DECISION DOCUMENT
NATIONWIDE PERMIT 44

This document discusses the factors considered by the Corps of Engineers (Corps) during the issuance process for this Nationwide Permit (NWP). This document contains: (1) the public interest review required by Corps regulations at 33 CFR 320.4(a)(1) and (2); (2) a discussion of the environmental considerations necessary to comply with the National Environmental Policy Act; and (3) the impact analysis specified in Subparts C through F of the 404(b)(1) Guidelines (40 CFR Part 230). This evaluation of the NWP includes a discussion of compliance with applicable laws, consideration of public comments, an alternatives analysis, and a general assessment of individual and cumulative environmental effects, including the general potential effects on each of the public interest factors specified at 33 CFR 320.4(a).

1.0 Text of the Nationwide Permit

Mining Activities. Discharges of dredged or fill material into non-tidal waters of the United States for mining activities, except for coal mining activities, provided the activity meets all of the following criteria:

(a) For mining activities involving discharges of dredged or fill material into non-tidal jurisdictional wetlands, the discharge must not cause the loss of greater than 1/2-acre of non-tidal jurisdictional wetlands;

(b) For mining activities involving discharges of dredged or fill material in non-tidal jurisdictional open waters (e.g., rivers, streams, lakes, and ponds) or work in non-tidal navigable waters of the United States (i.e., section 10 waters), the mined area, including permanent and temporary impacts due to discharges of dredged or fill material into jurisdictional waters, must not exceed 1/2-acre; and

(c) The acreage loss under paragraph (a) plus the acreage impact under paragraph (b) does not exceed 1/2-acre.

This NWP does not authorize discharges of dredged or fill material into non-tidal wetlands adjacent to tidal waters.

Notification: The permittee must submit a pre-construction notification to the district engineer prior to commencing the activity. (See general condition 32.) If reclamation is required by other statutes, then a copy of the final reclamation plan must be submitted with the pre-construction notification. (Authorities: Sections 10 and 404)

1.1 Requirements

General conditions of the NWPs are in the Federal Register notice announcing the issuance of this NWP. Pre-construction notification requirements, additional conditions, limitations, and restrictions are in 33 CFR part 330.

1.2 Statutory Authorities

- Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403)
- Section 404 of the Clean Water Act (33 U.S.C. 1344)

1.3 Compliance with Related Laws (33 CFR 320.3)

1.3.1 General

Nationwide permits are a type of general permit designed to authorize certain activities that have no more than minimal individual and cumulative adverse environmental effects and generally comply with the related laws cited in 33 CFR 320.3. Activities that result in more than minimal individual and cumulative adverse environmental effects cannot be authorized by NWPs. Individual review of each activity authorized by an NWP will not normally be performed, except when pre-construction notification to the Corps is required or when an applicant requests verification that an activity complies with an NWP. Potential adverse impacts and compliance with the laws cited in 33 CFR 320.3 are controlled by the terms and conditions of each NWP, regional and case-specific conditions, and the review process that is undertaken prior to the issuance of NWPs.

The evaluation of this NWP, and related documentation, considers compliance with each of the following laws, where applicable: Section 10 of the Rivers and Harbors Act of 1899; Sections 401, 402, and 404 of the Clean Water Act; Section 307(c) of the Coastal Zone Management Act of 1972, as amended; Section 302 of the Marine Protection, Research and Sanctuaries Act of 1972, as amended; the National Environmental Policy Act of 1969; the Fish and Wildlife Act of 1956; the Migratory Marine Game-Fish Act; the Fish and Wildlife Coordination Act, the Federal Power Act of 1920, as amended; the National Historic Preservation Act of 1966; the Interstate Land Sales Full Disclosure Act; the Endangered Species Act; the Deepwater Port Act of 1974; the Marine Mammal Protection Act of 1972; Section 7(a) of the Wild and Scenic Rivers Act; the Ocean Thermal Energy Act of 1980; the National Fishing Enhancement Act of 1984; the Magnuson-Stevens Fishery and Conservation and Management Act, the Bald and Golden Eagle Protection Act; and the Migratory Bird Treaty Act. In addition, compliance of the NWP with other Federal requirements, such as Executive Orders and Federal regulations addressing issues such as floodplains, essential fish habitat, and critical resource waters is considered.

1.3.2 Terms and Conditions

Many NWPs have pre-construction notification requirements that trigger case-by-case review of certain activities. Two NWP general conditions require case-by-case review of all activities that might affect federally-listed endangered or threatened species (or species proposed for listing) or designated critical habitat (or critical habitat proposed for such designation) or historic properties (i.e., general conditions 18 and 20, respectively). General condition 16 restricts the use of NWPs for activities that are located in Federally-designated wild and scenic rivers. None of the NWPs authorize the construction of artificial reefs. If a proposed activity will impact a Corps federally authorized Civil Works project, general condition 31 requires that a review by the appropriate Corps office. General condition 28 addresses the use of an NWP with other NWPs to authorize a single and complete project, to ensure that the acreage limits of each of the NWPs used to authorize that project are not exceeded.

In some cases, activities authorized by an NWP may require other federal, state, or local authorizations. Examples of such cases include, but are not limited to: activities that are in marine sanctuaries or affect marine sanctuaries or marine mammals; the ownership, construction, location, and operation of ocean thermal conversion facilities or deep water ports beyond the territorial seas; activities that result in discharges of dredged or fill material into waters of the United States and require Clean Water Act section 401 water quality certification; or activities in a state operating under a coastal zone management program approved by the Secretary of Commerce under the Coastal Zone Management Act. In such cases, a provision of the NWPs states that an NWP does not obviate the need to obtain other authorizations required by law. [33 CFR 330.4(b)(2)]

Additional safeguards include provisions that allow the Chief of Engineers, division engineers, and/or district engineers to: assert discretionary authority and require an individual permit for a specific activity; modify NWPs for specific activities by adding special conditions on a case-by-case basis; add conditions on a regional or nationwide basis to certain NWPs; or take action to suspend or revoke an NWP or NWP authorization for activities within a region or state. Regional conditions are imposed to protect important regional concerns and resources. [33 CFR 330.4(e) and 330.5]

1.3.3 Review Process

The analyses in this document and the coordination that was undertaken prior to the issuance of the NWP fulfill the requirements of the National Environmental Policy Act (NEPA), the Fish and Wildlife Coordination Act, and other acts promulgated to protect the quality of the environment.

All NWPs that authorize activities that may result in discharges into waters of the United States require compliance with the water quality certification requirements of section 401 of the Clean Water Act. Nationwide permits that authorize activities within, or affecting land or water uses within a state that has a Federally-approved coastal zone management program, must also be certified as consistent with the state's program, unless a presumption of concurrence occurs. The procedures to ensure that the NWPs comply with these laws are described in 33 CFR 330.4(c) and (d), respectively.

2.0 Purpose and Need for the Proposed Action

The proposed action is the issuance of this NWP to authorize discharges of dredged or fill material into waters of the United States under section 404 of the Clean Water Act and work in navigable waters of the United States under section 10 of the Rivers and Harbors Act of 1899 for mining activities that result in no more than minimal individual and cumulative adverse environmental effects. This proposed action is needed for efficient implementation of the Corps Regulatory Program, by authorizing with little, if any, delay or paperwork this category of activities, when those activities have no more than minimal individual and cumulative adverse environmental effects. The NWP also provides an incentive to project proponents to reduce impacts to jurisdictional waters and wetlands to receive the required authorization under section 404 of the Clean Water Act and section 10 of the Rivers and Harbors Act of 1899 in less time than it takes to obtain individual permits for those activities. Issuing an NWP to authorize activities that have no more than minimal adverse environmental effects instead of processing individual permit applications for these activities, reduces regulatory burdens on the public, benefits the environment through reduced losses of jurisdictional waters and wetlands, and allows the Corps to allocate more of its resources towards evaluating proposed activities requiring authorization under section 404 of the Clean Water Act and section 10 of the Rivers and Harbors Act of 1899 that have the potential to cause more substantial adverse environmental effects.

3.0 Alternatives

This evaluation includes an analysis of alternatives based on the text of NEPA, which requires consideration of a reasonable range of alternatives to the proposed agency action that are technically and economically feasible, and meet the purpose and need of the proposal. The alternatives identified below are based on an analysis of the reasonably foreseeable potential environmental impacts and socio-economic impacts to the Corps, federal, tribal, and state resource agencies, the general public, and prospective permittees.

3.1 No Action Alternative (Do Not Reissue or Modify the Nationwide Permit)

The no action alternative would be to allow this NWP to continue to authorize activities until it expires on March 14, 2026, and not reissue or modify the NWP. After the NWP expires, under the no action alternative activities that were authorized by this NWP would require individual permits, unless Corps districts issued regional general permits to authorize a similar category of activities that the NWP authorized.

3.2 Reissue the Nationwide Permit With Modifications

This alternative consists of modifying and reissuing the NWP while considering the comments received in response to the proposal to reissue this NWP with modifications, including the proposed changes identified by the Corps and changes suggested by commenters. This alternative includes changes to the terms and conditions of this NWP, including quantitative limits for this NWP, pre-construction notification thresholds and requirements, and other provisions of this NWP. This alternative also includes consideration of modifying, adding, or removing general conditions that apply to this NWP. In addition, this alternative includes the mechanisms in the Corps' NWP program regulations at 33 CFR 330.5(c) and (d) where division and district engineers can modify, suspend, or revoke NWP authorizations on a regional or case-by-case basis to ensure that the NWP authorizes only those activities that result in no more than minimal individual and cumulative adverse environmental effects.

In the proposed rule published in the June 18, 2025, issue of the Federal Register (90 FR 26100), the Corps requested comments on the proposed reissuance of this NWP. The Corps did not propose any changes to this NWP.

Since the Corps' NWP program began in 1977, the Corps has continuously strived to develop NWPs that only authorize activities that result in no more than minimal individual and cumulative adverse environmental effects. Every five years the Corps reevaluates the NWPs during the reissuance process, and may modify an NWP to address concerns for the aquatic environment. Utilizing collected data and institutional knowledge concerning activities authorized by the Corps regulatory program, the Corps reevaluates the potential impacts of activities authorized by NWPs. The Corps also uses substantive public comments on proposed NWPs to assess the expected impacts.

3.3 Reissue the Nationwide Permit Without Modifications

This alternative consists of reissuing the NWP without any modifications before it expires on March 14, 2026. This alternative also includes the mechanisms in the

Corps' NWP program regulations where division and district engineers can modify, suspend, or revoke NWP authorizations on a regional or case-by-case basis to ensure that the NWP authorizes only those activities that result in no more than minimal individual and cumulative adverse environmental effects (see 33 CFR 330.5(c) and (d)).

4.0 Environmental Consequences

4.1 General Evaluation Criteria

NWPs can only authorize activities that have no more than minimal individual and cumulative adverse environmental impacts (see 33 U.S.C. 1344(e), 33 CFR 322.2(f), and 33 CFR 323.2(h)). This environmental assessment contains a general evaluation of the reasonably foreseeable effects of the individual activities authorized by this NWP and the reasonably foreseeable cumulative effects of the activities authorized by this NWP during the 5-year period it is anticipated to be in effect. In the assessment of these reasonably foreseeable individual and cumulative effects, the terms and limits of the NWP, pre-construction notification requirements, and the NWP general conditions are considered. The NWP general conditions include mitigation measures that avoid, minimize, rectify, and reduce individual and cumulative adverse environmental effects. For a specific activity authorized by the NWP, the district engineer may require compensatory mitigation and/or other forms of mitigation to ensure that the individual and cumulative adverse environmental effects caused by that NWP activity are no more than minimal.

The environmental effects of a proposed action are evaluated by assessing the direct and indirect effects that the action would likely have on the current environmental setting (Canter 1996). Effects are changes in ecosystem structure and functions over time (Spaling and Smit 1993) that are caused by anthropogenic and natural disturbances. How an ecosystem responds to disturbances is dependent on context, connections at various scales (e.g., local, regional, global) between ecosystems and ecosystem components, and the ecosystem's current structure and functions (Walker and Salt 2006). Disturbances to ecosystems are not always harmful, and disturbances may be an important component of the ecosystem's dynamics (Wallington et al. 2005) that help maintain its structure and function, as well as the ecological services it provides. Some ecosystems require management by people to maintain or enhance their structure and functions (Comberti et al. 2015), as well as their resilience to disturbances (Lui et al. 2007) and other drivers of change.

Ecosystems are heterogeneous, open systems that interact with other ecosystems that occur in a landscape (Wallington et al. 2005) or a seascape. Ecosystems are subjected to multiple categories of disturbances over a variety of spatial (e.g., local, regional, global) and temporal scales (Foley et al. 2015, Elmqvist et al. 2003). A disturbance is an anthropogenic or natural event that alters or disrupts the structure and functions of an ecosystem, often to a substantial degree (Clewell and Aronson 2013). Disturbances are often caused by external influences, such as human activities (e.g., land use changes) and storms (Clewell and Aronson 2013). Activities authorized by this NWP are likely to act as disturbances that might temporarily or permanently change the structure and functions of aquatic ecosystems. When evaluating the potential environmental consequences of the issuance of this NWP on the current environmental setting, the direct and indirect impacts caused by activities authorized by this NWP should not be considered in isolation from the direct and indirect impacts on aquatic ecosystem structure and functions caused by other human activities, including activities not subject to the Corps' permitting authorities, because it is the collective impacts (i.e., cumulative impacts) of NWP activities and other categories of human activities that could alter the structure and functions of aquatic ecosystems.

For this environmental assessment, the proposed action is the issuance of this NWP. Because this environmental assessment is prepared for an NWP that may be used to authorize discharges of dredged or fill material into waters of the United States and work in navigable waters of the United States across the country, it is a general, national scale assessment that takes into consideration the quantity and quality of waters and wetlands described with available national-scale information summarized in Appendix A of this document to describe the current environmental setting. Because the decision by Corps Headquarters on whether to issue an NWP is made in advance of that NWP going into effect and becoming available for use by project proponents to provide DA authorization for their activities, this environmental assessment does not identify or characterize any specific sites at which this NWP may be used during the five year period it is in effect. This environmental assessment also does not address the degree to which specific waters and wetlands on a project site may perform ecological functions and services that may be directly or indirectly affected by the activities authorized by the NWP, because that information is not available at the geographic scale of this environmental assessment. In addition, the specific functions and services performed by waters and wetlands, and the degree to which they perform those functions and services, varies substantially among individual waters and wetlands, and may also vary over time (e.g., seasonally).

The decision on whether to issue an NWP is based on a general assessment of the reasonably foreseeable direct, indirect, and cumulative impacts on waters and wetlands across the country during the five-year period it is anticipated to be in effect. As such, this assessment must be speculative or predictive in general terms. Because the NWP authorizes activities across the United States and its territories, activities eligible for NWP authorization may be constructed in a wide variety of environmental settings, and affect waters and wetlands of varying quality, from severely degraded (i.e., performing ecological functions and services to a low degree, or not performing one or more ecological functions and services) to performing some or all ecological functions and services to a moderate or high degree. NWP activities may result in permanent or temporary losses of aquatic ecosystems and the functions and services they provide, or partial or complete losses of aquatic ecosystems and the functions and services they provide. Therefore, it is difficult to predict all of the reasonably foreseeable direct and indirect impacts that may be caused by each activity authorized by an NWP. For example, the NWP that authorizes 25 cubic yard discharges of dredged or fill material into various types of waters of the United States may be used to fulfill a variety of project purposes, and the direct and indirect environmental effects caused by those discharges may vary as a result of the characteristics of that activity and the environmental characteristics of the site and landscape or seascape setting in which the activity takes place. Therefore, some NWPs activities require pre-construction notification for certain activities to provide district engineers the opportunity to review proposed activities on a case-by-case basis, consider the current environmental setting including the functions and services that may be performed by the affected waters and wetlands, and determine whether the NWP activity will result in no more than minimal individual and cumulative adverse environmental effects.

The Corps expects that the convenience and time savings associated with the use of this NWP will encourage applicants to design their projects to fall within the scope of the NWP rather than request individual permits for activities which could result in greater adverse impacts to the aquatic environment. The avoidance and minimization encouraged by the issuance of this NWP, as well as other mitigation measures that may be required for specific activities authorized by this NWP, is likely to help reduce cumulative effects to the Nation's wetlands, streams, and other aquatic resources caused by activities authorized by this NWP during the five year period it is anticipated to be in effect.

After this NWP is issued, division engineers prepare supplemental documentation to address whether regional conditions, regional suspensions, or regional revocations of this NWP are necessary to help ensure that the activities authorized by this NWP within a particular geographic area (e.g., watershed, seascape, county, state) result in no more than minimal individual and cumulative adverse environmental effects (see 33 CFR 330.5(c)). In addition, when reviewing PCNs, district engineers may add conditions to specific NWP activities to ensure that those activities will result in no more than minimal individual and cumulative adverse environmental effects (see 33 CFR 330.5(d)).

In a specific watershed or other geographic region, division or district engineers may make a preliminary determination that the cumulative adverse environmental effects of activities authorized by this NWP during the five year period may be becoming more than minimal. In such circumstances, division and district engineers will conduct more detailed assessments to determine whether additional regional conditions or suspension or revocation of the NWP is appropriate to ensure that activities with more than minimal cumulative adverse environmental effects are not being authorized by the NWP. Division and district engineers have the authority to require individual permits in watersheds or other geographic areas where the cumulative adverse environmental effects are determined to be more than minimal, or to add conditions to the NWP either on a case-by-case or regional basis to require mitigation measures to ensure that the cumulative adverse environmental effects of these activities are no more than minimal. When a division or district engineer determines, using local or regional information, that a watershed or other geographic region is subject to more than minimal cumulative adverse environmental effects due to the use of this NWP, he or she will use the revocation and modification procedure at 33 CFR 330.5. In reaching the final decision, the division or district engineer will compile information on the cumulative adverse effects and amend the supplemental documentation that was prepared in accordance with 33 CFR 330.5(c)(1)(iii).

