural components included in the Recommended Plan are in conflict with the requirements for upstream and downstream communities to meet Clean Water Act goals related to their National Pollution Discharge Elimination System (NPDES) wastewater permits. As part of these permits, the wastewater treatment plans are charged with bringing the East Branch DuPage River in compliance with the aquatic life use standard set by the Illinois Environmental Protection Agency (IEPA). Both structural components, the rebuilding and increased elevation of the levee system on the East Branch DuPage River in Lisle and the construction of a restriction on Lacey Creek, as proposed will potentially compromise the ability for the East Branch DuPage River and Lacey Creek to meet Clean Water Act goals.

National trends for restoring and protecting stream biological health include reconnection to the floodplain and the removal of dams. Locally, the DRSCW has been a direct partner involved in two local projects aimed at restoring stream biological health. These are the removal of the Churchill Woods dam on the East Branch DuPage River (upstream of the proposed structural components) and removal of two dams and 1.25 miles of stream restoration at the Preserve at Oak Meadows on Salt Creek. The DRSCW is also in the design phase of three additional stream restoration and/or dam modification projects: the modification of the Fawell Dam on the West Branch DuPage River, the modification of the Graue Mill Dam on Salt Creek and a stream restoration on the Lower East Branch DuPage River (downstream of the proposed structural components). These projects are fully funded by the DRSCW Special Condition and will be completed by 2025. The ACOE structural improvements as described in the Draft DuPage River, Illinois Feasibility Report and Integrated Environmental Assessment are potentially in conflict of these efforts.
The DRSCW does recognize the imperative need for flood mitigation along the East Branch DuPage River in Lisle, Illinois and supports the US ACOE’s efforts outlined in this report. However, the DRSCW encourages the US ACOE and any public sponsors to include any and all opportunities to mitigate the impact of projects on the biological health of the East Branch DuPage River and Lacey Creek in the project’s final design. Practices to be consider should include but not limited to the placement of in-stream habitat including riffle-run sequences, the systematic placement of cobble and gravel to create a more natural creek bed, and the use of natural streambank stabilization practices including root wads that serve as habitat for fish and macroinvertebrates. Native riparian vegetation should also be fully integrated into the projects including on the inside slopes of the levee systems. Appropriate native vegetation could be selected and managed through annual mowing or burning so that visual inspections of the levee can be easily completed and no damage is caused to the structural integrity of the levee. Native riparian vegetation is critically important to the adult stages of aquatic insects and these aquatic insect communities are part of the evaluation process to determine whether streams meet Clean Water Act goals. Without intact riparian areas, it is unlikely that this segment of stream will meet those goals. Similar improvements in the watersheds have driven substantial improvements in aquatic communities in the watersheds.

In regards to the Lacey Creek restriction, it is critical that this feature be designed and operated such that it does not serve as a barrier to fish passage. One potential design alternative that should be considered in the use of an open bottom culvert rather than a traditional four side culvert so that the steam bottom through the restriction is naturalized and at grade. The DRSCW is also concerned that extent, depth and duration of floodwaters behind the structure will damage to native vegetation established in the temporary impoundment. The US ACOE should include a table similar to Table 4-3 comparing flood inundation times and elevations with the Lacey Creek Restriction Project with the operation of the rapid drawdown sluicegate so that the full extent of the potential damages by the floodwaters can be evaluated. Additional information on impacts of the restriction to sediment transport in Lacey Creek should also be documented in the report.

As clearly described above, the East Branch DuPage River and Lacey Creek is a part of a larger watershed management program that aims to identify and implement stream improvement projects with the objective of meeting Clean Water Act goals. It is with great understanding that flooding issues need to be addressed in this segment of stream, but this does not have to be done at the expense of not meeting Clean Water Act goals. The DRSCW has data available that can help guide the design of both the East Branch DuPage River levee and the Lacey Creek restriction so that ecological features included within the project areas are done in a way to maximize positive responses in the aquatic health of these systems. The DRSCW is more than willing to share this information to the US ACOE or any public sponsors and requests to be included in future dialogue on the design of these projects.

As part of the watershed management program mentioned above, the DRSCW and the Lower DuPage River Watershed Coalition (LDRW) has been collecting water chemistry, macroinvertebrate, fish and physical data within the study area since 2006. The Draft DuPage River, Illinois Feasibility Report and Integrated Environmental Assessment includes a discussion of the data included in the 2012 Biological and Water Quality Study of the Lower DuPage River Watershed in Section 2.2 Ecological Resources but mentions in numerous places the lack of data within the East Branch DuPage River. In addition to the 2012 report for the Lower DuPage River, the following reports are available for the study area from the DRSCW and include data that should be included in Section 2.2 and utilized in the evaluation of the impacts of the proposed structural improvements:

- Biological and Water Quality Study of the E. Branch DuPage River Watershed, 2014
- Biological and Water Quality Study of the W. Branch DuPage River Watershed, 2012
- Biological and Water Quality Study of the E. Branch DuPage River Watershed, 2011
- Biological and Water Quality Study of the Salt Creek Watershed, 2010
Again, we would like to thank you on behalf of all our members for giving us the opportunity to comment on the report and look forward to working with the US ACOE as these projects are implemented.

Sincerely,

Deanna Doohaluk

Deanna Doohaluk
Watershed Project Manager
DuPage River Salt Creek Workgroup
Planning Branch  
Environmental Formulation and Analysis Section

Ms. Deanna Doohaluk  
Watershed Project Manager  
DuPage River Salt Creek Workgroup  
10S404 Knoch Knolls Road  
Naperville, Illinois  60532

Dear Ms. Doohaluk:

   The U.S Army Corps of Engineers has received and reviewed your comments from the public review period for the DuPage River Flood Risk Management Feasibility Report and Integrated Environmental Assessment. Thank you very much for your time during this review.

   The Chicago District reviewed the draft TMDL for the DuPage River/Salt Creek Watershed dated January, 2019. We have determined that implementation of the recommended plan will not prevent the upstream and downstream communities from implementing the best management practices recommended in the draft TMDL.

   The recommended plan for repair of the Lisle Levee and the Lacey Creek restriction includes native plantings to promote local biodiversity, assist with erosion control, and provide overhanging vegetative habitat for aquatic species in the DuPage River.

   While the structural components of the recommended plan are focused on flood risk management, we plan to implement several measures within the project to help minimize impacts to the environment and promote biodiversity. The current culverts that exist at Lacey Creek prevent the passage of fish under most conditions. We are proposing that the new culvert include natural stream bottom features constructed from glacially derived cobbles to promote fish and macroinvertebrate habitat. The culvert design will be refined during the detailed design and specifications phase. At that time, the Chicago District plans to work with local stakeholders, including the Morton Arboretum and the DuPage County Forest Preserve District, to develop a culvert that minimizes upstream impacts to adjacent habitat and promotes ecosystem health within the constraints of our flood risk management authority.
Please provide the data you mentioned in your letter that will help guide our
design to minimize impact to the Project Manager, Mr. Imad Samara, via email
(information below). The Chicago District would like to review these data and
see if any information can be applied during the detailed design and specification
phase.

Once again, thank you very much for your review of the DuPage River,
Illinois Feasibility Report and Integrated Environmental Assessment. If you have
any questions, please feel free to call the Project Manager, Imad Samara, at 312-
846-5560, or via email at imad.n.samara@usace.army.mil.

Sincerely,

Susanne J. Davis, P.E.
Chief, Planning Branch
To whom it may concern,

I am writing again on behalf of the St Joseph Creek Condo Assn in Lisle as I did last year. (Please see below).

I tried to read through the feasibility reports but it is quite overwhelming. I did notice that St Joseph Creek was mentioned in the report with potential storage areas, levee repairs etc. The report also mentioned 4 areas of concern but the area around the St Joseph Creek Condos was not mentioned. We are South of Ogden, North of the Burlington Northern RR and East of St Joseph Creek. The Creek goes through the property west bound and curves north. On the west side of the Creek is the McKenzie Station Townhome Assn. When they were first built in the mid 90's, there were 2 retention ponds with a pump to pump water north. We were told that the pump stopped working about 10 years ago and the Village of Lisle did not make the HOA repair or replace it and the pump house has been removed. So now when it rains, the ponds fill up and instead of pumps pumping the water north, the water overflows into St Joseph Creek where it curves. The Creek then overflows into the 4721 St Joseph Creek building and eventually into 4711 and 4731. We have flooded twice since that pump has gone out (4/18/13 and 10/14/17). The October 2017 flood was not mentioned in the study. We nearly flooded on 2/20/18 and on 4/30/19 were told by the Village to evacuate the garages because the creek was rising.

We are constantly monitoring the creek which rises so quickly now without substantial rainfall. We've asked if we can raise the curb around the curve to keep the water from overflowing into our basements but are told we can't. We were also told that something was going to be done by the end of 2019 that was not part of this study which would help with our situation but we haven't heard anything and our emails for status have not been returned. I don't understand how the Village or County would allow the pump for the McKenzie Station Townhomes retention ponds to be removed and then not allow us to protect ourselves by raising the curb. It seems that all of the attention is going towards single family residential and that we don't matter. We have 135 families that are impacted by the flooding. We deserve as much consideration as everyone else does.

Please include St Joseph Creek Condos in your plans for Flood prevention.

Thanking you in advance. Respectfully yours,

Tony Then
President, St Joseph Creek Condo Assn.

-----Original Message-----
From: tonnjul@aol.com <mailto:tonnjul@aol.com> [mailto:tonnjul@aol.com]
<mailto:tonnjul@aol.com> ]
Sent: Saturday, September 22, 2018 9:28 AM
To: LRC.LRC-PROJ-DuPageRiver <dupageriver@usace.army.mil>
Cc: Sarah.Hunn@dupageco.org
Subject: [Non-DoD Source] East Branch DuPage River / St. Joseph Creek, Lisle, Illinois

Re: St Joseph Creek Condo Association
4711, 4721, 4731 St Joseph Creek Road
Lisle, Illinois 60532

To whom it may concern:
My name is Anton "Tony" Then. I am the president of the St Joseph Creek Condo Association in Lisle, Illinois. I am writing on behalf of the Association's 135 homeowners.

Our Association consists of three 5 story buildings. Each building has 45 units, plus 20 underground parking spaces. The garage / basement area houses all of our mechanicals: boilers for heat and hot water, elevators, electric meters and panels, alarm panels as well as the laundry rooms. In addition, there is a storage locker room for residents to store personal property. The 4721 building has 2 restrooms for residents to use during the pool season as well as for the Association's maintenance staff.

In July, 1996, there was approximately 17 inches of rain. St Joseph Creek overflowed into our 3 buildings leaving up to 5.5 ft of water and causing hundreds of thousands of dollars of damage to the buildings. A total of 47 cars were lost as well as personal property.

On April 18, 2013, St Joseph Creek overflowed again, this time with almost 8 feet of water in our buildings and causing $888,000 damage to the buildings in addition to loss of 27 cars and residents personal belongings in the storage area. 135 residents and their families were without hot water for days and without heat for weeks. Elevators were down for months and residents including handicapped and elderly had to climb up 5 flights of stairs often with groceries, laundry etc. Some were forced to stay at hotels or with family or friends.

After great financial loss and emotional stress, the Association got put back together only to flood again 4 1/2 years later on October 14, 2017. Another $400,000 of damage and all the inconvenience and financial, mental and emotional stress started all over again.

Between the April 18, 2013 and October 14, 2017 Floods, the Association looked for a solution to prevent flooding from occurring again. I spoke and met with the then Village of Lisle's Storm Water Administrator, Marilyn Suceo to discuss what could be done. The Association felt that by building a wall by raising the curb along the curve where the low spot of St Joseph Creek Road runs, two purposes would be served: 1) prevent overflow from St Joseph Creek from pouring into the 4721 building which then overflows into the 4711 and 4731 buildings and 2) by raising the curb, it would also act as a safety barrier to prevent cars from driving or sliding into the creek as the edge of the road is very close to it. The Village stated that the wall would not be allowed because the Association would be diverting water and "making it someone else's problem". The Association was also made aware that the pumps for the McKenzie Station town homes detention ponds haven't worked for 10 years and that because code changed, the pumps were no longer required. The purpose of the pumps was to pump water upward and away from the area. But since the pumps weren't working, the detention ponds fill up and overflow into the creek and then into the St Joseph Creek Condos. The Village expressed concern over McKenzie Station's retention walls and sidewalks getting damaged not fully understanding how the 135 families of the St Joseph Creek Condos have been affected by
the flooding - no heat, no hot water, no electric, no elevators etc at great expense - financially as well as emotionally.

On February 20th, 2018, only 4 months after the October 14, 2017 flood, there was a lot of rain and the creek was rising ... fast. The Village contacted me to ask that the cars be moved out of the garage and I advised that we had already begun doing that. They also asked if we could put up a sandbag wall which we paid $3500 to have it done quickly. The rain kept coming, and the creek was within 6 inches of overflowing ... again. Fortunately, the rain slowed down and we were spared.

This is more than about cars. This is about 135 families panicking every time it rains. It's about 135 families without heat, hot water, electric, elevators etc. It's about 135 families losing cars and personal belongings. It's about $1.3 million spent in 4 1/2 years for repairs from flood damage. It's about FEMA non renewing the Association's Flood insurance and placing us into the Severe Repetitive Loss category which will cost the Association more money. It's about putting off other Association projects and repairs because our bank account has been depleted. It's about property values being lowered. It's about how this has financially and emotionally affected our Association of 135 families.

We're looking for a solution. We feel the raised curb along St Joseph Creek would be a good place to start. While financial assistance would be great, we are only asking for permission to do so, at our expense. If putting up a sand bag wall that was recommended and allowed by the Village isn't "making our problem someone else's", why would a concrete wall?

We attended the 8/15/18 Feasibility Study meeting in Wheaton to learn that the only possible Federal funding is for repairs to the Levee. I also learned that local authorities will do some work on or around St Joseph Creek next year and hope and pray it will benefit us.

I am asking that you remember what the 135 residents of St Joseph Creek Condo Association have gone through and allow us to build the wall by raising the curb. This, together with any work done by the Village of Lisle, DuPage County and the Army Corps of Engineers will hopefully prevent any future flooding.

I thank you in advance for your consideration.

Respectfully,
Anton "Tony" Then
Home:  630-969-3808
Cell:  630-502-4477
Email:  tonnjul@aol.com

P.S.  I am forwarding an email from the Village of Lisle's former Storm water Administrator, Marilyn Sucoe, from 1/24/18. Please see below

-----Original Message-----
From: Marilyn L. Sucoe <msucoe@villageoflisle.org>
To: Hunn, Sarah <Sarah.Hunn@dupageco.org>; Brodzinsky, Sara K
CIV US ARMY CELRC (US) <Sara.K.Brodzinsky@usace.army.mil>
Good evening,

I have been speaking with a St. Joseph Creek Condominium board member, Tony Then regarding the most recent flooding in October 2017. The association would like me pass along their concerns with ground elevations along the east side of St. Joseph Creek, especially the lowest portion of the creek bank just south and west of building 4721 St. Joseph Creek Rd. In the first photo below, the red arrow shows the location of the overflow of the creek just after midnight on October 15, 2017. They are hoping that a flood wall or raised creek bank to protect their property is being considered in your study.

All three buildings, 4711, 4721 and 4731, have underground parking that flooded in July 1996, April 2013 and October 2017. The table below provides the peak USGS gage heights and flows for these events. The attached video shows the flooding of the 4721 building in October 2017. The water spills over the creek banks at the low point just south of the 4721 building’s parking garage entrance ramp. Once the garage at 4721 fills, the water will them flow into 4711 and eventually all the sump pump pits overflow and water goes into 4731 building as well. In 2017, 4721 flooded about 5.5 feet, 4711 around 3 feet and 4731 only 1 foot deep.

<table>
<thead>
<tr>
<th>Event</th>
<th>USGS Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 18, 1996</td>
<td>11.89 (1280 cfs)*</td>
</tr>
<tr>
<td>April 18, 2013</td>
<td>14.98 (2290 cfs)</td>
</tr>
<tr>
<td>October 14, 2107</td>
<td>12.85 (1560 cfs)</td>
</tr>
</tbody>
</table>

* Estimated based on flow as no gage height is available.

In addition to NFIP claims, their private insurer has paid claims and the association has covered large repair bills. In 2013, a total of about $888,000 spent completing repairs on the three buildings. This included damages covered by the NFIP and a private insurance company and $250,000 covered by the association. For the 2017 event they have spent $400,000 to date with around $120,000 out of pocket. The final claim decisions haven’t been made by the NFIP and the private insurer on the 2017 claims.

I know Sarah Hunn and other County staff were in Lisle on October 14 and 15, 2017. Sarah and I spoke about issues along the East Branch, I don’t recall if Sarah was aware of the flooding at this location along St. Joseph Creek.

Please let me know if you need any additional information. I was out of town during the October flood but Village staff, as well as Mr. Then, were there.
Marilyn Sucoe

Marilyn L. Sucoe, P.E., CFM
Staff Engineer/Stormwater Administrator
Village of Lisle
925 Burlington Ave
Lisle, Illinois  60532
630-271-4107; 630-271-4155 (fax)
mailto:msucoe@villageoflisle.org

The information contained in this communication is the property of the Village of Lisle and is intended solely for the use of the individual or entity to whom it was addressed. The information may be confidential or privileged. Unauthorized use, disclosure or copying of this communication is strictly prohibited and may be unlawful. If you have received this communication in error, please notify us immediately by replying to the sender at the Village of Lisle and deleting it from your system. Please be advised that this communication may be subject to release under the Freedom of Information Act.
Planning Branch
Environmental Formulation and Analysis Section

Mr. Tony Then
President, St. Joseph Creek Condo Assn.
4731 St. Joseph Creek Road #4I
Lisle, Illinois 60532

Dear Mr. Then:

The U.S Army Corps of Engineers (USACE) has received and reviewed your comments from the public review period for the DuPage River Flood Risk Management Feasibility Report and Integrated Environmental Assessment. Thank you very much for your time during this review and for the well thought out comments.

Your May 15, 2019 letter describes flooding that has been experienced at three of the condominium buildings within your association and was a follow up to your initial letter, which you submitted to the Chicago District on September 22, 2018, which similarly described the flooding. As a result of your initial comment, the USACE project team reviewed potential projects which could be completed to reduce future risk of flooding to your structures and has included nonstructural floodproofing as part of our final recommended plan. You should have received a letter via certified mail last month informing you that your property was included. A copy of the letter is enclosed for your reference. The structures included are: 4711 St. Joseph Creek Road; 4721 St. Joseph Creek Road; and 4723 St. Joseph Creek Road.

At this point, only a conceptual level design has been developed for floodproofing of these structures. Specific details regarding the engineering design will need to be completed after the feasibility report is approved at the USACE Headquarters level. Following approval, initiation of the detailed design and engineering specifications phase of the project will depend on receipt of federal funding and a partnership agreement with a nonfederal sponsor. As stated in the enclosed letter, you will be contacted at the initiation of the design phase for your input.
Once again, thank you very much for your review of the DuPage River, Illinois Feasibility Report and Integrated Environmental Assessment. If you have any questions please feel free to contact me at susanne.j.davis@usace.army.mil.

Sincerely,

Susanne J. Davis, P. E  
Chief, Planning Branch

Enclosure
Dear Property Owner:

As you may be aware, in partnership with the DuPage County Stormwater Management and the Will County Executive Office, the U.S. Army Corps of Engineers (USACE), Chicago District is conducting a feasibility study to address flood risk in DuPage and Will counties.

The study investigated structural and nonstructural measures to reduce flood risk associated with the DuPage River and its major tributaries.

- Structural measures include civil works projects such as levees, floodwalls, channel modifications, and diversions.
- Nonstructural measures modify the potential damages to structures from flooding though acquisitions (buy-out), floodproofing, or elevation or structures identified to be at risk of flooding.

Potential structural and nonstructural measures were evaluated for their cost effectiveness, technical feasibility, and environmental acceptability to identify a Recommended Plan.

A draft Feasibility report and Integrated Environmental Assessment was released for public review and comment on July 31, 2018. This report presented the status of the study and the Tentatively Selected Plan for implementation of flood risk reduction projects. During public meetings held in August 2018, USACE committed to inform property owners of properties included in the nonstructural components of the Recommended Plan prior to finalization of the study. This letter is to inform you that your property is included as one of the nonstructural features included in the Recommended Plan. This means that your property may be eligible for acquisition, floodproofing, or elevation through which would be funded through a cost-sharing agreement between USACE and a local nonfederal sponsor.

An updated report was released for comment on May 2, 2019 and made available online at: https://www.lrc.usace.army.mil/Missions/Civil-Works-Projects/DuPage-River

Note that the current Recommended Plan is undergoing USACE policy review as well as public review and is subject to change. If approved, the project would be implemented after it receives federal funding and after a cost-sharing agreement with a nonfederal sponsor is finalized.
Once the funding agreements are in place, you (and any tenants) can expect to receive official notice of the project’s initiation with additional details about the anticipated timeline. An in-person initial meeting will be held to discuss the next steps and answer any questions. All improvements will be implemented with input from owners and sponsors of the project.

The Army Corps of Engineers is accepting comments on the report from May 2, 2019, through May 17, 2019. Comments may be submitted by e-mail to dupageriver@usace.army.mil or mailed to: U.S. Army Corps of Engineers, Chicago District, 231 S. LaSalle Street, Ste. 1500, Chicago, IL 60604, ATTN: DuPage River. Mailed comments must be postmarked by May 17, 2019.

Please direct any comments on the report through the submittal options listed above and any questions related to your property’s inclusion in the recommended plan to Imad Samara, Project Manager, at Imad.N.Samara@usace.army.mil or (312) 846-5560.

Sincerely,

[Signature]

Susanne J. Davis, P.E.
Chief, Planning Branch
Team, please review and respond as soon as practical. Thank you!

Colonel Aaron W. Reisinger  
Commander, Chicago District  
U.S. Army Corps of Engineers  
312-846-5300 (Office)  
312-823-4364 (Cell)  
231 S. LaSalle, Floor 15  
Chicago, IL  60604

-----Original Message-----  
From: Reisinger, Aaron W COL USARMY CELRC (US)  
Sent: Friday, May 17, 2019 11:41 AM  
To: Bill Graham <billgrahampe@aol.com>  
Subject: RE: [Non-DoD Source] Photo: May 2019 Flooding East Branch DuPage River and Comments on Final Study

Mr. Graham, thank you for your note and detailed comments. I will have the team review and respond as soon as possible.

Respectfully,  
Colonel Reisinger

Colonel Aaron W. Reisinger  
Commander, Chicago District  
U.S. Army Corps of Engineers  
312-846-5300 (Office)  
312-823-4364 (Cell)  
231 S. LaSalle, Floor 15  
Chicago, IL  60604

-----Original Message-----  
From: Bill Graham <billgrahampe@aol.com>  
Sent: Friday, May 17, 2019 10:01 AM  
To: LRC.LRC-PROJ-DuPageRiver <dupageriver@usace.army.mil>; Reisinger, Aaron W COL USARMY CELRC (US) <Aaron.W.Reisinger@usace.army.mil>  
Subject: [Non-DoD Source] Photo: May 2019 Flooding East Branch DuPage River and Comments on Final Study
Colonel Aaron W. Reisinger  
USACE, Chicago District  
231 S. LaSalle St., Suite 1500  
Chicago, Il. 60604

Subject: DuPage River – Final Feasibility Report

Dear Col. Reisinger,

Thank you for your April 30 response to my comments of September 19, 2018. Thank you for issuing a final report with public response summary and thank you for returning the Lacey Creek Restriction to its rightful place in the response plan.

My comments and your responses were grouped into five topics, four of which your responses resolved. Thank you.

1. Alternative Structural Measures  
2. Lacey Creek Restriction  
3. Economic Costs of Rte 53 closure  
4. Impacts of Levee to adjacent reaches  
5. Need for Open and Effective Public Involvement

Your detailed response to comment 3 merits further development. Rather than repeat my comment and your response, I incorporate these by reference from your April 30 letter, Page 3 and 4. The study and your letter estimate the annualized damage as $28,000 per year.

Your letter suggests the Corps “developed the estimates documented in the report based on best available information.” This standard is required by Good engineering practice.

Your method uses models to simulate events for which actual data is readily available. When a model predicted outcomes deviate from actual data, good engineering practice would be to recalibrate and rerun the model to align with known conditions, or preferably to use known conditions and data for planning.

IDOT maintains records of road closings and openings for Route 53 between Butterfield and Park. They recorded 13 road closing incidents from September 2008 to May 2019. Total duration of road closure was 673 hours, an average of 64 hours per year (Summary Attached). Using the study cost per hour of road closing ($10,000), flooding costs born by the community exceed $500,000 per year.
on average; the study number of $28,000/year should be discarded as it does not represent best available information or good engineering practice.

A range of precipitation events caused this flooding. I ask that you adjust your model to reflect actual facts, not predictions regarding road closings. I further ask that you adjust upward the benefit estimates for the Lacey Creek Restriction. This is useful to offset potential added costs to assure the restriction addresses limitations placed on the project by the non-Federal sponsor, the Morton Arboretum (p130).

New Comments on Final Report

6. Social and Environmental Impacts at Lacey Creek

In the report under Uncertainties (5.2.6.2, p 149), potential impacts to significant environmental resources are raised as issues for project design. These appear to relate primarily to the potential affect on vegetation of temporary inundation during peak runoff retention periods. Alternatives to such inundation should include retention on the property impacted at Morton Arboretum and low berms to confine water to the restriction area.

Joy Morton provided storm water retention at the West Side by creating Sterling and Marmo Lakes around 1925, including a control structure (dam). In building the new Administration complex and parking area in the 1990s, Morton constructed a pioneering permeable parking area with retention structures to both mitigate peak flows and filter runoff prior to discharge to the East Branch. Runoff from the west portion of the Arboretum is uncontrolled. Owing to steep slopes here, runoff moves very rapidly to Lacey Creek and the East Branch.

I ask that the Corps and County consider permitting the Arboretum to install retention for peak flows from their west side prior to release to the East Branch and/or Lacey Creek. This could reduce the scale and volume requiring retention at the Lacey Creek Restriction. Installing such retention is consistent with Arboretum vision, values and historic practice. In no event should flooding be allowed to continue unabated owing to species of vegetation deemed needing protection. This vegetation is replicated throughout the Arboretum and region and is not endangered. Human suffering and high costs should prevail over minor impacts of temporary inundation.

Social impacts are raised regarding the need to obtain easements from landowners and right of way owners including the Forest Preserve, Morton Arboretum, Commonwealth Edison and a natural gas pipeline. The report should balance these against the offsetting social impacts of the flooding of downstream residential areas at Valley View and flooding of State Highway 53, which cause detours for about 80,000 vehicle trips per year.

The Lacey Creek Basin encompasses 4.6 square miles and drains runoff northwesterly from Downers Grove and through the Tollways before being dumped into the East Branch heading south at Hidden Lake. There is a tremendous quantity of flow that arrives quickly to the flood sensitive area of Hidden Lake. The East Branch at Eagle Lake is quickly overtopped causing roadway flooding a closing on an annual frequency. Contrary to the Corps report, this does not occur with a probability 0.04 events per year. The beleaguered residents and drivers should get relief from these events, despite concerns regarding transient inundation of vegetation on a forest floor at the Aboretum.

7. Lacey Creek Culvert
This structure is largely blocked with large logs and brush and appears to be not inspected or maintained. Throughout most its length from where it flows under Finley Road, the creek is overgrown with vegetation and blocked with timber and other debris. These conditions continue in the ditch portion of Lacey Creek; this ditch may have been constructed to assist in moving storm water more quickly away from the Tollways. Had the ditch not been constructed, there likely would have been greater time of travel for the flow in the Creek and peak flow would not arrive so quickly and with such devastating effect on the community.

Please ask that the County arrange to survey and maintain this waterway and culvert prior to further delays in implementing the Lacey Creek Restriction over the next 4-5 years. Perhaps the County Storm Water Ordinance requires routine inspection and maintenance of this feature. Stakeholders discharging to the creek and though which the creek is routed might contribute to its maintenance.