4.2 Impact Analysis

This NWP authorizes discharges of dredged or fill material into non-tidal waters of the United States for mining activities. This NWP does not authorize discharges into tidal waters or non-tidal wetlands adjacent to tidal waters. The acreage limit for this NWP is 1/2 acre.

Pre-construction notification is required for all activities authorized by this NWP. The pre-construction notification requirement allows district engineers to review proposed activities on a case-by-case basis to ensure that the individual and cumulative adverse environmental effects of those activities are no more than minimal. If the district engineer determines that the adverse environmental effects of a particular project are more than minimal after considering mitigation, then discretionary authority will be asserted and the applicant will be notified that another form of DA authorization, such as a regional general permit or individual permit, is required (see 33 CFR 330.4(e) and 330.5).

See section 1.0 of this document for a more complete description of the activities authorized by this NWP, as well as limitations on those activities. The general conditions that apply to this NWP also impose further limitations on authorized activities.

The potential impacts of activities authorized by this NWP on the Corps' public interest review factors listed in 33 CFR 320.4(a)(1) are discussed in more detail in Appendix B of this document. The potential impacts on the aquatic environment that could be caused by discharges of dredged or fill material into waters of the United States authorized by this NWP are discussed, in general terms, in the Clean Water Act section 404(b)(1) Guidelines analysis in Appendix C of this document.

In this environmental assessment, the analysis of environmental consequences is a qualitative analysis because of the paucity of quantitative data at a national scale on the quantity of aquatic ecosystems within the current environmental setting, as well as the paucity of data relating to the specific ecosystem functions and services performed by those aquatic ecosystems and the degree to which those aquatic ecosystem functions and services are performed. In addition, there is a lack of quantitative data at a national scale concerning the various human activities and natural factors that may directly or indirectly affect aquatic ecosystems and the functions and services they provide. As discussed throughout this environmental assessment, the activities authorized by this NWP are just one category among many categories of human activities that directly and indirectly affect waters and wetlands and the ecological functions and services those waters and wetlands provide. This environmental assessment focuses on the potential impacts on waters and wetlands that are reasonably foreseeable and would occur after this NWP is issued and goes into effect.

The terms of this NWP, including any acreage limits or any other quantitative limits in the text of the NWP, the protections provided by the NWP general conditions, plus any regional conditions imposed by division engineers and activity-specific conditions imposed by district engineers, will help ensure that the activities authorized by this NWP will result in no more than minimal individual and cumulative adverse environmental effects. An additional safeguard in the NWP Program is the ability of district engineers to exercise discretionary authority and require project proponents to obtain individual permits for proposed activities whenever a district engineer determines that a proposed activity will result in more than minimal individual or cumulative adverse environmental effects after considering any mitigation proposed by the project proponent (see 33 CFR 330.1(e)(3)).

In high value waters, division and district engineers can: 1) prohibit the use of the NWP in those waters and require an individual permit or regional general permit; 2) decrease the acreage limit for the NWP; 3) add regional conditions to the NWP to ensure that the individual and cumulative adverse environmental effects are no more than minimal; or 4) for those NWP activities that require pre-construction notification, add special conditions to NWP authorizations, such as compensatory mitigation requirements, to ensure that the adverse environmental effects are no more than minimal. Nationwide permits can authorize activities in high value waters as long as the individual and cumulative adverse environmental effects are no more than minimal.

Corps divisions and districts also monitor the use of this NWP and the authorized impacts identified in NWP verification letters. At a later time, if warranted, a division engineer may add regional conditions to further restrict or prohibit the use of this NWP to ensure that it does not authorize activities that result in more than minimal cumulative adverse environmental effects in a particular geographic region (e.g., a watershed, landscape unit, or seascape unit). To the extent practicable, division and district engineers will use data stored within automated information systems and institutional knowledge about the typical adverse effects of activities authorized by this NWP, as well as substantive public comments, to assess the individual and cumulative adverse environmental effects caused by regulated activities authorized by this NWP.

4.2.1 Individual impacts

The individual environmental impacts are the reasonably foreseeable direct and indirect impacts to ecosystems caused by a specific activity authorized by this NWP (i.e., discharges of dredged or fill material into waters of the United States and work in navigable waters of the United States) at a project site. Activities authorized by this NWP are likely to be disturbances that have the potential to temporarily or permanently change the structure and functions of aquatic ecosystems, including the degree to which those aquatic ecosystems perform ecosystem services. The types of activities generally considered to be “discharges of dredged or fill material into waters of the United States” and “work in navigable waters of the United States” are discussed below.

This NWP authorizes discharges of dredged or fill material into waters of the United States. The Corps’ regulations define “dredged material” as “material that is excavated or dredged from waters of the United States.” [33 CFR 323.2(c)] The term “discharge of dredged material” means “any addition of dredged material into, including redeposit of dredged material other than incidental fallback within, the waters of the United States.” [33 CFR 323.2(d)(1)] The term “discharge of dredged material” includes, but is not limited to, (1) the addition of dredged material to a specified discharge site located in waters of the United States; (2) the runoff or overflow from a contained land or water disposal area; and (3) any addition, including redeposit other than incidental fallback, of dredged material, including excavated material, into waters of the United States which is incidental to any activity, including mechanized land clearing, ditching, channelization, or other excavation. [33 CFR 323.2(d)(1)]

Under 33 CFR 323.2(d)(2), the term “discharge of dredged material” does not include any of the following:

> (1) discharges of pollutants into waters of the United States resulting from the onshore subsequent processing of dredged material that is extracted for any commercial use (other than fill). These discharges are subject to section 402 of the Clean Water Act even though the extraction and deposit of such material may require a permit from the Corps or applicable State section 404 program.
>
> (2) Activities that involve only the cutting or removing of vegetation above the ground (e.g., mowing, rotary cutting, and chainsawing)

where the activity neither substantially disturbs the root system nor involves mechanized pushing, dragging, or other similar activities that redeposit excavated soil material.

(3) Incidental fallback.

The term “fill material” is defined at 33 CFR 323.2(e)(1) as meaning “material placed in waters of the United States where the material has the effect of: (1) replacing any portion of a water of the United States with dry land; or (2) changing the bottom elevation of any portion of a water of the United States. Examples of fill material include: “rock, sand, soil, clay, plastics, construction debris, wood chips, overburden from mining or other excavation activities, and materials used to create any structure or infrastructure in the waters of the United States.” [33 CFR 323.2(e)(2)] “Fill material” does not include trash or garbage (see 33 CFR 323.2(e)(3)). Discharges of trash or garbage may be regulated under section 402 of the Clean Water Act or other federal, state, or local laws and regulations.

The Corps’ regulations define the term “discharge of fill material” as meaning “the addition of fill material into waters of the United States.” [33 CFR 323.2(f)] Examples of discharges of fill material provided in section 323.2(f) include, but are not limited to, the following activities: (1) the placement of fill that is necessary for the construction of any structure or infrastructure in a water of the United States; (2) the building of any structure, infrastructure, or impoundment requiring rock, sand, dirt, or other material for its construction; (3) site-development fills for recreational, industrial, commercial, residential, or other uses; (4) causeways or road fills; (5) dams and dikes; (6) artificial islands; (7) property protection and/or reclamation devices such as riprap, groins, seawalls, breakwaters, and revetments; (8) beach nourishment; (9) levees; (10) fill for structures such as sewage treatment facilities, intake and outfall pipes associated with power plants and subaqueous utility lines; (11) placement of fill material for construction or maintenance of any liner, berm, or other infrastructure associated with solid waste landfills; (12) placement of overburden, slurry, or tailings or similar mining-related materials; and (13) artificial reefs. Under 33 CFR 323.2(f), the term “discharge of fill material” does not include plowing, cultivating, seeding and harvesting for the production of food, fiber, and forest products.

Discharges of dredged or fill material into a water or wetland subject to the Corps’ jurisdiction under section 404 of the Clean Water Act may result in the complete or partial loss of wetland area, stream bed, or area of another type of aquatic ecosystem. That complete or partial loss of aquatic ecosystem area may result in a complete or partial loss of aquatic ecosystem functions and services, or changes in the types of ecosystem functions or services being performed at that site. The direct effects to waters and wetlands caused by activities authorized by this NWP may change those waters and wetlands to components of the built environment or uplands, convert an aquatic resource type to another aquatic resource type, or alter the functions and services provided by those waters and wetlands. The direct effects to waters and wetlands caused by activities authorized by this NWP may be permanent or temporary.

The indirect effects to waters and wetlands caused by activities authorized by this NWP may also convert an aquatic ecosystem type to another aquatic ecosystem type. The indirect effects to waters and wetlands caused by activities authorized by this NWP may be permanent or temporary. The contribution of activities authorized by this NWP to cumulative or aggregate effects to waters and wetlands is also dependent on the degree or magnitude to which the potentially affected aquatic resources perform ecological functions and services. Nearly all waters and wetlands have been directly and indirectly affected by human activities over time (e.g., Halpern et al. 2008 for oceans, Lotze et al. 2006 for estuaries, Zedler and Kercher 2005 for wetlands, Allan 2004 for streams), including land uses in areas that drain to these aquatic ecosystems.

This NWP also authorizes work in navigable waters of the United States, more specifically discharges of dredged or fill material into waters of the United States that are also navigable waters of the United States as defined in 33 CFR part 329. The Corps' section 10 regulations define the term "work" as including, "without limitation, any dredging or disposal of dredged material, excavation, filling, or other modification of a navigable water of the United States." [33 CFR 322.2(c)] Under this NWP, the section 10 authorization applies to discharges of dredged or fill material into waters of the United States that are also navigable waters under section 10 of the Rivers and Harbors Act of 1899. Work in navigable waters of the United States, such as discharges of dredged or fill material, may alter the ecological functions and services performed by those navigable waters.

Work in navigable waters of the United States does not typically result in losses of navigable waters. Examples of exceptions would include fills in navigable waters to create fast land along the shoreline, or artificial islands. Work in navigable waters may alter the physical, chemical, and biological characteristics of those waters, but they generally do not result in a loss in the quantity of navigable waters. Work in navigable waters may alter the ecological functions and services provided by those waters. Those alterations will vary, depending on the specific characteristics of the specific activity authorized by this NWP and the environmental setting in which the NWP activity may occur. The environmental setting will vary from site to site, and from region to region across the country.

As discussed above, the individual impacts of activities authorized by this NWP include the direct and indirect effects caused by discharges of dredged or fill material into waters of the United States and work in navigable waters of the United States at a specific site. Whether the individual adverse environmental effects of an NWP activity are no more than minimal are dependent on activity-specific and site-specific factors. The activity-specific factors include the size and configuration of the

NWP, the timing of the NWP activity, the extent that aquatic resource functions will be lost as a result of the NWP activity (e.g., partial or complete loss), the duration of the adverse effects (temporary or permanent), whether any best management practices or other mitigation measures are being used to reduce direct and indirect impacts, and how the project proponent conducts the NWP activity (e.g., what equipment is used to conduct the discharge dredged or fill material or to install structures or do work in navigable waters). The site-specific factors include the current environmental setting in the vicinity of the NWP activity, the type of resource(s) that will be affected by the NWP activity, the functions provided by the aquatic ecosystems that will be affected by the NWP activity, the degree or magnitude to which the aquatic ecosystems perform those functions, and the importance of the aquatic ecosystem functions to the region (e.g., watershed or ecoregion).

Discharges of dredged or fill material into waters of the United States and work in navigable waters of the United States are anthropogenic disturbances that can affect the structure and functions of aquatic ecosystems, including the degree to which those functions are performed, but they are just two categories of anthropogenic disturbances among many categories of anthropogenic and natural disturbances that can affect the structure and functions of aquatic ecosystems. Many of the categories of human activities and natural factors that can affect the structure and functions of aquatic ecosystems are identified in Appendix A of this environmental assessment.

Among the various regions and individual sites in the United States and its territories where this NWP may be used for activities that require DA authorization, there is substantial variability in the current environmental setting. As discussed in Appendix A, the current environmental setting is the result of direct and indirect alterations of aquatic and terrestrial ecosystems by various human activities and natural disturbances that have occurred over time (e.g., Ellis et al. 2021, Evans and Davis 2018, Clewell and Aronson 2013). The types of ecological functions and services provided by aquatic ecosystems vary considerably by region and by specific aquatic ecosystems, with some aquatic ecosystems performing ecological functions and services to a high degree, and other aquatic ecosystems performing ecological functions and services to a lesser degree. Given the geographic scope in which this NWP can be used to authorize activities under section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act of 1899 (i.e., the United States and its territories), the wide variability in aquatic ecosystem structure and functions from site to site and from region to region, and the limited quantitative data available at a national scale on functions and services provided by various types of aquatic ecosystems, the analysis of potential environmental consequences of the issuance of this NWP is a qualitative analysis. In addition, if this NWP is issued, it will be issued before many specific sites for proposed NWP activities are identified. Therefore, the impact analysis in this environmental assessment is a general, qualitative analysis and cannot consider site-specific characteristics associated with a particular NWP activity.

The individual activities authorized by this NWP are likely to affect, to some degree, the ecological functions and services provided by waters and wetlands. In addition, individual activities authorized by this NWP may indirectly affect non-aquatic ecosystems, such as upland forests and grasslands, as well as cultural or production ecosystems (e.g., parks or agricultural areas) that are cultural ecosystems that are managed by people. The severity of potential impacts to aquatic ecosystems caused by activities authorized by this NWP is dependent on a variety of factors. Impacts to aquatic ecosystems caused by activities authorized by this NWP may result in a partial, total, or no loss of aquatic ecosystem functions and services, depending on the specific characteristics of the NWP activity and the environmental setting in which the NWP activity occurs. In addition, the duration of those impacts may vary by activity, with some NWP activities causing permanent impacts, some NWP activities causing temporary impacts, and other NWP activities causing both permanent and temporary impacts. In addition, the duration of permanent or temporary impacts caused by an NWP activity may also be influenced by the resilience and resistance of the affected aquatic ecosystems to disturbances caused by the NWP activity.

The impacts of individual activities authorized by this NWP are also likely to vary by the biotic and abiotic characteristics of the site and the surrounding area. Some NWP activities may result in losses of most or all aquatic ecosystem functions and services at the site of an NWP activity. For example, an NWP activity may convert an aquatic ecosystem or a part of an aquatic ecosystem to dry land or a building or other type of engineered feature, and eliminate all or most of the aquatic ecosystem functions and services that were provided by that site. Some NWP activities may cause losses of some ecosystem functions and services while retaining or enhancing other ecosystem functions and services at the project site (e.g., an NWP activity that converts an aquatic ecosystem to a different type of aquatic or terrestrial ecosystem that provides some ecological functions and services). Some NWP activities may result in no long-term changes in ecological functions and services performed by the affected waters and wetlands because the NWP activity caused only temporary impacts and either the site recovered or was restored after that NWP activity was completed.

When determining whether a proposed NWP activity will cause no more than minimal individual and cumulative adverse environmental effects, the district engineer will consider the direct and indirect effects caused by the NWP activity. The district engineer will also consider the cumulative adverse environmental effects caused by activities authorized by the NWP and whether those cumulative adverse environmental effects are no more than minimal. The district engineer will also consider site specific factors, such as the environmental setting in the vicinity of the NWP activity, the type of ecosystem that will be affected by the NWP activity, the functions provided by the aquatic ecosystems that will be affected by the NWP activity, the degree or magnitude to which the aquatic ecosystems perform those functions, the extent that aquatic ecosystem functions will be lost as a result of the NWP activity (e.g., partial or complete loss), the duration of the adverse effects (temporary or permanent), the importance of the aquatic ecosystem functions to the region (e.g., watershed or ecoregion), and mitigation required by the district engineer. If an appropriate functional or condition assessment method is available and practicable to use, that assessment method may be used by the district engineer to assist in the minimal adverse environmental effects determination. These criteria are listed in the NWPs in Section D, “District Engineer’s Decision.” The district engineer may add case-specific special conditions to the NWP authorization to address site-specific environmental concerns.

For a proposed NWP activity that may result in more than minimal individual adverse environmental effects, the district engineer will provide the applicant the opportunity to submit a mitigation proposal to reduce the adverse environmental effects so that they are no more than minimal (33 CFR 330.1(e)(3)). If the applicant cannot or will not submit an acceptable mitigation proposal to reduce the adverse environmental effects of the proposed NWP activity so that they are no more than minimal, the district engineer will exercise discretionary authority and require an individual permit for that activity (33 CFR 330.1(d)).

Additional conditions can be placed on NWP authorizations on a regional or activity-specific basis by division or district engineers to comply with applicable laws (e.g., section 7 of the Endangered Species Act and section 106 of the National Historic Preservation Act) and ensure that the authorized activities have no more than minimal individual and cumulative adverse environmental effects. Regional conditions added to this NWP by division engineers will be used to account for differences in aquatic ecosystem functions, services, and values across the country, ensure that the NWP authorizes only those activities with no more than minimal individual and cumulative adverse environmental effects. Regional conditions also allow each Corps district to prioritize its workload based on where its efforts will best serve to protect the aquatic environment and other relevant public interest review factors. Regional conditions can restrict or prohibit the use of an NWP in certain waters (e.g., high value waters or specific types of wetlands or waters. Specific NWPs can also be revoked on a geographic or watershed basis where the individual and cumulative adverse environmental effects resulting from the use of those NWPs are more than minimal.

Under 33 CFR 330.4(f)(2), for an NWP activity proposed by a non-federal permittee, the district engineer will review the pre-construction notification to determine if ESA section 7 consultation is required for that activity. If the district engineer determines that the proposed NWP activity may affect listed species or designated critical habitat, ESA section 7 consultation will be conducted with the U.S. Fish and Wildlife Service (U.S. FWS) or National Marine Fisheries Service (NMFS) depending on which species the district engineer determined may be affected by the proposed

NWP activity. During the ESA section 7 consultation process the U.S. FWS or NMFS will evaluate the effects of the action caused by the proposed NWP activity, the status of the species and critical habitat, and the consequences of other activities that are caused by the proposed action but that are not part of the action that are reasonably certain to occur within the action area. For formal ESA section 7 consultations, the U.S. FWS or NMFS will formulate their opinion as to whether the proposed NWP activity is likely to jeopardize the continued existence of listed species (or species proposed for listing) or result in the destruction or adverse modification of critical habitat (or critical habitat proposed for such designation) (see 50 CFR 402.14(g)). The ESA section 7 consultation requirements may also be fulfilled through informal consultation, when the U.S. FWS or NMFS provide their written concurrence that a proposed NWP activity is not likely to adversely affect endangered or threatened species or their designated critical habitat (see 50 CFR 402.13(c)).

4.2.2 Cumulative impacts

The activities authorized by this NWP must result in no more than minimal cumulative adverse environmental effects (see 33 USC 1344(e)(1); also see 33 CFR 322.2(f)(1) and 33 CFR 323.2(h)(1)). The cumulative impacts caused by the issuance of this NWP are the collective impacts on the environment across the country that are directly or indirectly caused by the use of this NWP to authorize discharges of dredged or fill material into waters of the United States under section 404 of the Clean Water Act and work in navigable waters of the United States under section 10 of the Rivers and Harbors Act of 1899 during the period it is anticipated to be in effect (i.e., five years or less). The cumulative impacts to the current environmental setting that are anticipated to be caused by activities authorized by this NWP during the next five years are evaluated against the current environmental setting to determine whether those cumulative impacts will be no more than minimal (for the purposes of general permit authorization) and will not have a reasonably foreseeable significant impact on the quality of the human environment, for the purposes of the National Environmental Policy Act.

The evaluation of cumulative impacts on the current environmental setting also needs to take into account activities authorized by other forms of DA authorization that will occur during the five year period this NWP is in effect, because activities authorized by standard individual permits, letters of permission, other NWPs, regional general permits, and programmatic general permits are also likely to cause direct and indirect environmental effects, including effects on aquatic ecosystems.

The evaluation of cumulative impacts on the current environmental setting must also take into account the direct and indirect environmental impacts caused by activities conducted by other federal, non-federal, and private entities across the country that do not require DA authorization and are likely to occur concurrently with the activities authorized by this NWP during the five-year period it is likely to be in effect. Examples of the activities that can alter the structure and functions of aquatic ecosystems and are not subject to the Corps' permitting authorities include changes in upland land use, discharges of pollutants regulated under section 402 of the Clean Water Act, non-point sources of pollution, harvesting species that inhabit waters and wetlands, and species introductions. Additional examples of activities not regulated by the Corps that directly and indirect affect the structure and functions of aquatic ecosystems and the services they may perform are provided in Table A-12.

The activities authorized by this NWP, activities authorized by other forms of DA authorization (e.g., individual permits, regional general permits), and the activities conducted by other federal, non-federal, and private entities across the country that do not require Department of the Army authorization will interact with each other and may cause changes to the current environmental setting, including the structure and functions of aquatic ecosystems, and the ecosystem services they may provide. As discussed further in this section, those interactions may be additive, synergistic, or antagonistic. The assessment of cumulative impacts, especially at the large geographic scale covered by this environmental assessment (i.e., the United States and its territories, where the NWP can be used) is a difficult task for numerous reasons, such as: The complexities of aquatic ecosystems and the landscapes and seascapes they are located in are complex and our limited understanding of those systems (Harris and Heathwaite 2012); (2) the multitude of contributors to cumulative impacts; (3) the various ways in which the contributors to cumulative impacts can interact with each other; and (4) the challenges in determining whether a change in ecosystem structure and functions is caused by a specific activity or type of activity.

Based on reported use of this NWP during the period of March 15, 2021, to March 14, 2024, the Corps estimates that this NWP will be used approximately 15 times per year on a national basis, resulting in impacts to approximately 6 acres of waters of the United States, including jurisdictional wetlands. All activities authorized by this NWP require pre-construction notification to the district engineer.

Based on reported use of this NWP during that time period, the Corps estimates that 9 percent of the NWP 44 verifications will require compensatory mitigation to offset the authorized impacts to waters of the United States and ensure that the authorized activities result in only minimal adverse effects on the aquatic environment. The verified activities that do not require compensatory mitigation will have been determined by Corps district engineers to result in no more than minimal individual and cumulative adverse effects on the aquatic environment without compensatory mitigation. During the period of 2026 to 2031, the Corps expects little change to the percentage of NWP 44 verifications requiring compensatory mitigation, because there have been no substantial changes in the mitigation general condition or the NWP regulations for determining when compensatory mitigation may be required for NWP activities. The Corps estimates that approximately one acre of compensatory mitigation will be required each year to offset authorized impacts. The demand for these types of activities could increase or decrease during the five year period this NWP is anticipated to be in effect.

Based on these annual estimates, the Corps estimates that approximately 75 activities could be authorized until this NWP expires, resulting in impacts to approximately 30 acres of waters of the United States, including jurisdictional wetlands. Approximately 5 acres of compensatory mitigation would be required to offset those impacts. During the period this NWP is in effect, the individual and cumulative impacts on the aquatic environment caused by activities authorized by this NWP are expected to result in only minor changes to the current environmental setting at the scale at which this NWP is issued (i.e., the United States and its territories), which is described in Appendix A of this document. Division engineers have the authority to modify, suspend, or revoke this NWP in a particular geographic region (e.g., a Corps district, state, watershed, or seascape) if they believe those discharges of dredged or fill material into waters of the United States are likely to result in more than minimal individual and cumulative adverse environmental effects in the identified geographic region (see 33 CFR 330.5(c)). District engineers have the authority to modify, suspend, or revoke this NWP on a case-by-case basis if they determine those discharges of dredged or fill material into waters of the United States are likely to result in more than minimal individual and cumulative adverse environmental effects on the project site (see 33 CFR 330.5(d)).

Cumulative impacts result from the accumulation of direct and indirect impacts caused by multiple activities in a particular geographic area that persist over time (MacDonald 2000). Substantial changes in ecosystem structure and function are usually the result of the cumulative impacts of multiple disturbances (Hughes et al. 2013, Levin and Mollmann 2015, Scheffer and Carpenter 2003) and other drivers of ecosystem change.

Human activities that disturb ecosystems may interact with each other and cause larger impacts than expected, and natural variation in those ecosystems may also affect the severity of cumulative impacts (Clarke Murray et al. 2014). Disturbances are anthropogenic and natural events that change the structure and/or functions of an ecosystem, usually in a substantial manner (Clewell and Aronson 2013). Those changes may be temporary or permanent, depending on the ecological resilience of the ecosystem and whether thresholds are crossed (Suding and Hobbs 2008).

Cumulative impacts have also been defined as being produced by the interactions of multiple activities within a landscape, such as a watershed or ecoregion (Gosselink and Lee 1989). Cumulative impacts can also occur at a continental scale (Gosselink and Lee 1989). In coastal areas and ocean waters, the counterpart to a landscape unit for evaluating cumulative impacts would be a seascape. A seascape consists of marine and estuarine waters and their adjacent coastal lands (Pungetti et al. 2012). Since cumulative impacts occur at a broad geographic scale, it is usually difficult to clearly establish cause-and-effect relationships between the numerous activities that contribute to cumulative impacts and the ecosystems' responses to those multiple activities (Gosselink and Lee 1989). In a watershed or other type of ecological system, at any point in time there are numerous activities that overlap in space and time, which makes it difficult to establish precise causal linkages between specific activities, their impacts, and ecological outcomes (Harris and Heathwaite 2012).

All ecosystems are subjected to multiple disturbances that cause cumulative impacts to those ecosystems (Hodgson et al. 2019, Hodgson and Halpern 2018, Suding and Hobbs 2009). Cumulative impacts to aquatic ecosystems and other ecosystems include all human activities that can affect those ecosystems, and extend well beyond the activities authorized by this NWP. Cumulative impacts to aquatic ecosystems are caused by a variety of human activities (see section A.3 of Appendix A for a discussion and list of those activities). Natural disturbances may also contribute to cumulative impacts to aquatic ecosystems and other ecosystems, because they have to potential to change ecosystem structure and functions. Cumulative impacts have gained a substantial human component because of the numerous activities conducted by people as they interact with their environment (Crain et al. 2008).

Contributors to cumulative impacts are not limited to activities that are regulated by a single agency, but they also include activities that are not regulated by that agency (Gosselink et al. 1990). Therefore, cumulative impact assessment should consider the impacts of multiple projects that occur in a region, as well as other human activities that are not considered "projects" per se, such as on-going agricultural activities, forestry activities, urbanization, and fossil fuel consumption (Spaling 1994) that are not subjected to environmental review by any entity (Hunsicker et al. 2016) but are likely to directly or indirectly affect ecosystem structure and functions. Some "non-project" contributors to cumulative impacts may be identified in a cumulative impact analysis but there may be other non-project contributors to cumulative impacts that cannot be identified (Spaling 1994) by the entity conducting the cumulative impact assessment.

Disturbances from various anthropogenic sources interact with each other to cause additional indirect or higher order effects to ecosystems (Hodgson and Halpern 2018). Therefore, when assessing cumulative impacts, it is important to consider not only the multitude of human activities and natural disturbances that contribute to cumulative impacts to aquatic ecosystems and other ecosystems, but how those disturbances interact with each other. There are a number of different ways in which impacts caused by human activities and natural disturbances can interact with each other and potentially change the structure and functions of ecosystems, which presents additional challenges to assessing cumulative impacts and where or not they are more than minimal or significant. Because of the complexity of ecological systems and potential higher order interactions among disturbances that are likely to affect ecosystem components, it is difficult to predict how cumulative impacts will change ecosystem structure and functions (Crain et al. 2008). There is substantial uncertainty in determining the severity of cumulative impacts because we do not fully understand how various disturbances interact with each other, and with ecosystem components, over space and time (Clarke Murray et al. 2014), and how those interactions control or influence ecological processes (Groffman et al. 2006).

Interactions among human and natural disturbances to ecosystems may by additive, synergistic, or antagonistic (Côté et al. 2016, Kelly et al. 2014, Crain et al. 2008). Under an additive interaction, an ecosystem's response to two or more disturbances is the sum of those disturbances (Côté et al. 2016). Under a synergistic interaction, an ecosystem's response to two or more disturbances is greater than the response from each disturbance (Côté et al. 2016). That is, for synergistic interactions the collective effects are more severe than they would be if they were simply added together. Under an antagonistic interaction, an ecosystem's response to two or more disturbances is smaller than the response from each disturbance (Côté et al. 2016). In other words, for antagonistic interactions the collective effects are less than they would be if they were added together. As the number of anthropogenic and natural disturbances affecting an ecosystem increases, the likelihood of more complex interactions among those disturbances increases (Crain et al. 2008). When there are multiple disturbances acting on an ecosystem at the same time, it is difficult to identify which types of disturbance interactions are occurring (Côté et al. 2016).

Many cumulative impact assessment methods assume additive interactions between disturbances and ecosystem components, but broader ecological studies show that synergistic and antagonistic interactions among disturbances are common (Korpinen and Andersen 2016). Some cumulative impact assessments assume that synergistic interactions are the most common form of disturbance interaction, and more consideration needs to be given to antagonistic and additive interactions (Côté et al. 2016). Assuming that all or most interactions among disturbances are synergistic interactions can lead to a false conclusion that ecosystem structure and functions have become more degraded than they actually have been. To avoid such false conclusions, it is important to consider antagonistic and additive disturbance interactions (Côté et al. 2016) when evaluating cumulative impacts and whether it is necessary to respond to those types of cumulative impacts. Côté and others (2016) recommend that natural resource managers consider that synergistic, antagonistic, and additive interactions among disturbances are equally likely to occur. In watersheds, cross-scale interactions between patterns and processes, multiple disturbances or stressors, and the organisms that inhabit those watersheds, as well as our limited understanding of these complex, adaptive, nonlinear systems (Harris and Heathwaite 2012) produces unavoidable uncertainty that poses challenges to making management decisions, including decisions regarding actions to respond to cumulative impacts.

For activities authorized by this NWP, the contribution of those activities to cumulative impacts on the structure and functions of jurisdictional waters and wetlands is dependent in part on how the disturbances cause by NWP activities interact with the disturbances caused by other human activities and natural events that occur during the period this NWP is in effect. Those interactions may be additive, synergistic, and/or antagonistic. Cross-scale interactions among ecosystems and disturbances are also likely to occur over geographic scales such as landscapes, watersheds, and seascapes, to further complicate the evaluation of cumulative impacts. The specific types of interactions that occur among NWP activities and other anthropogenic disturbances may vary by aquatic ecosystem types and geographic regions. The interactions that occur may also depend on the degree to which the affected jurisdictional waters and wetlands perform ecological functions and services, the categories of human activities and natural disturbances that affect the structure and function of jurisdictional waters and wetlands in that region, and other factors. The complexity of aquatic ecosystems, the potential types of interactions among the various causes of disturbance that can occur, and other factors make it difficult to predict how aquatic ecosystems in a particular region will respond to the cumulative impacts of the activities authorized by this NWP, activities authorized by other forms of DA authorization, and other activities that are not subject to the Corps' permitting authorities. Because of this uncertainty, a monitoring and reactive approach to addressing cumulative impacts through the division and district engineer's authority to modify, suspend, or revoke NWP authorization on a regional or activity-specific basis is likely to be the most effective approach for ensuring in a particular region that this NWP authorizes only those activities that have no more than minimal cumulative adverse environmental effects.

All ecosystems are subject to disturbances, and it is the type, magnitude, and frequency of disturbances that causes an ecosystem to either: (1) maintain its structure and functions, (2) improve its structure and functions, or (3) exhibit a decline in its structure and functions (Spaling 1994). All ecosystems have some capacity to assimilate various amounts of disturbances without degrading ecosystem structure or functions (Spaling 1994). Potential ecosystem responses to multiple disturbances should take into account ecosystem dynamics, because ecosystems are not static and they are constantly changing in response to anthropogenic and natural drivers of environmental change as well as their internal processes that influence species composition and abundance (Clewell and Aronson 2013). Cumulative impact assessment should consider how aquatic ecosystems and other ecosystems respond to multiple and overlapping disturbances, and whether those ecosystems will continue to maintain their structure and functions or change their structure and functions to one or more alternative states.

Ecosystems are complex adaptive systems that self-organize in response to changes in environmental and biological drivers at various scales (Levin 1999), including human activities. Complexity imposes basic limits on what people can know and predict, so it is necessary to learn to expect surprises as ecosystems change (Harris and Heathwaite 2012). Ecosystem complexity is due to variability in the physical environment, stochastic variations in ecological processes, and differences in how anthropogenic and natural disturbances affect those ecosystems (Clewell and Aronson 2013). Ecosystem complexity poses challenges in attempting to predict when, and whether, cumulative impacts will alter the structure and functions of the ecosystems being assessed. Other factors, including ecological resilience and potential ecological thresholds may also influence how ecosystems respond to various disturbances.

Ecological science has altered its understanding of how ecosystems change over time, from static models based on equilibrium and predictable behavior to complex, dynamic models that are based on non-equilibrium and unpredictable behavior that accounts for the complexity and non-linearity of ecosystem dynamics (Wallington et al. 2005). Some ecosystems may exhibit gradual, continuous overall responses to multiple disturbances, while other ecosystems exhibit more complex dynamics, expressing little or no change in structure and functions in response to multiple disturbances until a threshold is reached where those ecosystems undergo abrupt, discontinuous (i.e., non-linear) changes in structure and functions (Wallington et al. 2005, Scheffer et al. 2001). Non-linear threshold dynamics in ecosystems are more difficult to predict than linear ecosystem responses to disturbances (Foley et al. 2015). Most ecosystems exhibit complex dynamics, especially as human activities have had increasing cumulative impacts on these systems (Suding and Hobbs 2009) over time.

Most ecosystems can tolerate disturbances and continue to provide ecological functions and services until they reach an ecological threshold that when crossed, causes the ecosystem to change to an alternative state with a substantially different structure and functions (Selkoe et al. 2015, Hunsicker et al. 2016, Suding and Hobbs 2009, Groffman et al. 2006, Scheffer et al. 2001). An ecological threshold is a point where a small change in environmental conditions caused by one or more disturbances results in an ecosystem undergoing a large, non-linear change in its structure and function (Kelly et al. 2015, Suding and Hobbs 2009, Groffman et al. 2006). Abrupt changes in ecosystem structure and function caused by crossing a threshold may occur when human activities reduce the resilience of those ecosystems (Folke et al. 2004). For many ecosystems it generally takes a substantial amount of collective disturbances (i.e., cumulative impacts) to cause an ecosystem to cross a threshold and abruptly change to a different structure and functions (Scheffer et al. 2001, Selkoe et al. 2015). However, some ecosystems may have a lower capacity to absorb disturbances and resist change because they are currently near an ecological threshold where a small amount of additional disturbance may cause the ecosystem to change to a different structure and functions (Selkoe et al. 2015).