There are many institutional stakeholders and governmental representatives who have tolerated these conditions for decades and it is time they join together and serve the community that supports them all financially. Because these local institutions have failed in their obligations to the community, the Federal Army Corps of Engineers has had to step in to try to protect the community. Unfortunate it is that we have to rely on the Federal Government, but no local stakeholder should be allowed to hinder, delay or prevent a project that has been determined with benefits above costs. If such interference is tolerated, the citizens will soon learn who it is that is still preventing mitigation of flooding. The people can then act through our County, State and Federal representatives.

Thanks again for including the Lacey Creek Restriction in the plan. We are fortunate to have available land on which practical and affordable retention can be installed. Based on your comprehensive study, it has been shown that there is no other practical or cost effective alternative structural measure available to mitigate local flooding. We need the Corps to lead this effort to a successful conclusion, because for several decades local institutions and governmental representatives have failed to protect the community.

Thank you for your service to our Country.

Sincerely,

William K. Graham, P.E.
3s351 Juniper Lane
Glen Ellyn, IL 60137
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5/3/19
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Hours

673

Hours/Year
William K. Graham, P.E.
351 Juniper Lane
Glen Ellyn, IL

630-730-0060

billgrahamPE@aol.com
Dear Mr. Graham:

The U.S. Army Corps of Engineers has received and reviewed your comments from the public review period for the DuPage River Flood Risk Management Feasibility Report and Integrated Environmental Assessment. Thank you very much for your time during this review and for the well thought out comments. Members of the Project Delivery Team for the project have provided the below responses to the comments and recommendations listed in your letter.

I ask that you adjust your model to reflect actual facts (related to the Route 53 road closure records), not predictions regarding road closings. I further ask that you adjust upward the benefit estimate for the Lacey Creek Restriction.

Thank you for providing Illinois Department of Transportation (IDOT) records of roadway closures on Route 53 between Butterfield and Park. As you noted, IDOT has documented several closures along this roadway over the approximately 10 years for which data was provided. The road closure information we incorporated in the study was coordinated through local community input as well as hydraulic model analysis to estimate frequency. Uncertainty in all estimates used for our study are acknowledged and the data you submitted indicates that our assumptions on road closures may have been lower than actual closure records indicate.

It is important to note that USACE must formulate and recommend projects based on authorities allocated to us by Congress. Specifically, we are not permitted to develop measures solely for the purpose of benefiting transportation, as transportation responsibility has been assigned to other federal and local agencies. The most direct and effective solution to reduce flooding on Route 53 and in the Valley View neighborhood is to elevate the roadway through the flood damage area. Per policy, USACE cannot recommend projects which are exclusively or predominantly roadway improvement projects such as a roadway elevation project. USACE is aware that IDOT has considered elevating the roadway in this area to reduce the frequency of future road closures due to flooding, but to our knowledge no funding has been allocated for the construction of this solution.

USACE did evaluate several other options for reducing flood elevations in the Valley View area:
Multiple floodwater storage options upstream of the flood problem areas were considered. While storage can reduce flood profiles to some extent, general even large storage solutions only act to reduce flood profiles incrementally and do not often eliminate all flooding. Due to the large flow rates on the East Branch, floodwater storage options large enough to reduce damages due to flooding in any significant way were not available. Storage options considered based on available land for storage projects were minimally effective for flood damage reduction.

The construction of a levee or floodwall with sheetpile cutoff wall to reduce groundwater flooding was also considered. Options for placement of a levee or floodwall were challenging due to space restrictions and would likely need to be either constructed as a road raise or placed west of the roadway. If a levee was constructed in the location of the existing Route 53 roadway and the roadway elevated, this project would be very expensive and challenging to implement, particularly taking into account that raising the roadway would require raising all access points including private drives and roadway intersections which would be very costly. If a levee or floodwall was placed west of the roadway, flood reduction benefits would be afforded only to the residential area and not the Route 53 roadway. In both cases, the cost of these options would not exceed the economic benefits and therefore these options were determined not to be appropriate solutions.

If, as you suggested, damage estimates were updated to assume more frequent and longer duration road closures, we agree that we may have estimated higher average annual economic damages for this area. However, we still believe that the most effective solution for this area is predominantly elevating the roadway, which is outside USACE authority. Furthermore, the Lacey Creek project is currently economically justified and included in our recommended plan and therefore adjustment of economic benefits is not necessary for including of the project in our recommended plan.

I ask that the Corps and County consider permitting the Arboretum to install retention for peak flows from their west side prior to release to the East Branch and/or Lacey Creek.

The Morton Arboretum as a private entity has the ability to build retention ponds under the guidelines of local, state and federal regulations. While USACE would be the federal permitting agency related to potential wetland impacts and work within the waters of the United States, it is the decision of the arboretum to construct these features. During the planning process, USACE investigated several storage options both upstream and downstream of Morton Arboretum. Those options were all found to be to be too costly for the benefits added, therefore additional storage ponds within the area would likely have minimal benefits.
Please ask that the County arrange to survey and maintain this waterway and culvert prior to further delays in implementing the Lacey Creek Restriction over the next 4-5 years. Perhaps the County Storm Water Ordinance requires routine inspection and maintenance of this feature. Stakeholders discharging to the creek and though which the creek is routed might contribute to its maintenance.

The County is aware of the maintenance issue on Lacey Creek. Please reach out to your local municipality to determine what steps are being taken to consideration to alleviate the maintenance issues.

Once again, thank you very much for your review of the DuPage River, Illinois Feasibility Report and Integrated Environmental Assessment. If you have any questions please feel free call the Project Manager Imad Samara at 312-846-5560 or via email at imad.n.samara@usace.army.mil.

Sincerely,

Susanne J. Davis, P. E
Chief, Planning Branch
Various Counties
Various Locations
  DuPage River, Illinois Feasibility Study and Integrated Environmental Assessment
  DuPage County - Bloomingdale, Lombard, Lisle, Winfield, Warrenville, Naperville, Milton Township and Lisle Township; Will County - Bolingbrook, Joliet, Romeoville, Crest Hill, Plainfield, Minooka, Channahon, Plainfield Township and Wheatland Township
  SHPO Log #019110215

June 7, 2019

Susanne Davis
U.S. Army Corps of Engineers, Chicago District
231 S. LaSalle St., Suite 1500
Chicago, IL 60604

Dear Ms. Davis:

Thank you for requesting comments from our office concerning the possible effects of your project on cultural resources. Our comments are required by Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations, 36 CFR 800: "Protection of Historic Properties".

Our staff has reviewed the specifications of the referenced project as submitted by your office. The Morton Arboretum is eligible for listing on the National Register of Historic Places. We cannot adequately review this proposed project until the following additional documentation has been submitted to our office:

Please submit a full scope of work, including the work proposed to the I&M Canal.

Please submit an illustrated architectural inventory and description with dates of construction of all 38 buildings proposed to be effected by this undertaking. The April 2019 feasibly report is not complete.

We require additional information about the history and context of the Forest Preserve District of DuPage County (FPDDC) to determine whether the forest preserves created by the FPDDC, individually and as an entire system, are significant and historic cultural landscapes eligible for listing on the National Register of Historic Places under Criteria “A” and “C.” The FPDDC was established in 1915 as the fifth county forest-preserve district in the United States, and in 1917, the FPDDC purchased its first land (York Woods), which suggests that the FPDDC’s legacy is indeed significant. Please submit a historical context of the FPDDC, including this portion of the project area. Two important guides written by the National Park Service may be of assistance: National Register Bulletin 18: “How to Evaluate and Nominate Designed Historic Landscapes” (www.nps.gov/nr/publications/bulletins/nrb18/) and Preservation Brief 36: “Protecting
Cultural Landscapes: Planning, Treatment and Management of Historic Landscapes" (www.nps.gov/tps/how-to-preserve/briefs/36-cultural-landscapes.htm). Surveys and contexts will assist the FPDDC and other entities (such as the Army Corps of Engineers) to better understand the significance of these resources individually and as a system and plan accordingly.

In your reply, please refer to SHPO Log #019110215. If you have any further questions, please call 217/782-4836.

Sincerely,

[Signature]

Robert F. Appleman
Deputy State Historic Preservation Officer
Dear Mr. Appleman:

The U.S Army Corps of Engineers has received and reviewed your comments from the public review period for the DuPage River Flood Risk Management Feasibility Report and Integrated Environmental Assessment (SHPO Log #019110215). Thank you for your time to review and for your comments and concerns. The Project Delivery Team has responded the submitted comments and are outlined below.

*The Morton Arboretum is eligible for listing on the National Register of Historic Places.*

The USACE recognizes that the Morton Arboretum is eligible, but is not listed at this time. Ongoing coordination with Morton Arboretum will continue in the Detailed Design and Specification Phase to minimize any impacts to their property.

*Please submit a full scope of work, including the work proposed to the I&M Canal.*

The scope of work is outlined in the DuPage River Feasibility Flood Risk Management project document that was reviewed by your office. Detailed design and specifications will be completed after project approval and funded has been received to proceed to implementation. The Recommended Plan includes the non-structural component that consists of buying out, flood proofing, or raising 38 structures within the floodplain. It also includes two structural components: repair of the Lisle Levee to approximately the 1% annual chance of exceedance floodplain height and the construction of a berm on Lacey Creek to cause a restriction point to detain flow from Lacey Creek temporarily. The plan does not include any impacts or changes to the I&M Canal. A few potential projects were investigated near and adjacent to the I&M Canal, but they were found to not be cost beneficial and are not part of the final plan.

*Please submit an illustrated architectural inventory and description with dates of construction of all 38 building proposed to be effected by this undertaking. The April 2019 feasibility report is not complete.*
A document outlining the buildings that are part of the non-structural plan is attached (Attachment 1) with this document. The file outlines the year the building was built, a description of the building and a photograph of the building. USACE did not provide the pictures and locations for the buildings in the feasibility report in an effort to protect the privacy of the residents. During the feasibility process USACE reached out to each owner/resident individually with a letter to let them know their structure was being considered in the non-structural plan. We will continue to coordinate with each resident as additional details are worked out during detailed design and specifications phase.

We require additional information about the history and context of the Forest Preserve District of DuPage County (FPDDC) to determine whether the forest preserves created by the FPDDC, individually and as an entire system, are significant and historic cultural landscapes eligible for listing on the national register of historic places under criteria “A” and “C”.

In the case of the Lacey Creek Restriction, located between the Hidden Lake Forest Preserve and The Morton Arboretum, no adverse impacts are anticipated to historical or cultural resources. For the purposes of this study, The USACE is going to assume that the Hidden Lake Forest Preserve is eligible for listing as part of the larger DuPage Forest Preserve system. However, based on our analysis no significant adverse impacts will occur. The Area of Potential Effects (APE) which includes the footprint of the berm and the area that may be inundated during a 100 year storm is outlined in attachment 2. The total impact on the Forest Preserve from the construction of the berm is 0.4 acres. In addition, a total of up to 26.9 acres may be inundated temporarily and infrequently during rainfall events up to and including the 1% Annual Chance Exceedance Event (ACE), also known as the 100 year storm. The potential APE for the 1% event represents a worst case scenario. However, the impacts that could be attributed to floodwater inundation would be temporary as the restriction will be designed and operated to release water quickly after peak flows on the East Branch of the DuPage River dissipate. It is also important to note that a large portion of the APE is already listed as a floodway. Currently, a 100 year flood event impacts the APE up to the elevation of 676.4 – 678.8 feet NAVD depending on the location within the APE and covers approximately 19.7 acres of Forest Preserve Property. With the new restriction point in place, elevation from 680.8 to 682.1 feet NAVD will be inundated during a 100 year storm event which can be seen in Figure 4-7 of the feasibility report and covers approximately 26.9 acres.

The majority of the APE has been surveyed in the past and was greatly disturbed when the utility easement was created, resulting in disturbances to the surrounding landscape as shown in Figure 4-8 of the feasibility report. Despite these past disturbances, the USACE plans to implement project features that will minimize impacts to both the ecological and the potential cultural landscape. Currently planned project features include placing cobble to help promote aquatic habitat for macroinvertebrates and fish resident in Lacey Creek. The berm will also be planted with native vegetation to help blend in with the surrounding landscape. Additional engineering features to minimize impacts will be
coordinated with Morton Arboretum and the Forest Preserve during the detailed
design phase to ensure that we minimize impacts to the surrounding area. The
small impact to the APE, previous land disturbances and the planned project
features outlined above resulted in a finding of no adverse impacts to the cultural
landscape or other historic resources.

Once again, thank you very much for your review of the DuPage River, Illinois
Feasibility Report and Integrated Environmental Assessment. If you have any
questions please feel free call the Project Manager Imad Samara at 312-846-5560
or email at imad.n.samara@usace.army.mil.

Sincerely,

Susanne J. Davis, P. E
Chief, Planning Branch

Enclosures
Please see comment below.

-----Original Message-----
From: Michael LaRonge [mailto:Michael.LaRonge@fcpotawatomi-nsn.gov]
Sent: Thursday, June 6, 2019 4:13 PM
To: Samara, Imad N CIV USARMY CELRC (US) <Imad.N.Samara@usace.army.mil>


Dear Mr. Samara,

Pursuant to consultation under Section 106 of the National Historic Preservation Act (1966 as amended) the Forest County Potawatomi Community (FCPC), a Federally Recognized Native American Tribe, reserves the right to comment on Federal undertakings, as defined under the act.

The Tribal Historic Preservation has reviewed the information you provided for the project. The DuPage River is a resources used by Potawatomi Peoples during their occupation of the area. The Tribal Historic Preservation Office was unable to locate the Section 106 compliance documents for this federal undertaking and request a copy of said materials prior to making a decision as to the level of interest the Community wishes to take in this project.

Your interest in protecting cultural and historic properties is appreciated. If you have any questions or concerns, please contact me at phone number or email listed below.

Respectfully,

Michael LaRonge
Tribal Historic Preservation Officer
Natural Resources Department
Forest County Potawatomi Community
5320 Wensaut Lane
P.O. Box 340
G5 – Planning Information
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<td><em>Xanthcephalus canthocephalus</em></td>
<td>Yellow-headed Blackbird</td>
<td>Bird</td>
<td>LE</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><em>Anmocrypta clarum</em></td>
<td>Western Sand Darter</td>
<td>Fish</td>
<td>LE</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><em>Erismystax x-punctatus</em></td>
<td>Gravel Chub</td>
<td>Fish</td>
<td>LT</td>
<td></td>
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<tr>
<td><em>Etheostoma exile</em></td>
<td>Iowa Darter</td>
<td>Fish</td>
<td>LT</td>
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<tr>
<td><em>Fundulus diaphanus</em></td>
<td>Banded Killifish</td>
<td>Fish</td>
<td>LT</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><em>Fundulus dispar</em></td>
<td>Starhead Topminnow</td>
<td>Fish</td>
<td>LT</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><em>Hybopsis amnus</em></td>
<td>Pallid Shiner</td>
<td>Fish</td>
<td>LE</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><em>Moxostoma carinatum</em></td>
<td>River Redhorse</td>
<td>Fish</td>
<td>LT</td>
<td></td>
<td>X</td>
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<tr>
<td><em>Notropis anogenus</em></td>
<td>Pugnose Shiner</td>
<td>Fish</td>
<td>LE</td>
<td></td>
<td>X</td>
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<tr>
<td><em>Notropis Boops</em></td>
<td>Bigeye Shiner</td>
<td>Fish</td>
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<td></td>
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<tr>
<td><em>Notropis chalybaeus</em></td>
<td>Ironcolor Shiner</td>
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<tr>
<td><em>Notropis heterodon</em></td>
<td>Blackchin Shiner</td>
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<td>LT</td>
<td>X</td>
<td>X</td>
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<tr>
<td><em>Notropis heterolepis</em></td>
<td>Blacknose Shiner</td>
<td>Fish</td>
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<td>X</td>
<td>X</td>
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<tr>
<td><em>Notropis texanus</em></td>
<td>Weed Shiner</td>
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<td></td>
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<tr>
<td><em>Aflexia rubranura</em></td>
<td>Redveined Prairie Leafhopper</td>
<td>Insect</td>
<td>LE</td>
<td></td>
<td>X</td>
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<tr>
<td><em>Papaiapema eryngii</em></td>
<td>Eryngium Stem Borer</td>
<td>Insect</td>
<td>LE</td>
<td></td>
<td>X</td>
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<tr>
<td><em>Somatochlora hinea</em></td>
<td>Hine's Emerald Dragonfly</td>
<td>Insect</td>
<td>LE</td>
<td>X</td>
<td>X</td>
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<tr>
<td><em>Spermophilus franklinii</em></td>
<td>Franklin's Ground Squirrel</td>
<td>Mammal</td>
<td>LT</td>
<td></td>
<td>X</td>
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<tr>
<td><em>Alasmidonta viridis</em></td>
<td>Slippershell</td>
<td>Mussel</td>
<td>LT</td>
<td>X</td>
<td>X</td>
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<tr>
<td><em>Cyclonaias tuberculata</em></td>
<td>Purple Wartyback</td>
<td>Mussel</td>
<td>LT</td>
<td></td>
<td>X</td>
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<tr>
<td><em>Elliptio dilatata</em></td>
<td>Spike</td>
<td>Mussel</td>
<td>LT</td>
<td></td>
<td>X</td>
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<tr>
<td><em>Ligumia recta</em></td>
<td>Black Sandshell</td>
<td>Mussel</td>
<td>LT</td>
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<td>X</td>
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<tr>
<td>Scientific Name</td>
<td>Common Name</td>
<td>Family</td>
<td>Life Stage</td>
<td>Phase</td>
<td>Notes</td>
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<tr>
<td><em>Plethobasus cyphyus</em></td>
<td>Sheepnose Mussel</td>
<td>LE</td>
<td>X</td>
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<tr>
<td><em>Amelanchier interior</em></td>
<td>Shadnose Plant</td>
<td>LT</td>
<td>X</td>
<td></td>
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<tr>
<td><em>Asclepias meadii</em></td>
<td>Meadow's Milkweed Plant</td>
<td>LE</td>
<td>X</td>
<td>X</td>
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<tr>
<td><em>Aster furcatus</em></td>
<td>Forked Aster Plant</td>
<td>LT</td>
<td>X</td>
<td></td>
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<tr>
<td><em>Beckmannia syzigachne</em></td>
<td>American Slough Grass Plant</td>
<td>LT</td>
<td>X</td>
<td></td>
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<tr>
<td><em>Calopogon oklahomensis</em></td>
<td>Oklahoma Grass Plant</td>
<td>LT</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td><em>Calopogon tuberosus</em></td>
<td>Grass Pink Orchid Plant</td>
<td>LT</td>
<td>X</td>
<td></td>
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<tr>
<td><em>Carex bromoides</em></td>
<td>Sedge Plant</td>
<td>LT</td>
<td>X</td>
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<tr>
<td><em>Carex crptolepis</em></td>
<td>Tuckerman's Sedge Plant</td>
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<tr>
<td><em>Carex viridula</em></td>
<td>Little Green Sedge Plant</td>
<td>LT</td>
<td>X</td>
<td>X</td>
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<tr>
<td><em>Carex woodii</em></td>
<td>Pretty Sedge Plant</td>
<td>LT</td>
<td>X</td>
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<tr>
<td><em>Corallorhiza maculata</em></td>
<td>Spotted Coral-root Orchid Plant</td>
<td>LT</td>
<td>X</td>
<td>X</td>
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<tr>
<td><em>Corydalis aurea</em></td>
<td>Golden Corydalis Plant</td>
<td>LE</td>
<td>X</td>
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<tr>
<td><em>Cypripedium candidum</em></td>
<td>White Lady's Slipper Plant</td>
<td>LT</td>
<td>X</td>
<td>X</td>
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<tr>
<td><em>Dalea foliosa</em></td>
<td>Leafy Prairie Clover Plant</td>
<td>LT</td>
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<td>X</td>
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<tr>
<td><em>Dichanthelium boreale</em></td>
<td>Northern Panic Grass Plant</td>
<td>LT</td>
<td>X</td>
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<td><em>Drosera intermedia</em></td>
<td>Narrow-leaved Sundew Plant</td>
<td>LT</td>
<td>X</td>
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<td><em>Eleocharis rostellata</em></td>
<td>Beaked Spike Rush Plant</td>
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<td><em>Elymus trachycaulus</em></td>
<td>Bearded Wheat Grass Plant</td>
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<tr>
<td><em>Gratilloa quatermaniae</em></td>
<td>Hedge Hyssop Plant</td>
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<tr>
<td><em>Hypericum adpressum</em></td>
<td>Shore St. John's Wort Plant</td>
<td>LE</td>
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<tr>
<td><em>Iliamna remotna</em></td>
<td>Kanakakee Mallow Plant</td>
<td>LE</td>
<td>X</td>
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<tr>
<td><em>Isoetes butleri</em></td>
<td>Quillwort Plant</td>
<td>LT</td>
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<tr>
<td><em>Juncus alpinus</em></td>
<td>Richardson's Rush Plant</td>
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<tr>
<td><em>Lespedeza leptostachya</em></td>
<td>Prairie Bush Clover Plant</td>
<td>LE</td>
<td>X</td>
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<tr>
<td><em>Liatris scarioza var. nieuwendii</em></td>
<td>Blazing Star Plant</td>
<td>LT</td>
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<tr>
<td><em>Lycopus clavatum</em></td>
<td>Running Pine Plant</td>
<td>LE</td>
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<tr>
<td><em>Malvastrum hispidum</em></td>
<td>False Mallow Plant</td>
<td>LT</td>
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<tr>
<td><em>Melanthium virginicum</em></td>
<td>Bunchflower Plant</td>
<td>LT</td>
<td>X</td>
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<tr>
<td><em>Misumata patula</em></td>
<td>Slender Sandwort Plant</td>
<td>LT</td>
<td>X</td>
<td>X</td>
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<tr>
<td><em>Oenothera perennis</em></td>
<td>Small Sundrops Plant</td>
<td>LT</td>
<td>X</td>
<td>X</td>
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<tr>
<td><em>Penstemon tubaeformis</em></td>
<td>Tube Beard Tongue Plant</td>
<td>LT</td>
<td>X</td>
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<tr>
<td><em>Plantago cordata</em></td>
<td>Heart-leaved Plantain Plant</td>
<td>LT</td>
<td>X</td>
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<tr>
<td><em>Platanthera flava var. herbiola</em></td>
<td>Tubercled Orchid Plant</td>
<td>LT</td>
<td>X</td>
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<tr>
<td><em>Platanthera leucophaea</em></td>
<td>Easter Prairie Fringed Orchid Plant</td>
<td>LE</td>
<td>X</td>
<td>X</td>
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<tr>
<td><em>Rubus odoratus</em></td>
<td>Purple-flowering Raspberry Plant</td>
<td>LE</td>
<td>X</td>
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<tr>
<td><em>Rubus pubescens</em></td>
<td>Dwarf Raspberry Plant</td>
<td>LT</td>
<td>X</td>
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<tr>
<td><em>Rubus schneideri</em></td>
<td>Bristly Blackberry Plant</td>
<td>LT</td>
<td>X</td>
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<tr>
<td><em>Salvia azurea ssp. Pitcheri</em></td>
<td>Blue Sage Plant</td>
<td>LT</td>
<td>X</td>
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<tr>
<td><em>Sanguisorba canadensis</em></td>
<td>American Burnet Plant</td>
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<td>X</td>
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<tr>
<td><em>Scirpus hattorianus</em></td>
<td>Bulrush Plant</td>
<td>LE</td>
<td>X</td>
<td></td>
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<tr>
<td><em>Sisyrinchium montanum</em></td>
<td>Mountain Blue-eyed Grass Plant</td>
<td>LE</td>
<td>X</td>
<td></td>
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<tr>
<td><em>Sparganium emersum</em></td>
<td>Green-fruited Burreed Plant</td>
<td>LE</td>
<td>X</td>
<td></td>
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<tr>
<td><em>Spiranthes lucida</em></td>
<td>Yellow-lipped Ladies' Tresses Plant</td>
<td>LE</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td><em>Tetraneuris herbacea</em></td>
<td>Lakeside Daisy Plant</td>
<td>LE</td>
<td>X</td>
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</tr>
</tbody>
</table>
### List of State Threatened (LT) and State Endangered (LE) species found within DuPage and Will Counties.

<table>
<thead>
<tr>
<th>Species Name</th>
<th>Common Name</th>
<th>Category</th>
<th>Status</th>
<th>X1</th>
<th>X2</th>
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<tbody>
<tr>
<td>Tomanthera auriculata</td>
<td>Ear-leafed Foxglove</td>
<td>Plant</td>
<td>LT</td>
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<td>X</td>
</tr>
<tr>
<td>Trifolium reflexum</td>
<td>Buffalo Clover</td>
<td>Plant</td>
<td>LT</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Triglochin palustris</td>
<td>Slender Bog Arrow Grass</td>
<td>Plant</td>
<td>LT</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Vaccinium macrocarpon</td>
<td>Large Cranberry</td>
<td>Plant</td>
<td>LE</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Valerianella chenopodifolia</td>
<td>Corn Salad</td>
<td>Plant</td>
<td>LE</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Valerianella umbilicata</td>
<td>Corn Salad</td>
<td>Plant</td>
<td>LE</td>
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</tr>
<tr>
<td>Veronica scutellata</td>
<td>Marsh Speedwell</td>
<td>Plant</td>
<td>LT</td>
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<td>X</td>
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<tr>
<td>Viola canadensis</td>
<td>Canada Violet</td>
<td>Plant</td>
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<tr>
<td>Viola conspersa</td>
<td>Dog Violet</td>
<td>Plant</td>
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</tr>
<tr>
<td>Viola primulifolia</td>
<td>Primrose Violet</td>
<td>Plant</td>
<td>LE</td>
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</tr>
<tr>
<td>Blemmys guttata</td>
<td>Spotted Turtle</td>
<td>Reptile</td>
<td>LE</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Clonophis kirtlandi</td>
<td>Kirkland's Snake</td>
<td>Reptile</td>
<td>LT</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Emydoidea blandingii</td>
<td>Blanding's Turtle</td>
<td>Reptile</td>
<td>LE</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Sistrurus catenatus catenatus</td>
<td>Eastern Massasauga</td>
<td>Reptile</td>
<td>LE</td>
<td>X</td>
<td></td>
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<tr>
<td>Terrapene ornata</td>
<td>Ornate Box Turtle</td>
<td>Reptile</td>
<td>LT</td>
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<td></td>
</tr>
</tbody>
</table>
Planning Branch
Environmental Formulation Section

Mr. Heacock
Illinois Environmental Protection Agency
Division of Water Pollution Control
Facility Evaluation Unit
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

RE: Section 404/401 Water Quality Certification Regional Permit – DuPage River Flood Risk Management 206

Dear Mr. Heacock,

Enclosed is documentation for work associated with the USACE and DuPage County Flood Risk Management Project. The documentation details the requirements set forth by Regional Permit 5 Category I for Wetland & Stream Restoration and Enhancement, and Regional Permit 7 Temporary Construction, under which this project qualifies. This notice is being submitted solely to the ILEPA, as permits required from Illinois Department of Natural Resources, Office of Water Resources will be handled separately. This is not a request/application for a 401 Permit, but a notice that 401 Water Quality is already assumed based on the nature-based measures of the project and supporting analyses.

The proposed project involves restricting flows on Lacey Creek in Lisle, Illinois. The restrictions will primarily be effective at higher storm events to act as temporary water storage. In attempt, to minimize any impacts, natural fluvial stones and substrates will be used to develop a naturalized channel adjacent and through the restriction point. This channel will allow fish to swim through during normal and moderate flows while creating additional interstitial spacing important for both fish and invertebrates. In addition, any land impacted during construction will be replanted with native species. This addition of fluvial stone and native plants will provide a slight benefit to the project area.

If you have any questions regarding the permit application or the project, please contact Nicholas Barkowski at 312-846-5578.

Sincerely,

Susanne J. Davis
Chief of Planning

Enclosures
Applicant: US Army Corps of Engineers  
IDNR Project Number: 1807390

Contact: Nicholas Barkowski  
Date: 02/13/2018

Address: 231 S. Lasalle St.  
Suite 1500  
Chicago, IL 60604

Project: DuPage River Flood Risk Management  
Address: Between Ogden Avenue and I-88, Lisle

Description: Investigation into potential alternatives to minimize flood damages from the DuPage River near the Lisle Levee

Natural Resource Review Results

The Illinois Natural Heritage Database shows the following protected resources may be in the vicinity of the project location:

Morton Arboretum INAI Site
Black-Crowned Night Heron (Nycticorax nycticorax)

An IDNR staff member will evaluate this information and contact you to request additional information or to terminate consultation if adverse effects are unlikely.