Non-linear ecosystem dynamics and thresholds apply to a wide variety of ecosystems, but not all ecosystems (Foley et al. 2015, Groffman et al. 2006, Suding and Hobbs 2009). Threshold dynamics in ecosystems are strongly influenced by human activities (Suding and Hobbs 2009). Non-linear ecosystem dynamics and threshold responses are common in marine ecosystems (Hunsicker et 2016). Numerous aquatic ecosystems (e.g., lakes, coral reefs, oyster reefs, fish communities) can shift between alternative states instead of exhibiting gradual responses to disturbances and changing environmental conditions (Scheffer et al. 2001). Ecological thresholds associated with shifts to alternative states have also been observed in terrestrial ecosystems (Groffman et al. 2006). Ecological thresholds are more difficult to identify in terrestrial ecosystems because those ecosystems change more slowly (Groffman et al. 2006). It is also more challenging to identify thresholds in ecosystems that respond more slowly to disturbances, and to develop effective management responses when those ecosystems change to an alternative state (Hughes et al. 2013).

Resilience is the ability of ecosystems to withstand or absorb disturbance while maintaining their basic structure and functions (Suding and Hobbs 2009, Walker and Salt 2006, Folke et al. 2004). An ecosystem with greater resilience can absorb more disturbances than an ecosystem with lower resilience (Kelly et al. 2014). Resilience is linked to non-linear dynamics, where an ecosystem can absorb disturbances to some degree before approaching an ecological threshold where an additional amount of disturbance causes that ecosystem to abruptly change to a different structure and functions (Kelly et al. 2014). Loss of resilience can increase an ecosystem's susceptibility to changing to a different structure and functions, and some changes to alternative states may be irreversible (Folke et al. 2004). Human activities can affect the resilience of ecosystems by changing their biotic composition and how those ecosystems respond to disturbances (Suding and Hobbs 2009). Examples of human activities that can reduce the resilience of ecosystems, and the ability of those ecosystems to sustain their structure and functions after being subjected to disturbances, include land use changes, pollution, resource exploitation, changes in disturbance regimes, and changes in environmental conditions (Folke et al. 2004). Activities authorized by this NWP may also contribute to decreases in aquatic ecosystem resilience, but those contributions are likely to be insignificant because of the wide variety of potential disturbances outside of the Corps' jurisdictional authority to which ecosystems are exposed.

Aquatic ecosystems may exhibit linear or non-linear ecosystem dynamics in response to direct and indirect impacts caused by activities authorized by this NWP and other anthropogenic and natural disturbances. Therefore, there is uncertainty in how these aquatic ecosystems will respond to activities authorized by this NWP and other disturbances. Depending on the degree to which aquatic ecosystems are resilient to disturbances caused by activities authorized by this NWP and to other anthropogenic and natural disturbances, some aquatic ecosystems in a watershed or other region may exhibit little or no change in structure and functions during the period this NWP is in effect. Under these circumstances, the use of this NWP during the period it is in effect could be considered as resulting in no more than minimal cumulative adverse environmental effects. There may be waterbodies, watersheds, or other regions where jurisdictional waters and wetlands are at or near ecological thresholds that where additional disturbances, including disturbances caused by activities authorized by this NWP, may cause those aquatic ecosystems to shift to an alternative state with substantially different structure and functions. In those situations, division and district engineers will determine whether activities authorized by this NWP were responsible for the substantial changes in structure and functions of the aquatic ecosystems in that region, and may take action to modify, suspend, or revoke the NWP in that region or modify, suspend, or revoke the NWP authorization for specific activities in that region.

Current environmental laws (e.g., the Clean Water Act, the National Environmental Policy Act) were passed in the late 1960s and early 1970s, before ecological science began to understand that many ecosystems exhibit non-linear responses to disturbances (Kelly et al. 2014). Therefore, those environmental laws assume that ecosystems exhibit linear responses to disturbances. Activities authorized by this NWP during the period it is in effect may, or may not, alter the structure, functions, and dynamics of aquatic ecosystems, and the responses of those ecosystems to multiple disturbances may be linear or non-linear. In most cases, our current understanding of aquatic ecosystems or other ecosystems is not sufficient for predicting how they are likely to respond to single disturbances or multiple disturbances (Clarke Murray et al. 2014, Kelly et al. 2014, Suding and Hobbs 2009, Cocklin et al. 1992).

Cumulative impacts are evaluated against the current environmental setting, and the current environmental setting is the product of environmental change (Cocklin et al. 1992) that has occurred over many years over broad geographic areas (e.g., landscapes, seascapes) as a result of a variety of human activities and natural disturbances. For a particular ecosystem, its response to cumulative impacts may be dependent on the current condition of that ecosystem (Clarke Murray et al. 2014), which may not be well understood with currently available information. Ecological thresholds can provide useful, science-based targets for environmental regulation (Kelly et al. 2014), including the evaluation of the cumulative impacts to ecosystems caused by multiple human activities and natural disturbances. However, because of ecosystem complexity and dynamics, our incomplete understanding of these ecosystems, incomplete information about the current functions and services provided by these ecosystems, whether a particular ecosystem is near an ecological threshold where it might be more susceptible to transforming to an alternative state, incomplete information about other concurrent activities that might affect ecosystem structure and functions, and other information gaps make it difficult to predict whether or not the cumulative use of this NWP during the five year period it is in effect may, or may not, cause no more than minimal adverse cumulative effects.

Because this NWP authorizes activities across the United States and its territories, for the issuance of this NWP, the analysis of cumulative impacts would be the accumulation of impacts caused by activities authorized by this NWP during the period it is in effect (i.e., no more than five years), and how those accumulated impacts could affect the current environmental setting within the United States and its territories. The effects of those accumulated impacts on ecosystem structure and functions are also dependent on how the impacts authorized by this NWP interact (i.e., synergistically, antagonistically, or additively) with impacts caused by other federal, non-federal, and private actions that occur during the period this NWP is in effect, because the activities conducted under this NWP cannot be isolated from those federal, non-federal, and private actions, or from activities that are authorized by other forms of DA authorization, such as individual permits and regional general permits. During the five year period this NWP is in effect, it is the collective impacts of all of these activities that may alter the structure and functions of the ecosystems being evaluated for cumulative impacts.

Cumulative impact analysis can utilize either a stressor-based approach or an effects-based approach (e.g., Duinker et al. 2013, Dubé 2003, Cocklin et al. 1992). A stressor-based approach evaluates the cumulative effects caused by a specific type of disturbance or cause of environmental change (Cocklin et al. 1992). A stressor-based approach to cumulative impact assessment does not take into account other potential anthropogenic or natural disturbances that may also cause changes in ecosystem structure and functions (Duinker et al. 2013, Noble 2010). A stressor-based approach to cumulative impact assessment is unlikely to be effective in identifying and implementing management actions that could reduce or reverse those cumulative impacts because it might not identify all of the primary drivers of change in aquatic ecosystem structure and functions. With respect to the activities authorized by this NWP, under a stressor-based approach to cumulative impact analysis, those NWP activities might not be a substantial driver of changes in aquatic ecosystem structure and functions in a waterbody, watershed, or other geographic region.

In contrast to a stressor-based approach, an effects-based approach to cumulative impact analysis uses a broader definition of “cumulative impact” and thus takes into account the various categories of human activities (including NWP activities) and natural disturbances that contribute to cumulative environmental change. An effects-based approach to cumulative impact assessment is likely to be more robust than a stressor-based approach (Duinker et al. 2013, Duinker and Greig 2006). The complexity associated with the various categories of anthropogenic and natural disturbances that affect aquatic ecosystems and how they interact with each other present challenges with decision-making and management of cumulative impacts for a particular category of anthropogenic disturbance, such as activities authorized by this NWP. Those challenges arise because other anthropogenic disturbances, not activities authorized by this NWP, may be the primary drivers of substantial changes in ecosystem structure and functions in the areas where this NWP can be used to authorize activities regulated by the Corps. An effects-based approach to cumulative impact analysis may help point managers and decision-makers to broader courses of actions to respond to cumulative impacts and help support the sustainability of ecosystems in a region and their ability to provide ecological functions and services (e.g., Duinker and Greig 2006, Gosselink et al. 1990).

Because of the numerous categories of anthropogenic activities that contribute to cumulative effects to aquatic ecosystems, and the fact that activities authorized by this NWP do not occur in isolation from those other human activities, a stressor-based approach is not appropriate for an environmental assessment to determine whether the issuance of this NWP might cause more than minimal cumulative adverse environmental effects in the United States and its territories. In other words, during the period this NWP is in effect it is the interactions among: (1) the current environmental setting (i.e., the environmental baseline); (2) activities authorized by this NWP; (3) activities authorized by other forms of DA authorization; and (4) federal, non-federal, and private activities that the Corps does not have the authority to regulate (see section A.3 of Appendix A of this document) that have substantial influence on cumulative impacts that may, or may not, change the structure and functions of aquatic ecosystems within the geographic scope of the cumulative impact analysis. Therefore, this environmental assessment takes an effects-based approach to evaluating cumulative impacts of the proposed action and its alternatives.

There are a number of ecological considerations that should be taken into consideration when evaluating cumulative impacts, including the cumulative impacts of one category of activities (e.g., activities authorized by this NWP), that can alter or disrupt ecological processes and affect the structure and functions of jurisdictional waters and wetlands and other aquatic ecosystems and the services they provide. Those ecological considerations include: (1) the difficulties of establishing cause-and-effect relationships between a specific category of anthropogenic or natural disturbance and changes in ecosystem structure and functions; (2) evaluating how various types of anthropogenic and natural disturbances interact with each other; (3) ecosystem dynamics; (4) and ecological thresholds in ecosystems that exhibit non-linear dynamics. Cumulative effects analysis should take into account the complexity, uncertainty, and natural variation of ecosystems (Clarke Murray et al. 2014). Another challenge with cumulative impact assessment in practice is that there are currently substantial gaps in our ecological understanding of how multiple anthropogenic and natural disturbances interact with each other to cause changes to ecosystems and the ecological functions and services they provide (Hodgson et al. 2019, Côté et al. 2016, Clarke Murray et al. 2014).

When the capacity of a waterbody to perform ecological functions decreases substantially, it is usually difficult to identify one specific activity that is responsible for that degradation, because that degradation is usually the result of multiple anthropogenic disturbances that caused cumulative environmental change in that waterbody (Dubé 2003). When considering cumulative impacts to aquatic ecosystems caused by a specific category of anthropogenic disturbances, firmly establishing a cause-and-effect relationship between that disturbance category and subsequent environmental change is difficult because of the complexity of these ecosystems, their dynamic nature, and the many categories of human activities and natural disturbances that can affect their structure and function (e.g., Korpinen and Andersen 2016, Clarke Murray et al. 2014, Cocklin et al. 1992). Establishing a decisive cause-and-effect relationship between the use of the NWP in a region and substantial changes in the structure and functions of aquatic ecosystems in that region is difficult because of the greater likelihood that those substantial changes were caused by a combination of human activities and natural disturbances that affect the structure and function of those aquatic ecosystems. NWP activities occur concurrently with other human activities and natural disturbances, and the collective disturbances caused by human activities are the causes of cumulative change in aquatic ecosystems. Slowly-occurring changes to ecosystem structure and functions can also make it difficult to identify cause-and-effect linkages between disturbances and changes in ecosystem structure and function, making decision-making for regulatory and resource agencies more challenging (Hughes et al. 2013, Kelly et al. 2015).

Attempting to manage cumulative effects requires an understanding all of the various anthropogenic and natural disturbances that can affect the ecosystem(s) being evaluated, not just the disturbances caused by a specific category of activities (Noble 2010). Therefore, all of those human activities and natural disturbances should be considered when assessing cumulative effects and determining whether there are appropriate management actions that could be required under the Corps' permitting authorities (and any other applicable federal, tribal, state, and local regulatory authorities) to address substantial cumulative adverse environmental effects. Because of the variety of human activities and natural disturbances that contribute to cumulative environmental change, resource managers should also understand that cumulative impacts are likely to continue to occur even if one particular of category of activities (e.g., the activities authorized by this NWP) is prohibited from occurring in that region for the foreseeable future.

Ecological thresholds can guide decision-making for regulatory programs (Kelly et al. 2014) for ecosystems with non-linear dynamics. However, it is difficult to predict where these thresholds are, and ecosystems may exhibit little change before a threshold is reached (Scheffer et al. 2009). If an ecological threshold exists, it may be difficult to identify because many thresholds are not known to exist until after an ecosystem has changed to an alternative state, especially if the ecosystem has resisted change after being exposed to multiple disturbances (Selkoe et al. 2015). Ecological thresholds are less useful for decision-making for ecosystems that have linear dynamics, because they change gradually in response to multiple disturbances over time, with no discernable threshold. Thresholds may be a critical tool for evaluating the significance of cumulative impacts (Duinker et al. 2013). Identifying ecological thresholds requires gathering sufficient information to better understand ecosystem dynamics and reduce uncertainty about where ecological thresholds may occur and under what circumstances they may be reached (Kelly et al. 2014) and cause the ecosystem to exhibit a substantial change in structure and functions. In addition, ecological thresholds are likely to change as ecosystems change over time, and it may be difficult to predict where an ecological threshold will exist in the future (Standish et al. 2014). Another factor to consider regarding the use of ecological thresholds in decision-making is that slower transitions to alternative states (i.e., substantial changes in ecosystem structure and functions) can be more difficult to identify and manage than sudden transitions to alternative states (Hughes et al. 2013). In some ecosystems, these transitions can take decades, centuries, or longer to occur (Hughes et al. 2013). Therefore, the utility of ecological thresholds in decision-making by Corps divisions and districts, as well as natural resource managers, is dependent on how quickly these transitions shifts are likely to occur in a particular ecosystem.

Implementing an approach to use ecological thresholds to make decisions regarding cumulative environmental change and shifts to alternative states has a number of challenges, such as the difficulty of identifying useful thresholds and the possibility that some for ecosystems it might not be possible to identify practical thresholds (Duinker and Greig 2006). The identification of ecological thresholds is also complicated by the complexity of interactions between ecosystems, geography, local environmental factors, and large-scale environmental factors, and how ecosystems respond to disturbance (Standish et al. 2014). In addition, thresholds are likely to vary by specific ecosystems, with individual ecosystems having different thresholds, depending on site-specific and regional characteristics, including the types of disturbances a particular ecosystem is subjected (Groffman et al. 2006). Because of the difficulty in identifying thresholds in advance of an ecosystem shifting to a substantially different structure and functions, the most certain way to identify thresholds in ecosystems is to observe when a change to a substantially different structure and functions occurs (Kelly et al. 2014, Selkoe et al. 2015).

For jurisdictional waters and wetlands that exhibit non-linear responses to multiple disturbances, including disturbances caused by NWP activities, the “more than minimal cumulative adverse environmental effects” threshold could be interpreted as the occurrence of a substantial change in structure and functions after an ecological threshold is crossed. In other words, cumulative effects caused by activities authorized by this NWP during the period it is in effect would be no more than minimal if the aquatic ecosystems within the regional spatial scale at which cumulative effects are assessed (e.g., a waterbody, watershed, county, state, or Corps district) exhibit little or no change in aquatic ecosystem structure and functions during that time period.

For jurisdictional waters and wetlands that exhibit linear (additive or gradual) responses to multiple disturbances, including disturbances caused by NWP activities, the “more than minimal cumulative adverse environmental effects” threshold is more difficult to define ecologically because each disturbance causes an incremental change in the structure and function of that aquatic ecosystem. For jurisdictional waters and wetlands that exhibit linear responses to multiple disturbances, division and district engineers would have to exercise their judgment as to when the “more than minimal cumulative adverse environmental effects” threshold is exceeded in a particular region.

Because of differences between non-linear and linear responses by ecosystems to cumulative impacts, and other variables such as aquatic ecosystem resilience, the degree to which aquatic ecosystems have been affected by past human activities and natural disturbances, and gaps in understanding how aquatic ecosystems respond to multiple, interacting disturbances, a reactive approach by division and district engineers to address the potential cumulative adverse environmental effects caused by activities authorized by this NWP during the period it is in effect is warranted. If division and district engineers observe that jurisdictional waters and wetlands in a region are undergoing substantial changes in structure and function, they can take actions under 33 CFR 330.5(c) and (d) to modify, suspend, or revoke that NWP in that geographic area.

Cumulative impact analysis involves uncertainty because of our limited understanding of ecosystems, including aquatic ecosystems, and how various human activities and natural disturbances affect the structure and function of those ecosystems (Clarke Murray et al. 2014). An additional challenge to assessing cumulative impacts is the difficulty of quantifying the response of an ecosystem to a specific disturbance, including the degree to which that disturbance affects the structure and functions of that ecosystem (Clarke Murray et al. 2014). Furthermore, if ecosystem response to a particular disturbance is difficult to quantify, then it is likely to be even more difficult to quantify how an ecosystem responds to the cumulative impacts of multiple disturbances and other drivers of ecosystem change. These factors point to the challenges and difficulties in quantifying cumulative impacts and determining whether or not they are likely to have a reasonably foreseeable significant impact on the quality of the human environment.

The use of thresholds for determining the significance or severity of cumulative impacts should focus on the use of ecological thresholds, rather than regulatory thresholds, because regulatory thresholds are typically not based on ecological concepts (Duinker et al. 2013), such as ecosystems dynamics in response to multiple disturbances and other drivers. In addition, some regulatory thresholds, especially qualitative thresholds (e.g., an environmental change that is “no more than minimal”), are subjective, and present challenges in defining that regulatory threshold and how to apply it to decision-making. Compared to regulatory thresholds, one advantage that ecological thresholds have as an environmental decision-making tool is that ecological thresholds are not arbitrary because they are based on observable biophysical ecosystem responses (Kelly et al. 2015).