Location
The applicant is responsible for the accuracy of the location submitted for the project.

County: DuPage

Township, Range, Section:
38N, 10E, 3
38N, 10E, 10

IL Department of Natural Resources  
Government Jurisdiction

Contact  
U.S. Army Corps of Engineers

Adam Rawe  
217-785-5500
Division of Ecosystems & Environment

Disclaimer

The Illinois Natural Heritage Database cannot provide a conclusive statement on the presence, absence, or condition of natural resources in Illinois. This review reflects the information existing in the Database at the time of this inquiry, and should not be regarded as a final statement on the site being considered, nor should it be a substitute for detailed site surveys or field surveys required for environmental assessments. If additional protected resources are encountered during the project’s implementation, compliance with applicable statutes and regulations is required.

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Page 1 of 2
1. The IDNR EcoCAT website was developed so that units of local government, state agencies and the public could request information or begin natural resource consultations on-line for the Illinois Endangered Species Protection Act, Illinois Natural Areas Preservation Act, and Illinois Interagency Wetland Policy Act. EcoCAT uses databases, Geographic Information System mapping, and a set of programmed decision rules to determine if proposed actions are in the vicinity of protected natural resources. By indicating your agreement to the Terms of Use for this application, you warrant that you will not use this web site for any other purpose.

2. Unauthorized attempts to upload, download, or change information on this website are strictly prohibited and may be punishable under the Computer Fraud and Abuse Act of 1986 and/or the National Information Infrastructure Protection Act.

3. IDNR reserves the right to enhance, modify, alter, or suspend the website at any time without notice, or to terminate or restrict access.

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Unauthorized use, tampering with or modification of this system, including supporting hardware or software, may subject the violator to criminal and civil penalties. In the event of unauthorized intrusion, all relevant information regarding possible violation of law may be provided to law enforcement officials.

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March 22, 2018

Nicholas Barkowski
US Army Corps of Engineers
231 S. Lasalle St.
Suite 1500
Chicago, IL 60604

RE: DuPage River Flood Risk Management
   Project Number(s): 1807390
   County: DuPage

Dear Applicant:

This letter is in reference to the project you recently submitted for consultation. The natural resource review provided by EcoCAT identified protected resources that may be in the vicinity of the proposed action. The Department has evaluated this information and concluded that adverse effects are unlikely. Therefore, consultation under 17 Ill. Adm. Code Part 1075 is terminated.

This consultation is valid for two years unless new information becomes available that was not previously considered; the proposed action is modified; or additional species, essential habitat, or Natural Areas are identified in the vicinity. If the project has not been implemented within two years of the date of this letter, or any of the above listed conditions develop, a new consultation is necessary.

The natural resource review reflects the information existing in the Illinois Natural Heritage Database at the time of the project submittal, and should not be regarded as a final statement on the site being considered, nor should it be a substitute for detailed site surveys or field surveys required for environmental assessments. If additional protected resources are encountered during the project’s implementation, you must comply with the applicable statutes and regulations. Also, note that termination does not imply IDNR’s authorization or endorsement of the proposed action.

Please contact me if you have questions regarding this review.

Adam Rawe
Division of Ecosystems and Environment
217-785-5500
Applicant: Nick Barkowski  
IDNR Project Number: 1810530  
Contact: Nick Barkowski  
Date: 05/02/2018

Address: 231 S. LaSalle St.  
Suite 1500  
Chicago, IL 60604

Project: DuPage Flood Risk Management  
Address: South east of Hidden Lake Forest Preserve, Lisle

Description: Investigating locations for water storage and levee modifications to minimize damages to the surrounding communities within in the DuPage River. This site will look to restrict flow within Lacey Creek to as temporary storage.

Natural Resource Review Results
The Illinois Natural Heritage Database shows the following protected resources may be in the vicinity of the project location:

- Morton Arboretum INAI Site
- Black-Crowned Night Heron (Nycticorax nycticorax)
- Blanding's Turtle (Emydoidea blandingii)
- Least Bittern (Ixobrychus exilis)
- Marsh Speedwell (Veronica scutellata)
- Spotted Coral-Root Orchid (Corallorhiza maculata)

An IDNR staff member will evaluate this information and contact you to request additional information or to terminate consultation if adverse effects are unlikely.

Location
The applicant is responsible for the accuracy of the location submitted for the project.

County: DuPage

Township, Range, Section:
39N, 10E, 36

IL Department of Natural Resources  
Contact
Adam Rawe  
217-785-5500  
Division of Ecosystems & Environment

Government Jurisdiction
U.S. Army Corps of Engineers

Disclaimer
The Illinois Natural Heritage Database cannot provide a conclusive statement on the presence, absence, or condition of natural resources in Illinois. This review reflects the information existing in the Database at the time of this inquiry, and should not be regarded as a final statement on the site being considered, nor should it be a substitute for detailed site surveys or field surveys required for environmental assessments. If additional protected resources are encountered during the project’s implementation, compliance with applicable statutes and regulations is required.
Terms of Use
By using this website, you acknowledge that you have read and agree to these terms. These terms may be revised by IDNR as necessary. If you continue to use the EcoCAT application after we post changes to these terms, it will mean that you accept such changes. If at any time you do not accept the Terms of Use, you may not continue to use the website.

1. The IDNR EcoCAT website was developed so that units of local government, state agencies and the public could request information or begin natural resource consultations on-line for the Illinois Endangered Species Protection Act, Illinois Natural Areas Preservation Act, and Illinois Interagency Wetland Policy Act. EcoCAT uses databases, Geographic Information System mapping, and a set of programmed decision rules to determine if proposed actions are in the vicinity of protected natural resources. By indicating your agreement to the Terms of Use for this application, you warrant that you will not use this web site for any other purpose.

2. Unauthorized attempts to upload, download, or change information on this website are strictly prohibited and may be punishable under the Computer Fraud and Abuse Act of 1986 and/or the National Information Infrastructure Protection Act.

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EcoCAT operates on a state of Illinois computer system. We may use software to monitor traffic and to identify unauthorized attempts to upload, download, or change information, to cause harm or otherwise to damage this site. Unauthorized attempts to upload, download, or change information on this server is strictly prohibited by law.

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Privacy
EcoCAT generates a public record subject to disclosure under the Freedom of Information Act. Otherwise, IDNR uses the information submitted to EcoCAT solely for internal tracking purposes.
May 3, 2018

Mr. Nick Barkowski
U.S. Army Corps of Engineers
Chicago District, Regulatory Branch
231 South LaSalle Street, Suite 1500
Chicago, IL 60604

RE: DuPage Flood Risk Management- Lacey Creek Site
EcoCAT No. 1810530
County: DuPage

Dear Mr. Barkowski:

The Illinois Department of Natural Resources has received your consultation request regarding the DuPage flood risk management project, specifically temporary storage within Lacey Creek.

Review of the Natural Heritage Database indicates the Morton Arboretum INAI site is located near the proposed project site. Blanding’s turtle, marsh speedwell and spotted coral-root orchid records exist within the INAI site. Two bird species, the black-crowned night heron and least bittern are unlikely to adversely affected by the project.

Records for the state-listed threatened marsh speedwell (*Veronica scutellate*) and state-listed endangered spotted coral-root orchid (*Corallorhiza maculate*) occur immediately south of the project area. Pursuant to the *Illinois Endangered Species Protection Act* [520 ILCS 10/], state-listed plants belong to the landowner and their fate resides with the landowner’s conservation decisions. However, express written permission from the landowner should be obtained from construction companies/crews to “take” listed plants to comply with the *Illinois Endangered Species Protection Act*. Regardless, the department recommends the area be surveyed by a qualified biologist for these species and conservation measures be employed to mitigate impacts if found. Such measures may include seed collection and/or translocation to appropriate habitat, as well as surface soil conservation, which may contain the seed bank.
Records of the state-endangered Blanding’s turtle (*Emydoidea blandingii*) exist in the project vicinity. The Department recommends work on the project occurs during the turtle’s inactive season from approximately November 1st to March 1st. If work must occur during the active season, all on-site personnel should be educated about this species and be instructed to contact the Department immediately if they are encountered in the project area. Fliers with photos of adult and juvenile Blanding’s turtles, and life-history information, should be distributed to personnel. The flier should also contain contact information for the Department (Dan Kirk, Natural Heritage Division, 630-553-1372). State-listed species may not be handled without the appropriate permits pursuant to the Illinois Endangered Species Protection Act. Exclusionary fencing should be installed around the work area, trenched into the ground, and inspected daily for Blanding’s turtles. Excavations should be inspected daily for trapped wildlife and safely covered overnight. Soil or other potential turtle nesting medium stockpiles should also have exclusionary fencing installed around the perimeter to discourage turtle nesting and potential harm.

Given the above recommendations are adopted, the Department has determined that impacts to Blanding’s turtle, marsh speedwell and spotted coral-root orchid are unlikely.

Consultation on the part of the Department is closed, unless the USACE desires additional information or advice related to this proposal. Consultation for Part 1075 is valid for two years unless new information becomes available which was not previously considered; the proposed action is modified; or additional species, essential habitat, or Natural Areas are identified in the vicinity. If the action has not been implemented within two years of the date of this letter, or any of the above listed conditions develop, a new consultation is necessary.

The natural resource review reflects the information existing in the Illinois Natural Heritage Database at the time of the project submittal and should not be regarded as a final statement on the project being considered, nor should it be a substitute for detailed site surveys or field surveys required for environmental assessments. If additional protected resources are unexpectedly encountered during the project’s implementation, the applicant must comply with the applicable statutes and regulations.

Thank you for the opportunity to comment. Please contact me if you have any questions regarding this review.

Sincerely,

Adam Rawe
Resource Planner
Impact Assessment Section
Department of Natural Resources
(217)785-4991
adam.rawe@illinois.gov
In Reply Refer To:  
Consultation Code: 03E13000-2019-TA-0219  
Event Code: 03E13000-2019-E-00590  
Project Name: Lisle Levee

Subject: Verification letter for the 'Lisle Levee' project under the January 5, 2016, Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-eared Bat and Activities Excepted from Take Prohibitions.

Dear Nicholas Barkowski:

The U.S. Fish and Wildlife Service (Service) received on April 25, 2019 your effects determination for the 'Lisle Levee' (the Action) using the northern long-eared bat (*Myotis septentrionalis*) key within the Information for Planning and Consultation (IPaC) system. This IPaC key assists users in determining whether a Federal action is consistent with the activities analyzed in the Service’s January 5, 2016, Programmatic Biological Opinion (PBO). The PBO addresses activities excepted from “take” prohibitions applicable to the northern long-eared bat under the Endangered Species Act of 1973 (ESA) (87 Stat.884, as amended; 16 U.S.C. 1531 et seq.).

Based upon your IPaC submission, the Action is consistent with activities analyzed in the PBO. The Action may affect the northern long-eared bat; however, any take that may occur as a result of the Action is not prohibited under the ESA Section 4(d) rule adopted for this species at 50 CFR §17.40(o). Unless the Service advises you within 30 days of the date of this letter that your IPaC-assisted determination was incorrect, this letter verifies that the PBO satisfies and concludes your responsibilities for this Action under ESA Section 7(a)(2) with respect to the northern long-eared bat.

Please report to our office any changes to the information about the Action that you submitted in IPaC, the results of any bat surveys conducted in the Action area, and any dead, injured, or sick northern long-eared bats that are found during Action implementation. If the Action is not completed within one year of the date of this letter, you must update and resubmit the information required in the IPaC key.
This IPaC-assisted determination allows you to rely on the PBO for compliance with ESA Section 7(a)(2) only for the northern long-eared bat. It does not apply to the following ESA-protected species that also may occur in the Action area:

- Eastern Massasauga (=rattlesnake), *Sistrurus catenatus* (Threatened)
- Eastern Prairie Fringed Orchid, *Platanthera leucophaea* (Threatened)
- Hine's Emerald Dragonfly, *Somatochlora hineana* (Endangered)
- Leafy Prairie-clover, *Dalea foliosa* (Endangered)
- Mead's Milkweed, *Asclepias meadii* (Threatened)
- Prairie Bush-clover, *Lespedeza leptostachya* (Threatened)
- Rusty Patched Bumble Bee, *Bombus affinis* (Endangered)

If the Action may affect other federally listed species besides the northern long-eared bat, a proposed species, and/or designated critical habitat, additional consultation between you and this Service office is required. If the Action may disturb bald or golden eagles, additional coordination with the Service under the Bald and Golden Eagle Protection Act is recommended.

[1] Take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct [ESA Section 3(19)].
**Action Description**
You provided to IPaC the following name and description for the subject Action.

1. **Name**
Lisle Levee

2. **Description**

The following description was provided for the project 'Lisle Levee':

Repairing the levee and raising it to an elevation that would protect against the 1% ACE (100-year) flood. Based on the H&H models, this elevation varies from 667 to 667.8 NAVD88. The proposed crest elevation increase ranges from 0-2 feet as compared to the existing configuration. The existing slopes would be repaired to a slope of 2.5 feet horizontal to every 1 vertical foot (2.5:1) and the existing crest repaired to a 10’ minimum top-width. Numerous structures, such as stairs and decking, and woody brush and roots that have been allowed on the levee or within 15-feet of the base of the levee on both the river and the land sides would be removed, per levee safety standards. Given the proximity of the existing levee to numerous existing homes, some waivers of the 15-foot clearance rule would likely need to be reviewed. Along with slope repair, native plantings would be incorporated along the riverside toe for erosion protection.

Approximate location of the project can be viewed in Google Maps: [https://www.google.com/maps/place/41.8007204153869N88.0816225669523W](https://www.google.com/maps/place/41.8007204153869N88.0816225669523W)

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**Determination Key Result**
This Federal Action may affect the northern long-eared bat in a manner consistent with the description of activities addressed by the Service’s PBO dated January 5, 2016. Any taking that may occur incidental to this Action is not prohibited under the final 4(d) rule at 50 CFR §17.40(o). Therefore, the PBO satisfies your responsibilities for this Action under ESA Section 7(a)(2) relative to the northern long-eared bat.

**Determination Key Description: Northern Long-eared Bat 4(d) Rule**

This key was last updated in IPaC on May 15, 2017. Keys are subject to periodic revision.

This key is intended for actions that may affect the threatened northern long-eared bat.

The purpose of the key for Federal actions is to assist determinations as to whether proposed actions are consistent with those analyzed in the Service’s PBO dated January 5, 2016.

Federal actions that may cause prohibited take of northern long-eared bats, affect ESA-listed species other than the northern long-eared bat, or affect any designated critical habitat, require ESA Section 7(a)(2) consultation in addition to the use of this key. Federal actions that may affect species proposed for listing or critical habitat proposed for designation may require a conference under ESA Section 7(a)(4).
Determination Key Result

This project may affect the threatened Northern long-eared bat; therefore, consultation with the Service pursuant to Section 7(a)(2) of the Endangered Species Act of 1973 (87 Stat.884, as amended; 16 U.S.C. 1531 et seq.) is required. However, based on the information you provided, this project may rely on the Service’s January 5, 2016, Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-Eared Bat and Activities Excepted from Take Prohibitions to fulfill its Section 7(a)(2) consultation obligation.

Qualification Interview

1. Is the action authorized, funded, or being carried out by a Federal agency?  
   Yes

2. Have you determined that the proposed action will have “no effect” on the northern long-eared bat? (If you are unsure select "No")
   No

3. Will your activity purposefully Take northern long-eared bats?
   No

4. Is the project action area located wholly outside the White-nose Syndrome Zone?
   Automatically answered
   No

5. Have you contacted the appropriate agency to determine if your project is near a known hibernaculum or maternity roost tree?

   Location information for northern long-eared bat hibernacula is generally kept in state Natural Heritage Inventory databases – the availability of this data varies state-by-state. Many states provide online access to their data, either directly by providing maps or by providing the opportunity to make a data request. In some cases, to protect those resources, access to the information may be limited. A web page with links to state Natural Heritage Inventory databases is available at www.fws.gov/midwest/endangered/mammals/nleb/nhisites.html.
   Yes

6. Will the action affect a cave or mine where northern long-eared bats are known to hibernate (i.e., hibernaculum) or could it alter the entrance or the environment (physical or other alteration) of a hibernaculum?
   No
7. Will the action involve Tree Removal?
   Yes

8. Will the action only remove hazardous trees for the protection of human life or property?
   No

9. Will the action remove trees within 0.25 miles of a known northern long-eared bat hibernaculum at any time of year?
   No

10. Will the action remove a known occupied northern long-eared bat maternity roost tree or any trees within 150 feet of a known occupied maternity roost tree from June 1 through July 31?
    No
Project Questionnaire

If the project includes forest conversion, report the appropriate acreages below. Otherwise, type ‘0’ in questions 1-3.

1. Estimated total acres of forest conversion:
5.39

2. If known, estimated acres of forest conversion from April 1 to October 31
0

3. If known, estimated acres of forest conversion from June 1 to July 31
0

If the project includes timber harvest, report the appropriate acreages below. Otherwise, type ‘0’ in questions 4-6.

4. Estimated total acres of timber harvest
0

5. If known, estimated acres of timber harvest from April 1 to October 31
0

6. If known, estimated acres of timber harvest from June 1 to July 31
0

If the project includes prescribed fire, report the appropriate acreages below. Otherwise, type ‘0’ in questions 7-9.

7. Estimated total acres of prescribed fire
0

8. If known, estimated acres of prescribed fire from April 1 to October 31
0

9. If known, estimated acres of prescribed fire from June 1 to July 31
0

If the project includes new wind turbines, report the megawatts of wind capacity below. Otherwise, type ‘0’ in question 10.
10. What is the estimated wind capacity (in megawatts) of the new turbine(s)?

0
In Reply Refer To: Consultation Code: 03E13000-2019-TA-0218
Event Code: 03E13000-2019-E-00586
Project Name: Lacey Creek Restriction

Subject: Verification letter for the 'Lacey Creek Restriction' project under the January 5, 2016, Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-eared Bat and Activities Excepted from Take Prohibitions.

Dear Nicholas Barkowski:

The U.S. Fish and Wildlife Service (Service) received on April 25, 2019 your effects determination for the 'Lacey Creek Restriction' (the Action) using the northern long-eared bat (Myotis septentrionalis) key within the Information for Planning and Consultation (IPaC) system. This IPaC key assists users in determining whether a Federal action is consistent with the activities analyzed in the Service’s January 5, 2016, Programmatic Biological Opinion (PBO). The PBO addresses activities excepted from "take"[1] prohibitions applicable to the northern long-eared bat under the Endangered Species Act of 1973 (ESA) (87 Stat.884, as amended; 16 U.S.C. 1531 et seq.).

Based upon your IPaC submission, the Action is consistent with activities analyzed in the PBO. The Action may affect the northern long-eared bat; however, any take that may occur as a result of the Action is not prohibited under the ESA Section 4(d) rule adopted for this species at 50 CFR §17.40(o). Unless the Service advises you within 30 days of the date of this letter that your IPaC-assisted determination was incorrect, this letter verifies that the PBO satisfies and concludes your responsibilities for this Action under ESA Section 7(a)(2) with respect to the northern long-eared bat.

Please report to our office any changes to the information about the Action that you submitted in IPaC, the results of any bat surveys conducted in the Action area, and any dead, injured, or sick northern long-eared bats that are found during Action implementation. If the Action is not completed within one year of the date of this letter, you must update and resubmit the information required in the IPaC key.
This IPaC-assisted determination allows you to rely on the PBO for compliance with ESA Section 7(a)(2) only for the northern long-eared bat. It does not apply to the following ESA-protected species that also may occur in the Action area:

- Eastern Massasauga (=rattlesnake), *Sistrurus catenatus* (Threatened)
- Eastern Prairie Fringed Orchid, *Platanthera leucophaea* (Threatened)
- Hine's Emerald Dragonfly, *Somatochlora hineana* (Endangered)
- Leafy Prairie-clover, *Dalea foliosa* (Endangered)
- Mead's Milkweed, *Asclepias meadii* (Threatened)
- Prairie Bush-clover, *Lespedeza leptostachya* (Threatened)

If the Action may affect other federally listed species besides the northern long-eared bat, a proposed species, and/or designated critical habitat, additional consultation between you and this Service office is required. If the Action may disturb bald or golden eagles, additional coordination with the Service under the Bald and Golden Eagle Protection Act is recommended.

[1]Take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct [ESA Section 3(19)].
Action Description
You provided to IPaC the following name and description for the subject Action.

1. Name
Lacey Creek Restriction

2. Description

The following description was provided for the project 'Lacey Creek Restriction':

This alternative is located on Lacey Creek, a tributary to the East Branch DuPage River. A new earthen embankment and culvert near the confluence with the East Branch DuPage River is proposed that would restrict flows in large events, while normal flow and lower flow events pass through unimpeded. This new 72” x 44” culvert would restrict any flow larger than a low flow event, causing raised water elevations on the surrounding Forest Preserve and Morton Arboretum lands. The new path over the culvert would be at elevation 680.5’, allowing water to overflow if it reaches that level. By restricting flow from large storms, flood flows and elevations are reduced on the East Branch. Water surface elevations in larger storm events are increased upstream of the proposed restriction, however, this area is forested and open space and results in no damage to structures. There is no excavation associated with this alternative, but nearly 283 acre-feet of new flood storage is realized due to the increased water surface profile. This alternative would provide significant reductions in water surface elevation in the downtown Lisle area. The berm will impact approximately 0.4 acres.

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/41.82527560216985N88.04677320481696W
Determination Key Result

This Federal Action may affect the northern long-eared bat in a manner consistent with the description of activities addressed by the Service’s PBO dated January 5, 2016. Any taking that may occur incidental to this Action is not prohibited under the final 4(d) rule at 50 CFR §17.40(o). Therefore, the PBO satisfies your responsibilities for this Action under ESA Section 7(a)(2) relative to the northern long-eared bat.

Determination Key Description: Northern Long-eared Bat 4(d) Rule

This key was last updated in IPaC on May 15, 2017. Keys are subject to periodic revision.

This key is intended for actions that may affect the threatened northern long-eared bat.

The purpose of the key for Federal actions is to assist determinations as to whether proposed actions are consistent with those analyzed in the Service’s PBO dated January 5, 2016.

Federal actions that may cause prohibited take of northern long-eared bats, affect ESA-listed species other than the northern long-eared bat, or affect any designated critical habitat, require ESA Section 7(a)(2) consultation in addition to the use of this key. Federal actions that may affect species proposed for listing or critical habitat proposed for designation may require a conference under ESA Section 7(a)(4).
Determination Key Result

This project may affect the threatened Northern long-eared bat; therefore, consultation with the Service pursuant to Section 7(a)(2) of the Endangered Species Act of 1973 (87 Stat.884, as amended; 16 U.S.C. 1531 et seq.) is required. However, based on the information you provided, this project may rely on the Service’s January 5, 2016, Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-Eared Bat and Activities Excepted from Take Prohibitions to fulfill its Section 7(a)(2) consultation obligation.

Qualification Interview

1. Is the action authorized, funded, or being carried out by a Federal agency?
   Yes

2. Have you determined that the proposed action will have “no effect” on the northern long-eared bat? (If you are unsure select "No")
   No

3. Will your activity purposefully Take northern long-eared bats?
   No

4. Is the project action area located wholly outside the White-nose Syndrome Zone?
   Automatically answered
   No

5. Have you contacted the appropriate agency to determine if your project is near a known hibernaculum or maternity roost tree?

   Location information for northern long-eared bat hibernacula is generally kept in state Natural Heritage Inventory databases – the availability of this data varies state-by-state. Many states provide online access to their data, either directly by providing maps or by providing the opportunity to make a data request. In some cases, to protect those resources, access to the information may be limited. A web page with links to state Natural Heritage Inventory databases is available at www.fws.gov/midwest/endangered/mammals/nleb/nhisites.html.
   Yes

6. Will the action affect a cave or mine where northern long-eared bats are known to hibernate (i.e., hibernaculum) or could it alter the entrance or the environment (physical or other alteration) of a hibernaculum?
   No
7. Will the action involve Tree Removal?
   
   Yes

8. Will the action only remove hazardous trees for the protection of human life or property?

   No

9. Will the action remove trees within 0.25 miles of a known northern long-eared bat hibernaculum at any time of year?

   No

10. Will the action remove a known occupied northern long-eared bat maternity roost tree or any trees within 150 feet of a known occupied maternity roost tree from June 1 through July 31?

    No
Project Questionnaire

If the project includes forest conversion, report the appropriate acreages below. Otherwise, type ‘0’ in questions 1-3.

1. Estimated total acres of forest conversion: 19

2. If known, estimated acres of forest conversion from April 1 to October 31 0

3. If known, estimated acres of forest conversion from June 1 to July 31 0

If the project includes timber harvest, report the appropriate acreages below. Otherwise, type ‘0’ in questions 4-6.

4. Estimated total acres of timber harvest 0

5. If known, estimated acres of timber harvest from April 1 to October 31 0

6. If known, estimated acres of timber harvest from June 1 to July 31 0

If the project includes prescribed fire, report the appropriate acreages below. Otherwise, type ‘0’ in questions 7-9.

7. Estimated total acres of prescribed fire 0

8. If known, estimated acres of prescribed fire from April 1 to October 31 0

9. If known, estimated acres of prescribed fire from June 1 to July 31 0

If the project includes new wind turbines, report the megawatts of wind capacity below. Otherwise, type ‘0’ in question 10.
10. What is the estimated wind capacity (in megawatts) of the new turbine(s)?

0
Classification of Wetlands and Deepwater Habitats of the United States

By

Lewis M. Cowardin¹, Virginia Carter², Francis C. Golet³, and Edward T. LaRoe⁴

U.S. Department of the Interior
Fish and Wildlife Service
Office of Biological Services
Washington, D.C. 20240
Abstract

This classification, to be used in a new inventory of wetlands and deepwater habitats of the United States, is intended to describe ecological taxa, arrange them in a system useful to resource managers, furnish units for mapping, and provide uniformity of concepts and terms. Wetlands are defined by plants (hydrophytes), soils (hydric soils), and frequency of flooding. Ecologically related areas of deep water, traditionally not considered wetlands, are included in the classification as deepwater habitats.

Systems form the highest level of the classification hierarchy; five are defined—Marine, Estuarine, Riverine, Lacustrine, and Palustrine. Marine and Estuarine Systems each have two Subsystems, Subtidal and Intertidal; the Riverine System has four Subsystems, Tidal, Lower Perennial, Upper Perennial, and Intermittent; the Lacustrine has two, Littoral and Limnetic; and the Palustrine has no Subsystems.

Within the Subsystems, Classes are based on substrate material and flooding regime, or on vegetative life form. The same Classes may appear under one or more of the Systems or Subsystems. Six Classes are based on substrate and flooding regime: (1) Rock Bottom with a substrate of bedrock, boulders, or stones; (2) Unconsolidated Bottom with a substrate of cobbles, gravel, sand, mud, or organic material; (3) Rocky Shore with the same substrates as Rock Bottom; (4) Unconsolidated Shore with the same substrates as Unconsolidated Bottom; (5) Streambed with any of the substrates; and (6) Reef with a substrate composed of the living and dead remains of invertebrates (corals, mollusks, or worms). The bottom Classes, (1) and (2) above, are flooded all or most of the time and the shore Classes, (3) and (4), are exposed most of the time. The Class Streambed is restricted to channels of intermittent streams and tidal channels that are dewatered at low tide. The life form of the dominant vegetation defines the five Classes based on vegetative form: (1) Aquatic Bed, dominated by plants that grow principally on or below the surface of the water; (2) Moss-Lichen Wetland, dominated by mosses or lichens; (3) Emergent Wetland, dominated by emergent herbaceous angiosperms; (4) Scrub-Shrub Wetland, dominated by shrubs or small trees; and (5) Forested Wetland, dominated by large trees.

The Dominance Type, which is named for the dominant plant or animal forms, is the lowest level of the classification hierarchy. Only examples are provided for this level; Dominance Types must be developed by individual users of the classification.

Modifying terms applied to the Classes or Subclasses are essential for use of the system. In tidal areas, the type and duration of flooding are described by four Water Regime Modifiers: subtidal, irregularly exposed, regularly flooded, and irregularly flooded. In nontidal areas, eight Regimes are used: permanently flooded, intermittently exposed, semipermanently flooded, seasonally flooded, saturated, temporarily flooded, intermittently flooded, and artificially flooded. A hierarchical system of Water Chemistry Modifiers, adapted from the Venice System, is used to describe the salinity of the water. Fresh waters are further divided on the basis of pH. Use of a hierarchical system of soil modifiers taken directly from U.S. soil taxonomy is also required. Special modifiers are used where appropriate: excavated, impounded, diked, partly drained, farmed, and artificial.

Regional differences important to wetland ecology are described through a regionalization that combines a system developed for inland areas by R. G. Bailey in 1976 with our Marine and Estuarine provinces.

The structure of the classification allows it to be used at any of several hierarchical levels. Special data required for detailed application of the system are frequently unavailable, and thus data gathering may be
prerequisite to classification. Development of rules by the user will be required for specific map scales. Dominance Types and relationships of plant and animal communities to environmental characteristics must also be developed by users of the classification. Keys to the Systems and Classes are furnished as a guide, and numerous wetlands and deepwater habitats are illustrated and classified. The classification system is also compared with several other systems currently in use in the United States.

This resource is based on the following source (Northern Prairie Publication 0421):

This resource should be cited as:
Figures
- Figure 1 — Classification hierarchy of wetlands and deepwater habitats
- Figure 2 — Distinguishing features of habitats in the Marine System
- Figure 3 — Distinguishing features of habitats in the Estuarine System
- Figure 4 — Distinguishing features of habitats in the Riverine System
- Figure 5 — Distinguishing features of habitats in the Lacustrine System
- Figure 6 — Distinguishing features of habitats in the Palustrine System
- Figure 7 — Ecoregions of the United States
- Figure 8 — Comparison of water chemistry subclasses

Plates
- Plates 1-4
- Plates 5-8
- Plates 9-12
- Plates 13-16
- Plates 17-20
- Plates 21-24
- Plates 25-28
- Plates 29-32
- Plates 33-36
- Plates 37-40
- Plates 41-44
- Plates 45-48
- Plates 49-52
- Plates 53-56
- Plates 57-60
- Plates 61-64
- Plates 65-68
- Plates 69-72
- Plates 73-76
- Plates 77-80
- Plates 81-84
- Plates 85-86

3U.S. Fish and Wildlife Service, Northern Prairie Wildlife Research Center, Jamestown, North Dakota 58401
2U.S. Geological Survey, Reston, Virginia 22092
3Department of Natural Resources Science, University of Rhode Island, Kingston, Rhode Island 02881
4U.S. National Oceanographic and Atmospheric Administration, Office of Coastal Zone Management, Washington, D.C. 20235

5Classification of Wetlands and Deepwater Habitats of the United States
Classification of Wetlands and Deepwater Habitats of the United States

Foreword

Wetlands and deepwater habitats are essential breeding, rearing, and feeding grounds for many species of fish and wildlife. They may also perform flood protection and pollution control functions. Increasing National and international recognition of these values has intensified the need for reliable information on the status and extent of wetland resources. To develop comparable information over large areas, a clear definition and classification of wetlands and deepwater habitats is required.

The classification system contained in this report was developed by wetland ecologists, with the assistance of many private individuals and organizations and local, State, and Federal agencies. An operational draft was published in October 1977, and a notice of intent to adopt the system for all pertinent Service activities was published December 12, 1977 (42 FR 62432).

The Fish and Wildlife Service is officially adopting this wetland classification system. Future wetland data bases developed by the Service, including the National Wetlands Inventory, will utilize this system. A one-year transition period will allow for training of Service personnel, amendment of administrative manuals, and further development of the National Wetlands Inventory data base. During this period, Service personnel may continue to use the old wetland classification described in Fish and Wildlife Service Circular 39 for Fish and Wildlife Coordination Act reports, wetland acquisition priority determinations, and other activities in conjunction with the new system, where immediate conversion is not practicable.

Upon completion of the transition period, the Circular 39 system will no longer be officially used by the Fish and Wildlife Service except where the applicable laws still reference that system or when the only information available is organized according to that system and cannot be restructured without new field surveys.

Other Federal and State agencies are encouraged to convert to the use of this system. No specific legal authorities require the use of this system — or any other system for that matter. However, it is expected that the benefits of National consistency and a developing wetland data base utilizing this system will result in acceptance and use by most agencies involved in wetland management. Training can be provided to users by the Service, depending on the availability of resources. Congressional committees will be notified of this adoption action and will be encouraged to facilitate general adoption of the new system by amending any laws that reference the Circular 39 system.
This is a new system and users will need to study and learn the terminology. The Service is preparing a
document to aid in comparing and translating the new system to the Service’s former classification system.
In the coming year, the Fish and Wildlife Service, in conjunction with the Soil Conservation Service, also
plans to develop initial lists of hydrophytic plants and hydric soils that will support interpretation and use of
this system.

We believe that this system will provide a suitable basis for information gathering for most scientific, educa-
tional, and administrative purposes; however, it will not fit all needs. For instance, historical or potentially
restorable wetlands are not included in this system, nor was the system designed to accommodate all the
requirements of the many recently passed wetland statutes. No attempt was made to define the proprietary or
jurisdictional boundaries of Federal, State, or local agencies. Nevertheless, the basic design of the classifica-
tion system and the resulting data base should assist substantially in the administration of these programs.

This report represents the most current methodology available for wetland classification and culminates a
long-term effort involving many wetland scientists. Although it may require revision from time to time, it
will serve us well in the years ahead. We hope all wetland personnel in all levels of government and the
private sector come to know it and use it for the ultimate benefit of America’s wetlands.

Lynn Greenwalt, Director
U.S Fish and Wildlife Service
Since its publication in 1979, Classification of Wetlands and Deepwater Habitats of the United States has been used in the National inventory of wetlands conducted by the U.S. Fish and Wildlife Service. The system has been widely used throughout the United States and is often cited in the scientific literature. There has also been considerable international interest in use of the classification.

Copies from the first printing have been expended and demand requires this reprinting. We have taken this opportunity to correct a number of minor typographical errors, bring plant names into conformity with the National List of Scientific Plant Names (U.S. Dept. Agriculture 1982), and to upgrade the quality of plates as well as furnish additional plates. No changes have been made that either alter the structure of the classification or the meaning of the definitions. Such major revisions must be deferred until certain prerequisite tasks are accomplished.

Completion of the list of hydrophytes and other plants occurring in wetlands and the list of hydric soils has been a task of far greater complexity than we envisioned when writing the classification. These lists have received extensive review and are being prepared as computer data bases. In addition, the lists will contain a great deal of ancillary information that will make possible the development of methodologies for their use in both the delineation and classification of wetlands. When the lists and methodologies are completed, reviewed, and tested we will revise the classification and use the lists to add precision to the definitions. At the same time, we will address specific technical problems that have arisen during application of the classification.

The plates at the end of this publication are included primarily to illustrate a variety of examples of wetland classification. We have attempted to include photographs from various regions of the country insofar as possible; however, final selection of plates was based on the availability of both high-quality photographs and the detailed field data required for accurate classification. While on sabbatical leave from the University of Rhode Island in 1985, Dr. Frank Golet took numerous photographs of Alaskan wetlands. Addition of many of these and several photographs from other regions helps somewhat to correct a regional imbalance.

We acknowledge the assistance of Dr. J. Henry Sather who served as editor for the reprinting. He spent many hours compiling minor errors and inconsistencies and preparing final copy for the printer. We thank Mr. Jon Hall, National Wetlands Inventory Coordinator for the Alaska region, for his assistance to Dr. Golet during his stay in Alaska.

Lewis M. Cowardin
Virginia Carter
Francis C. Golet
Edward T. LaRoe
September 24, 1985
Classification of Wetlands and Deepwater Habitats of the United States

Introduction

The U.S. Fish and Wildlife Service conducted an inventory of the wetlands of the United States (Shaw and Fredine 1956) in 1954. Since then, wetlands have undergone considerable change, both natural and man related, and their characteristics and natural values have become better defined and more widely known. During this interval, State and Federal legislation has been passed to protect wetlands, and some Statewide wetland surveys have been conducted.

In 1974, the U.S. Fish and Wildlife Service directed its Office of Biological Services to design and conduct a new National inventory of wetlands. Whereas the single purpose of the 1954 inventory was to assess the amount and types of valuable waterfowl habitat, the scope of the new project is considerably broader (Montanari and Townsend 1977). It will provide basic data on the characteristics and extent of the Nation’s wetlands and deepwater habitats and should facilitate the management of these areas on a sound, multiple-use basis.

Before the 1954 inventory was begun, Martin et al. (1953) had devised a wetland classification system to serve as a framework for the National inventory. The results of the inventory and an illustrated description of the 20 wetland types were published as U.S. Fish and Wildlife Service Circular 39 (Shaw and Fredine 1956). This circular has been one of the most common and most influential documents used in the continuous battle to preserve a critically valuable but rapidly diminishing National resource (Stegman 1976). However, the shortcomings of this work are well known (e.g., see Leitch 1966; Stewart and Kantrud 1971).

In attempting to simplify their classification, Martin et al. (1953) not only ignored ecologically critical differences, such as the distinction between fresh and mixosaline inland wetlands but also placed dissimilar habitats, such as forests of boreal black spruce (Picea mariana) and of southern cypress-gum (Taxodium distichum-Nyssa aquatica) in the same category, with no provisions in the system for distinguishing between them. Because of the central emphasis on waterfowl habitat, far greater attention was paid to vegetated areas than to nonvegetated areas. Probably the greatest single disadvantage of the Martin et al. system was the inadequate definition of types, which led to inconsistencies in application.

Numerous other classifications of wetlands and deepwater habitats have been developed (Stewart and Kantrud 1971; Golet and Larson 1974; Jeglum et al. 1974; Odum et al. 1974; Zoltai et al. 1975; Millar 1976), but most of these are regional systems and none would fully satisfy National needs. Because of the weaknesses inherent in Circular 39, and because wetland ecology has become significantly better understood since 1954, the U.S. Fish and Wildlife Service elected to construct a new National classification system as the first step toward a new National inventory. The new classification, presented here, has been designed to meet four long-range objectives: (1) to describe ecological units that have certain homogeneous natural attributes; (2) to arrange these units in a system that will aid decisions about resource management; (3) to furnish units for inventory and mapping; and (4) to provide uniformity in concepts and terminology throughout the United States.
Scientific and common names of plants (Appendix A) and animals (Appendix B) were taken from various sources cited in the text. No attempt has been made to resolve nomenclatorial problems where there is a taxonomic dispute. Many of the terms used in this classification have various meanings even in the scientific literature and in some instances our use of terms is new. We have provided a glossary (Appendix C) to guide the reader in our usage of terms.
Classification of Wetlands and Deepwater Habitats of the United States

Wetlands and Deepwater Habitats

Concepts and Definitions

Marshes, swamps, and bogs have been well-known terms for centuries, but only relatively recently have attempts been made to group these landscape units under the single term “wetlands.” This general term has grown out of a need to understand and describe the characteristics and values of all types of land, and to wisely and effectively manage wetland ecosystems. There is no single, correct, indisputable, ecologically sound definition for wetlands, primarily because of the diversity of wetlands and because the demarcation between dry and wet environments lies along a continuum. Because reasons or needs for defining wetlands also vary, a great proliferation of definitions has arisen. The primary objective of this classification is to impose boundaries on natural ecosystems for the purposes of inventory, evaluation, and management.

Wetlands

In general terms, wetlands are lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. The single feature that most wetlands share is soil or substrate that is at least periodically saturated with or covered by water. The water creates severe physiological problems for all plants and animals except those that are adapted for life in water or in saturated soil.

WETLANDS are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year.

The term wetland includes a variety of areas that fall into one of five categories: (1) areas with hydrophytes and hydric soils, such as those commonly known as marshes, swamps, and bogs; (2) areas without hydrophytes but with hydric soils— for example, flats where drastic fluctuation in water level, wave action, turbidity, or high concentration of salts may prevent the growth of hydrophytes; (3) areas with hydrophytes but nonhydric soils, such as margins of impoundments or excavations where hydrophytes have become established but hydric soils have not yet developed; (4) areas without soils but with hydrophytes such as the seaweed-covered portion of rocky shores; and (5) wetlands without soil and without hydrophytes, such as gravel beaches or rocky shores without vegetation.

Drained hydric soils that are now incapable of supporting hydrophytes because of a change in water regime are not considered wetlands by our definition. These drained hydric soils furnish a valuable record of historic wetlands, as well as an indication of areas that may be suitable for restoration.

Wetlands as defined here include lands that are identified under other categories in some land-use classifications. For example, wetlands and farmlands are not necessarily exclusive. Many areas that we define as
wetlands are farmed during dry periods, but if they are not tilled or planted to crops, a practice that destroys the natural vegetation, they will support hydrophytes.

Deepwater Habitats
DEEPWATER HABITATS are permanently flooded lands lying below the deepwater boundary of wetlands. Deepwater habitats include environments where surface water is permanent and often deep, so that water, rather than air, is the principal medium within which the dominant organisms live, whether or not they are attached to the substrate. As in wetlands, the dominant plants are hydrophytes; however, the substrates are considered nonsoil because the water is too deep to support emergent vegetation (U.S. Soil Conservation Service, Soil Survey Staff 1975).

Wetlands and deepwater habitats are defined separately because traditionally the term wetland has not included deep permanent water; however, both must be considered in an ecological approach to classification. We define five major Systems: Marine, Estuarine, Riverine, Lacustrine, and Palustrine. The first four of these include both wetland and deepwater habitats but the Palustrine includes only wetland habitats.

Limits

The upland limit of wetland is designated as (1) the boundary between land with predominantly hydrophytic cover and land with predominantly mesophytic or xerophytic cover; (2) the boundary between soil that is predominantly hydric and soil that is predominantly nonhydric; or (3) in the case of wetlands without vegetation or soil, the boundary between land that is flooded or saturated at some time during the growing season each year and land that is not.

The boundary between wetland and deepwater habitat in the Marine and Estuarine Systems coincides with the elevation of the extreme low water of spring tide; permanently flooded areas are considered deepwater habitats in these Systems. The boundary between wetland and deepwater habitat in the Riverine and Lacustrine Systems lies at a depth of 2 m (6.6 feet) below low water; however, if emergents, shrubs, or trees grow beyond this depth at any time, their deepwater edge is the boundary.

The 2-m lower limit for inland wetlands was selected because it represents the maximum depth to which emergent plants normally grow (Welch 1952; Zhadin and Gerd 1963; Sculthorpe 1967). As Daubenmire (1968:138) stated, emergents are not true aquatic plants, but are “amphibious,” growing in both permanently flooded and wet, nonflooded soils. In their wetland classification for Canada, Zoltai et al. (1975) also included only areas with water less than 2 m deep.

¹The U.S. Fish and Wildlife Service is preparing a list of hydrophytes and other plants occurring in wetlands of the United States.
²The U.S. Soil Conservation Service is preparing a preliminary list of hydric soils for use in this classification system.
Fig. 1. Classification hierarchy of wetlands and deepwater habitats, showing Systems, Subsystems, and Classes. The Palustrine System does not include deepwater habitats.
The structure of this classification is hierarchical, progressing from Systems and Subsystems, at the most general levels, to Classes, Subclasses, and Dominance Types. Figure 1 illustrates the classification structure to the class level. Table 1 lists the Classes and Subclasses for each System and Subsystem. Artificial keys to the Systems and Classes are given in Appendix E. Modifiers for water regime, water chemistry, and soils are applied to Classes, Subclasses, and Dominance Types. Special modifiers describe wetlands and deepwater habitats that have been either created or highly modified by man or beavers.

### System and Subsystem

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*ST = Subtidal, IT = Intertidal, TI = Tidal, LP = Lower Perennial, UP = Upper Perennial, IN = Intermittent, LM = Limnetic, LT = Littoral.
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aST = Subtidal, IT = Intertidal, TI = Tidal, LP = Lower Perennial, UP = Upper Perennial, IN = Intermittent, LM = Limnetic, LT = Littoral.
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Classification of Wetlands and Deepwater Habitats of the United States

Hierarchical Structure

Systems and Subsystems

The term SYSTEM refers here to a complex of wetlands and deepwater habitats that share the influence of similar hydrologic, geomorphologic, chemical, or biological factors. We further subdivide Systems into more specific categories called SUBSYSTEMS.

The characteristics of the five major Systems—Marine, Estuarine, Riverine, Lacustrine, and Palustrine—have been discussed at length in the scientific literature and the concepts are well recognized; however, there is frequent disagreement as to which attributes should be used to bound the Systems in space. For example, both the limit of tidal influence and the limit of ocean-derived salinity have been proposed for bounding the upstream end of the Estuarine System (Caspers 1967). As Bormann and Likens (1969) pointed out, boundaries of ecosystems are defined to meet practical needs.

Marine System

Definition. The Marine System (Fig. 2) consists of the open ocean overlying the continental shelf and its associated high-energy coastline. Marine habitats are exposed to the waves and currents of the open ocean and the water regimes are determined primarily by the ebb and flow of oceanic tides. Salinities exceed 30 ‰, with little or no dilution except outside the mouths of estuaries. Shallow coastal indentations or bays without appreciable freshwater inflow, and coasts with exposed rocky islands that provide the mainland with little or no shelter from wind and waves, are also considered part of the Marine System because they generally support typical marine biota.

Limits. The Marine System extends from the outer edge of the continental shelf shoreward to one of three lines: (1) the landward limit of tidal inundation (extreme high water of spring tides), including the splash zone from breaking waves; (2) the seaward limit of wetland emergents, trees, or shrubs; or (3) the seaward limit of the Estuarine System, where this limit is determined by factors other than vegetation. Deepwater habitats lying beyond the seaward limit of the Marine System are outside the scope of this classification system.

Description. The distribution of plants and animals in the Marine System primarily reflects differences in four factors: (1) degree of exposure of the site to waves; (2) texture and physicochemical nature of the substrate; (3) amplitude of the tides; and (4) latitude, which governs water temperature, the intensity and duration of solar radiation, and the presence or absence of ice.

Subsystems.

- Subtidal. — The substrate is continuously submerged.
- Intertidal. — The substrate is exposed and flooded by tides; includes the associated splash zone.

Classes. Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Reef, Rocky Shore, and Unconsolidated Shore.
Fig. 2. Distinguishing features and examples of habitats in the Marine System. EHWS = extreme high water of spring tides; ELWS = extreme low water of spring tides.

Estuarine System

Definition. The Estuarine System (Fig. 3) consists of deepwater tidal habitats and adjacent tidal wetlands that are usually semiclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land. The salinity may be periodically increased above that of the open ocean by evaporation. Along some low-energy coastlines there is appreciable dilution of sea water. Offshore areas with typical estuarine plants and animals, such as red mangroves (Rhizophora mangle) and eastern oysters (Crassostrea virginica), are also included in the Estuarine System.³

Limits. The Estuarine System extends (1) upstream and landward to where ocean-derived salts measure less than 0.5 % during the period of average annual low flow; (2) to an imaginary line closing the mouth of a river, bay, or sound; and (3) to the seaward limit of wetland emergents, shrubs, or trees where they are not included in (2). The Estuarine System also includes offshore areas of continuously diluted sea water.
Description. The Estuarine System includes both estuaries and lagoons. It is more strongly influenced by its association with land than is the Marine System. In terms of wave action, estuaries are generally considered to be low-energy systems (Chapman 1977:2).

Estuarine water regimes and water chemistry are affected by one or more of the following forces: oceanic tides, precipitation, freshwater runoff from land areas, evaporation, and wind. Estuarine salinities range from hyperhaline to oligohaline (Table 2). The salinity may be variable, as in hyperhaline lagoons (e.g., Laguna Madre, Texas) and most brackish estuaries (e.g., Chesapeake Bay, Virginia-Maryland); or it may be relatively stable, as in sheltered euhaline embayments (e.g., Chincoteague Bay, Maryland) or brackish embayments with partly obstructed access or small tidal range (e.g., Pamlico Sound, North Carolina). (For an extended discussion of estuaries and lagoons see Lauff 1967.)

Subsystems.

- **Subtidal.** — The substrate is continuously submerged.
- **Intertidal.** — The substrate is exposed and flooded by tides; includes the associated splash zone.


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![Diagram of Estuarine System](image)

**Fig. 3.** Distinguishing features and examples of habitats in the Estuarine System. EHWS = extreme high water of spring tides; ELWS = extreme low water of spring tides.

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3The Coastal Zone Management Act of 1972 defines an estuary as “that part of a river or stream or other body of water having unimpaired connection with the open sea, where the sea-water is measurably diluted with freshwater derived from land drainage.” The Act further states that “the term includes estuary-type areas of the Great Lakes.” However, in the present system we do not consider areas of the Great Lakes as Estuarine.
Riverine System

Definition. The Riverine System (Fig. 4) includes all wetlands and deepwater habitats contained within a channel, with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) habitats with water containing ocean-derived salts in excess of 0.5 ‰. A channel is “an open conduit either naturally or artificially created which periodically or continuously contains moving water, or which forms a connecting link between two bodies of standing water” (Langbein and Iseri 1960:5).

Limits. The Riverine System is bounded on the landward side by upland, by the channel bank (including natural and man-made levees), or by wetland dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens. In braided streams, the system is bounded by the banks forming the outer limits of the depression within which the braiding occurs.

The Riverine System terminates at the downstream end where the concentration of ocean-derived salts in the water exceeds 0.5 ‰ during the period of annual average low flow, or where the channel enters a lake. It terminates at the upstream end where tributary streams originate, or where the channel leaves a lake. Springs discharging into a channel are considered part of the Riverine System.

Description. Water is usually, but not always, flowing in the Riverine System. Upland islands or Palustrine wetlands may occur in the channel, but they are not included in the Riverine System. Palustrine Moss-Lichen Wetlands, Emergent Wetlands, Scrub-Shrub Wetlands, and Forested Wetlands may occur adjacent to the Riverine System, often on a floodplain. Many biologists have suggested that all the wetlands occurring on the river floodplain should be a part of the Riverine System because they consider their presence to be the result of river flooding. However, we concur with Reid and Wood (1976:72,84) who stated, “The floodplain is a flat expanse of land bordering an old river . . . . Often the floodplain may take the form of a very level plain occupied by the present stream channel, and it may never, or only occasionally, be flooded . . . . It is this subsurface water [the ground water] that controls to a great extent the level of lake surfaces, the flow of streams, and the extent of swamps and marshes.”

Subsystems. The Riverine System is divided into four Subsystems: the Tidal, the Lower Perennial, the Upper Perennial, and the Intermittent. Each is defined in terms of water permanence, gradient, water velocity, substrate, and the extent of floodplain development. The Subsystems have characteristic flora and fauna (see Illies and Botosaneanu 1963; Hynes 1970; Reid and Wood 1976). All four Subsystems are not necessarily present in all rivers, and the order of occurrence may be other than that given below.

- **Tidal.** — The gradient is low and water velocity fluctuates under tidal influence. The streambed is mainly mud with occasional patches of sand. Oxygen deficits may sometimes occur and the fauna is similar to that in the Lower Perennial Subsystem. The floodplain is typically well developed.

- **Lower Perennial.** — The gradient is low and water velocity is slow. There is no tidal influence, and some water flows throughout the year. The substrate consists mainly of sand and mud. Oxygen deficits may sometimes occur, the fauna is composed mostly of species that reach their maximum abundance in still water, and true planktonic organisms are common. The gradient is lower than that of the Upper Perennial Subsystem and the floodplain is well developed.

- **Upper Perennial.** — The gradient is high and velocity of the water fast. There is no tidal influence and some water flows throughout the year. The substrate consists of rock, cobbles, or gravel with occasional patches of sand. The natural dissolved oxygen concentration is normally near saturation. The fauna is characteristic of running water, and there are few or no planktonic forms. The gradient is high compared with that of the Lower Perennial Subsystem, and there is very little floodplain.
Intermittent. — In this Subsystem, the channel contains flowing water for only part of the year. When the water is not flowing, it may remain in isolated pools or surface water may be absent.

Classes. Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Streambed, Rocky Shore, Unconsolidated Shore, and Emergent Wetland (nonpersistent).

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**Lacustrine System**

Definition. The Lacustrine System (Fig. 5) includes wetlands and deepwater habitats with all of the following characteristics: (1) situated in a topographic depression or a dammed river channel; (2) lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30% areal coverage; and (3) total area exceeds 8 ha (20 acres). Similar wetland and deepwater habitats totaling less than 8 ha are also included in the Lacustrine System if an active wave-formed or bedrock shoreline feature makes up all or part of the boundary, or if the water depth in the deepest part of the basin exceeds 2 m (6.6 feet) at low water. Lacustrine waters may be tidal or nontidal, but oceanderived salinity is always less than 0.5 ‰.
Limits. The Lacustrine System is bounded by upland or by wetland dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens. Lacustrine Systems formed by damming a river channel are bounded by a contour approximating the normal spillway elevation or normal pool elevation, except where Palustrine wetlands extend lakeward of that boundary. Where a river enters a lake, the extension of the Lacustrine shoreline forms the Riverine-Lacustrine boundary.

Description. The Lacustrine System includes permanently flooded lakes and reservoirs (e.g., Lake Superior), intermittent lakes (e.g., playa lakes), and tidal lakes with ocean-derived salinities below 0.5 ‰ (e.g., Grand Lake, Louisiana). Typically, there are extensive areas of deep water and there is considerable wave action. Islands of Palustrine wetland may lie within the boundaries of the Lacustrine System.

Subsystems.
- Limnetic. — All deepwater habitats within the Lacustrine System; many small Lacustrine Systems have no Limnetic Subsystem.
- Littoral. — All wetland habitats in the Lacustrine System. Extends from the shoreward boundary of the system to a depth of 2 m (6.6 feet) below low water or to the maximum extent of nonpersistent emergents, if these grow at depths greater than 2 m.

Classes. Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Rocky Shore, Unconsolidated Shore, and Emergent Wetland (nonpersistent).

![Fig. 5. Distinguishing features and examples of habitats in the Lacustrine System.](image-url)
Palustrine System

Definition. The Palustrine System (Fig. 6) includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5‰. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 ha (20 acres); (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 2 m at low water; and (4) salinity due to ocean-derived salts less than 0.5‰.

Limits. The Palustrine System is bounded by upland or by any of the other four Systems.

Description. The Palustrine System was developed to group the vegetated wetlands traditionally called by such names as marsh, swamp, bog, fen, and prairie, which are found throughout the United States. It also includes the small, shallow, permanent or intermittent water bodies often called ponds. Palustrine wetlands may be situated shoreward of lakes, river channels, or estuaries; on river floodplains; in isolated catchments; or on slopes. They may also occur as islands in lakes or rivers. The erosive forces of wind and water are of minor importance except during severe floods.

The emergent vegetation adjacent to rivers and lakes is often referred to as “the shore zone” or the “zone of emergent vegetation” (Reid and Wood 1976), and is generally considered separately from the river or lake. As an example, Hynes (1970:85) wrote in reference to riverine habitats, “We will not here consider the long list of emergent plants which may occur along the banks out of the current, as they do not belong, strictly speaking, to the running water habitat. “ There are often great similarities between wetlands lying adjacent to lakes or rivers and isolated wetlands of the same class in basins without open water.

Subsystems. None.

Fig. 6. Distinguishing features and examples of habitats in the Palustrine System.
Classes, Subclasses, and Dominance Types

The CLASS is the highest taxonomic unit below the Subsystem level. It describes the general appearance of the habitat in terms of either the dominant life form of the vegetation or the physiography and composition of the substrate — features that can be recognized without the aid of detailed environmental measurements. Vegetation is used at two different levels in the classification. The life forms — trees, shrubs, emergents, emergent mosses, and lichens — are used to define Classes because they are relatively easy to distinguish, do not change distribution rapidly, and have traditionally been used as criteria for classification of wetlands. Other forms of vegetation, such as submerged or floating-leaved rooted vascular plants, free-floating vascular plants, submergent mosses, and algae, though frequently more difficult to detect, are used to define the Class Aquatic Bed. Pioneer species that briefly invade wetlands when conditions are favorable are treated at the Subclass level because they are transient and often not true wetland species.