This qualitative assessment of cumulative impacts that may be caused by the issuance of this NWP is necessary because of the lack of data concerning: (1) the quantity of aquatic ecosystems across the country, (2) the degree to which those aquatic ecosystems perform various ecological functions and services, (3) the numbers, types, and impacts of federal, non-federal, and private actions across the country that may affect the structure and functions of aquatic ecosystems, (4) what types of interactions are likely to occur among the various anthropogenic disturbances to aquatic ecosystems, (5) the degree to which those aquatic ecosystems are resilient to disturbances, and (6) other data gaps. These data limitations make it difficult to conclude, with any confidence, that the issuance of this NWP is likely to cause more than minimal cumulative adverse environmental effects to aquatic ecosystems in the United States and its territories. However, because of the “no more than minimal cumulative adverse effects” is much lower than the threshold for requiring an environmental impact statement under NEPA, the issuance of this NWP will not have a reasonably foreseeable significant impact on the quality of the human environment.

Because the activities authorized by this NWP constitute only a small proportion of the categories of human activities across the country that directly and indirectly affect ocean waters, estuarine waters, lakes, wetlands, streams, and other aquatic resources, the activities authorized by this NWP during the period it is anticipated to be in effect are likely to result in only a minor incremental change to the jurisdictional waters and wetlands in the affected environment (i.e., the current environmental setting in the United States and its territories), and the ecological functions and services those waters and wetlands provide. Division and district engineers will monitor the use of this NWP on a regional and activity-specific basis, and under their authorities in 33 CFR 330.5(c) and (d), will modify, suspend, or revoke NWP authorizations in situations where those activities will result in more than minimal cumulative adverse environmental effects in a waterbody, watershed, or other geographic region.

If, during the period the NWP is in effect, Corps Headquarters determines that this NWP is resulting in more than minimal cumulative adverse environmental effects across the country, it will take action under 33 CFR 330.5(b) to modify, suspend, or revoke this NWP. At a regional scale, division and district engineers will take actions under 33 CFR 330.5(c) and (d) respectively, to modify, suspend, or revoke this NWP when they determine that the use of this NWP in a region or for a specific activity will result in more than minimal cumulative adverse environmental effects.

4.3 Impact Analysis for Alternatives to the Proposed Action

4.3.1 No Action Alternative (Do Not Modify or Reissue the Nationwide Permit)

The no action alternative would not achieve one of the goals of the Corps' Nationwide Permit Program, which is to regulate with little, if any, delay or paperwork certain activities having minimal impacts (33 CFR 330.1(b)). The no action alternative would also reduce the Corps' ability to pursue the current level of review for other activities that have greater adverse effects on the aquatic environment, including activities that require individual permits as a result of division or district engineers exercising their discretionary authority under the NWP program. The no action alternative would also reduce the Corps' ability to conduct compliance actions.

If this NWP is not available, substantial additional resources would be required for the Corps to evaluate these minor activities through the individual permit process, and for the public and federal, tribal, and state resource agencies to review and comment on the large number of public notices for these activities. In a considerable majority of cases, when the Corps publishes public notices for proposed activities that result in no more than minimal adverse environmental effects, the Corps typically does not receive responses to these public notices from either the public or federal, tribal, and state resource agencies. Therefore, processing individual permits for these minimal impact activities is not likely to result in substantive changes to those activities. Another important benefit of the NWP program that would not be achieved through the no action alternative is the incentive for project proponents to design their projects so that those activities meet the terms and conditions of an NWP. The Corps believes the NWPs have significantly reduced adverse effects to the aquatic environment because most applicants modify their activities that require DA authorization to comply with the NWPs and avoid the longer permit application review times and larger costs typically associated with the individual permit process.

Under the no action alternative, district engineers may issue regional general permits or programmatic general permits to authorize similar categories of activities that would have no more than minimal adverse environmental effects that could have been authorized by this NWP. However, those regional general permits or programmatic general permits may have different quantitative limits, different restrictions, and other permit conditions, and those quantitative limits, restrictions, and permit conditions may result in the authorization of activities that have greater, similar, or lesser adverse environmental effects than the activities that would have been authorized by this NWP. Under the no action alternative, there may be differences in consistency in implementation of the Corps Regulatory Program among Corps districts. District engineers can tailor their regional general permits and programmatic general permits to effectively address the specific categories of aquatic resources found in their geographic areas of responsibility, the specific categories of activities that occur in those geographic areas, and the ecological functions and services those categories of aquatic resources provide. The environmental consequences of this aspect of the no action alternative are more difficult to predict because of the potential variability of regional general permits and programmatic general permits among Corps districts across the country, when such general permits are available to authorize a similar category of activities as this NWP authorizes.

If this NWP is not reissued, districts would have to draft, propose, and issue regional general permits or programmatic general permits through the public notice and comment process and prepare applicable environmental documentation to support their decisions on whether to issue those regional general permits or programmatic general permits. It would take a substantial amount of time to issue those regional general permits and programmatic general permits, and in the interim proposed activities would have to be authorized through the individual permit process.

4.3.2 Reissue the Nationwide Permit With Modifications

This NWP was developed to authorize discharges of dredged or fill material into waters of the United States and work in navigable waters of the United States for mining activities that have no more than minimal individual and cumulative adverse environmental effects. The Corps has considered changes to the terms and conditions of this NWP suggested by comments received in response to the proposed rule, as well as modifying or adding NWP general conditions, as discussed in Appendix E of this document and the preamble of the Federal Register notice announcing the reissuance of this NWP.

Changing the terms and conditions of this NWP would likely result in changes the number of activities authorized by this NWP, and the environmental impacts of authorized activities. The environmental consequences of changing the terms and conditions of this NWP may vary, depending on whether modifications for the reissued NWP are more restrictive, less restrictive, or is similarly restrictive compared to previously issued versions of this NWP. The environmental consequences of changing the terms and conditions of this NWP are also dependent on the application of existing tools used to ensure that activities authorized by this NWP will only have no more than minimal adverse environmental effects. Those tools include the quantitative limits of the NWP, the pre-construction notification process, and the ability of division and district engineers to modify, suspend, or revoke this NWP on a regional or case-by-case basis.

Changing the national terms and conditions of this NWP may change the incentives for project proponents to reduce their proposed impacts to jurisdictional waters and wetlands to qualify for NWP authorization, and receive the required DA authorization for regulated activities in less time than it would take to receive individual permits for those activities. Under the individual permit process, the project proponent may request authorization for activities that have greater impacts on jurisdictional waters and wetlands, and may result in larger losses of aquatic resource functions and services.

The environmental consequences of division engineers exercising their discretionary authority to modify, suspend, or revoke this NWP on a regional basis may be a reduction in the number of activities that could be authorized by this NWP in a region or more NWP activities requiring pre-construction notification through regional changes in the PCN requirements for this NWP. The environmental consequences are likely to include reduced losses of waters of the United States because regional conditions can only further condition or restrict the applicability of an NWP (see 33 CFR 330.1(d)). The modification, suspension, or revocation of this NWP on a regional basis by division engineers may also reduce the number of activities authorized by this NWP, which may increase the number of activities that require standard individual permits. If more activities require standard individual permits, permitted losses of jurisdictional waters and wetlands may increase because standard individual permits have no quantitative limits.

An environmental consequence of regional conditions added to the NWPs by division engineers is the enhanced ability to address differences in aquatic resource functions, services, and values among different regions across the nation. Corps divisions may add regional conditions to the NWPs to enhance protection of the aquatic environment in a region (e.g., a Corps district, state, or watershed) and address regional concerns regarding jurisdictional waters and wetlands and other resources (e.g., listed species or cultural resources) that may be affected or impacted by the activities authorized by this NWP. Division engineers can also revoke an NWP in a region if the use of that NWP results in more than minimal adverse environmental effects, especially in high value or rare waters or wetlands. When an NWP is issued or reissued by the Corps, division engineers issue supplemental documents that evaluate potential impacts of the NWP at a regional level, and assess cumulative impacts caused by this NWP on a regional basis during the period this NWP is in effect. [33 CFR 330.5(c)]

An environmental consequence of district engineers modify, suspending, or revoking this NWP on a case-by-case basis is the ability of district engineers to address site-specific conditions, including the degree to which aquatic resources on the project site provide ecological functions and services. Activity-specific modifications may also address site-specific resources (e.g., listed species or cultural resources) that may be affected by NWP activities. The environmental consequences of modification of this NWP on an activity-specific basis by district engineers may be further reductions in losses of waters of the United States for specific activities authorized by NWP because of mitigation required by district engineers during their reviews of PCNs to ensure that those activities result in no more than minimal individual and cumulative adverse environmental effects (see 33 CFR 330.1(e)(3)). Examples of mitigation that may be required by district engineers include permit conditions requiring compensatory mitigation to offset losses of waters of the United States or conditions added to the NWP authorization to prohibit the permittee from conducting the activity during specific times of the year to protect spawning fish and shellfish. If a proposed NWP activity will result in more than minimal adverse environmental effects, then the district engineer will exercise discretionary authority and require an individual permit. The individual permit review process requires a project-specific alternatives analysis, including the consideration of off-site alternatives, and a public interest review.

4.3.3 Reissue the Nationwide Permit Without Modifications

Retaining the current terms and conditions of this NWP would likely result in little or no changes in the number of activities authorized by this NWP, and the environmental impacts of authorized activities. Project proponents would likely continue to design their project to qualify for NWP authorization. Retaining the current national terms and conditions of this NWP would likely continue to provide incentives for project proponents to reduce their proposed impacts to jurisdictional waters and wetlands to qualify for NWP authorization, and receive the required DA authorization for regulated activities in less time than it would take to receive individual permits for those activities. Under this alternative, for those activities that require individual permits project proponents may request authorization for activities that have greater impacts on jurisdictional waters and wetlands, and may result in larger losses of aquatic resource functions and services.

Under this alternative, the environmental consequences of division engineers exercising their discretionary authority to modify, suspend, or revoke this NWP on a regional basis would be similar to the environmental consequences discussed in section 4.3.2 of this document. Corps divisions may add regional conditions to the NWPs to enhance protection of the aquatic environment in a region (e.g., a Corps district, state, or watershed) and address regional concerns regarding jurisdictional waters and wetlands and other resources (e.g., listed species or cultural resources) that may be affected or impacted by the activities authorized by this NWP. Division engineers can also revoke an NWP in a region if the use of that NWP results in more than minimal adverse environmental effects, especially in high value or rare waters or wetlands. When an NWP is issued or reissued by the Corps, division engineers issue supplemental documents that evaluate potential impacts of the NWP at a regional level, and assess cumulative impacts caused by this NWP on a regional basis during the period this NWP is in effect. [33 CFR 330.5(c)]

Under this alternative, the ability of district engineers to modify, suspended, or revoke this NWP on a case-by-case to address site-specific conditions, including the degree to which aquatic resources on the project site provide ecological functions and services, is likely to have environmental consequences similar to the environmental consequences of the alternative identified in section 3.2 of this document. Activity-specific modifications under this alternative may also address site-specific resources (e.g., listed species or cultural resources) that may be affected by NWP activities. Activity-specific modifications may also include mitigation requirements similar to the potential mitigation requirements discussed in section 4.3.2 of this document.

The reissuance of this NWP adopts the alternative identified in section 3.3 of this document. The Corps has considered the comments received in response to the proposed rule, and made changes to the NWPs, general conditions, and definitions to address those comments. Division engineer may add regional conditions to this NWP to help ensure that the use of the NWPs in a particular geographic area will result in no more than minimal individual and cumulative adverse environmental effects. District engineers may also add regional conditions to this NWP to help ensure compliance with other applicable laws, such as section 7 of the Endangered Species Act, section 106 of the National Historic Preservation Act, and the essential fish habitat provisions of the Magnuson-Stevens Fishery Conservation and Management Act. Division engineers may also add regional conditions to this NWP to fulfill its tribal trust responsibilities.

Corps divisions and districts also monitor the use of this NWP and the authorized impacts identified in NWP verification letters. At a later time, if warranted, a division engineer may add regional conditions to further restrict or prohibit the use of this NWP to ensure that it does not authorize activities that result in more than minimal adverse environmental effects in a particular geographic region (e.g., a watershed, landscape unit, or seascape unit). To the extent practicable, division and district engineers will use regulatory automated information systems and institutional knowledge about the typical adverse effects of activities authorized by this NWP, as well as substantive public comments, to assess the individual and cumulative adverse environmental effects resulting from regulated activities authorized by this NWP.

5.0 Determinations

5.1 Finding of No Significant Impact

Based on the information in this document, the Corps has determined that the discharges of dredged or fill material into waters of the United States and the work in navigable waters of the United States authorized by the issuance of this NWP will not have a reasonably foreseeable significant impact on the quality of the human environment. During the five-year period this NWP will be in effect, the activities authorized by this NWP will result in only minor changes to the current environmental setting described in Appendix A of this environmental assessment. Therefore, the preparation of an environmental impact statement is not required for the issuance of this NWP.

5.2 Public Interest Determination

In Appendix B of this document, and in accordance with the requirements of 33 CFR 320.4, the Corps has determined, based on the information in this document, that the issuance of this NWP to authorize discharges of dredged or fill material into waters of the United States and work in navigable waters of the United States for mining activities is not contrary to the public interest.

5.3 Section 404(b)(1) Guidelines Compliance

In Appendix C of this document, this NWP has been evaluated for compliance with the 404(b)(1) Guidelines, including Subparts C through G. Based on the information in this document, the Corps has determined that the discharges authorized by this NWP comply with the 404(b)(1) Guidelines, with the inclusion of appropriate and practicable conditions, including mitigation measures required by the NWP general conditions, that minimize adverse effects on affected aquatic ecosystems. The discharges of dredged or fill material into waters of the United States authorized by this NWP will result in only minor changes to the current environmental setting described in Appendix A of this document, and will have no more than minimal individual and cumulative adverse effects on the aquatic environment during the 5-year period this NWP is in effect.

5.4 Section 176(c) of the Clean Air Act General Conformity Rule Review

This issuance of this NWP has been analyzed for conformity applicability pursuant to regulations implementing section 176(c) of the Clean Air Act. It has been determined that the activities authorized by this permit will not exceed de minimis levels of direct emissions of a criteria pollutant or its precursors and are exempted by 40 CFR 93.153. Any later indirect emissions are generally not within the Corps continuing program responsibility and generally cannot be practicably controlled by the Corps. For these reasons, a conformity determination is not required for this NWP.

FOR THE COMMANDER

Dated: 05JAN26

JEKelly
Jason E. Kelly
Major General, U.S. Army
Deputy Commanding General for Civil and Emergency Operations

Appendix A – Current Environmental Setting

The current environmental setting is the baseline against which the environmental effects of the proposed action and alternatives are evaluated to determine whether the issuance of this NWP will have a significant impact on the quality of the human environment. The current environmental setting is also used to evaluate whether the activities authorized by this NWP across the country during the five year period it is likely to be in effect are likely to result in no more than minimal individual and cumulative adverse environmental effects when added to the current environmental setting and other federal, tribal, state, local, and private actions taking place concurrently with the activities authorized by this NWP. The current environmental setting consists of the present condition (i.e., structure and function) of aquatic and terrestrial ecosystems in the United States, including cultural ecosystems and urban ecosystems that have been directly and indirectly affected by past and present federal, non-federal, and private activities, as well as natural events such as storms, earthquakes, and wildfires.

The current environmental setting includes terrestrial and aquatic ecosystems within the United States and its territories, as well as the built environment. Ecosystems are assemblages of biotic and abiotic components in waterbodies or on land in which their components interact to form complex food webs, nutrient cycles, and energy flows (Gann et al. 2019). They are heterogeneous, open systems that interact with other ecosystems that occur in a landscape (Wallington et al. 2005) or a seascape, and are comprised of biotic components (e.g., animals, plants, fungi, protists) and abiotic elements (e.g., air, water, soil, rocks, chemical elements). The current environmental setting also includes cultural, social, and economic systems in the United States and its territories. The affected environment also includes social-ecological systems, which are complex, integrated systems of people and nature (Gann et al. 2019). The geographic scope of this environmental assessment, and its characterization of the current environmental setting, covers the United States and its territories because this NWP may be used across the country to authorize discharges of dredged or fill material into waters of the United States and work in navigable waters of the United States, unless the NWP is revoked or suspended by a division or district engineer under the procedures in 33 CFR 330.5(c) and (d), respectively.

All of the Earth's ecosystems have been affected either directly or indirectly by human activities (Vitousek et al. 1997). The current environmental setting has been shaped by human activities, environmental changes, natural disturbances, and a variety of other factors over thousands of years. Humans have been managing, altering, and manipulating landscapes, including ecosystems within those landscapes, for more than 12,000 years (Ellis 2021). Examples of land use practices that affect landscapes and ecosystems include burning, hunting, species domestication, species propagation, and cultivation (Ellis et al. 2021). Pre-industrial people in North America occasionally caused large amounts of environmental impacts through activities such as agriculture, hydrological engineering, over-hunting, establishing dense urban environments, moving species from place-to-place, and conducting prescribed burning at a scale that altered global and regional environmental conditions (Evans and Davis 2018). This includes indigenous people who have managed and altered ecosystems and landscapes throughout North America (Holl 2020).