Use of life forms at the Class level has two major advantages: (1) extensive biological knowledge is not required to distinguish between various life forms, and (2) it has been established that various life forms are easily recognizable on a great variety of remote sensing products (e.g., Radforth 1962; Anderson et al. 1976). If vegetation (except pioneer species) covers 30% or more of the substrate, we distinguish Classes on the basis of the primary life form of the plants that constitute the uppermost layer of vegetation and that possess an areal coverage 30% or greater. For example, an area with 50% areal coverage of trees over a shrub layer with a 60% areal coverage would be classified as Forested Wetland; an area with 20% areal coverage of trees over the same (60%) shrub layer would be classified as Scrub-Shrub Wetland. When trees or shrubs alone cover less than 30% of an area but in combination cover 30% or more, the wetland is assigned to the Class Scrub-Shrub. When trees and shrubs cover less than 30% of the area but the total cover of vegetation (except pioneer species) is 30% or greater, the wetland is assigned to the appropriate Class for the predominant life form below the shrub layer. Finer differences in life forms are recognized at the Subclass level. For example, Forested Wetland is divided into the Subclasses Broad-leaved Deciduous, Needle-leaved Deciduous, Broad-leaved Evergreen, Needle-leaved Evergreen, and Dead. Subclasses are named on the basis of the predominant life form.

If vegetation covers less than 30% of the substrate, the physiography and composition of the substrate are the principal characteristics used to distinguish Classes. The nature of the substrate reflects regional and local variations in geology and the influence of wind, waves, and currents on erosion and deposition of substrate materials. Bottoms, Shores, and Streambeds are separated on the basis of duration of inundation. In the Riverine, Lacustrine, and Palustrine Systems, Bottoms are submerged all or most of the time, whereas Streambeds and Shores are exposed all or most of the time. In the Marine and Estuarine Systems, Bottoms are Subtidal, whereas Streambeds and Shores are Intertidal. Bottoms, Shores, and Streambeds are further divided at the Class level on the basis of the important characteristic of rock versus unconsolidated substrate. Subclasses are based on finer distinctions in substrate material unless, as with Streambeds and Shores, the substrate is covered by, or shaded by, an areal coverage of pioneering vascular plants (often nonhydrophytes) of 30% or more; the Subclass is then simply “vegetated.” Further detail as to the type of vegetation must be obtained at the level of Dominance Type. Reefs are a unique class in which the substrate itself is composed primarily of living and dead animals. Subclasses of Reefs are designated on the basis of the type of organism that formed the reef.

The DOMINANCE TYPE is the taxonomic category subordinate to Subclass. Dominance Types are determined on the basis of dominant plant species (e.g., Jeglum et al. 1974), dominant sedentary or sessile animal species (e.g., Thorson 1957), or dominant plant and animal species (e.g., Stephenson and Stephenson 1972). A dominant plant species has traditionally meant one that has control over the community (Weaver and
Clements 1938:91), and this plant is also usually the predominant species (Cain and Castro 1959:29). When the Subclass is based on life form, we name the Dominance Type for the dominant species or combination of species (codominants) in the same layer of vegetation used to determine the Subclass.5 For example, a Needle-leaved Evergreen Forested Wetland with 70% areal cover of black spruce (Picea mariana) and 30% areal cover of tamarack (Larix laricina) would be designated as a Picea mariana Dominance Type. When the relative abundance of codominant species is nearly equal, the Dominance Type consists of a combination of species names. For example, an Emergent Wetland with about equal areal cover of common cattail (Typha latifolia) and hardstem bulrush (Scirpus acutus) would be designated a Typha latifolia-Scirpus acutus Dominance Type.

When the Subclass is based on substrate material, the Dominance Type is named for the predominant plant or sedentary or sessile macroinvertebrate species, without regard for life form. In the Marine and Estuarine Systems, sponges, alcyonarians, mollusks, crustaceans, worms, ascidians, and echinoderms may all be part of the community represented by the Macoma balthica Dominance Type. Sometimes it is necessary to designate two or more codominant species as a Dominance Type. Thorson (1957) recommended guidelines and suggested definitions for establishing community types and dominants on level bottoms.

4 Our initial attempts to use familiar terms such as marsh, swamp, bog, and meadow at the Class level were unsuccessful primarily because of wide discrepancies in the use of these terms in various regions of the United States. In an effort to resolve that difficulty, we based the Classes on the fundamental components (life form, water regime, substrate type, water chemistry) that give rise to such terms. We believe that this approach will greatly reduce the misunderstandings and confusion that result from the use of the familiar terms.

5 Percent areal cover is seldom measured in the application of this system, but the term must be defined in terms of area. We suggest 2 m² for herbaceous and moss layers, 16 m² for shrub layers, and 100 m² for tree layers (Mueller-Dombois and Ellenberg 1974:74). When percent areal cover is the key for establishing boundaries between units of the classification, it may occasionally be necessary to measure cover on plots, in order to maintain uniformity of ocular estimates made in the field or interpretations made from aerial photographs.

Rock Bottom

Definition. The Class Rock Bottom includes all wetlands and deepwater habitats with substrates having an areal cover of stones, boulders, or bedrock 75% or greater and vegetative cover of less than 30%. Water regimes are restricted to subtidal, permanently flooded, intermittently exposed, and semipermanently flooded.

Description. The rock substrate of the rocky benthic or bottom zone is one of the most important factors in determining the abundance, variety, and distribution of organisms. The stability of the bottom allows a rich assemblage of plants and animals to develop. Rock Bottoms are usually high-energy habitats with well-aerated waters. Temperature, salinity, current, and light penetration are also important factors in determining the composition of the benthic community. Animals that live on the rocky surface are generally firmly attached by hooking or sucking devices, although they may occasionally move about over the substrate. Some may be permanently attached by cement. A few animals hide in rocky crevices and under rocks, some move rapidly enough to avoid being swept away, and others burrow into the finer substrates between boulders. Plants are also firmly attached (e.g., by hold-fasts), and in the Riverine System both plants and animals are commonly streamlined or flattened in response to high water velocities.

Subclasses and Dominance Types.

- Bedrock. — Bottoms in which bedrock covers 75% or more of the surface.
- Rubble. — Bottoms with less than 75% areal cover of bedrock, but stones and boulders alone, or in
combination with bedrock, cover 75% or more of the surface.

Examples of Dominance Types for these two Subclasses in the Marine and Estuarine Systems are the encrusting sponges *Hippopospongia*, the tunicate *Cnemidocarpa*, the sea urchin *Strongylocentrotus*, the sea star *Pisaster*, the sea whip *Muricea*, and the American lobster *Homarus americanus*. Examples of Lacustrine, Palustrine, and Riverine Dominance Types are the freshwater sponges *Spongilla* and *Heteromeyenia*, the pond snail *Lymnaea*, the mayfly *Ephemerella*, various midges of the *Chironomidae*, the caddisfly *Hydropsyche*, the leech *Helobdella*, the riffle beetle *Psephenus*, the chironomid midge *Eukiefferiella*, the crayfish *Procambarus*, and the black fly *Simulium*.

Dominance Types for Rock Bottoms in the Marine and Estuarine Systems were taken primarily from Smith (1964) and Ricketts and Calvin (1968), and those for Rock Bottoms in the Lacustrine, Riverine, and Palustrine Systems from Krecker and Lancaster (1933), Stehr and Branson (1938), Ward and Whipple (1959), Clarke (1973), Hart and Fuller (1975), Slack et al. (1977), and Pennak (1978).

**Unconsolidated Bottom**

**Definition.** The Class Unconsolidated Bottom includes all wetland and deepwater habitats with at least 25% cover of particles smaller than stones, and a vegetative cover less than 30%. Water regimes are restricted to subtidal, permanently flooded, intermittently exposed, and semipermanently flooded.

**Description.** Unconsolidated Bottoms are characterized by the lack of large stable surfaces for plant and animal attachment. They are usually found in areas with lower energy than Rock Bottoms, and may be very unstable. Exposure to wave and current action, temperature, salinity, and light penetration determines the composition and distribution of organisms.

Most macroalgae attach to the substrate by means of basal hold-fast cells or discs; in sand and mud, however, algae penetrate the substrate and higher plants can successfully root if wave action and currents are not too strong. Most animals in unconsolidated sediments live within the substrate, e.g., *Macoma* and the amphipod *Melita*. Some, such as the polychaete worm *Chaetopterus*, maintain permanent burrows, and others may live on the surface, especially in coarse-grained sediments.

In the Marine and Estuarine Systems, Unconsolidated Bottom communities are relatively stable. They vary from the Arctic to the tropics, depending largely on temperature, and from the open ocean to the upper end of the estuary, depending on salinity. Thorson (1957) summarized and described characteristic types of level-bottom communities in detail.

In the Riverine System, the substrate type is largely determined by current velocity, and plants and animals exhibit a high degree of morphologic and behavioral adaptation to flowing water. Certain species are confined to specific substrates and some are at least more abundant in one type of substrate than in others. According to Hynes (1970:208), “The larger the stones, and hence the more complex the substratum, the more diverse is the invertebrate fauna.” In the Lacustrine and Palustrine Systems, there is usually a high correlation, within a given water body, between the nature of the substrate and the number of species and individuals. For example, in the profundal bottom of eutrophic lakes where light is absent, oxygen content is low, and carbon dioxide concentration is high, the sediments are ooze-like organic materials and species diversity is low. Each substrate type typically supports a relatively distinct community of organisms (Reid and Wood 1976:262).
Subclasses and Dominance Types.

- **Cobble-Gravel.** — The unconsolidated particles smaller than stones are predominantly cobble and gravel, although finer sediments may be intermixed. Examples of Dominance Types for the Marine and Estuarine Systems are the mussels *Modiolus* and *Mytilus*, the brittle star *Amphipholis*, the soft-shell clam *Mya*, and the Venus clam *Saxidomus*. Examples for the Lacustrine, Palustrine, and Riverine Systems are the midge *Diamesa*, stonefly-midge *Nemoura-Eukiefferiella* (Slack et al. 1977), chironomid midge-caddisfly-snail *Chironomus-Hydropsyche-Physa* (Krecker and Lancaster 1933), the pond snail *Lymnaea*, the mayfly *Baetis*, the freshwater sponge *Eunapius*, the oligochaete worm *Lumbriculus*, the scud *Gammarus*, and the freshwater mollusks *Anodonta*, *Elliptio*, and *Lampsilis*.

- **Sand.** — The unconsolidated particles smaller than stones are predominantly sand, although finer or coarser sediments may be intermixed. Examples of Dominance Types in the Marine and Estuarine Systems are the wedge shell *Donax*, the scallop *Pecten*, the tellin shell *Tellina*, the heart urchin *Echinocardium*, the lugworm *Arenicola*, the sand dollar *Dendraster*, and the sea pansy *Renilla*. Examples for the Lacustrine, Palustrine, and Riverine Systems are the snail *Physa*, the scud *Gammarus*, the oligochaete worm *Limnodrilus*, the mayfly *Ephemerella*, the freshwater mollusks *Elliptio* and *Anodonta*, and the fingernail clam *Sphaerium*.

- **Mud.** — The unconsolidated particles smaller than stones are predominantly silt and clay, although coarser sediments or organic material may be intermixed. Organisms living in mud must be able to adapt to low oxygen concentrations. Examples of Dominance Types for the Marine and Estuarine Systems include the terebellid worm *Amphitrite*, the boring clam *Platyodon*, the deep-sea scallop *Placopecten*, the quahog *Mercenaria*, the macoma *Macoma*, the echiurid worm *Urechis*, the mud snail *Nassarius*, and the sea cucumber *Thyone*. Examples of Dominance Types for the Lacustrine, Palustrine, and Riverine Systems are the sewage worm *Tubifex*, freshwater mollusks *Anodonta*, *Anodontoides*, and *Elliptio*, the fingernail clams *Pisidium* and *Sphaerium*, and the midge *Chironomus*.

- **Organic.** — The unconsolidated material smaller than stones is predominantly organic. The number of species is limited and faunal productivity is very low (Welch 1952). Examples of Dominance Types for Estuarine and Marine Systems are the soft-shell clam *Mya*, the false angel wing *Petricola pholadiformis*, the clam worm *Nereis*, and the mud snail *Nassarius*. Examples for the Lacustrine, Palustrine, and Riverine Systems are the sewage worm *Tubifex*, the snail *Physa*, the harpacticoid copepod *Canthocamptus*, and the oligochaete worm *Limnodrilus*.

Dominance Types for Unconsolidated Bottoms in the Marine and Estuarine Systems were taken predominantly from Miner (1950), Smith (1964), Abbott (1968), and Ricketts and Calvin (1968). Dominance Types for Unconsolidated Bottoms in the Lacustrine, Riverine, and Palustrine Systems were taken predominantly from Krecker and Lancaster (1933), Stehr and Branson (1938), Johnson (1970), Brinkhurst and Jamieson (1972), Clarke (1973), Hart and Fuller (1974), Ward (1975), and Pennak (1978).

**Aquatic Bed**

**Definition.** The Class Aquatic Bed includes wetlands and deepwater habitats dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Water regimes include subtidal, irregularly exposed, regularly flooded, permanently flooded, intermittently exposed, semipermanently flooded, and seasonally flooded.

**Description.** Aquatic Beds represent a diverse group of plant communities that require surface water for optimum growth and reproduction. They are best developed in relatively permanent water or under condi-
tions of repeated flooding. The plants are either attached to the substrate or float freely in the water above
the bottom or on the surface.

Subclasses and Dominance Types.

☐ Algal. — Algal Beds are widespread and diverse in the Marine and Estuarine Systems, where they
occupy substrates characterized by a wide range of sediment depths and textures. They occur in both
the Subtidal and Intertidal Subsystems and may grow to depths of 30 m (98 feet). Coastal Algal Beds
are most luxuriant along the rocky shores of the Northeast and West. Kelp (Macrocystis) beds are
especially well developed on the rocky substrates of the Pacific Coast. Dominance Types such as the
rockweeds Fucus and Ascophyllum and the kelp Laminaria are common along both coasts. In tropical
regions, green algae, including forms containing calcareous particles, are more characteristic;
Halimeda and Pencilus are common examples. The red alga Laurencia, and the green algae
Caulerpa, Enteromorpha, and Ulva are also common Estuarine and Marine dominance types;
Enteromorpha and Ulva are tolerant of fresh water and flourish near the upper end of some estuaries.
The stonewort Chara is also found in estuaries.
Inland, the stoneworts Chara, Nitella, and Tolypella are examples of algae that look much like
vascular plants and may grow in similar situations. However, meadows of Chara may be found in
Lacustrine water as deep as 40 m (131 feet) (Zhadin and Gerd 1963), where hydrostatic pressure
limits the survival of vascular submergents (phanerogams) (Welch 1952). Other algae bearing less
resemblance to vascular plants are also common. Mats of filamentous algae may cover the bottom in
dense blankets, may rise to the surface under certain conditions, or may become stranded on Uncon-
solidated or Rocky Shores.

☐ Aquatic Moss. — Aquatic mosses are far less abundant than algae or vascular plants. They occur
primarily in the Riverine System and in permanently flooded and intermittently exposed parts of
some Lacustrine systems. The most important Dominance Types include genera such as Fissidens,
Drepanoclados, and Fontinalis. Fontinalis may grow to depths as great as 120 m (394 feet)
(Hutchinson 1975). For simplicity, aquatic liverworts of the genus Marsupella are included in this
Subclass.

☐ Rooted Vascular. — Rooted Vascular Reds include a large array of vascular species in the Marine
and Estuarine Systems. They have been referred to by others as temperate grass flats (Phillips 1974);
tropical marine meadows (Odum 1974); and eelgrass beds, turtlegrass beds, and seagrass beds
(Akins and Jefferson 1973; Eleuterius 1973; Phillips 1974). The greatest number of species occur in
shallow, clear tropical, or subtropical waters of moderate current strength in the Caribbean and along
the Florida and Gulf Coasts. Principal Dominance Types in these areas include turtlgrass (Thalassia
testudinum), shoalgrass (Halodule wrightii), manatee grass (Cynodocea filiformis), widgeon grass
(Ruppia maritima), sea grasses (Halophila spp.), and wild celery (Vallisneria americana).
Five major vascular species dominate along the temperate coasts of North America: shoalgrass, surf
grasses (Phyllospadix scouleri, P. torreyi), widgeon grass, and eelgrass (Zostera marina). Eelgrass
beds have the most extensive distribution, but they are limited primarily to the more sheltered estua-
rine environment. In the lower salinity zones of estuaries, stands of widgeon grass, pondweed
(Potamogeton), and wild celery often occur, along with naiads (Najas) and water milfoil
(Myriophyllum).
In the Riverine, Lacustrine, and Palustrine Systems, rooted vascular aquatic plants occur at all depths
within the photic zone. They often occur in sheltered areas where there is little water movement
(Wetzel 1975): however, they also occur in the flowing water of the Riverine System, where they
may be streamlined or flattened in response to high water velocities. Typical inland genera include
pondweeds, horned pondweed (Zannichellia palustris), ditch grasses (Ruppia), wild celery, and
waterweed (Elodea). The riverweed (Postostemum ceratophyllum) is included in this class despite its lack of truly recognizable roots (Sculthorpe 1967).

Some of the rooted vascular species are characterized by floating leaves. Typical dominants include water lilies (Nymphaea, Nuphar), floating-leaf pondweed (Potamogeton natans), and water shield (Brasenia schreberi). Plants such as yellow water lily (Nuphar luteum) and water smartweed (Polygonum amphibium), which may stand erect above the water surface or substrate, may be considered either emergents or rooted vascular aquatic plants, depending on the life form adopted at a particular site.

Floating Vascular. — Beds of floating vascular plants occur mainly in the Lacustrine, Palustrine, and Riverine Systems and in the fresher waters of the Estuarine System. The plants float freely either in the water or on its surface. Dominant plants that float on the surface include the duckweeds (Lemna, Spirodela), water lettuce (Pistia stratiotes), water hyacinth (Eichhornia crassipes), water nut (Trapa natans), water ferns (Salvinia spp.), and mosquito ferns (Azolla). These plants are found primarily in protected portions of slow-flowing rivers and in the Lacustrine and Palustrine Systems. They are easily moved about by wind or water currents and cover a large area of water in some parts of the country, particularly the Southeast. Dominance Types for beds floating below the surface include bladderworts (Utricularia), coontails (Ceratophyllum), and watermeals (Wolffia) (Sculthorpe 1967; Hutchinson 1975).

**Reef**

Definition. The Class Reef includes ridge-like or mound-like structures formed by the colonization and growth of sedentary invertebrates. Water regimes are restricted to subtidal, irregularly exposed, regularly flooded, and irregularly flooded.

Description. Reefs are characterized by their elevation above the surrounding substrate and their interference with normal wave flow; they are primarily subtidal, but parts of some reefs may be intertidal as well. Although corals, oysters, and tube worms are the most visible organisms and are mainly responsible for reef formation, other mollusks, foraminifera, coralline algae, and other forms of life also contribute substantially to reef growth. Frequently, reefs contain far more dead skeletal material and shell fragments than living matter.

Subclasses and Dominance Types.

- **Coral.** — Coral Reefs are widely distributed in shallow waters of warm seas, in Hawaii, Puerto Rico, the Virgin Islands, and southern Florida. They were characterized by Odum (1971) as stable, well-adapted, highly diverse, and highly productive ecosystems with a great degree of internal symbiosis. Coral Reefs lie almost entirely within the Subtidal Subsystem of the Marine System, although the upper part of certain Reefs may be exposed. Examples of Dominance Types are the corals Porites, Acropora, and Montipora. The distribution of these types reflects primarily their elevation, wave exposure, the age of the Reef, and its exposure to waves.

- **Mollusk.** — This Subclass occurs in both the Intertidal and Subtidal Subsystems of the Estuarine System. These Reefs are found on the Pacific, Atlantic, and Gulf Coasts and in Hawaii and the Caribbean. Mollusk Reefs may become extensive, affording a substrate for sedentary and boring organisms and a shelter for many others. Reef mollusks are adapted to great variations in water level, salinity, and temperature, and these same factors control their distribution. Examples of Dominance Types for this Subclass are the oysters Ostrea and Crassostrea (Smith 1964; Abbott 1968; Ricketts and Calvin 1968).
Worm. — Worm Reefs are constructed by large colonies of Sabellariid worms living in individual tubes constructed from cemented sand grains. Although they do not support as diverse a biota as do Coral and Mollusk Reefs, they provide a distinct habitat which may cover large areas. Worm Reefs are generally confined to tropical waters, and are most common along the coasts of Florida, Puerto Rico, and the Virgin Islands. They occur in both the Intertidal and Subtidal Systems of the Marine and Estuarine Systems where the salinity approximates that of sea water. The reefworm Sabellaria is an example of a Dominance Type for this Subclass (Ricketts and Calvin 1968).

Streambed

Definition. The Class Streambed includes all wetland contained within the Intermittent Subsystem of the Riverine System and all channels of the Estuarine System or of the Tidal Subsystem of the Riverine System that are completely dewatered at low tide. Water regimes are restricted to irregularly exposed, regularly flooded, irregularly flooded, seasonally flooded, temporarily flooded, and intermittently flooded.

Description. Streambeds vary greatly in substrate and form depending on the gradient of the channel, the velocity of the water, and the sediment load. The substrate material frequently changes abruptly between riffles and pools, and complex patterns of bars may form on the convex side of single channels or be included as islands within the bed of braided streams (Crickmay 1974). In mountainous areas the entire channel may be cut through bedrock. In most cases streambeds are not vegetated because of the scouring effect of moving water, but, like Unconsolidated Shores, they may be colonized by “pioneering” annuals or perennials during periods of low flow or they may have perennial emergents and shrubs that are too scattered to qualify the area for classification as Emergent Wetland or Scrub-Shrub Wetland.

Subclasses and Dominance Types.

- **Bedrock.** — This Subclass is characterized by a bedrock substrate covering 75% or more of the stream channel. It occurs most commonly in the Riverine System in high mountain areas or in glacialized areas where bedrock is exposed. Examples of Dominance Types are the mollusk Ancylus, the oligochaete worm Limnodrilus, the snail Physa, the fingernail clam Pisidium, and the mayflies Caenis and Ephemerella.

- **Rubble.** — This Subclass is characterized by stones, boulders, and bedrock that in combination cover more than 75% of the channel. Like Bedrock Streambeds, Rubble Streambeds are most common in mountainous areas and the dominant organisms are similar to those of Bedrock and are often forms capable of attachment to rocks in flowing water.

- **Cobble-Gravel.** — In this Subclass at least 25% of the substrate is covered by unconsolidated particles smaller than stones; cobbles or gravel predominate. The Subclass occurs in riffle areas or in the channels of braided streams. Examples of Dominance Types in the Intermittent Subsystem of the Riverine System are the snail Physa, the oligochaete worm Limnodrilus, the mayfly Caenis, the midge Chironomus, and the mosquito Anopheles. Examples of Dominance Types in the Estuarine System or Tidal Subsystem of the Riverine System are the mussels Modiolus and Mytilus.

- **Sand.** — In this Subclass, sand-sized particles predominate among the particles smaller than stones. Sand Streambed often contains bars and beaches interspersed with Mud Streambed or it may be interspersed with Cobble-Gravel Streambed in areas of fast flow or heavy sediment load. Examples of Dominance Types in the Riverine System are the scud Gammarus, the snails Physa and Lymnaea, and the midge Chironomus; in the Estuarine System the ghost shrimp Callianassa is a common Dominance Type.
Mud. — In this Subclass, the particles smaller than stones are chiefly silt or clay. Mud Streambeds are common in arid areas where intermittent flow is characteristic of streams of low gradient. Such species as tamarisk (Tamarix gallica) may occur, but are not dense enough to qualify the area for classification as Scrub-Shrub Wetland. Mud Streambeds are also common in the Estuarine System and the Tidal Subsystem of the Riverine System. Examples of Dominance Types for Mud Streambeds include the crayfish Procambarus, the pouch snail Aplexa, the fly Tabanus, the snail Lymnaea, the fingernail clam Sphaerium, and (in the Estuarine System) the mud snail Nassarius.

Organic. — This Subclass is characterized by channels formed in peat or muck. Organic Streambeds are common in the small creeks draining Estuarine Emergent Wetlands with organic soils. Examples of Dominance Types are the mussel Modiolus in the Estuarine System and the oligochaete worm Limnodrilus in the Riverine System.

Vegetated. — These streambeds are exposed long enough to be colonized by herbaceous annuals or seedling herbaceous perennials (pioneer plants). This vegetation, unlike that of Emergent Wetlands, is usually killed by rising water levels or sudden flooding. A typical Dominance Type is Panicum capillare.

Dominance Types for Streambeds in the Estuarine System were taken primarily from Smith (1964), Abbott (1968), and Ricketts and Calvin (1968) and those for streambeds in the Riverine System from Krecker and Lancaster (1933), Stehr and Branson (1938), van der Schalie (1948), Kenk (1949), Cummins et al. (1964), Clarke (1973), and Ward (1975).

Rocky Shore

Definition. The Class Rocky Shore includes wetland environments characterized by bedrock, stones, or boulders which singly or in combination have an areal cover of 75% or more and an areal coverage by vegetation of less than 30%. Water regimes are restricted to irregularly exposed, regularly flooded, irregularly flooded, seasonally flooded, temporarily flooded, and intermittently flooded.

Description. In Marine and Estuarine Systems, Rocky Shores are generally high-energy habitats which lie exposed as a result of continuous erosion by wind-driven waves or strong currents. The substrate is stable enough to permit the attachment and growth of sessile or sedentary invertebrates and attached algae or lichens. Rocky Shores usually display a vertical zonation that is a function of tidal range, wave action, and degree of exposure to the sun. In the Lacustrine and Riverine Systems, Rocky Shores support sparse plant and animal communities.

Subclasses and Dominance Types.

Bedrock. — These wetlands have bedrock covering 75% or more of the surface and less than 30% areal coverage of macrophytes.

Rubble. — These wetlands have less than 75% areal cover of bedrock, but stones and boulders alone or in combination with bedrock cover 75% or more of the area. The areal coverage of macrophytes is less than 30%.

Communities or zones of Marine and Estuarine Rocky Shores have been widely studied (Lewis 1964; Ricketts and Calvin 1968; Stephenson and Stephenson 1972). Each zone supports a rich assemblage of invertebrates and algae or lichens or both. Dominance Types of the Rocky Shores often can be characterized by one or two dominant genera from these zones.
The uppermost zone (here termed the littorine-lichen zone) is dominated by periwinkles (Littorina and Nerita) and lichens. This zone frequently takes on a dark, or even black appearance, although abundant lichens may lend a colorful tone. These organisms are rarely submerged, but are kept moist by sea spray. Frequently this habitat is invaded from the landward side by semimarine genera such as the slater Ligia.

The next lower zone (the balanoid zone) is commonly dominated by mollusks, green algae, and barnacles of the balanoid group. The zone appears white. Dominance Types such as the barnacles Balanus, Chthamalus, and Tetracita may form an almost pure sheet, or these animals may be interspersed with mollusks, tube worms, and algae such as Pelvetia, Enteromorpha, and Ulva.

The transition between the littorine-lichen and balanoid zones is frequently marked by the replacement of the periwinkles with limpets such as Acmaea and Siphonaria. The limpet band approximates the upper limit of the regularly flooded intertidal zone.

In the middle and lower intertidal areas, which are flooded and exposed by tides at least once daily, lie a number of other communities which can be characterized by dominant genera. Mytilus and gooseneck barnacles (Pollicipes) form communities exposed to strong wave action. Aquatic Beds dominated by Fucus and Laminaria lie slightly lower, just above those dominated by coralline algae (Lithothamnion). The Laminaria Dominance Type approximates the lower end of the Intertidal Subsystem; it is generally exposed at least once daily. The Lithothamnion Dominance Type forms the transition to the Subtidal Subsystem and is exposed only irregularly.

In the Palustrine, Riverine, and Lacustrine various species of lichens such as Verrucaria spp. and Dermatocarpon fluviatile, as well as blue-green algae, frequently form characteristic zones on Rocky Shores. The distribution of these species depends on the duration of flooding or wetting by spray and is similar to the zonation of species in the Marine and Estuarine Systems (Hutchinson 1975). Though less abundant than lichens, aquatic liverworts such as Marsupella emarginata var. aquatica or mosses such as Fissidens julianus are found on the Rocky Shores of lakes and rivers. If aquatic liverworts or mosses cover 30% or more of the substrate, they should be placed in the Class Aquatic Bed. Other examples of Rocky Shore Dominance Types are the caddisfly Hydropsyche and the fingernail clam Pisidium.

Unconsolidated Shore

Definition. The Class Unconsolidated Shore includes all wetland habitats having three characteristics: (1) unconsolidated substrates with less than 75% areal cover of stones, boulders, or bedrock; (2) less than 30% areal cover of vegetation other than pioneering plants; and (3) any of the following water regimes: irregularly exposed, regularly flooded, irregularly flooded, seasonally flooded, temporarily flooded, intermittently flooded, saturated, or artificially flooded. Intermittent or intertidal channels of the Riverine System and intertidal channels of the Estuarine System are classified as Streambed.

Description. Unconsolidated Shores are characterized by substrates lacking vegetation except for pioneering plants that become established during brief periods when growing conditions are favorable. Erosion and deposition by waves and currents produce a number of landforms such as beaches, bars, and flats, all of which are included in this Class. Unconsolidated Shores are found adjacent to Unconsolidated Bottoms in all Systems; in the Palustrine and Lacustrine Systems, the Class may occupy the entire basin. As in Unconsolidated Bottoms, the particle size of the substrate and the water regime are the important factors determining the types of plant and animal communities present. Different substrates usually support characteristic invertebrate fauna. Faunal distribution is controlled by waves, currents, interstitial moisture, salinity, and grain size (Hedgpeth 1957; Ranwell 1972; Riedl and McManus 1974).
Subclasses and Dominance Types.

- **Cobble-Gravel.** — The unconsolidated particles smaller than stones are predominantly cobble and gravel. Shell fragments, sand, and silt often fill the spaces between the larger particles. Stones and boulders may be found scattered on some Cobble-Gravel Shores. In areas of strong wave and current action these shores take the form of beaches or bars, but occasionally they form extensive flats. Examples of Dominance Types in the Marine and Estuarine Systems are: the acorn barnacle *Balanus*, the limpet *Patella*, the periwinkle *Littorina*, the rock shell *Thais*, the mussels *Mytilus* and *Modiolus*, and the Venus clam *Saxidomus*. In the Lacustrine, Palustrine, and Riverine Systems examples of Dominance Types are the freshwater mollusk *Elliptio*, the snails *Lymnaea* and *Physa*, the toad bug *Gelastocoris*, the leech *Erpodella*, and the springtail *Agrenia*.

- **Sand.** — The unconsolidated particles smaller than stones are predominantly sand which may be either calcareous or terrigenous in origin. They are prominent features of the Marine, Estuarine, Riverine, and Lacustrine Systems where the substrate material is exposed to the sorting and washing action of waves. Examples of Dominance Types in the Marine and Estuarine Systems are the wedge shell *Donax*, the soft-shell clam *Mya*, the quahog *Mercenaria*, the olive shell *Oliva*, the blood worm *Euzonus*, the beach hopper *Orchestia*, the pismo clam *Tivela stultorum*, the mole crab *Emerita*, and the lugworm *Arenicola*. Examples of Dominance Types in the Riverine, Lacustrine, and Palustrine Systems are the copepods *Parastenocaris* and *Phyllognathopus*, the oligochaete worm *Pristina*, the freshwater mollusks *Anodonta* and *Elliptio*, and the fingernail clams *Pisidium* and *Sphaerium*.

- **Mud.** — The unconsolidated particles smaller than stones are predominantly silt and clay. Anaerobic conditions often exist below the surface. Mud Shores have a higher organic content than Cobble-Gravel or Sand Shores. They are typically found in areas of minor wave action. They tend to have little slope and are frequently called flats. Mud Shores support diverse populations of tube-dwelling and burrowing invertebrates that include worms, clams, and crustaceans (Gray 1974). They are commonly colonized by algae and diatoms which may form a crust or mat. Irregularly flooded Mud Shores in the Estuarine System have been called salt flats, pans, or pannes. They are typically high in salinity and are usually surrounded by, or lie on the landward side of, Emergent Wetlands (Martin et al. 1953, Type 15). In many arid areas, Palustrine and Lacustrine Mud Shores are encrusted or saturated with salt. Martin et al. (1953) called these habitats inland saline flats (Type 9); they are also called alkali flats, salt flats, and salt pans. Mud Shores may also result from removal of vegetation by man, animals, or fire, or from the discharge of thermal waters or pollutants. Examples of Dominance Types in the Marine and Estuarine Systems include the fiddler crab *Uca*, the ghost shrimp *Callianassa*, the mud snails *Nassarius* and *Macoma*, the clam worm *Nereis*, the sea anemone *Cerianthus*, and the sea cucumber *Thyone*. In the Lacustrine, Palustrine, and Riverine Systems, examples of Dominance Types are the fingernail clam *Pisidium*, the snails *Aplexa* and *Lymaea*, the crayfish *Procambarus*, the harpacticoid copepods *Canthocamptus* and *Bryocamptus*, the fingernail clam *Sphaerium*, the freshwater mollusk *Elliptio*, the shore bug *Saldula*, the isopod *Asellus*, the crayfish *Cambarus*, and the mayfly *Tortopus*.

- **Organic.** — The unconsolidated material smaller than stones is predominantly organic soils of formerly vegetated wetlands. In the Marine and Estuarine Systems, Organic Shores are often dominated by microinvertebrates such as foraminifera, and by *Nassarius*, *Littorina*, *Uca*, *Modiolus*, *Mya*, *Nereis*, and the false angel wing *Petricola pholadiformis*. In the Lacustrine, Palustrine, and Riverine Systems, examples of Dominance Types are *Canthocamptus*, *Bryocamptus*, *Chironomus*, and the backswimmer *Notonecta*.

- **Vegetated.** — Some nontidal shores are exposed for a sufficient period to be colonized by herbaceous annuals or seedling herbaceous perennials (pioneer plants). This vegetation, unlike that of Emergent Wetlands, is usually killed by rising water levels and may be gone before the beginning of the next
growing season. Many of the pioneer species are not hydrophytes but are weedy mesophytes that cannot tolerate wet soil or flooding. Examples of Dominance Types in the Palustrine, Riverine, and Lacustrine Systems are cocklebur (Xanthium strumarium) and barnyard grass (Echinochloa crus-galli).

Dominance Types for Unconsolidated Shores in the Marine and Estuarine Systems were taken primarily from Smith (1964), Morris (1966), Abbott (1968), Ricketts and Calvin (1968), and Gosner (1971). Dominance Types for Unconsolidated Shores in the Lacustrine, Riverine, and Palustrine Systems were taken primarily from Stehr and Branson (1938), Kenk (1949), Ward and Whipple (1959), Cummins et al. (1964), Johnson (1970), Ingram (1971), Clarke (1973), and Hart and Fuller (1974).

**Moss-Lichen Wetland**

Definition. The Moss-Lichen Wetland Class includes areas where mosses or lichens cover substrates other than rock and where emergents, shrubs, or trees make up less than 30% of the areal cover. The only water regime is saturated.

Description. Mosses and lichens are important components of the flora in many wetlands, especially in the north, but these plants usually form a ground cover under a dominant layer of trees, shrubs, or emergents. In some instances higher plants are uncommon and mosses or lichens dominate the flora. Such Moss-Lichen Wetlands are not common, even in the northern United States where they occur most frequently.

Subclasses and Dominance Types.

- **Moss.** — Moss Wetlands are most abundant in the far north. Areas covered with peat mosses (Sphagnum spp.) are usually called bogs (Golet and Larson 1974; Jeglum et al. 1974; Zoltai et al. 1975), whether Sphagnum or higher plants are dominant. In Alaska, Drepanocladus and the liverwort Chiloscyphus fragilis may dominate shallow pools with impermanent water; peat moss and other mosses (Campylium stellatum, Aulacomnium palustre, and Oncophorus wahlenbergii) are typical of wet soil in this region (Britton 1957; Drury 1962).

- **Lichen.** — Lichen Wetlands are also a northern Subclass. Reindeer moss (Cladina rangiferina) forms the most important Dominance Type. Pollett and Bridgewater (1973) described areas with mosses and lichens as bogs or fens, the distinction being based on the availability of nutrients and the particular plant species present. The presence of Lichen Wetlands has been noted in the Hudson Bay Lowlands (Sjörs 1959) and in Ontario (Jeglum et al. 1974).

**Emergent Wetland**

Definition. The Emergent Wetland Class is characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants. All water regimes are included except subtidal and irregularly exposed.

Description. In areas with relatively stable climatic conditions, Emergent Wetlands maintain the same appearance year after year. In other areas, such as the prairies of the central United States, violent climatic fluctuations cause them to revert to an open water phase in some years (Stewart and Kantrud 1972). Emergent Wetlands are found throughout the United States and occur in all Systems except the Marine. Emergent Wetlands are known by many names, including marsh, meadow, fen, prairie pothole, and slough. A reas that
are dominated by pioneer plants which become established during periods of low water are not Emergent Wetlands and should be classified as Vegetated Unconsolidated Shores or Vegetated Streambeds.

Subclasses and Dominance Types.

- Persistent. — Persistent Emergent Wetlands are dominated by species that normally remain standing at least until the beginning of the next growing season. This Subclass is found only in the Estuarine and Palustrine Systems.
  Persistent Emergent Wetlands dominated by saltmarsh cordgrass (Spartina alterniflora), saltmeadow cordgrass (S. patens), big cordgrass (S. cynosuroides), needle rush (Juncus roemerianus), narrow-leaved cattail (Typha angustifolia), and southern wild rice (Zizaniopsis miliacea) are major components of the Estuarine systems of the Atlantic and Gulf Coasts of the United States. On the Pacific Coast, common pickleweed (Salicornia Virginica), sea blite (Suaeda californica), arrow grass (Triglochin maritimum), and California cordgrass (Spartina foliosa) are common dominants.
  Palustrine Persistent Emergent Wetlands contain a vast array of grasslike plants such as cattails (Typha spp.), bulrushes (Scirpus spp.), saw grass (Cladium jamaicense), sedges (Carex spp.); and true grasses such as reed (Phragmites australis), manna grasses (Glyceria spp.), slough grass (Beckmannia syzigachne), and whitetop (Schochoa festucacea). There is also a variety of broad-leaved persistent emergents such as purple loosestrife (Lythrum salicaria), dock (Rumex mexicanus), waterwillow (Decodon verticillatus), and many species of smartweeds (Polygonum).

- Nonpersistent. — Wetlands in this Subclass are dominated by plants which fall to the surface of the substrate or below the surface of the water at the end of the growing season so that, at certain seasons of the year, there is no obvious sign of emergent vegetation. For example, wild rice (Zizania aquatica) does not become apparent in the North Central States until midsummer and fall, when it may form dense emergent stands. Nonpersistent emergents also include species such as arrow arum (Peltandra virginica), pickerelweed (Pontederia cordata), and arrowheads (Sagittaria spp.). Movement of ice in Estuarine, Riverine, or Lacustrine Systems often removes all traces of emergent vegetation during the winter. Where this occurs the area should be classified as Nonpersistent Emergent Wetland.

**Scrub-Shrub Wetland**

**Definition.** The Class Scrub-Shrub Wetland includes areas dominated by woody vegetation less than 6 m (20 feet) tall. The species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions. All water regimes except subtidal are included.

**Description.** Scrub-Shrub Wetlands may represent a successional stage leading to Forested Wetland, or they may be relatively stable communities. They occur only in the Estuarine and Palustrine Systems, but are one of the most widespread classes in the United States (Shaw and Fredine 1956). Scrub-Shrub Wetlands are known by many names, such as shrub swamp (Shaw and Fredine 1956), shrub carr (Curtis 1959), bog (Heinselman 1970), and pocosin (Kologiski 1977). For practical reasons we have also included forests composed of young trees less than 6 m tall.
Subclasses and Dominance Types.

- **Broad-leaved Deciduous.** — In Estuarine System Wetlands the predominant deciduous and broad-leaved trees or shrubs are plants such as sea-myrtle (Baccharis halimifolia) and marsh elder (Iva frutescens). In the Palustrine System typical Dominance Types are alders (Alnus spp.), willows (Salix spp.), buttonbush (Cephalanthus occidentalis), red osier dogwood (Cornus stolonifera), honeycup (Zenobia pulverulenta), spirea (Spiraea douglasii), bog birch (Betula pumila), and young trees of species such as red maple (Acer rubrum) or black spruce (Picea mariana).

- **Needle-leaved Deciduous.** — This Subclass, consisting of wetlands where trees or shrubs are predominantly deciduous and needleleaved, is represented by young or stunted trees such as tamarack or bald cypress (Taxodium distichum).

- **Broad-leaved Evergreen.** — In the Estuarine System, vast wetland acreages are dominated by mangroves (Rhizophora mangle, Laguncularia racemosa, Conocarpus erectus, and Avicennia germinans) that are less than 6 m tall. In the Palustrine System, the broad-leaved evergreen species are typically found on organic soils. Northern representatives are labrador tea (Ledum groenlandicum), bog rosemary (Andromeda glaucophylla), bog laurel (Kalmia polifolia), and the semi-evergreen black ti-ti (Cyrilla racemiflora) are characteristic broad-leaved evergreen species.

- **Needle-leaved Evergreen.** — The dominant species in Needle-leaved Evergreen Wetlands are young or stunted trees such as black spruce or pond pine (Pinus serotina).

- **Dead.** — Dead woody plants less than 6 m tall dominate Dead Scrub-Shrub Wetlands. These wetlands are usually produced by a prolonged rise in the water table resulting from impoundment of water by landslides, man, or beavers. Such wetlands may also result from various other factors such as fire, salt spray, insect infestation, air pollution, and herbicides.

**Forested Wetland**

Definition. The Class Forested Wetland is characterized by woody vegetation that is 6 m tall or taller. All water regimes are included except subtidal.

Description. Forested Wetlands are most common in the eastern United States and in those sections of the West where moisture is relatively abundant, particularly along rivers and in the mountains. They occur only in the Palustrine and Estuarine Systems and normally possess an overstory of trees, an understory of young trees or shrubs, and a herbaceous layer. Forested Wetlands in the Estuarine System, which include the mangrove forests of Florida, Puerto Rico, and the Virgin Islands, are known by such names as swamps, hammocks, heads, and bottoms. These names often occur in combination with species names or plant associations such as cedar swamp or bottomland hardwoods.

Subclasses and Dominance Types.

- **Broad-leaved Deciduous.** — Dominant trees typical of Broadleaved Deciduous Wetlands, which are represented throughout the United States, are most common in the South and East. Common dominants are species such as red maple, American elm (Ulmus americana), ashes (Fraxinus pennsylvania and F. nigra), black gum (Nyssa sylvatica), tupelo gum (N. aquatica), swamp white oak (Quercus bicolor), overcup oak (Q. lyrata), and basket oak (Q. michauxii). Wetlands in this subclass generally occur on mineral soils or highly decomposed organic soils.

- **Needle-leaved Deciduous.** — The southern representative of the Needle-leaved Deciduous Subclass
is bald cypress (Taxodium distichum), which is noted for its ability to tolerate long periods of surface inundation. Tamarack is characteristic of the Boreal Forest Region, where it occurs as a dominant on organic soils. Relatively few other species are included in this Subclass.

- **Broad-Leaved Evergreen.** — In the Southeast, Broad-leaved Evergreen Wetlands reach their greatest development. Red bay (Persea borbonia), loblolly bay (Gordonia lasianthus), and sweet bay (Magnolia virginiana) are prevalent, especially on organic soils. This Subclass also includes red mangrove, black mangrove (Avicennia germinans), and white mangrove (Laguncularia racemosa), which are adapted to varying levels of salinity.

- **Needle-leaved Evergreen.** — Black spruce, growing on organic soils, represents a major dominant of the Needle-leaved Evergreen Subclass in the North. Though black spruce is common on nutrient-poor soils, Northern white cedar (Thuja occidentalis) dominates northern wetlands on more nutrient-rich sites. Along the Atlantic Coast, Atlantic white cedar (Chamaecyparis thyoides) is one of the most common dominants on organic soils. Pond pine is a common needle-leaved evergreen found in the Southeast in association with dense stands of broad-leaved evergreen and deciduous shrubs.

- **Dead.** — Dead Forested Wetlands are dominated by dead woody vegetation taller than 6 m (20 feet). Like Dead Scrub-Shrub Wetlands, they are most common in, or around the edges of, man-made impoundments and beaver ponds. The same factors that produce Dead Scrub-Shrub Wetlands produce Dead Forested Wetlands.

### Classification of Wetlands and Deepwater Habitats of the United States

#### Modifiers

To fully describe wetlands and deepwater habitats, one must apply certain Modifiers at the Class level and at lower levels in the classification hierarchy. The Modifiers described were adapted from existing classifications or were developed specifically for this system.

#### Water Regime Modifiers

Precise description of hydrologic characteristics requires detailed knowledge of the duration and timing of surface inundation, both yearly and long-term, as well as an understanding of groundwater fluctuations. Because such information is seldom available, the water regimes that, in part, determine characteristic wetland and deepwater plant and animal communities are described here in only general terms. Water regimes are grouped under two major headings, Tidal and Nontidal.

Tidal Water Regime Modifiers are used for wetlands and deepwater habitats in the Estuarine and Marine Systems and Nontidal Modifiers are used for all nontidal parts of the Palustrine, Lacustrine, and Riverine Systems. The Tidal Subsystem of the Riverine System and tidally influenced parts of the Palustrine and...
Lacustrine Systems require careful selection of Water Regime Modifier. We designate subtidal and irregularly exposed wetlands and deepwater habitats in the Palustrine, Riverine, and Lacustrine Systems as permanently flooded-tidal rather than subtidal, and Palustrine, Riverine, and Lacustrine wetlands regularly flooded by the tide as regularly flooded. If Palustrine, Riverine, and Lacustrine wetlands are only irregularly flooded by tides, we designate them by the appropriate nontidal Water Regime Modifier with the word tidal added, as in seasonally flooded-tidal.

Tidal

The water regimes are largely determined by oceanic tides.

Subtidal. The substrate is permanently flooded with tidal water.

Irregularly Exposed. The land surface is exposed by tides less often than daily.

Regularly Flooded. Tidal water alternately floods and exposes the land surface at least once daily.

Irregularly Flooded. Tidal water floods the land surface less often than daily.

The periodicity and amplitude of tides vary in different parts of the United States, mainly because of differences in latitude and geomorphology. On the Atlantic Coast, two nearly equal high tides are the rule (semidiurnal). On the Gulf Coast, there is frequently only one high tide and one low tide each day (diurnal); and on the Pacific Coast there are usually two unequal high tides and two unequal low tides (mixed semidiurnal).

Individual tides range in height from about 9.5 m (31 feet) at St. John, New Brunswick (U.S. National Oceanic and Atmospheric Administration 1973) to less than 1 m (3.3 feet) along the Louisiana coast (Chabreck 1972). Tides of only 10 cm (4.0 inches) are not uncommon in Louisiana. Therefore, though no hard and fast rules apply, the division between regularly flooded and irregularly flooded water regimes would probably occur approximately at mean high water on the Atlantic Coast, lowest level of the higher high tide on the Pacific Coast, and just above mean tide level of the Gulf Coast. The width of the intertidal zone is determined by the tidal range, the slope of the shoreline, and the degree of exposure of the site to wind and waves.

Nontidal

Though not influenced by oceanic tides, nontidal water regimes may be affected by wind or seiches in lakes. Water regimes are defined in terms of the growing season, which we equate to the frost-free period (see the U.S. Department of Interior National Atlas 1970:110-111 for generalized regional delineation). The rest of the year is defined as the dormant season, a time when even extended periods of flooding may have little influence on the development of plant communities.

Permanently Flooded. Water covers the land surface throughout the year in all years. Vegetation is composed of obligate hydrophytes.

Intermittently Exposed. Surface water is present throughout the year except in years of extreme drought.

Semipermanently Flooded. Surface water persists throughout the growing season in most years. When surface water is absent, the water table is usually at or very near the land surface.

Seasonally Flooded. Surface water is present for extended periods especially early in the growing season,
but is absent by the end of the season in most years. When surface water is absent, the water table is often near the land surface.

**Saturated.** The substrate is saturated to the surface for extended periods during the growing season, but surface water is seldom present.

**Temporarily Flooded.** Surface water is present for brief periods during the growing season, but the water table usually lies well below the soil surface for most of the season. Plants that grow both in uplands and wetlands are characteristic of the temporarily flooded regime.

**Intermittently Flooded.** The substrate is usually exposed, but surface water is present for variable periods without detectable seasonal periodicity. Weeks, months, or even years may intervene between periods of inundation. The dominant plant communities under this regime may change as soil moisture conditions change. Some areas exhibiting this regime do not fall within our definition of wetland because they do not have hydric soils or support hydrophytes.

**Artificially Flooded.** The amount and duration of flooding is controlled by means of pumps or siphons in combination with dikes or dams. The vegetation growing on these areas cannot be considered a reliable indicator of water regime. Examples of artificially flooded wetlands are some agricultural lands managed under a rice-soybean rotation, and wildlife management areas where forests, crops, or pioneer plants may be flooded or dewatered to attract wetland wildlife. Neither wetlands within or resulting from leakage from man-made impoundments, nor irrigated pasture lands supplied by diversion ditches or artesian wells, are included under this modifier.

### Water Chemistry Modifiers

The accurate characterization of water chemistry in wetlands and deepwater habitats is difficult, both because of problems in measurement and because values tend to vary with changes in the season, weather, time of day, and other factors. Yet, very subtle changes in water chemistry, which occur over short distances, may have a marked influence on the types of plants or animals that inhabit an area. A description of water chemistry, therefore, must be an essential part of this classification system.

The two key characteristics employed in this system are salinity and hydrogen-ion concentration (pH). All habitats are classified according to salinity, and freshwater habitats are further subdivided by pH levels.

### Salinity Modifiers

Differences in salinity are reflected in the species composition of plants and animals. Many authors have suggested using biological changes as the basis for subdividing the salinity range between sea water and fresh water (Remane and Schlieper 1971). Others have suggested a similar subdivision for salinity in inland wetlands (Moyle 1946; Bayly 1967; Stewart and Kantrud 1971). Since the gradation between fresh and hypersaline or hyperhaline waters is continuous, any boundary is artificial, and few classification systems agree completely.

Estuarine and Marine waters are a complex solution of salts, dominated by sodium chloride (NaCl). The term haline is used to indicate the dominance of ocean salt. The relative proportions of the various major ions are usually similar to those found in sea water, even if the water is diluted below sea water strength. Dilution of sea water with fresh water and concentration of sea water by evaporation result in a wide range of recorded salinities in both surface water and interstitial (soil) water.
We have modified the Venice System, suggested at a “Symposium on the Classification of Brackish Waters” in 1958, for use in the Marine and Estuarine Systems (Table 2). The System has been widely used during recent years (Macan 1961, 1963; Burbank 1967; Carriker 1967; Reid and Wood 1976), although there has been some criticism of its applicability (den Hartog 1960; Price and Gunter 1964).

The salinity of inland water is dominated by four major cations, calcium (Ca), magnesium (Mg), sodium (Na), and potassium (K); and three major anions, carbonate (CO₃), sulfate (SO₄), and chloride (Cl) (Wetzel 1975). Salinity is governed by the interactions between precipitation, surface runoff, groundwater flow, evaporation, and sometimes evapotranspiration by plants. The ionic ratios of inland waters usually differ appreciably from those in the sea, although there are exceptions (Bayly 1967). The great chemical diversity of these waters, the wide variation in physical conditions such as temperature, and often the relative impermanence of surface water, make it extremely difficult to subdivide the inland salinity range in a meaningful way. Bayly (1967) attempted a subdivision on the basis of animal life; Moyle (1945) and Stewart and Kantrud (1971) have suggested two very different divisions on the basis of plant life. We employ a subdivision that is identical to that used in the Estuarine and Marine Systems (Table 2).

The term saline is used to indicate that any of a number of ions may be dominant or codominant. The term brackish has been applied to inland waters of intermediate salinity (Remane and Schlieper 1971; Stewart and Kantrud 1971), but is not universally accepted (see Bayly 1967:84); therefore, mixosaline is used here. In some inland wetlands, high soil salinities control the invasion or establishment of many plants. These salinities are expressed in units of specific conductance as well as percent salt (Ungar 1974) and they are also covered by the salinity classes in Table 2.

<table>
<thead>
<tr>
<th>Coastal Modifiers</th>
<th>Inland Modifiers</th>
<th>Salinity (parts per thousand)</th>
<th>Approximate specific conductance (μMhos at 25°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyperhaline</td>
<td>Hypersaline</td>
<td>&gt;40</td>
<td>&gt;60,000</td>
</tr>
<tr>
<td>Euhaline</td>
<td>Eusaline</td>
<td>30.0-40</td>
<td>45,000-60,000</td>
</tr>
<tr>
<td>Mixohaline (Brackish)</td>
<td>Mixosaline</td>
<td>0.5-30</td>
<td>800-45,000</td>
</tr>
<tr>
<td>Polyhaline</td>
<td>Polysaline</td>
<td>18.0-30</td>
<td>30,000-45,000</td>
</tr>
<tr>
<td>Mesohaline</td>
<td>Mesosaline</td>
<td>5.0-18</td>
<td>8,000-30,000</td>
</tr>
<tr>
<td>Oligohaline</td>
<td>Oligosaline</td>
<td>0.5-5</td>
<td>800-8,000</td>
</tr>
<tr>
<td>Fresh</td>
<td>Fresh</td>
<td>&lt;0.5</td>
<td>&lt;800</td>
</tr>
</tbody>
</table>

*Coastal Modifiers are used in the Marine and Estuarine Systems.

*Inland Modifiers are used in the Riverine, Lacustrine, and Palustrine Systems.

*The term Brackish should not be used for inland wetlands or deepwater habitats.

Table 2. Salinity Modifiers used in this classification system.
pH Modifiers

Acid waters are, almost by definition, poor in calcium and often generally low in other ions, but some very soft waters may have a neutral pH (Hynes 1970). It is difficult to separate the effects of high concentrations of hydrogen ions from low base content, and many studies suggest that acidity may never be the major factor controlling the presence or absence of particular plants and animals. Nevertheless, some researchers have demonstrated a good correlation between pH levels and plant distribution (Sjörs 1950; Jeglum 1971). Jeglum (1971) showed that plants can be used to predict the pH of moist peat.

There seems to be little doubt that, where a peat layer isolates plant roots from the underlying mineral substrate, the availability of minerals in the root zone strongly influences the types of plants that occupy the site. For this reason, many authors subdivide freshwater, organic wetlands into mineral-rich and mineral-poor categories (Sjörs 1950; Heinselman 1970; Jeglum 1971; Moore and Bellamy 1974). We have instituted pH modifiers for freshwater wetlands (Table 3) because pH has been widely used to indicate the difference between mineral-rich and mineral-poor sites, and because it is relatively easy to determine. The ranges presented here are similar to those of Jeglum (1971), except that the upper limit of the circumneutral level (Jeglum’s mesotrophic) was raised to bring it into agreement with usage of the term in the United States. The ranges given apply to the pH of water. They were converted from Jeglum’s moist-peat equivalents by adding 0.5 pH units.

<table>
<thead>
<tr>
<th>Modifier</th>
<th>pH of Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acid</td>
<td>&gt; 5.5</td>
</tr>
<tr>
<td>Circumneutral</td>
<td>5.5-7.4</td>
</tr>
<tr>
<td>Alkaline</td>
<td>&lt; 7.4</td>
</tr>
</tbody>
</table>

Table 3. pH Modifiers used in this classification system.
Soil Modifiers

Soil is one of the most important physical components of wetlands. Through its depth, mineral composition, organic matter content, moisture regime, temperature regime, and chemistry, it exercises a strong influence over the types of plants that live on its surface and the kinds of organisms that dwell within it. In addition, the nature of soil in a wetland, particularly the thickness of organic soil, is of critical importance to engineers planning construction of highways or buildings. For these and other reasons, it is essential that soil be considered in the classification of wetlands.