Around the beginning of the 19th century, the degree of impacts of human activities on the Earth's ecosystems began to exceed the degree of impacts to ecosystems caused by natural disturbances and variability (Steffen et al. 2007). Over 75 percent of the ice-free land on Earth has been altered by human occupation and use (Ellis and Ramankutty 2008). Approximately 33 percent of the Earth's ice-free land consists of lands heavily used by people: urban areas, villages, lands used to produce crops, and occupied rangelands (Ellis and Ramankutty 2008). Human activities, and their impacts on organisms and communities inhabiting the Earth, have substantially increased since the 1970s because of growing human populations and increases in economic activities, including average per capita incomes (Diaz et al. 2018). These anthropogenic impacts have caused large global declines in the areal extent of ecosystems and their integrity, the species composition of local ecological communities, the abundance and number of wild species, and the number of locally domesticated varieties of species (Diaz et al. 2018).

In North America, multithreaded networks of stream channels and wetlands were common before land use changes (especially deforestation and agricultural conversions), mill dam construction, and other activities caused substantial sediment deposits to accumulate in valleys where these anastomosing riverine systems were located (e.g., Merritts et al. 2011, Wohl et al. 2021). Harvesting beaver and removal of large wood also contributed to losses of stream and wetland complexes in river valleys (Pollock et al. 2014).

For marine ecosystems, Halpern et al. (2008) determined that there are no marine waters that are unaffected by human activities, and that 41 percent of the area of ocean waters are affected by multiple anthropogenic stressors (e.g., land use activities that generate pollution that go to coastal waters, marine habitat destruction or modification, and the extraction of resources). The marine waters most highly impacted by human activities are located on the continental shelf and in slope areas, which are affected by both land-based and ocean-based human activities (Halpern et al. 2008).

The current environmental setting is the product of the cumulative or aggregated effects of human activities that have persisted over time, as well as the natural processes that have influenced, and continue to influence, the structure and function of aquatic ecosystems and other ecosystems. The current environmental setting includes the present effects of past activities authorized by previously issued versions of this NWP and other NWPs. The current environmental setting also includes the present effects of past activities authorized by other forms of DA authorization, as well as many types of human activities that are not regulated by the Corps under its permitting authorities. The current environmental setting varies substantially in different areas of the country and in different waterbodies. The current environmental setting is dependent in part on the degree to which past and present human activities have altered aquatic and terrestrial ecosystems in a particular geographic area over time. For a particular site in which an NWP activity may take place, the current environmental setting can range from highly developed/altered areas (e.g., urban and suburban areas, where human impacts to ecosystems are highest) to production areas (e.g., agricultural lands) to seminatural areas (e.g., parks) to near natural areas (e.g., wilderness where human impacts to ecosystems are lowest) (van Andel and Aronson 2012). Human impacts on semi-natural ecosystems are lower than human impacts to production ecosystems (van Andel and Aronson 2012). Because humans have altered aquatic and terrestrial environments in numerous, substantial ways for thousands of years (e.g., Ellis et al. 2021, Evans and Davis 2018), the current environmental setting takes into account how past and present human activities, natural disturbances, and changing biotic and abiotic conditions have modified existing aquatic and terrestrial resources.

Ecosystems and human communities are highly dependent upon each other, and through their interactions they comprise social-ecological systems (Walker and Salt 2006). They usually maintain reciprocal relationships with each other, where humans make contributions to the maintenance and enhancement of ecosystems (“services to ecosystems”) and ecosystems provide a variety of services to people (Comberti et al. 2015). Most ecosystems have been shaped by human uses, such as providing food, fiber, medicines, or culturally important artifacts (e.g. totems, spiritually significant tools), and the concept of traditional cultural ecosystems acknowledges that ecosystems are the result of co-evolution of plants, animals, and humans in response to past environmental conditions (Gann et al. 2019). Because the degree and scale of human impacts have increased substantially over the past several decades, even those ecosystems that may be considered “pristine” are changing in response to impacts attributed to human activities, even when those activities occur a substantial distance from the specific ecosystem being evaluated (Holl 2020).

Ecosystems are subjected to multiple categories of disturbances over a variety of spatial (local, regional, global) and temporal scales (Foley et al. 2015, Elmqvist et al. 2003). A disturbance is an anthropogenic or natural event that alters or disrupts the structure and function of an ecosystem, often to a substantial degree (Clewell and Aronson 2013). Disturbances are often caused by external influences, such as human activities (e.g., land use changes) and storms (Clewell and Aronson 2013). A disturbance can have positive, negative, or neutral effects on ecosystems.

The structure and function of aquatic ecosystems, including waters and wetlands subject to the Corps' permitting authorities, have been influenced by past and present activities in uplands, because land use/land cover changes in uplands and other activities in uplands have indirect effects on aquatic ecosystems (e.g., MEA 2005a, Reid 1993). Due to the large geographic scale of the affected environment (i.e., the United States and its territories), as well as the many past and present human activities that have shaped the affected environment, the affected environment can only be practicably described in general terms. In addition, for this environmental assessment it is not possible to describe the environmental conditions for specific sites where this NWP may be used to authorize regulated activities because those sites will be identified after this NWP is issued and goes into effect.

The total land area in the United States is approximately 2,260,000,000 acres, and the total land area in the contiguous United States is approximately 1,891,000,000 acres (Bigelow and Borchers 2017). Land uses in the United States as of 2012 is provided in Table A-1 (Bigelow and Borchers 2017). Of the land area in the entire United States, approximately 60 percent (1,370,000,000 acres) is privately owned (Bigelow and Borchers 2017). Of the remaining lands in the United States, the federal government hold 28 percent (644,000,000 acres), state and local governments own 8 percent (189,000,000 acres), and 3 percent (63,000,000 acres) is held in trust by the Bureau of Indian Affairs (Bigelow and Borchers 2017).

Table A-1. Major land uses in the United States – 2012 (Bigelow and Borchers 2017).

Land Use	Acres	Percent of Total
Agriculture	1,186,000,000	52.5
Forest land	502,000,000	22.2
Transportation use	27,000,000	1.2
Recreation and wildlife areas	254,000,000	11.2
National defense areas	27,000,000	1.2
Urban land	70,000,000	3.1
Miscellaneous use	196,000,000	8.5
Total land area	2,260,000,000	100.0

The National Land Cover Database tracks changes in land cover patterns in the conterminous United States, including changes in land use cover, impervious surface cover, and forest canopy cover. The 2016 National Land Cover Database uses imagery from Landsat (at 30 meter resolution) to estimate land cover, urban impervious surfaces, tree cover, shrub cover, herbaceous plant cover, and bare ground (Homer et al. 2020) in the conterminous United States. Table A-2 presents National Land Cover Database class covers for 2016, in square kilometers.

Table A-2. Classes of Land Cover in the Conterminous United States, in acres, in 2016 (Homer et al. 2020).

National Land Cover Database Class	2016 area (acres)	% of 2016 Land Cover
Open water	104,691,137	5.26
Perennial ice/snow	127,012	0.01
Developed-open space	57,396,650	2.84
Developed-low intensity	29,592,352	1.43
Developed-medium intensity	13,907,832	0.63
Developed-high intensity	5,006,355	0.23
Barren land	20,484,295	1.02
Deciduous forest	187,012,565	9.46
Conifer forest	228,271,009	11.61
Mixed forest	72,443,143	3.62
Shrub/scrub	434,938,831	21.77
Grassland herbaceous	276,365,624	13.89
Pasture/hay	125,422,784	6.52
Cultivated crops	324,477,536	15.90
Woody wetlands	87,158,763	4.33
Herbaceous wetlands	29,334,868	1.50

The five predominant land covers in the conterminous United States are cultivated crops, shrub/scrub, conifer forest, deciduous forest, and open water. The five least extensive land covers in the conterminous United States are perennial ice/snow, developed-high intensity, developed-medium intensity, barren land, and developed-low intensity. Changes in the areal extent of open waters and wetlands over time are driven primarily by variations in precipitation, and by land use intensity and external disturbances (Homer et al. 2020). Between 2001 and 2016, the total area of surface water decreased by 0.30 percent, from 424,962 square kilometers in 2001 to 423,670 square kilometers in 2016 (Homer et al. 2020). Between 2001 and 2016, the total area of woody wetlands changed from 351,624 square kilometers in 2001 to 352,719 square kilometers in 2016 (a 0.31 percent increase), and herbaceous wetland extents changed from 119,391 square kilometers (2001) to 118,714 square kilometers (2016) (a 0.57 percent decrease) (Homer et al. 2020). Homer et al. (2020) concluded that land use cover across the conterminous United States is dynamic and substantial, and between 2001 and 2016 nearly 8 percent of the landscape had at least one change in land cover use. Almost 50 percent of that change involved forested areas, for which change was driven by harvesting, disease, pests, and fire (Homer et al. 2020).

A.1 Quantity of Aquatic Ecosystems in the United States

There are approximately 283.1 million acres of wetlands in the United States; 107.7 million acres are in the conterminous United States and the remaining 175.4 million acres are in Alaska (Mitsch and Hernandez 2013). Wetlands occupy less than 9 percent of the global land area (Zedler and Kercher 2005). According to Lang et al.

(2024), wetlands and deepwater habitats cover less than 6 percent of the land area in the conterminous United States. Rivers and streams comprise approximately 0.52 percent of the total land area of the continental United States (Butman and Raymond 2011). Therefore, the wetlands, streams, rivers, and other aquatic habitats that are potentially waters of the United States and subject to regulation by the Corps under section 404 of the Clean Water Act and section 10 of the Rivers and Harbors Act of 1899 comprise a minor proportion of the land area of the United States. The remaining land area of the United States (more than 92 percent, depending on the proportion of wetlands, streams, rivers, and other aquatic habitats that are subject to regulation under those two statutes) is outside the Corps regulatory authority. Inventories of wetlands, streams, and other aquatic resources are incomplete because the techniques used for those studies cannot identify some of those resources (e.g., Tiner (2017) for wetlands; Meyer and Wallace (2001) for streams).

Dahl (1990) estimated that approximately 53 percent of the wetlands in the conterminous United States were lost in the 200-year period from the 1780s to 1980s, while Alaska lost less than one percent of its wetlands and Hawaii lost approximately 12 percent of its original wetland acreage. In the 1780s, there were approximately 221 million acres of wetlands in the conterminous United States (Dahl 1990). California lost the largest percentage of its wetlands (91 percent), whereas Florida lost the largest acreage (9.3 million acres) (Dahl 1990). During that 200-year period, 22 states lost more than 50 percent of their wetland acreage, and 10 states have lost more than 70 percent of their original wetland acreage (Dahl 1990).

Frayer et al. (1983) evaluated wetland status and trends in the United States during the period of the mid-1950s to the mid-1970s. During that 20-year period, approximately 7.9 million acres of wetlands (4.2 percent) were lost in the conterminous United States. Much of the loss of estuarine emergent wetlands was due to changes to estuarine subtidal deepwater habitat, and some loss of estuarine emergent wetlands was due to urban development. For palustrine vegetated wetlands, nearly all of the losses of those wetlands were due to agricultural activities (e.g., conversion to agricultural production).

The U.S. Fish and Wildlife Service also examined the status and trends of wetlands in the United States during the period of the mid-1970s to the 1980s, and found that there was a net loss of more than 2.6 million acres of wetlands (2.5 percent) during that time period (Dahl and Johnson 1991). Freshwater wetlands comprised 98 percent of those wetland losses (Dahl and Johnson 1991). During that time period, losses of estuarine wetlands were estimated to be 71,000 acres, with most of that loss due to changes of emergent estuarine wetlands to open waters caused by shifting sediments (Dahl and Johnson 1991). Conversions of wetlands to agricultural use were responsible for 54 percent of the wetland losses, and conversion to other land uses resulted in the loss of 41 percent of wetlands (Dahl and Johnson 1991). Urban development was responsible for five percent of the wetland loss (Dahl and Johnson 1991). The annual rate of wetland loss has decreased substantially since the 1970s (Dahl 2011, Lang et al. 2024), when wetland regulation became more prevalent (Brinson and Malvárez 2002). Eutrophication of coastal waters can cause losses of emergent estuarine wetlands, through changes in growth patterns of marsh plants and decreases in the stability of the wetland substrate, which changes those marshes to mud flats (Deegan et al. 2012).

The Federal Geographic Data Committee has established the Cowardin system developed by the U.S. Fish and Wildlife Service (USFWS) (Cowardin et al. 1979) as the national standard for wetland mapping, monitoring, and data reporting (Lang et al. 2024) (see Federal Geographic Data Committee 2013). The Cowardin system is a hierarchical system which describes various wetland and deepwater habitats, using structural characteristics such as vegetation, substrate, and water regime as defining characteristics. Wetlands are defined by plant communities, soils, or inundation or flooding frequency. Deepwater habitats are permanently flooded areas located below the wetland boundary. In rivers and lakes, deepwater habitats are usually more than two meters deep. The Cowardin et al. (1979) definition of "wetland" differs from the definition used by the Corps for the purposes of implementing section 404 of the Clean Water Act. The Corps' regulations define "wetlands" as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." [33 CFR 328.3(c)(1)] The Cowardin et al. (1979) requires only one of the three factors (i.e., wetland vegetation, soils, hydrology) to be present for an area to be a wetland, while the Corps' wetland definition requires all three factors to be present under normal circumstances (Tiner 2017, Mitsch and Gosselink 2015). The NWI produced by applying the Cowardin et al. (1979) definition is the only national scale wetland inventory available. There is no national inventory of wetland acreage based on the Corps' wetland definition at 33 CFR 328.3(c)(1).

There are five major systems in the Cowardin classification scheme: marine, estuarine, riverine, lacustrine, and palustrine (Cowardin et al. 1979). The marine system consists of open ocean on the continental shelf and its high energy coastlines. The estuarine system consists of tidal deepwater habitats and adjacent tidal wetlands that are usually partially enclosed by land, but may have open connections to open ocean waters. The riverine system generally consists of all wetland and deepwater habitats located within a river channel. The lacustrine system generally consists of wetland and deepwater habitats located within a topographic depression or dammed river channel, with a total area greater than 20 acres. The palustrine system generally includes all non-tidal wetlands and wetlands located in tidal areas with salinities less than 0.5 parts per thousand; it also includes ponds less than 20 acres in size. Approximately 95 percent of wetlands in the conterminous United States are freshwater wetlands, and the remaining 5 percent are estuarine or marine wetlands (Lang et al. 2024).

The Emergency Wetlands Resources Act of 1986 (Public Law 99-645) requires the USFWS to submit wetland status and trends reports to Congress (Lang et al. 2024). The latest wetland status and trends report, which covers the period of 2009 to 2019, is summarized in Table A-3. The USFWS wetland status and trends report only provides information on acreage of the various aquatic habitat categories and does not assess the quality or condition of those aquatic habitats (Lang et al. 2024).

Table A-3. Estimated aquatic resource acreages in the conterminous United States in 2019 (Lang et al. 2024).

Aquatic Habitat Category	Estimated Area in 2019 (acres)
Marine intertidal	209,000
Estuarine intertidal unconsolidated shore	1,035,000
Estuarine intertidal vegetated	4,817,000
All intertidal waters and wetlands	6,061,000
Palustrine ponds	6,876,000
Palustrine farmed	1,973,000
Palustrine vegetated	101,527,000
• Palustrine emergent wetlands	30,008,000
• Palustrine shrub wetlands	19,091,000
• Palustrine forested wetlands	52,428,000
All palustrine wetlands	110,376,000
Lacustrine deepwater habitats	17,227,000
Riverine deepwater habitats	7,402,000
Estuarine subtidal habitats	20,043,000
All deepwater habitats	44,672,000
All wetlands and deepwater habitats	161,109,000

The acreage of lacustrine deepwater habitats does not include the open waters of Great Lakes (Lang et al. 2024). A study conducted by Hall et al. (1994), found that there are more than 204 million acres of wetlands and deepwater habitats in the State of Alaska, including approximately 174.7 million acres of wetlands. Wetlands and deepwater habitats comprise approximately 50.7 percent of the surface area in Alaska (Hall et al. 1994). The Alaska Department of Environmental Conservation's Division of Water estimates that the total wetland acreage in Alaska is 130 million acres.[1]

According to the U.S. Fish and Wildlife Service's most recent wetland status and trends report (Lang et al. 2024), during the period of 2009 to 2019 a net loss of 221,000 acres of wetlands occurred in the conterminous United States. During that time period, 194,000 acres of wetlands were converted to uplands, and 27,000 acres of wetlands changed to become deepwater habitats. The acreage of vegetated wetlands decreased while the acreage of non-vegetated wetlands increased. The largest driver of wetland losses during the time period evaluated by Lang et al. (2024) was the conversion of wetlands to upland forested plantations (a net loss of approximately 83,000 acres, or 26.9 percent of wetland losses in the conterminous United States). The second largest driver of wetland losses during 2009 to 2019 was the conversion to upland agriculture (a net loss of approximately 78,000 acres, or 25.3 percent of wetland losses). Conversions of wetlands to urban upland developments resulted in the net loss of approximately 50,000 acres of wetlands (16.2 percent), and conversions of wetlands to uplands for other purposes resulted in the net loss of approximately 43,000 acres of wetlands (14.0 percent) during the period of 2009 to 2019. Other drivers of wetland loss during 2009 to 2019 that were identified by Lang et al. (2024) were the conversions of wetlands to deepwater habitats and the construction of upland rural developments, both of which resulted in losses of approximately 27,000 acres, or 8.8 percent of the total wetland loss acreage.