According to the U.S. Soil Conservation Service, Soil Survey Staff (1975:1-2), soil is limited to terrestrial situations and shallow waters; however, “areas are not considered to have soil if the surface is permanently covered by water deep enough that only floating plants are present ....” Since emergent plants do not grow beyond a depth of about 2 m in inland waters, the waterward limit of soil is virtually equivalent to the waterward limit of wetland, according to our definition. Wetlands can then be regarded as having soil in most cases, whereas deepwater habitats are never considered to have soil.

The most basic distinction in soil classification in the United States is between mineral soil and organic soil (U.S. Soil Conservation Service, Soil Survey Staff 1975). The Soil Conservation Service recognizes nine orders of mineral soils and one order of organic soils (Histosols) in its taxonomy. Their classification is hierarchical and permits the description of soils at several levels of detail. For example, suborders of Histosols are recognized according to the degree of decomposition of the organic matter.

We use the Modifiers mineral and organic in this classification. Mineral soils and organic soils are differentiated on the basis of specific criteria that are enumerated in soil taxonomy (U.S. Soil Conservation Service, Soil Survey Staff 1975:13-14, 65). These criteria are restated in our Appendix D for ready reference. If a more detailed classification is desired, the U.S. Soil Conservation Service classification system should be used.

Special Modifiers

Many wetlands and deepwater habitats are man-made, and natural ones have been modified to some degree by the activities of man or beavers. Since the nature of these modifications often greatly influences the character of such habitats, special modifying terms have been included here to emphasize their importance. The following Modifiers should be used singly or in combination wherever they apply to wetlands and deepwater habitats.

Excavated
Lies within a basin or channel excavated by man.

Impounded
Created or modified by a barrier or dam which purposefully or unintentionally obstructs the outflow of water. Both man-made dams and beaver dams are included.

Diked
Created or modified by a man-made barrier or dike designed to obstruct the inflow of water.

Partly Drained
The water level has been artificially lowered, but the area is still classified as wetland because soil moisture
is sufficient to support hydrophytes. Drained areas are not considered wetland if they can no longer support hydrophytes.

Farmed
The soil surface has been mechanically or physically altered for production of crops, but hydrophytes will become reestablished if farming is discontinued.

Artificial
Refers to substrates classified as Rock Bottom, Unconsolidated Bottom, Rocky Shore, and Unconsolidated Shore that were emplaced by man, using either natural materials such as dredge spoil or synthetic materials such as discarded automobiles, tires, or concrete. Jetties and breakwaters are examples of Artificial Rocky Shores. Man-made reefs are an example of Artificial Rock Bottoms.

Regionalization for the Classification System

In this classification system, a given taxon has no particular regional alliance; its representatives may be found in one or many parts of the United States. However, regional variations in climate, geology, soils, and vegetation are important in the development of different wetland habitats; and management problems often differ greatly in different regions. For these reasons, there is a need to recognize regional differences. Regionalization is designed to facilitate three activities: (1) planning, where it is necessary to study management problems and potential solutions on a regional basis; (2) organization and retrieval of data gathered in a resource inventory; and (3) interpretation of inventory data, including differences in indicator plants and animals among the regions.

We recommend the classification and map (Fig. 7) of Bailey (1976) to fill the need for regionalization inland. Bailey’s classification of ecoregions is hierarchical. The upper four levels are domain (defined as including subcontinental areas of related climates), division (defined as including regional climate at the level of Köppen’s [1931] types), province (defined as including broad vegetational types), and section (defined as including climax vegetation at the level of Küchler’s [1964] types). On the map, the boundaries between the different levels are designated by lines of various widths and the sections are numbered with a four-digit code; digits 1 through 4 represent the first four levels in the hierarchy. The reader is referred to Bailey (1976, 1978) for detailed discussion and description of the units appearing on his map, reproduced in our Fig. 7.

The Bailey system terminates at the ocean, whereas the present wetland classification includes Marine and Estuarine habitats. Many workers have divided Marine and Estuarine realms into series of biogeographic provinces (e.g., U.S. Senate 1970; Ketchum 1972). These provinces differ somewhat in detail, but the broader concepts are similar. Figure 7 shows the distribution of 10 Marine and Estuarine provinces that we offer for North America.

- Arctic Province extends from the southern tip of Newfoundland (Avalon Peninsula), northward around Canada to the west coasts of the Arctic Ocean, Bering Sea, and Baffin and Labrador basins. It is characterized by the southern extension of floating ice, the 4°C summer isotherm, and Arctic biota.
- Acadian Province extends along the Northeast Atlantic Coast from the Avalon Peninsula to Cape Cod and is characterized by a well developed algal flora and boreal biota. The shoreline is heavily indented and frequently rocky. It has a large tidal range and is strongly influenced by the Labrador Current.
Virginian Province extends along the Middle Atlantic Coast from Cape Cod to Cape Hatteras. The province is transitional between the Acadian and Carolinian Provinces. The biota is primarily temperate, but has some boreal representatives. The Labrador Current occasionally extends down to Cape Hatteras and winter temperatures may approach 4°C. The tidal range is moderate.

Carolinian Province is situated along the South Atlantic Coast from Cape Hatteras to Cape Kennedy. It contains extensive marshes and well developed barrier islands. Waters are turbid and productive. The biota is temperate but has seasonal tropical elements. The Gulf Stream is the primary influence, and winter temperatures reach a minimum of 10°C; summer temperatures are tropical (in excess of 20°C). The tidal range is small to moderate.

West Indian Province extends from Cape Kennedy to Cedar Key, Florida, and also includes the southern Gulf of Mexico, the Yucatan Peninsula, Central America, and the Caribbean Islands. The shoreland is usually low-lying limestone with calcareous sands and marls, except for volcanic islands. The biota is tropical and includes reef corals and mangroves. Minimum winter temperatures are about 20°C and the tidal range is small.

Louisianian Province extends along the northern coast of the Gulf of Mexico from Cedar Key to Port Aransas, Texas. The characteristics of the province are similar to those of the Carolinian, reflecting the past submergence of the Florida Peninsula. The biota is primarily temperate and the tidal range is small.

Californian Province extends along the Pacific Coast from Mexico northward to Cape Mendocino. The shoreland is strongly influenced by coastal mountains and the coasts are rocky. Freshwater runoff is limited. In the southern part volcanic sands are present; marshes and swamps are scarce throughout the province. The climate is Mediterranean and is influenced by the California Current. The biota is temperate, and includes well developed offshore kelp beds. The tidal range is moderate.

Columbian Province extends along the northern Pacific Coast from Cape Mendocino to Vancouver Island. Mountainous shorelands with rocky foreshores are prevalent. Estuaries are strongly influenced by freshwater runoff. The biota is primarily temperate with some boreal components, and there are extensive algal communities. The province is influenced by both the Aleutian and California Currents. The tidal range is moderate to large.

Fjord Province extends along the Pacific Coast from Vancouver Island to the southern tip of the Aleutian Islands. Precipitous mountains, deep estuaries (some with glaciers), and a heavily indented shoreline subject to winter icing are typical of the coast. The biota is boreal to subArctic. The province is influenced by the Aleutian and Japanese Currents, and the tidal range is large.

Pacific Insular Province surrounds all the Hawaiian Islands. The coasts have precipitous mountains and wave action is stronger than in most of the other provinces. The biota is largely endemic and composed of tropical and subtropical forms. The tidal range is small.

Use of Bailey’s sections for the Riverine, Lacustrine, and Palustrine Systems and the Provinces defined above for the Marine and Estuarine Systems provides a regional locator for any Wetland in the United States.
Use of the Classification System

This System was designed for use over an extremely wide geographic area and for use by individuals and organizations with varied interests and objectives. The classification employs 5 System names, 8 Subsystem names, 11 Class names, 28 Subclass names, and an unspecified number of Dominance Types. It is, of necessity, a complex System when viewed in its entirety, but use of the System for a specific purpose at a local site should be simple and straightforward. Artificial keys to the Systems and Classes (Appendix E) are furnished to aid the user of the classification, but reference to detailed definitions in the text is also required. The purpose of this section is to illustrate how the System should be used and some of the potential pitfalls that could lead to its misuse.

Before attempting to apply the System, the user should consider four important points:

1. Information about the area to be classified must be available before the System can be applied. This information may be in the form of historical data, aerial photographs, brief on-site inspection, or detailed and intensive studies. The System is designed for use at varying degrees of detail. There are few areas for which sufficient information is available to allow the most detailed application of the System. If the level of detail provided by the data is not sufficient for the needs of the user, additional data gathering is mandatory.

2. Below the level of Class, the System is open-ended and incomplete. We give only examples of the vast number of Dominance Types that occur. The user may identify additional Dominance Types and determine where these fit into the classification hierarchy. It is also probable that as the System is used the need for additional Subclasses will become apparent.

3. One of the main purposes of the new classification is to ensure uniformity throughout the United States. It is important that the user pay particular attention to the definitions in the classification. Any attempt at modification of these definitions will lead to lack of uniformity in application.

4. One of the principal uses of the classification system will be the inventory and mapping of wetlands and deepwater habitats. A classification used in the mapping is scale-specific, both for the minimum size of units mapped and for the degree of detail attainable. It is necessary for the user to develop a specific set of mapping conventions for each application and to demonstrate their relationship to the generalized classification described here. For example, there are a number of possible mapping conventions for a small wetland basin 50 m (164 feet) in diameter with concentric rings of vegetation about the deepest zone. At a scale of 1:500 each zone may be classified and mapped; at 1:20,000 it might be necessary to map the entire basin as one zone and ignore the peripheral bands; and at 1:100,000 the entire wetland basin may be smaller than the smallest mappable unit, and such a small-scale map is seldom adequate for a detailed inventory and must be supplemented by information gathered by sampling. In other areas, it may be necessary to develop mapping conventions for taxa that cannot be easily recognized; for instance, Aquatic Beds in turbid waters may have to be mapped simply as Unconsolidated Bottom.

Hierarchical Levels andModifiers

We have designed the various levels of the system for specific purposes, and the relative importance of each will vary among users. The Systems and Subsystems are most important in applications involving large regions or the entire country. They serve to organize the Classes into meaningful assemblages of information for data storage and retrieval.

The Classes and Subclasses are the most important part of the system for many users and are basic to wet-
Fig. 7. Ecoregions of the United States after Bailey (1976) with the addition of 10 Marine and Estuarine Provinces proposed in our classification.
Domains, Divisions, Provinces, and Sections used on Bailey’s (1976) map and described in detail in Bailey (1978). Highland ecoregions are designated M mountain, P plateau, and A altiplano.

<table>
<thead>
<tr>
<th>Domain</th>
<th>Division</th>
<th>Province</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 Polar</td>
<td>1200 Tundra</td>
<td>1210 Arctic Tundra</td>
<td>M 1210 Brooks Range</td>
</tr>
<tr>
<td></td>
<td>1220 Bering Tundra</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1300 Subarctic</td>
<td>1310 Yukon Parkland</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>1320 Yukon Forest</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M 1310 Alaska Range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000 Humid Temperate</td>
<td>2100 Warm Continental</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2110 Laurentian Mixed Forest</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2111 Spruce-Fir Forest</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2112 Northern Hardwoods-Fir Forest</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2113 Northern Hardwoods Forest</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2114 Northern Hardwoods-Spruce Forest</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>M 2110 Columbia Forest</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>M 2111 Douglas-fir Forest</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>M 2112 Cedar-Hemlock-Douglas-fir Forest</td>
<td></td>
<td></td>
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<tr>
<td>2200 Hot Continental</td>
<td>2210 Eastern Deciduous Forest</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>2211 Mixed Mesophytic Forest</td>
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<tr>
<td></td>
<td>2212 Beech-M apple Forest</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>2213 Maple-Basswood Forest + Oak Savanna</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2214 Appalachian Oak Forest</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2215 Oak-Hickory Forest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2300 Subtropical</td>
<td>2310 Outer Coastal Plain Forest</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2311 Beech-Sweetgum-Magnolia-Pine-Oak</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2312 Southern Floodplain Forest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2320 Southeastern Mixed Forest</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2400 Marine</td>
<td>2410 Willamette-Puget Forest</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>M 2410 Pacific Forest (in conterminous U.S.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M 2411 Sitka Spruce-Cedar-Hemlock Forest</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>M 2412 Redwood Forest</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M 2413 Cedar-Hemlock-Douglas-fir Forest</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M 2414 California Mixed Evergreen Forest</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>M 2415 Silver fir-Douglas-fir Forest</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M 2410 Pacific Forest (in Alaska)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2500 Prairie</td>
<td>2510 Prairie Parkland</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2511 Oak-Hickory-Bluestem Parkland</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2512 Oak + Bluestem Parkland</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2520 Prairie Brushland
   2521 Mesquite-Buffalo Grass
   2522 Juniper-Oak-Mesquite
   2523 Mesquite-Acacia
2530 Tall-Grass Prairie
   2531 Bluestem Prairie
   2532 Wheatgrass-Bluestem-Needlegrass
   2533 Bluestem-Gamma Prairie
2600 Mediterranean (Dry-summer Subtropical)
   2610 California Grassland
   M 2610 Sierran Forest
   M 2620 California Chaparral
3000 Dry 3100 Steppe
   3110 Great Plains-Shortgrass Prairie
      3111 Gramma-Needlegrass-Wheatgrass
      3112 Wheatgrass-Needlegrass
      3113 Grama-Buffalo Grass
   M 3110 Rocky Mountain Forest
   M 3111 Grand-fir-Douglas-fir Forest
      M 3112 Douglas-fir Forest
      M 3113 Ponderosa Pine-Douglas-fir Forest
3120 Palouse Grassland
   M 3120 Upper Gila Mountains Forest
3130 Intermountain Sagebrush
   3131 Sagebrush-Wheatgrass
   3132 Lahontan Saltbush-Greasewood
   3133 Great Basin Sagebrush
   3134 Bonneville Saltbush-Greasewood
   3135 Ponderosa Shrub Forest
3140 Mexican Highland Shrub Steppe
   A 3140 Wyoming Basin
   A 3141 Wheatgrass-Needlegrass-Sagebrush
   A 3142 Sagebrush-Wheatgrass
   3200 Desert 3210 Chihuahuan Desert
      3211 Grama-Tobosa
      3212 Tarbush-Creosote Bush
   3220 American Desert
      3221 Creosote Bush
      3222 Creosote Bush-Bur Sage
4000 Humid Tropical
   4100 Savanna
   4110 Everglades
   4200 Rainforest
   M 4210 Hawaiian Islands
land mapping. Most Classes should be easily recognizable by users in a wide variety of disciplines. However, the Class designations apply to average conditions over a period of years, and since many wetlands are dynamic and subject to rapid changes in appearance, the proper classification of a wetland will frequently require data that span a period of years and several seasons in each of those years.

The Dominance Type is most important to users interested in detailed regional studies. It may be necessary to identify Dominance Types in order to determine which modifying terms are appropriate, because plants and animals present in an area tend to reflect environmental conditions over a period of time. Water regime can be determined from long-term hydrologic studies where these are available. The more common procedure will be to estimate this characteristic from the Dominance Types. Several studies have related water regimes to the presence and distribution of plants or animals (e.g., Stephenson and Stephenson 1972; Stewart and K antrand 1972; Chapman 1974).

Similarly, we do not intend that salinity measurements be made for all wetlands except where these data are required; often plant species or associations can be used to indicate broad salinity classes. Lists of halophytes have been prepared for both coastal and inland areas (e.g., Duncan 1974; MacDonald and Barbour 1974; Ungar 1974), and a number of floristic and ecological studies have described plants that are indicators of salinity (e.g., Penfound and Hathaway 1938; M oyle 1945; K urz and Wagner 1957; D illon 1966; A nderson et al. 1968; Chabreck 1972; Stewart and K antrand 1972; Ungar 1974).

In areas where the Dominance Types to be expected under different water regimes and types of water chemistry conditions have not been identified, detailed regional studies will be required before the classification can be applied in detail. In areas where detailed soil maps are available, it is also possible to infer water regime and water chemistry from soil series (U.S. Soil Conservation Service, Soil Survey Staff 1975).

Some of the Modifiers are an integral part of this system and their use is essential; others are used only for detailed applications or for special cases. Modifiers are never used with Systems and Subsystems; however, at least one Water Regime M odifier, one Water Chemistry M odifier, and one Soil M odifier must be used at all lower levels in the hierarchy. Use of the Modifiers listed under mixosaline and mixohaline (Table 2) is optional but these finer categories should be used whenever supporting data are available. The user is urged not to rely on single observations of water regime or water chemistry. Such measurements give misleading results in all but the most stable wetlands. If a more detailed Soil M odifier, such as soil order or suborder (U.S. Soil Conservation Service, Soil Survey Staff 1975) can be obtained, it should be used in place of the Modifiers, mineral and organic. Special M odifiers are used where appropriate.

Relationship to Other Wetland Classifications

There are numerous wetland classifications in use in the United States. Here we relate this system to three published classifications that have gained widespread acceptance. It is not possible to equate these systems directly for several reasons: (1) the criteria selected for establishing categories differ; (2) some of the classifications are not applied consistently in different parts of the country; and (3) the elements classified are not the same in various classifications.

The most widely used classification system in the United States is that of Martin et al. (1953) which was republished in U.S. Fish and Wildlife Service Circular 39 (Shaw and Fredine 1956). The wetland types are based on criteria such as water depth and permanence, water chemistry, life form of vegetation, and dominant plant species. In Table 4 we compare some of the major components of our system with the type descriptions listed in Circular 39.
In response to the need for more detailed wetland classification in the glaciated Northeast, Golet and Larson (1974) refined the freshwater wetland types of Circular 39 by writing more detailed descriptions and subdividing classes on the basis of finer differences in plant life forms. Golet and Larson's classes are roughly equivalent to Types 1-8 of Circular 39, except that they restrict Type 1 to river floodplains. The Golet and Larson system does not recognize the coastal (tidal) fresh wetlands of Circular 39 (Types 12-14) as a separate category, but classifies these areas in the same manner as nontidal wetlands. In addition to devising 24 subclasses, they also created 5 size categories, 6 site types giving a wetland's hydrologic and topographic location; 8 cover types (modified from Stewart and Kantrud 1971) expressing the distribution and relative proportions of cover and water; 3 vegetative interspersion types; and 6 surrounding habitat types. Since this system is based on the classes of Martin et al. (1953), Table 4 may also be used to compare the Golet and Larson system with the one described here. Although our system does not include size categories and site types, this information will be available from the results of the new inventory of wetlands and deepwater habitats of the United States.

Stewart and Kantrud (1971) devised a new classification system to better serve the needs of researchers and wetland managers in the glaciated prairies. Their system recognizes seven classes of wetlands which are distinguished by the vegetational zone occupying the central or deepest part and covering 5% or more of the wetland basin. The classes thus reflect the wetland's water regime; for example, temporary ponds (Class II) are those where the wet-meadow zone occupies the deepest part of the wetland. Six possible subclasses were created, based on differences in plant species composition that are correlated with variations in average salinity of surface water. The third component of classification in their system is the cover type, which represents differences in the spatial relation of emergent cover to open water or exposed bottom soil. The zones of Stewart and Kantrud's system are readily related to our water regime modifiers (Table 5), and the subclasses are roughly equivalent to our Water Chemistry Modifiers (Fig. 8).

Wetlands represent only one type of land and the classification of this part separate from the rest is done for practical rather than for ecological reasons (Cowardin 1978). Recently there has been a flurry of interest in a holistic approach to land classification (in Land Classification Series, Journal of Forestry, vol. 46, no. 10). A number of classifications have been developed (e.g., Radford 1978) or are under development (e.g., Driscoll et al. 1978). Parts of this wetland classification can be incorporated into broader hierarchical land classifications.

A classification system is most easily learned through use. To illustrate the application of this system, we have classified a representative group of wetlands and deepwater habitats of the United States (Plates 1-86).
<table>
<thead>
<tr>
<th>STEWART AND KANTRUD (1972)</th>
<th>APPROXIMATE SPECIFIC CONDUCTANCES (μMhos)</th>
<th>THIS CLASSIFICATION</th>
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<td>SALINE</td>
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<td>2,000</td>
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<tr>
<td>FRESH</td>
<td>800</td>
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</tr>
<tr>
<td></td>
<td>500</td>
<td>FRESH</td>
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</table>

Fig. 8. Comparison of the water chemistry subclasses of Stewart and Kantrud (1972) with Water Chemistry Modifiers used in the present classification system.
Acknowledgments

The breadth and complexity of preparing this classification caused us to solicit help and advice from individuals too numerous to list here. Frequently the recommendations were in conflict and we take responsibility for the decisions we have made but acknowledge all suggestions including those not accepted. Several meetings were crucial in formulating the present classification and in modifying earlier drafts. We thank those who attended the formative meeting at Bay St. Louis, Mississippi, January 1975; The National Wetland Classification and Inventory Workshop at College Park, Maryland, July 1975; and the review panels assembled at Sapelo Island, Georgia, and at St. Petersburg, Florida. We also thank those individuals and agencies who responded to distribution of the operational draft. Special credit is due the regional coordinators of the National Wetlands Inventory and P. B. Reed, who have furnished continuing consultation on application of the system. Martel Laboratories field-tested the system and furnished specific criticisms. We were advised by J. Everett on geomorphology, K. K. Young and O. Carter on soil taxonomy, R. P. Novitzki on hydrology, and R. H. Chabreck on coastal wetland ecology. M. L. Heinselman and R. H. Hofstetter helped with difficult problems of peatland ecology and terminology. R. L. Kologiski aided with botanical problems. J. H. Montanari, W. O. Wilen, and the entire National Wetlands Inventory staff furnished encouragement and logistic support. The staff of the Northern Prairie Wildlife Research Center contributed substantially to completion of the classification. Art work and graphics were prepared by J. Rodiek, R. L. Duval, and C. S. Shaiffer. J. H. Sather worked closely with us and served as editor on previous drafts.
References


Bailey, R. G. 1976. Ecoregions of the United States, U.S. Forest Service, Ogden, Utah. (Map only; scale 1:7,500,000.)


Classification of Wetlands and Deepwater Habitats of the United States.


### Appendix A. Scientific and Common Names of Plants

<table>
<thead>
<tr>
<th>Scientific name</th>
<th>Common name</th>
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<tr>
<td>Acer rubrum L.</td>
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<tr>
<td>Alisma plantago-aquatica L.</td>
<td>(Water plantain)</td>
</tr>
<tr>
<td>Alnus spp.</td>
<td>Alders</td>
</tr>
<tr>
<td>A. rugosa (DuRoi) Spreng.</td>
<td>Speckled alder</td>
</tr>
<tr>
<td>A. tenufolia Nutt.</td>
<td>Tiny leaf alder</td>
</tr>
<tr>
<td>Alnus spp.</td>
<td></td>
</tr>
<tr>
<td>A. rugosa (DuRoi) Spreng.</td>
<td>Speckled alder</td>
</tr>
<tr>
<td>A. tenufolia Nutt.</td>
<td>Tiny leaf alder</td>
</tr>
<tr>
<td>Andromeda glaucophylla Link</td>
<td>Bog rosemary</td>
</tr>
<tr>
<td>Arctophila fulva (Trin.)</td>
<td></td>
</tr>
<tr>
<td>Anderss.</td>
<td></td>
</tr>
<tr>
<td>Aristida stricta Michx.</td>
<td>(Three-awn)</td>
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<tr>
<td>Ascophyllum spp.</td>
<td>(Rockweeds)</td>
</tr>
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<td>Knotted wrack</td>
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<tr>
<td>Aulacomnium palustre (Hedw.) Schwaegr.</td>
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<td>Avicennia a germinans (L.) L.</td>
<td>Black mangrove</td>
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<tr>
<td>Azolla spp.</td>
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<tr>
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<td>Sea-Myrtle</td>
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<tr>
<td>Beckmannia a syzigachne (Steud.) Fernald</td>
<td>Slough grass</td>
</tr>
<tr>
<td>Betula nana L.</td>
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<td>B. pumila L.</td>
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<tr>
<td>Brasenia schreberi J. F. Gmel.</td>
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<tr>
<td>Calamagrostis canadensis (Michx.) Beauv.</td>
<td>Bluejoint</td>
</tr>
<tr>
<td>Calamagrostis canadensis (Michx.) Beauv.</td>
<td>Bluejoint</td>
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<tr>
<td>Calopogon spp.</td>
<td>Grass pinks</td>
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<tr>
<td>Calthta palustris L.</td>
<td>Marsh marigold</td>
</tr>
<tr>
<td>Campylium stellatum (Hedw.) C. Jens</td>
<td>(Moss)</td>
</tr>
<tr>
<td>C. aquatilis Wahl enb.</td>
<td>Sedges</td>
</tr>
<tr>
<td>Carex spp.</td>
<td>(Sedge)</td>
</tr>
<tr>
<td>C. atherodes Spreng.</td>
<td>Slough sedge</td>
</tr>
<tr>
<td>C. bi partita Al.</td>
<td>(Sedge)</td>
</tr>
<tr>
<td>C. lacustris Willd.</td>
<td>(Sedge)</td>
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<tr>
<td>C. lasiocarpa Ehrh.</td>
<td>(Sedge)</td>
</tr>
<tr>
<td>C. Lyngbyei Hornem</td>
<td>(Sedge)</td>
</tr>
<tr>
<td>C. paleacea Schreb. ex Wahl enb.</td>
<td>(Sedge)</td>
</tr>
<tr>
<td>C. pluriflora Hulten</td>
<td>(Sedge)</td>
</tr>
<tr>
<td>C. ramenskii Kom</td>
<td>(Sedge)</td>
</tr>
<tr>
<td>C. rariflora (Wahlenb.) J. E. Smith</td>
<td>(Sedge)</td>
</tr>
<tr>
<td>Cassiope tetragona (L.) D. Don</td>
<td>Beaked sedge</td>
</tr>
<tr>
<td>Caulerpa spp.</td>
<td>Lapl and cassiope</td>
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<tr>
<td>Cephalanthus occidentalis L.</td>
<td>(Green algae)</td>
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<tr>
<td>Ceratophyllum spp.</td>
<td>Buttonbush</td>
</tr>
<tr>
<td>Chamaecyparis thyoides (L.) B.S.P.</td>
<td>Coontails</td>
</tr>
<tr>
<td></td>
<td>Atlantic white cedar</td>
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</tbody>
</table>
Chamaedaphne calyculata (L.) Moench
Chara spp.
Chenopodi um glaucum L.
Chiloscyphus fragilis (Roth) Schiffn.
Chondrus crispus Stackhouse
Cladium jamaicense Crantz
Conocarpus erectus L.
Cornus stolonifera Mchx.
Cymodocea filiformis (Kuetz) Correll
Cyperus spp.
Cyrilla racemiflora L.
Decodon verticillatus (L.) Elliott
Dendranthema arcticum (L.) Tzel.
Dermatocarpon fluviatile (G. H. Web) Th. Fr.
Distichlis spicata (L.) Greene
Drepanocladium spp.
Dryas integrifolia Vahl
Echinochloa crusgalli (L.) Beauv.
Eichhornia crassipes (Mart.) Solms
Eleocharis spp.
Eleocharis palustris (L.) Roem & J. A. Schultes
Elymus arenarius L.
Empetrum nigrum L.
Enteromorpha spp.
Eriophorum spp.
E. russeolum Fr.
E. vaginatum L.
Fissidens spp.
F. julianus (Mont.) Schimper
Fontinalis spp.
Fraxinus nigra Marshall
F. pennsylvanica Marshall
Fucus spp.
F. spiralis L.
F. vesiculosus L.
Glyceria spp.
Gordonia lasianthus (L.) J. Ellis
Habenaria spp.
Halimeda spp.
Halodule wrightii Aschers.
Halophila spp.
Hippuris tetraphylla L.f.
Hydrilla verticillata Royle

Leatherleaf
(Stoneworts)
(Goosefoot)
(Liverwort)
Irish moss
(Roof moss)
Sawgrass
Taro
Buttonwood
Red osier dogwood
Manatee grass
Nut sedges
Black ti-ti
Water willow
Arctic daisy
Water hyacinth
(Spike rush)
(Spike rush)
(Lyme grass)
Crowberry
(Green algae)
Cotton grasses
(Cotton grass)
(Moss)
Black ash
(Red ash)
Rockweeds
(Rockweed)
(Rockweed)
Manna grasses
Loblolly bay
(Orchids)
(Green algae)
Shoal grass
(Sea grass)
(Mare's tail)
(Hydrilla)
Ilex glabra (L.) Gray
I. verticillata (L.) Gray
Iva frutescens L.
Juncus spp.
J. gerardii Loiseleur
J. militaris Bigel.
J. roemerianus Scheele
Kalnia angustifolia L.
K. polifolia Wangenh.
Kochia scoparia (L.) Schrad.
Languncaria racemosa (L.)
C. F. Gaertn.
Laminaria spp.
Larix laricina (DuRoi)
K. Koch
Laur鞑aia spp.
Ledum decumbens (Ait.)
Small
L. groenlandicum Oeder
Lemna spp.
L. minor L.
Leucothoe axillaris (Lam.)
D. Don
Ligusticum scoticum L.
Lithothamnium spp.
Lycopodium spicatum L.
Macrocrystis spp.
Magnolia virginiana L.
Marshella spp.
M. emarginata (Ehrenberg)
Dumortier
Myrica gale L.
Myriophyllum spp.
M. spicatum L.
Najas spp.
Nelumbo lutea (Willd.) Pers.
Nitella spp.
Nuphar luteum(L.) Sibth. &
J. E. Smith
Nymphaea spp.
N. odorata Soland. in Ait.
Nyssa aquatica L.
N. sylvatica Marshall
Oncophorus wahlenbergii
Brid.
Panicum capillare L.
Pedicularis sp.
Peltandra virginica (L.)
Kunth
Peltvetia spp.
Penicillus spp.
Persea borbonia (L.) Spreng.
Phragmites australis (Cav.)
Trin. ex Steud.
Phyllospadix scouleri Hook.
P. torreyi S. Wats.
Picea mariana (Mill.) B.S.P.
P. sitchensis (Bong.) Carriere
Pinus contorta Dougl. ex Loudon
P. palustris Mill.
P. serotina Michx.
Plataniastrum L.
Plantago maritima L.
Podostemum ceratophyllum Mchx.
Polygnum spp.
P. amphibium L.
P. bistorta L.
Pontederia cordata L.
Potamogeton spp.
P. gramineus L.
P. natans L.
Populus balsamifera L.
P. deltoides W. Bartram ex Marshall
Potentilla anserina L.
P. fruticosa L.
P. palustris (L.) Scop.
Puccinellia grandis Swallen
Quercus bicolor Willd.
Q. lyrata Walter
Q. michauxii Nutt.
Ranunculus pallasii Schlcht.
R. trichophyllus D. Chai
Rhizophora manglae L.
Rhododendron maximum L.
Rhynchospora spp.
Rubus chamaemorus L.
Rumex maritimus L.
R. mexicanus Meisn.
Ruppi a spp.
R. maritima L.
Sagittaria spp.
Salicornia spp.
S. europaea L.
S. virginica L.
Salix spp.
S. alaxensis (Anderss.) Coville
S. fuscens Anderss.
S. ovalifolia Trautv.
S. planifolia Pursh
S. reticulata L.
Salvinia spp.
Sarcobatus vermiculatus (Hook.) Torr.
Scirpus spp.
S. acutus Muhl. ex Bigel.
S. americanus Pers.
S. robustus Pursh
Scolochloa festucacea (Willd.) Link

(Surfgrass)
Black spruce
Sitka spruce
Lodgepole pine
Longleaf pine
Pond pine
Water lettuce
Seaside plantain
River weed
Smartweeds
Water smartweed
Bistort
Pickerel weed
Pondweeds
(Pondweed)
Floating-leaf pondweed
Balsam poplar

Cottonwood
Silverweed
Shrubby cinquefoil
Marsh cinquefoil
(Alkaligrass)
Swamp white oak
Overcup oak
Basket oak
(Crowfoot)
White water crowfoot
Red mangrove
Great laurel
Beak rushes
Cloudberry
Golden dock
(Dock)
Ditch grasses
Wedgeon grass
Arrowheads
Glassworts
(Samphire)
(Common pickleweed)
Willows
Feltleaf willow
Alaska bog willow
Ovalleaf willow
Diamondleaf willow
Netleaf willow
Water ferns
Greasewood
Bul rushes
Hardstem bulrush
Common threesquare (bul rush)
Solidago sempervirens L.  
Sparciana alterniflora  
Lois sel eur  
S. cynosuroides (L.) Roth  
S. foliosa Trin.  
S. patens (Ait.) Muhl.  

Sphagnum spp.  
Spi raea beauverdiana C. K. Schneid.  
S. douglasii Hook. (Spiraea)  
Spirodela spp.  
Stellaria spp.  
Suaeda californica S. Wats.  
Tamarix gallica L.  
Taxodium distichum (L.) C. Rich.  

Thalassia testudinum  
K. D. Koenig  
Thuja occidentalis L.  
Tralypella spp.  
Trapa natans L.  
Triglochin maritimum L.  
Typha spp.  
T. angustifolia L.  
T. latifolia L.  
Ulmus americana L.  
Ulva spp.  
Utricularia spp.  
U. macrorhiza LeConte  
Vaccinium corymbosum L.  
V. oxycoccos L.  
V. uliginosum L.  
V. vitis-idaea L.  
Vallisneria americana Michx.  
Verrucaria spp.  
Welwia spp.  
Wodwardia virginica (L.) J. E. Smith  
Xanthium strumarium L.  
Xyris spp.  
Xyris smalliana Nash  
Zannichellia palustris L.  
Zenobia pulverulenta  
(W. Bartram) Pollard  
Zizania aquatica L.  
Zizania palustris (Michx.) Doell & Aschers.  
Zostera marina L.  
Zosterella dubia (Jacq.) Small  

Seasi de gol denrod  
(Bur-reed)  
Saltmarsh cordgrass  
Big cordgrass  
California cordgrass  
Saltmeadow cordgrass  
Peat mosses  
Alaska spirea  
(Spiraea)  
Big duckweeds  
(Chickweed)  
(Sea blite)  
Tamarisk  

Bald cypress  
Turtle grass  
Northern white cedar  
(Stoneworts)  
Water nut  
Arrow grass  
Cattails  
Narrow-leaved cattail  
Common cattail  
American elm  
Sea lettuce  
Bladderworts  
(Bladderwort)  
Highbush blueberry  
Small cranberry  
Bog blueberry  
Mountain cranberry  
Wild celery  
(Lichens)  
Watermeals  

Virginia chain-fern  
(Cocklebur)  
Yellow-eyed grasses  
(Grass)  
Horned pondweed  
Honeycup  
Wild rice  
Southern wild rice  
Eel grass  
Water stargrass
<table>
<thead>
<tr>
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<th>Common name</th>
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<td>Acmaea spp.</td>
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<tr>
<td>Anodonta spp.</td>
<td>Freshwater mollusks</td>
</tr>
<tr>
<td>Anodonta des spp.</td>
<td>Freshwater mollusks</td>
</tr>
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<td>Anopheles spp.</td>
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<tr>
<td>Chironomidae spp.</td>
<td>Midge</td>
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<tr>
<td>Cht hamal us spp.</td>
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<td>Lampsilis spp.</td>
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<td>L. Common sea fan</td>
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<td>Gordonia ventalina</td>
<td></td>
</tr>
<tr>
<td>L. Common sea fan</td>
<td></td>
</tr>
<tr>
<td>Hydropsyche spp.</td>
<td></td>
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<tr>
<td>Lampsilis spp.</td>
<td></td>
</tr>
</tbody>
</table>
Ligia spp.
Limnodrilus spp.
Littorina spp.
Lumbriculus spp.
Lymnaea spp.
Macoma spp.
M. balthica (Linne)
Melita spp.
Mercenaria spp.
Molluscs spp.
Montipora spp.
Muricea spp.
Mya spp.
Mytilus spp.
Nassarius spp.
Nemura spp.
Nereis spp.
Nerita spp.
Notonecta spp.
Oliva spp.
Orchestia spp.
Ostrea spp.
Parastenocaris spp.
Patella spp.
Pecten spp.
Petricola pholadiformis Lam
Phyllophagnatopus viguieri
Maryek
Physa spp.
Pisaster spp.
Pisidium spp.
Placopecten spp.
Platyodon spp.
Pollicipes spp.
Porites spp.
Pristina spp.
Procambarus spp.
Psephenus spp.
Renilla spp.
Sabellaria spp.
Saludula spp.
Saxidomus spp.
Siphonaria spp.
Sphaerium spp.
Spongilla spp.
Strongylocentrotus spp.
Tabanus spp.
Tellina spp.
Tetraclita spp.
Thais spp.
Thyone spp.
Tivela stultorum (Mawe)
Tortopus spp.
Tubifex spp.
Uca spp.
Urechis spp.

Slaters
Oligochaete worms
Periwinkles
Oligochaete worms
Pond snails
Macomas
Baltic macoma
Anphi pods
Quahogs
Mussels
Coral
Sea whips
Soft-shell clams
Mussels
Mud snails
Stone flies
Clam worms
Nerites
Back swimmers
Olive shells
Beach hoppers
Oysters
Copepods
Limpets
Scallops
False angel wing
Copepod
Snails
Sea stars
Fingernail clams
Deep-sea scallops
Boring clams
Gooseneck barnacles
Coral
Oligochaete worms
Crayfish
Riffle beetles
Sea pansies
Reef worms
Shore bugs
Venus clams
Black flies
False limpets
Fingernail clams
Freshwater sponges
Sea urchins
Flies
Tellin shells
Acorn barnacles
Rock shells
Sea cucumbers
Pismo clam
Mayflies
Sewage worms
Fiddler crabs
Echiurid worms
Appendix C Glossary of Terms

acid Term applied to water with a pH less than 5.5.

alkaline Term applied to water with a pH greater than 7.4.

bar An elongated landform generated by waves and currents, usually running parallel to the shore, composed predominantly of unconsolidated sand, gravel, stones, cobbles, or rubble and with water on two sides.

beach A sloping landform on the shore of larger water bodies, generated by waves and currents and extending from the water to a distinct break in landform or substrate type (e.g., a foredune, cliff, or bank).

brackish Marine and Estuarine waters with Mixohaline salinity. The term should not be applied to inland waters.

boulder Rock fragments larger than 60.4 cm (24 inches) in diameter.

broad-leaved deciduous Woody angiosperms (trees or shrubs) with relatively wide, flat leaves that are shed during the cold or dry season; e.g., black ash (Fraxinus nigra).

broad-leaved evergreen Woody angiosperms (trees or shrubs) with relatively wide, flat leaves that generally remain green and are usually persistent for a year or more; e.g., red mangrove (Rhizophora mangle).

calcareous Formed of calcium carbonate or magnesium carbonate by biological deposition or inorganic precipitation in sufficient quantities to effervesce carbon dioxide visibly when treated with cold 0.1 normal hydrochloric acid. Calcareous sands are usually formed of a mixture of fragments of mollusk shell, echinoderm spines and skeletal material, coral, foraminifera, and algal platelets (e.g., Halimeda).

channel “A open conduit either naturally or artificially created which periodically or continuously contains moving water, or which forms a connecting link between two bodies of standing water” (Langbein and Iseri 1960:5).

channel bank The sloping land bordering a channel. The bank has steeper slope than the bottom of the channel and is usually steeper than the land surrounding the channel.

circumneutral Term applied to water with a pH of 5.5 to 7.4.

codominant Two or more species providing about equal areal cover which in combination control the environment.

cobbles Rock fragments 7.6 cm (3 inches) to 25.4 cm (10 inches) in diameter.

deciduous stand A plant community where deciduous trees or shrubs represent more than 50% of the total areal coverage of trees or shrubs.

dominant The species controlling the environment.


emergent hydrophytes Erect, rooted, herbaceous angiosperms that may be temporarily to permanently flooded at the base but do not tolerate prolonged inundation of the entire plant; e.g., bulrushes (Scirpus).
emergent mosses: Mosses occurring in wetlands, but generally not covered by water.

eutrophic lake: A lake that has a high concentration of plant nutrients such as nitrogen and phosphorus.

evergreen stand: A plant community where evergreen trees or shrubs represent more than 50% of the total areal coverage of trees and shrubs. The canopy is never without foliage; however, individual trees or shrubs may shed their leaves (Mueller-Dombois and Ellenberg 1974).

extreme high water of spring tides: The highest tide occurring during a lunar month, usually near the new or full moon. This is equivalent to extreme higher high water of mixed semidiurnal tides.

extreme low water of spring tides: The lowest tide occurring during a lunar month, usually near the new or full moon. This is equivalent to extreme lower low water of mixed semidiurnal tides.

flat: A level landform composed of unconsolidated sediments — usually mud or sand. Flats may be irregularly shaped or elongate and continuous with the shore, whereas bars are generally elongate, parallel to the shore, and separated from the shore by water.

floating plant: A non-anchored plant that floats freely in the water or on the surface; e.g., water hyacinth (Eichhornia crassipes) or common duckweed (Lemna minor).

floating-leaved plant: A rooted, herbaceous hydrophyte with some leaves floating on the water surface; e.g., white water lily (Nymphaea odorata), floating-leaved pondweed (Potamogeton natans). Plants such as yellow water lily (Nuphar luteum) which sometimes have leaves raised above the surface are considered floating-leaved plants or emergents, depending on their growth habit at a particular site.

floodplain: “a flat expanse of land bordering an old river…” (see Reid and Wood 1976:72, 84).

fresh: Term applied to water with salinity less than 0.5‰ dissolved salts.

gravel: A mixture composed primarily of rock fragments 2 mm (0.08 inch) to 7.6 cm (3 inches) in diameter. Usually contains much sand.


haline: Term used to indicate dominance of ocean salt.

herbaceous: With the characteristics of an herb; a plant with no persistent woody stem above ground.

histosols: Organic soils (see Appendix D).

hydric soil: Soil that is wet long enough to periodically produce anaerobic conditions, thereby influencing the growth of plants.

hydrophyte, hydrophytic: Any plant growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content.

hyperhaline: Term to characterize waters with salinity greater than 40‰, due to ocean-derived salts.
hypersaline Term to characterize waters with salinity greater than 40%, due to land-derived salts.

macrophytic algae Algal plants large enough either as individuals or communities to be readily visible without the aid of optical magnification.

mean high water The average height of the high water over 19 years.

mean higher high tide The average height of the higher of two unequal daily high tides over 19 years.

mean low water The average height of the low water over 19 years.

mean lower low water The average height of the lower of two unequal daily low tides over 19 years.

mean tide level A plane midway between mean high water and mean low water.

mesohaline Term to characterize waters with salinity of 5 to 18‰, due to ocean-derived salts.

mesophyte, mesophytic Any plant growing where moisture and aeration conditions lie between extremes. (Plants typically found in habitats with average moisture conditions, not usually dry or wet.)

mesosaline Term to characterize waters with salinity of 5 to 18‰, due to land-derived salts.

mineral soil Soil composed of predominantly mineral rather than organic materials.

mixohaline Term to characterize water with salinity of 0.5 to 30‰, due to ocean salts. The term is roughly equivalent to the term brackish.

mixosaline Term to characterize waters with salinity of 0.5 to 30‰, due to land-derived salts.

mud Wet soft earth composed predominantly of clay and silt—fine mineral sediments less than 0.074 mm in diameter (Black 1968; Liu 1970).

needle-leaved deciduous Woody gymnosperms (trees or shrubs) with needle-shaped or scale-like leaves that are shed during the cold or dry season; e.g., bald cypress (Tazodium distichum).

needle-leaved evergreen Woody gymnosperms with green, needle-shaped, or scale-like leaves that are retained by plants throughout the year; e.g., black spruce (Picea mariana).

nonpersistent emergents Emergent hydrophytes whose leaves and stems break down at the end of the growing season so that most above-ground portions of the plants are easily transported by currents, waves, or ice. The breakdown may result from normal decay or the physical force of strong waves or ice. At certain seasons of the year there are no visible traces of the plants above the surface of the water; e.g., wild rice (Zizania aquatica), arrow arum (Peltandra virginica).

obligate hydrophytes Species that are found only in wetlands—e.g., cattail (Typha latifolia) as opposed to ubiquitous species that grow either in wetland or on upland—e.g., red maple (Acer rubrum).

oligohaline Term to characterize water with salinity of 0.5 to 5.0‰ due to ocean-derived salts.

oligosaline Term to characterize water with salinity of 0.5 to 5.0‰ due to land-derived salts.

organic soil Soil composed of predominantly organic rather than mineral material. Equivalent to Histosol.
persistent emergent Emergent hydrophytes that normally remain standing at least until the beginning of the next growing season; e.g., cattails (Typha spp.) or bulrushes (Scirpus spp.).

photic zone The upper water layer down to the depth of effective light penetration where photosynthesis balances respiration. This level (the compensation level) usually occurs at the depth of 1% light penetration and forms the lower boundary of the zone of net metabolic production.

pioneer plants Herbaceous annual and seedling perennial plants that colonize bare areas as a first stage in secondary succession.

polyhaline Term to characterize water with salinity of 18 to 30‰, due to ocean salts.

polysaline Term to characterize water with salinity of 18 to 30‰, due to land-derived salts.

saline General term for waters containing various dissolved salts. We restrict the term to inland waters where the ratios of the salts often vary; the term haline is applied to coastal waters where the salts are roughly in the same proportion as found in undiluted sea water.

salinity The total amount of solid material in grams contained in 1 kg of water when all the carbonate has been converted to oxide, the bromine and iodine replaced by chlorine, and all the organic matter completely oxidized.

sand Composed predominantly of coarse-grained mineral sediments with diameters larger than 0.074 mm (Black 1968) and smaller than 2 mm (Liu 1970; Weber 1973).

shrub A woody plant which at maturity is usually less than 6 m (20 feet) tall and generally exhibits several erect, spreading, or prostrate stems and has a bushy appearance; e.g., speckled alder (Alnus rugosa) or buttonbush (Cephalanthus occidentalis).

sound A body of water that is usually broad, elongate, and parallel to the shore between the mainland and one or more islands.

spring tide The highest high and lowest low tides during the lunar month.

stone Rock fragments larger than 25.4 cm (10 inches) but less than 60.4 cm (24 inches).

submergent plant A vascular or nonvascular hydrophyte, either rooted or nonrooted, which lies entirely beneath the water surface, except for flowering parts in some species; e.g., wild celery (Vallisneria americana) or the stoneworts (Chara spp.).

terrigenous Derived from or originating on the land (usually referring to sediments) as opposed to material or sediments produced in the ocean (marine) or as a result of biologic activity (biogenous).

tree A woody plant which at maturity is usually 6 m (20 feet) or more in height and generally has a single trunk, unbranched for 1 m or more above the ground, and a more or less definite crown; e.g., red maple (Acer rubrum), northern white cedar (Thuja occidentalis).

water table The upper surface of a zone of saturation. No water table exists where that surface is formed by an impermeable body (Langbein and Iseri 1960:21).
woody plant  A seed plant (gymnosperm or angiosperm) that develops persistent, hard, fibrous tissues, basically xylem; e.g., trees and shrubs.

xerophyte, xerophytic  Any plant growing in a habitat in which an appreciable portion of the rooting medium dries to the wilting coefficient at frequent intervals. (Plants typically found in very dry habitats.)
Appendix D. Criteria for Distinguishing Organic Soils from Mineral Soils

The criteria for distinguishing organic soils from mineral soils in the United States (U.S. Soil Conservation Service, Soil Survey Staff 1975:13-14, 65) are quoted here so that those without ready access to a copy of the Soil Taxonomy may employ this information in the classification of wetlands:

For purposes of taxonomy, it is necessary, first, to define the limits that distinguish mineral soil material from organic soil material and, second, to define the minimum part of a soil that should be mineral if the soil is to be classified as a mineral soil.

Nearly all soils contain more than traces of both mineral and organic components in some horizons, but most soils are dominantly one or the other. The horizons that are less than about 20 to 35 percent organic matter by weight have properties that are more nearly those of mineral than of organic soils. Even with this separation, the volume of organic matter at the upper limit exceeds that of the mineral material in the fine-earth fraction.

MINERAL SOIL MATERIAL

Mineral soil material either

- Is never saturated with water for more than a few days and has <20 percent organic carbon by weight; or

- Is saturated with water for long periods or has been artificially drained, and has

  - Less than 18 percent organic carbon by weight if 60 percent or more of the mineral fraction is clay;
  - Less than 12 percent organic carbon by weight if the mineral fraction has no clay; or
  - A proportional content of organic carbon between 12 and 18 percent if the clay content of the mineral fraction is between zero and 60 percent.

Soil material that has more organic carbon than the amounts just given is considered to be organic material.

DISTINCTION BETWEEN MINERAL SOILS AND ORGANIC SOILS

Most soils are dominantly mineral material, but many mineral soils have horizons of organic material. For simplicity in writing definitions of taxa, a distinction between what is meant by a mineral soil and an organic soil is useful. In a mineral soil, the depth of each horizon is measured from the top of the first horizon of mineral material. In an organic soil, the depth of each horizon is measured from the base of the aerial parts of the growing plants or, if there is no continuous plant cover from the surface of the layer of organic materials. To apply the definitions of many taxa, therefore, one must first decide whether the soil is mineral or organic.

If a soil has both organic and mineral horizons, the relative thickness of the organic and the mineral soil materials must be considered. At some point one must decide that the mineral horizons are more important. This point is arbitrary and depends in part on the nature of the materials. A thick layer of sphagnum has a very low bulk density and contains less organic matter than a thinner layer of well-decomposed muck. It is much easier to measure thickness of layers in the field than it is to determine tons of organic matter per hectare. The definition of a mineral soil, therefore, is based on thickness of the horizons or layers, but the limits of thickness must vary with the kinds of materials. The definition that follows is intended to classify as mineral soils those that have no more organic material than the amount permitted in the histic epipedon, which is defined later in this chapter.
To determine whether a soil is organic or mineral, the thickness of horizons is measured from the surface of the soil whether that is the surface of a mineral or an organic horizon. Thus, any O horizon at the surface is considered an organic horizon, if it meets the requirements of organic soil material as defined later, and its thickness is added to that of any other organic horizons to determine the total thickness of organic soil materials.

**DEFINITION OF MINERAL SOILS**

Mineral soils, in this taxonomy, are soils that meet one of the following requirements:

- Mineral soil material <2 mm in diameter (the fine-earth fraction) makes up more than half the thickness of the upper 80 cm (31 in.);
- The depth to bedrock is <40 cm and the layer or layers of mineral soil directly above the rock either are 10 cm or more thick or have half or more of the thickness of the overlying organic soil material; or
- The depth to bedrock is >40 cm, the mineral soil material immediately above the bedrock is 10 cm or more thick, and either
  - Organic soil material is <40 cm thick and is decomposed (consisting of hemic or sapric materials as defined later) or has a bulk density of 0.1 or more; or
  - Organic soil material is <60 cm thick and either is undecomposed sphagnum or moss fibers or has a bulk density that is <0.1.

**ORGANIC SOIL MATERIALS**

Organic soil materials and organic soils

- Are saturated with water for long periods or are artificially drained and, excluding live roots, (a) have 18 percent or more organic carbon if the mineral fraction is 60 percent or more clay, (b) have 12 percent or more organic carbon if the mineral fraction has no clay, or (c) have a proportional content of organic carbon between 12 and 18 percent if the clay content of the mineral fraction is between zero and 60 percent; or
- Are never saturated with water for more than a few days and have 20 percent or more organic carbon.

Item 1 in this definition covers materials that have been called peats and mucks. Item 2 is intended to include what has been called litter or O horizons. Not all organic soil materials accumulate in or under water. Leaf litter may rest on a lithic contact and support a forest. The only soil in this situation is organic in the sense that the mineral fraction is appreciably less than half the weight and is only a small percentage of the volume of the soil.

**DEFINITION OF ORGANIC SOILS**

Organic soils (Histosols) are soils that

- Have organic soil materials that extend from the surface to one of the following:
  - A depth within 10 cm or less of a lithic or paralithic contact, provided the thickness of the organic soil materials is more than twice that of the mineral soil above the contact; or
Any depth if the organic soil material rests on fragmental material (gravel, stones, cobbles) and
the interstices are filled with organic materials, or rests on a lithic or paralithic contact; or

Have organic materials that have an upper boundary within 40 cm of the surface and

Have one of the following thicknesses:

60 cm or more if three-fourths or more of the volume is moss fibers or the moist bulk
density is < 0.1 g per cubic centimeter (6.25 lbs per cubic foot);

40 cm or more if

The organic soil material is saturated with water for long periods (>6 months) or
is artificially drained; and

The organic material consists of sapric or hemic materials or consists of fibric
materials that are less than three-fourths moss fibers by volume and have a
moist bulk density of 0.1 or more; and

Have organic soil materials that

Do not have a mineral layer as much as 40 cm thick either at the surface or whose upper
boundary is within a depth of 40 cm from the surface; and

Do not have mineral layers, taken cumulatively, as thick as 40 cm within the upper 80 cm.

It is a general rule that a soil is classed as an organic soil (Histosol) either if more than half of the upper 80
cm (32 in.) [sic] of soil is organic or if organic soil material of any thickness rests on rock or on fragmental
material having interstices filled with organic materials. Soils that do not satisfy the criteria for classification
as organic soils are mineral soils.
Appendix E. Artificial Keys to the Systems and Classes

Key to the Systems

1. Water regime influenced by oceanic tides, and salinity due to ocean-derived salts 0.5‰ or greater.
2. Semi-enclosed by land, but with open, partly obstructed or sporadic access to the ocean. Halinity wide-ranging because of evaporation or mixing of seawater with runoff from land. ESTUARINE
3. Emergents, trees, or shrubs present. ESTUARINE
4. Persistent emergents, trees, shrubs, or emergent mosses cover 30% or more of the area. PALUSTRINE
5. Situated in a channel; water, when present, usually flowing. RIVERINE
6. Area 8 ha (20 acres) or greater. LACUSTRINE
7. Wave-formed or bedrock shoreline feature present or water depth 2 m (6.6 feet) or more. LACUSTRINE

Key to the Classes

1. During the growing season of most years, areal cover by vegetation is less than 30%.
2. Substrate a ridge or mound formed by colonization of sedentary invertebrates (corals, oysters, tube worms). REEF
3. Water regime subtidal, permanently flooded, intermittently exposed, or semipermanently flooded. Substrate usually not soil. ROCK BOTTOM
4. Substrate of bedrock, boulders, or stones occurring singly or in combination covers 75% or more of the area. ROCK BOTTOM
5. Contained within a channel that does not have permanent flowing water. STREAMBED
6. Substrate of bedrock, boulders, or stones occurring singly or in combination covers 75% or more of the area. ROCKY SHORE
cobbles; with less than 75% of the cover consisting of stones, boulders, or bedrock........UNCONSOLIDATED SHORE

1. During the growing season of most years, percentage of area covered by vegetation 30% or greater.

7. Vegetation composed of pioneering annuals or seedling perennials, often not hydrophytes, occurring only at time of substrate exposure...............................8

8. Contained within a channel that does not have permanent flowing water........................................STREAMBED (VEGETATED)

8. Contained within a channel with permanent water, or not contained in a channel........................UNCONSOLIDATED SHORE (VEGETATED)

7. Vegetation composed of algae, bryophytes, lichens, or vascular plants that are usually hydrophytic perennials.......................9

9. Vegetation composed predominantly of nonvascular species........10

10. Vegetation macrophytic algae, mosses, or lichens growing in water or the splash zone of shores........AQUATIC BED

10. Vegetation mosses or lichens usually growing on organic soils and always outside the splash zone of shores...........................MOSS-LICHEN WETLAND

9. Vegetation composed predominantly of vascular species........11

11. Vegetation herbaceous...........................................12

12. Vegetation emergents............................................EMERGENT WETLAND

12. Vegetation submergent, floating-leaved, or floating................AQUATIC BED

11. Vegetation trees or shrubs........................................13

13. Dominants less than 6 m (20 feet) tall..........................SCRUB-SHRUB WETLAND

13. Dominants 6 m tall or taller..........................FORESTED WETLAND