Lang et al. (2024) also identified various drivers of wetland gains and losses in the United States. Those drivers include sea level rise; coastal storm impacts; changes in environmental conditions such as increased temperatures, increased evaporation, and altered precipitation patterns; development activities; agricultural activities; actions taken by federal, tribal, state, and local government entities; and conversions of wetlands to uplands for the purposes of development, agriculture, and other uses. Those drivers of wetland gains and losses interacted with each to produce greater losses (Lang et al. 2024). For freshwater wetlands, the primary drivers of loss were the construction of agricultural, urban, and industrial ponds, plus conversions of freshwater wetlands to agricultural uses, developments, and upland forest plantations (Lang et al. 2024). For saltwater (estuarine) wetlands, the changes from vegetated wetlands to unvegetated wetlands were driven mostly by estuarine emergent marshes changing to unvegetated wetlands or deepwater habitats because of sea level rise and coastal storms (Lang et al. 2024). Some of the wetland losses were the result of activities not regulated under the Clean Water Act, such as drainage activities that do not require DA authorization, exempt forestry activities, or water withdrawals. In addition, some of the lost wetland acreage consisted of wetlands that are not subject to federal jurisdiction under the Clean Water Act (Lang et al. 2024), such as wetlands that are not adjacent to

[1] https://dec.alaska.gov/water/wastewater/stormwater/permits-approvals/wetlands/ak-wetlands/#:~:text=Estimates%20place%20the%20total%20acreage,%2C%20streams%2C%20and%20underground%20aquifers. (accessed July 19, 2024)

navigable waters of the United States.

The National Resources Inventory (NRI) is a statistical survey conducted by the Natural Resources Conservation Service (NRCS) (USDA 2020) of natural resources on non-federal land in the United States. The NRCS defines non-federal land as privately owned lands, tribal and trust lands, and lands under the control of local and state governments. Acreages of palustrine and estuarine wetlands and the land uses those wetlands are subjected to are summarized in Table A-4. The 2017 NRI estimates that there are 111,000,000 acres of palustrine and estuarine wetlands on non-federal land and water areas in the United States (USDA 2020). The 2017 NRI estimates that there are 52,038,000 acres of open waters on non-federal land in the United States, including lacustrine, riverine, and marine habitats, as well as estuarine deepwater habitats.

Table A-4. The 2017 National Resources Inventory acreages for palustrine and estuarine wetlands on non-federal land, by land cover/use category (USDA 2020).

National Resources Inventory Land Cover/Use Category	Area of Palustrine and Estuarine Wetlands (acres)
cropland, pastureland, and Conservation Reserve Program land	17,400,000
forest land	66,000,000
rangeland	7,900,000
other rural land	14,800,000
developed land	1,500,000
water areas	3,700,000
Total	**111,000,000**

The land cover/use categories used by the 2017 NRI are defined below (USDA 2020). Croplands are areas used to produce crops grown for harvest. Pastureland is land managed for livestock grazing, through the production of introduced forage plants. Conservation Reserve Program land is under a Conservation Reserve Program contract. Forest land is comprised of at least 10 percent single stem woody plant species that will be at least 13 feet tall at maturity. Rangeland is land on which plant cover consists mostly of native grasses, herbaceous plants, or shrubs suitable for grazing or browsing, and introduced forage plant species. Other rural land consists of farmsteads and other farm structures, field windbreaks, marshland, and barren land. Developed land is comprised of large urban and built-up areas (i.e., urban and built-up areas 10 acres or more in size), small built-up areas (i.e., developed lands 0.25 to 10 acres in size), and rural transportation land (e.g., roads, railroads, and associated rights-of-way outside urban and built-up areas). Water areas are comprised of waterbodies and streams that are permanent open waters.

The wetlands data from the Fish and Wildlife Service's Status and Trends study and the Natural Resources Conservation Service's National Resources Inventory should not be compared, because they use different methods and analyses to produce their results (Dahl 2011).

Leopold, Wolman, and Miller (1964) estimated that there are approximately 3,250,000 miles of river and stream channels in the United States. This estimate is based on an analysis of 1:24,000 scale topographic maps. Their estimate does not include many small streams. Many small streams, especially headwater streams, are not mapped on 1:24,000 scale U.S. Geological Survey (USGS) topographic maps (Leopold 1994) or included in other inventories (Meyer and Wallace 2001), including the National Hydrography Dataset (Elmore et al. 2013). Many small streams and rivers are not identified through maps produced by aerial photography or satellite imagery because of inadequate image resolution or trees or other vegetation obscuring the visibility of those streams from above (Benstead and Leigh 2012). In a study of stream mapping in the southeastern United States, only 20 percent of the stream network was mapped on 1:24,000 scale topographic maps, and nearly none of the observed intermittent or ephemeral streams were indicated on those maps (Hansen 2001). Another study in Massachusetts showed that 1:25,000 metric scale topographic maps exclude over 27 percent of stream miles in a watershed (Brooks and Colburn 2011). For a 1:24,000 scale topographic map, the smallest tributary found by using 10-foot contour interval has a drainage area of 0.7 square mile and length of 1,500 feet, and smaller stream channels are common throughout the United States (Leopold 1994). Benstead and Leigh (2012) found that the density of stream channels (length of stream channels per unit area) identified by digital elevation models was three times greater than the drainage density calculated by using USGS maps. Elmore et al. (2013) made similar findings in watersheds in the mid-Atlantic, where they determined that the stream density was 2.5 times greater than the stream density calculated with the National Hydrography Dataset. Due to the difficulty in mapping small streams, there are no accurate estimates of the total number of river or stream miles in the conterminous United States that might be considered as "waters of the United States."

The quantity of the Nation's aquatic resources presented by studies that estimate the length or number of stream channels (see above) or the acreage of wetlands (e.g., USFWS status and trends studies, National Wetlands Inventory (NWI), and Natural Resources Inventory (NRI)) are underestimates, because those inventories do not include many small wetlands and streams. The USFWS status and trends studies do not include Alaska, Hawaii, or the territories. The underestimate of national wetland acreage by the USFWS status and trends studies and the NWI is primarily the result of the minimum size of wetlands detected through remote sensing techniques and the difficulty of identifying certain wetland types through those remote sensing techniques. The remote sensing approaches used by the USFWS for its NWI maps and its status and trends reports result in errors of omission that exclude wetlands that are difficult to identify through photointerpretation (Tiner 2017). These errors of omission are due to wetland type and the size of target mapping units (Tiner 2017). Therefore, it is important to understand the limitations of the source data when quantitatively describing the environmental baseline for wetlands, streams, and other types of aquatic ecosystems using maps and studies produced by remote sensing.

Factors affecting the accuracy of wetland maps made by remote sensing include: the degree of ease or difficulty in identifying a particular wetland type, map scale, the quality and scale of the source information (e.g., aerial or satellite photos), the environmental conditions when the imagery was obtained, the time of year the imagery was obtained (e.g., leaf-off versus leaf on), the quality of the images, the minimum mapping unit (or target mapping unit), the mapping equipment, and the skills of the people drawing the maps (Tiner 2017). In general, wetland types that are difficult to identify through field investigations are likely to be underrepresented in maps made by remote sensing (Tiner 2017). Wetlands difficult to identify through remote sensing include evergreen forested wetlands, wetlands at the drier end of the wetland hydrology continuum, and significantly drained wetlands (Tiner 2017). Wetland types that are more readily identified and delineated through remote sensing techniques include ponds, marshes, bogs, and fens (Tiner 2017). In the 2011 wetland status and trends report published by the USFWS, the target minimum wetland mapping unit was 1 acre, although some easily identified wetlands as small as 1/10-acre were identified in that effort (Dahl 2011). The NWI identifies wetlands regardless of their jurisdictional status under the Clean Water Act (Tiner 2017).

Because not all wetlands are identified through the remote sensing techniques discussed above for the national-scale inventories used to describe the current environmental setting in this environmental assessment, activities authorized by NWPs are likely to adversely affect a smaller proportion of the Nation’s wetland base than indicated by the wetlands acreage estimates provided in the most recent status and trends report, or the NWI maps for a particular region.

Another important consideration in this description of the current environmental setting is that not all wetlands, streams, and other types of aquatic resources are subject to federal jurisdiction under the Clean Water Act (Mitsch and Gosselink 2015). Non-jurisdictional wetlands, streams, and other types of aquatic resources can be altered or lost because of activities that do not require Clean Water Act section 404 authorization, and such alterations and losses may reduce the types and degrees of aquatic ecosystem functions and services being performed across the country. They can exacerbate losses of aquatic ecosystem functions and services caused by activities that require DA authorization, including activities that may be authorized by this NWP while it is in effect.

Three U.S. Supreme Court decisions have identified geographic limits to Clean Water Act's jurisdiction over waters and wetlands. In 2001, the U.S. Supreme Court held in *Solid Waste Agency of Northern Cook County v. Army Corps of Engineers* (531 U.S. 159) (SWANCC) that the use of isolated, non-navigable, intrastate waters by migratory birds is not, by itself a sufficient basis for exercising federal regulatory authority under the Clean Water Act over those waters. In the U.S. Supreme Court's 2006 decision in *Rapanos* v. *United States,* (547 U.S. 715), one justice stated that waters and wetlands regulated under the Clean Water Act must have a "significant nexus" to downstream traditional navigable waters. Four justices (the plurality) concluded that Clean Water Act jurisdiction applies only to relatively permanent waters connected to traditional navigable waters and to wetlands that have a continuous surface connection to those relatively permanent waters. The remaining justices in *Rapanos* stated that Clean Water Act jurisdiction applies to waters and wetlands that meet either the significant nexus test or the Plurality's test. In 2023, the U.S. Supreme Court's decision in *Sackett et ux. v. Environmental Protection Agency et al.* (598 U.S. 651) (Sackett II) held that the use of the term "waters" under the Clean Water Act is limited to those geographic features that are described in ordinary language as 'streams, oceans, rivers, and lakes,' and to adjacent wetlands that are "indistinguishable" from those bodies of water due to a continuous surface connection.

In a study covering the conterminous United States that was published after the U.S. Supreme Court's Sackett II decision, Greenhill et al. (2024) estimated that 67% of the stream miles identified in the National Hydrography Dataset are regulated under the Clean Water Act under the 2006 Rapanos decision, and 52% of wetlands are subject to Clean Water Act jurisdiction under the 2006 Rapanos decision. Greenhill et al. (2024) did not have sufficient data at the time they conducted their study to estimate the amounts of streams and wetlands regulated under the Clean Water Act under the 2023 Sackett II decision. After the 2001 SWANCC decision, Tiner (2003) used digital geographic data to examine 72 study areas across the United States to estimate the amount of wetlands and number of wetlands that predicted to be "geographically isolated wetlands", which were defined as "wetlands with no apparent surface-water connection to perennial rivers and streams, estuaries, or the ocean," and surrounded by dry land. While the geographically isolated wetlands estimated by Tiner (2003) were based on a definition that bears some resemblance to the "continuous surface connection" used in Sackett II to identify adjacent wetlands for the purposes of the Clean Water Act, those estimates show considerable variation in the number and acreage of geographically isolated wetlands across the United States. So the impact of Sackett II on the status of wetland jurisdiction under the Clean Water Act is likely to vary substantially by geographic region.

There are 95,471 miles of shoreline in the United States (NOAA 2024[2]). This

[2] https://oceanservice.noaa.gov/facts/shorelength.html#:~:text=As%20there%20is%20no%20

estimate includes the continental United States, and Alaska and Hawaii. In a different effort, Gittman et al. (2015) estimated that there are 99,524 miles of tidal shoreline in the conterminous United States.

A.2 Quality of Aquatic Ecosystems in the United States

There is a wide variety of factors that can affect the ability of rivers, streams, wetlands, lakes, estuarine waters, and marine waters to perform physical, chemical, and biological processes (i.e., functions) and provide services that can benefit human populations. The primary direct drivers of degradation and loss of waters and wetlands include infrastructure development, land conversion, water withdrawal, eutrophication and pollution, overharvesting and overexploitation, and the introduction of invasive alien species (MEA 2005a). For the purposes of this environmental assessment, "quality" refers to the ability of aquatic ecosystems to perform physical, chemical, and biological functions, and the ecosystem services (i.e., benefits to people) that may be produced by those functions. The Corps' regulations define "functions" as "the physical, chemical, and biological processes that occur in ecosystems." [33 CFR 332.2] "Quality" may also refer to the ecological condition of aquatic ecosystems. The Corps' regulations define "condition" as "the relative ability of an aquatic resource to support and maintain a community of organisms having a species composition, diversity, and functional organization comparable to reference aquatic resources in the region." [33 CFR 332.2] "Condition" is typically considered to be produced through the combined interactions of wetland structure and functions (Fennessy et al. 2007). Some assessments of aquatic ecosystems examine the specific physical chemical, and biological functions performed by waters and wetlands, while other assessments examine the condition of waters and wetlands, which can be considered an aggregation of the functions being performed by those wetlands and waters (Stein et al. 2010).

The quality of aquatic ecosystems is dependent on the degree to which those aquatic ecosystems are degraded or impaired. Degradation can be defined as the "incremental and progressive impairment of an ecosystem on account of continuing stress events or punctuated minor disturbances that occur with such frequency that natural recovery does not have time to occur" (Clewell and Aronson 2013). Gann et. al (2019) define the degradation of ecosystems as "a level of deleterious human impact to ecosystems that results in the loss of biodiversity and simplification or disruption in their composition, structure, and functioning, and generally leads to a reduction in the flow of ecosystem services." Clewell and Aronson (2013) define "impairment" as the "state or condition of an ecosystem or landscape that has been damaged, degraded, or destroyed as a result of extraordinary impact or disturbance from which spontaneous recovery to its former state is unlikely, at least in the short term." Most, if not all, aquatic and terrestrial ecosystems in the United States are degraded or impaired to some degree (e.g., Ellis et al. 2021) because of the direct

reference,in%201930%2D1940%20and%201970. (accessed August 9, 2024) and indirect impacts of human activities and other drivers, including natural disturbances, that have occurred over long periods of time (thousands of years).

The primary indirect drivers of degradation and loss of waters and wetlands are population growth and increasing economic development (MEA 2005a). Many of those causes of impairment are point and non-point sources of pollutants that are not regulated under section 404 of the Clean Water Act or section 10 of the Rivers and Harbors Act of 1899. The regulation of discharges of point sources of pollution other than dredged or fill material may occur through section 402 of the Clean Water Act, which is administered by states with approved programs and by the U.S. Environmental Protection Agency (USEPA). Two common causes of impairment for rivers and streams, habitat alterations and flow alterations, may be due in part to activities regulated by the Corps under section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act of 1899. Habitat changes and flow alterations in rivers and streams may also be the caused by activities that do not involve discharges of dredged or fill material or structures or work in navigable waters. For wetlands subject to Clean Water Act jurisdiction, impairment due to habitat alterations, flow alterations, and hydrology modifications may involve activities regulated by the Corps under section 404, but these causes of impairment may also be due to unregulated activities, such as changes in upland land use that affects the movement of water through a watershed or contributing drainage area or the removal of vegetation.

The inventories of aquatic ecosystems in the previous section, including the USFWS status and trends studies, do not assess the condition or quality of wetlands and deepwater habitats, including ocean waters, estuaries, rivers, streams, lakes and ponds. USEPA conducts national assessments on the condition of coastal waters, rivers and streams, lakes, and wetlands. Information on water quality in waters and wetlands, as well as the causes of water quality impairment, is collected by USEPA under sections 305(b) and 303(d) of the Clean Water Act. The following sections summarize information gathered by USEPA in its national-scale assessments of the ecological condition of coastal waters, rivers and streams, lakes, and wetlands.

A.2.1 Rivers and Streams

USEPA's National Rivers and Stream Assessment, Third Collaborative Survey,[3] examined the ecological condition of rivers and streams in the United States. The purpose of the National Rivers and Streams Assessment is to determine the percentage of rivers and streams that support healthy ecological communities and recreation, identify the most common problems for rivers and streams, determine whether the ecological condition of rivers and streams is getting better or worse, and determine whether water quality investments are properly targeted. The Third Collaborative Survey presented the results of surveys conducted in 2018 and 2019

[3] https://riverstreamassessment.epa.gov/webreport/ (accessed March 8, 2024)

by USEPA and tribal and state partners. The survey focused on perennial rivers and streams in the conterminous United States. The survey sampled 1,851 sites, and used standardized sampling procedures to collect data on biological, chemical, physical, and human health indicators for those perennial rivers and streams.

The survey examined various biological, physical, chemical, and biological indicators or river and stream condition. Specific river and stream sites were evaluated to determine whether those sites were in “good,” “fair,” or “poor” condition by comparing those sites to fixed benchmarks or a set of river and stream reference sites. Some indicators (e.g., microcystins, cylindrospermospin, enterococci) were compared to fixed benchmarks that were developed nationally from values in peer reviewed scientific literature, values published by USEPA, or USEPA-derived screening levels.

Biological indicators used for USEPA’s 2018-2019 National Rivers and Streams Assessment included benthic macroinvertebrates and fish communities. Benthic macroinvertebrates include aquatic insect larvae and nymphs, small aquatic mollusks, crustaceans such as crayfish, aquatic worms, and leeches. Benthic macroinvertebrates and fish are used as biological indicators of river and stream health because of their sensitivity to human-caused disturbances and their sensitivity to a particular stressor may be different.

Chemical indicators used for the 2018-2019 National Rivers and Streams Assessment included nutrients (i.e., total phosphorus and total nitrogen), salinity, and acidification. These four indicators were used by USEPA and their partners because of national or regional interest in these chemical components, and their potential influence on the biological communities present in rivers and streams.

Physical indicators used for the 2018-2019 National Rivers and Streams Assessment included in-stream fish habitat, riparian disturbance, riparian vegetation cover, and streambed sediments. In-stream habitat indicators examined habitat complexity provided by features such as rocks and boulders, undercut banks, overhanging vegetation, and large wood. Riparian disturbance indicated the extent and intensity of human activities that directly affected vegetated riparian areas along rivers and streams. Riparian vegetation cover examined the structure of riparian plant communities next to rivers and streams. Streambed sediments characterized the various sizes of particles on river and stream beds that contribute to habitat and other river and stream attributes.

Table A-5 presents the summary results for the biological, chemical, and physical indicators examined in USEPA’s 2018-2019 National Rivers and Streams Assessment.

Table A-5. Summary Results for USEPA’s 2018-2019 National

Rivers and Streams Assessment for Biological, Chemical, and Physical Indicators

Indicator	% good miles	% fair miles	% poor miles	% not assessed
Biological indicators				
• Benthic macroinvertebrate community	28	25	47	<1
• Fish community	35	19	29	16
Chemical indicators				
• Nutrients (total nitrogen)	32	24	44	<1
• Nutrients (total phosphorous)	36	23	42	0
• Acidification	99	<1	1	1
• Salinity	85	11	4	<1
Physical indicators				
• In-stream fish habitat	68	22	10	<1
• Riparian disturbance	36	42	22	<1
• Riparian vegetation cover	56	17	27	<1
• Streambed sediments	57	23	20	<1

Human health indicators for rivers and streams that were evaluated for USEPA's 2018-2019 National Rivers and Streams Assessment included microcystins and cylindrospermopsin (two algal toxins), enterococci, and three types of chemical contaminants that can occur in fish tissue: mercury, polychlorinated biphenyls, and polyfluoroalkyl substances (PFAS). Microcystins and cylindrospermopsin are toxins that may be released by blue-green algae, and they can have adverse effects on human health, such as skin rashes, respiratory symptoms, and potentially death. Enterococci can be used to indicate fecal contamination in rivers and streams. Mercury, polychlorinated biphenyls, and PFAS are used as indicators of the accumulation of contaminants in fish tissue, and whether fish harvested from rivers and streams are safe for human consumption. The survey results for human health indicators are provided in Table A-6 below.

Table A-6. Summary Results for USEPA's 2018-2019 National Rivers and Streams Assessment for Human Health Indicators

Human health indicator	% at or below criterion	% above criterion	% not assessed
Algal toxins			
• Microcystins risk condition	100	0	0
• Cylindrospermopsin risk condition	100	0	0
Enterococci bacteria	78	20	2
Mercury in fish tissue plugs	21	5	74

USEPA also assessed fish contamination in rivers, because contaminants in fish tissue present a human health threat. In the 2018-2019 National Rivers and

Streams Assessment, USEPA found that 26% of the sampled population (41,099 river miles) were inhabited by fish with mercury concentrations of greater than 300 parts per billion. Mercury exposure in humans can cause impaired neurological development, cardiovascular disease, loss of coordination, muscle weakness, and impaired speech and hearing. For polychlorinated biphenyls (PCBs), which can cause cancer in animals, USEPA found that 45% of the 41,099 sampled river miles had fish with total PCB concentrations greater than 12 parts per billion. In its 2018-2019 assessment, USEPA also evaluated concentrations of per- and poly-fluoroalkyl substances (PFAS) in fish tissues. PFAS are toxic to humans, they persist in the environment, and they can adversely affect immune systems, cardiovascular systems, and the liver. They have also been linked to decreased fertility or low birth weights, and increased risks of certain cancers. One type of PFAS, perfluorooctanoic substances (PFOS), is the most frequently detected PFAS in freshwater fish tissue. USEPA's 2018-2019 National Rivers and Streams Assessment found that 92% of the 41,099 sampled river miles were inhabited by fish with PFOS concentrations that exceeded the 0.25 parts per billion non-cancer screening level for fish consumption of less than 8 ounces per week.

Most of the indicators used by USEPA's 2018-2019 National Rivers and Streams Assessment to evaluate the ecological condition of these waters are primarily influenced by human activities other than the activities authorized by the NWPs (i.e., discharges of dredged or fill material into waters of the United States and structures or work into navigable waters of the United States). Changes to in-stream habitat and sediments in river and stream bed may be caused by NWP activities in some circumstances (e.g., discharging fill material to construct a road crossing or to stabilize stream banks), but in other cases those alterations may occur as a result of activities the Corps does not have the authority to regulate, the construction of impervious surfaces in uplands that alter watershed hydrology and river and stream hydrodynamics and cause subsequent changes in river and stream channel morphology through increased channel erosion during and shortly after storm events. In-stream habitat quality may also be adversely affected by runoff that carries sediments (e.g., silt and clay particles) from uplands to river or stream channels and increase embeddedness, which typically decreases the habitat quality of the river or stream bed. Inputs of pollutants to rivers and streams via point sources and non-point sources may also alter in-stream habitat quality. In wetland riparian areas, the removal or alteration of riparian vegetation can occur without any associated discharges of dredged or fill material (e.g., cutting down vegetation while leaving the roots and soil undisturbed). Removal and other alterations of riparian vegetation in upland riparian areas do not typically involve activities the Corps has the authority to regulate.

Increased inputs of nutrients such as nitrogen and phosphorous are often caused by non-point source pollution, and may also be caused by point source discharges regulated under Clean Water Act section 402. Acidification of river and stream waters may be caused by water picking up acidic compounds from the soil and rocks as it moves through the watershed. Acid mine drainage may be another contributor to river and stream acidification that the Corps does not have the authority to regulate. Higher salinity levels in rivers and streams may be caused by substances used to de-ice roads, mining and oil drilling activities, and discharges of industrial wastewater. Biological indicators such as macroinvertebrate communities and fish communities are often adversely affected by non-point sources of pollution (e.g., fertilizers washed away from lawns and agricultural fields) and discharges of pollutants regulated under section 402 of the Clean Water Act (e.g., sewage plant discharges). The production of algal toxins is often due to eutrophication of river and stream waters. Increases in chemical contaminants such as mercury in rivers and streams are typically caused by air deposition from coal combustion and waste incineration. Polychlorinated biphenyls (PCBs) and per- and polyfluoroalkyl substances (PFAS) are categories of pollutants the Corps does not have the authority to regulate under its permitting authorities.

A.2.2 Coastal Waters

In 2015, USEPA and its collaborators conducted the National Coastal Condition Assessment for estuaries in the conterminous United States, as well as the Great Lakes. Their results were published in 2021. For the National Coastal Condition Assessment, USEPA and its collaborators sampled 1,060 randomly selected sites in 28 coastal states. Estuarine waters in Alaska and Hawaii were excluded. Of the randomly selected sites, 699 were in estuaries and 361 were in the Great Lakes, representing about 27,479 square miles in estuaries and 7,118 square miles in the Great Lakes. Survey field crews collected samples to characterize four ecological and three human health indicators to assess the ecological condition of estuaries and nearshore Great Lakes waters (USEPA 2021).

The ecological indicators consisted of biological condition, eutrophication, sediment quality, and the ecological effects of fish tissue contamination. Assessing biological condition involved examining the invertebrates (e.g., molluscs, worms, crustaceans) inhabiting the sediments of estuaries and the Great Lakes, including their abundance, pollution sensitivity, and biodiversity. The eutrophication indicator considers the levels of nutrients, dissolved oxygen, chlorophyll *a*, and water clarity in estuaries and the Great Lakes. The sediment quality indicator examined contaminant levels in waterbody bottom sediments, as well as the toxicity of the sediments. The “ecological effects fish tissue contamination” indicator was used to determine whether contamination in fish might lead to lethal or nonlethal effects in predators such as mammals, birds, and other fish.

For estuaries, USEPA’s results for the biological condition, eutrophication, sediment quality, and the “ecological effects of fish tissue contamination” indicators are summarized in Table A-7.

Table A-7. Summary of the 2015 National Results for Biological,

Chemical, and Physical Indicators for Estuarine Coastal Waters (USEPA 2021).

Indicator	% good	% fair	% poor	% not assessed
Biological condition – benthic macroinvertebrates index	71	15	7	7
Eutrophication	33	51	15	<1
Sediment quality	76	19	3	3
Ecological effects of contaminated fish	15	20	55	10

For the biological condition indicator, USEPA examined benthic macroinvertebrates found that 71% of the estuarine area sampled was in “good” ecological condition, and 15% of the sampled areas were in “fair” condition; 7% of sampled areas were determined to be in “poor” ecological condition. Under the eutrophication index indicator, USEPA found that 33% of the sampled estuarine areas were in “good” condition, 51% were in “fair” condition, and 15% of the sampled areas were in “poor” condition. Regarding sediment quality, 76% of the sampled areas within estuarine waters was found to be in “good” condition, 19% of the sampled areas were determined to be in “fair” condition, and 3% of the sampled estuarine areas were in “poor” condition. For the “ecological effects of contaminated fish” indicator, USEPA found that 15% of sampled estuarine water areas were in “good” condition, 20% were in “fair” condition, 55% were in “poor” condition, and 10% of sampled estuarine waters area was not assessed for this indicator.

For human health indicators, USEPA’s 2015 National Coastal Condition Assessment examined enterococci contamination, microcystins, and mercury in fish plugs. Enterococci are a type of bacteria that live in the intestines of humans and mammals that indicate whether there is water contamination from the release of human and animal waste into estuarine waters. USEPA established a benchmark for enterococci levels in estuarine waters, and in the 2015 assessment they found that nearly 99% of estuarine waters sampled were below that benchmark, which indicated safe levels for people who might swim in those waters. Microcystins can be released from cyanobacteria during algal blooms that may occur under eutrophic conditions. Exposure to microcystins can adversely affect human health by causing skin rashes, eye irritation, respiratory symptoms, gastroenteritis, and potentially liver or kidney failure and death. In the estuaries surveyed by USEPA in 2015, they found that 100% of all estuaries sampled were at or below the benchmark they established for microcystins. Mercury is a toxic metal that can accumulate in fish tissue and, if that fish is consumed by humans, it may contribute to problems in vision, hearing, the nervous system, and psychological and cognitive impairments. In their 2015 survey, USEPA found that 55% of the samples of fish plugs from surveyed waters had mercury levels in fish fillet plugs that were below the established benchmark (300 parts per billion). Fish fillet plug samples determined to be above the established benchmark occurred in 2% of samples, and 43% of samples were not assessed for mercury in fish fillet plugs.

Table A-8 summarizes the results of USEPA's 2015 National Coastal Condition Assessment for the Great Lakes, specifically the four indicators discussed above: biological condition, eutrophication, sediment quality, and the ecological effects of fish tissue contamination.

Table A-8. Summary of the 2015 National Results for Biological, Chemical, and Physical Indicators for Great Lakes Coastal Waters (USEPA 2021).

Indicator	% good	% fair	% poor	% not assessed
Biological condition – benthic macroinvertebrates index	31	15	21	37
Eutrophication	54	22	24	<1
Sediment quality	62	15	2	21
Ecological effects of contaminated fish	17	19	47	17

For the biological condition indicator, USEPA found that 31% of the Great Lakes area sampled was in "good" ecological condition with respect to benthic macroinvertebrates, 15% of the sampled areas were in "fair" condition, and 21% of sampled areas were determined to be in "poor" ecological condition. Under the eutrophication index indicator, USEPA found that 54% of the sampled Great Lakes areas were in "good" condition, 22% were in "fair" condition, and 15% of the sampled areas were in "poor" condition. Regarding sediment quality, 62% of the sampled areas within Great Lakes waters were found to be in "good" condition, 15% of the sampled areas were determined to be in "fair" condition, and 2% of the sampled Great Lakes areas were in "poor" condition; 21% of the sampled Great Lakes areas were not assessed for the eutrophication index indicator. For the "ecological effects of contaminated fish" indicator, USEPA found that 17% of sampled Great Lakes water areas were in "good" condition, 19% were in "fair" condition, 47% were in "poor" condition, and 17% of sampled Great Lakes waters area was not assessed for this indicator.

For the Great Lakes, USEPA also established a benchmark for enterococci levels in those waters, and in their 2015 assessment they found that nearly 99% of Great Lakes waters sampled were below that benchmark, less than 1% were above the benchmark, and 1% were not assessed. In the Great Lakes waters surveyed by USEPA, they found that 99% of all estuaries sampled were at or below the benchmark they established for microcystins, and less than 1% were found to be above USEPA's benchmark. Regarding mercury in fish fillet plugs, in their 2015 assessment USEPA found that 65% of the samples of fish plugs from surveyed waters in the Great Lakes had mercury levels in fish fillet plugs that were below the established benchmark (300 parts per billion). Fish fillet plug samples determined to be above the established benchmark occurred in 6% of samples, and 29% of samples were not assessed for mercury in fish fillet plugs.

As a result of their 2015 National Coastal Condition Assessment, USEPA (2021) concluded that eutrophication is the most significant problem in coastal waters, and much of the nutrients that contribute to eutrophication in coastal waters comes from rivers that transport those nutrients from inland areas to estuaries and the Great Lakes. Eutrophication can result in algal blooms that can be harmful to aquatic organisms. They recognized the importance of efforts by federal agencies, tribes, and states to reduce nutrient pollution and other forms of pollution to coastal waters.

Benthic macroinvertebrates in estuarine and Great Lakes waters may be directly or indirectly affected by discharges of dredged or fill material into those waters that may be authorized by NWP. Benthic macroinvertebrates may also be directly or indirectly affected by structures and work in navigable waters of the United States authorized under section 10 of the Rivers and Harbors Act of 1899 that may be authorized by some NWPs. However, benthic macroinvertebrates may also be affected by activities in or near estuaries or the Great Lakes by activities that are not regulated under the Corps' permitting authorities or authorized by the NWPs. Examples of such activities may include point source discharges of pollutants into those waters authorized by the USEPA or states with approved programs under section 402 of the Clean Water Act, where those pollutants can change the species composition of benthic macroinvertebrate communities. Benthic macroinvertebrate communities may also change in response to non-point sources of pollution into those waters. For example, point source discharges of pollutants regulated under section 402 of the Clean Water Act and non-point sources of pollution may change benthic macroinvertebrate communities from being comprised of pollution intolerant species to being comprised of pollution tolerant species.

Eutrophication may be caused by inputs of higher levels of nutrients into estuarine waters and the Great Lakes from sources such as urban and agricultural runoff and discharges of treated wastewater. Excessive levels of these nutrients can cause estuarine and Great Lakes waters to produce harmful algal blooms, which can increase the abundance of phytoplankton, such as microscopic algae and cyanobacteria. Those organisms may produce harmful algal blooms that can reduce dissolved oxygen levels and release toxins to these waters. The activities authorized by the NWPs are not a direct source of increased nutrient loads that could cause eutrophication of estuarine and Great Lakes waters.

Sediment quality is an indicator of the absence or presence of persistent contaminants in estuarine waters and the Great Lakes. The contaminants may be metals and/or organic compounds. The presence of metals and organic compounds in bottom sediments of these waterbodies may have adverse effects on benthic communities and become concentrated in the food webs in estuarine waters and the Great Lakes, where they could cause harm to people that eat shellfish and fish from these waters. These contaminants are unlikely to be introduced into estuarine waters and the Great Lakes by discharges of dredged or fill material or structures and work authorized by the NWPs. They are more likely to be introduced into these waters via point source discharges regulated under section 402 of the Clean Water Act or unregulated or unintentional inputs by human activities.

The "ecological effects of fish contamination" indicator examines the degree to which fish absorb chemical contaminants from these waters. Those contaminants may come from a variety of sources, such as the water column, sediments, or by consuming other contaminated organisms. Sufficiently high levels of contaminants can cause lethal or non-lethal effects on birds, mammals, and other fish. Activities authorized by the NWPs are unlikely to be sources of the contaminants assessed for fish. Other indicators examined by the USEPA, specifically enterococci contamination, microcystins, and "mercury in fish fillet plugs" are also not likely to be influenced by discharges of dredged or fill material into waters of the United States or structures and work in navigable waters of the United States that may be authorized by the NWPs, because they are primarily influenced by sources of pollution that are outside of the Corps' authority to regulate under section 404 of the Clean Water Act and section 10 of the Rivers and Harbors Act of 1899.

A.2.3 Lakes

USEPA issued their report titled: "National Lakes Assessment: The Fourth Collaborative Survey of Lakes in the United States," which presents the results of their 2022 survey of lake condition in the conterminous United States.[4] The National Lakes Assessment examined the percentage of lake waters that support healthy ecosystems and recreation, the most common water quality problems in lakes, and whether lake water quality is improving or getting worse. The National Lakes Assessment categorizes lake condition as "good," "fair," or "poor." The National Lakes Assessment did not include the Great Lakes and the Great Salt Lake. It assessed ponds, natural lakes, and reservoirs that were at least 2.47 acres in area, with a water depth of at least 3.3 feet, and with at least 0.25 acre of open water. In their assessment, USEPA sampled 981 lakes out of a population size of 268,020 lakes. In the lake population, 31% of lakes were natural lakes and 69% of lakes were reservoirs.

The trophic state indicator evaluates the biological productivity of lakes. It relates to the total amount of algae in lakes, which includes algae, cyanobacteria, and other photosynthetic microorganisms. USEPA's 2022 National Lake Assessment found that 7% of surveyed lakes were oligotrophic, 19% were mesotrophic, 43% were eutrophic, and 30% were hypereutrophic; 1% of assessed lakes were not evaluated for the trophic state indicator. Eutrophic lakes have high nutrient levels and high biological productivity. Oligotrophic lakes have low concentrations of nutrients and

[4] https://nationallakesassessment.epa.gov/webreport/ (accessed February 4, 2025)

low rates of productivity. Mesotrophic lakes fall between eutrophic and oligotrophic lakes, and hypereutrophic lakes have extremely high levels of algae, plants, and cyanobacteria that typically cause reduced biological diversity and reduced lake metabolism.

Table A-9 provides a summary table of the biological, chemical, and physical indicators that were examined in the 2022 National Lake Assessment, and whether those indicators were found to be “good,” “fair,” or “poor.” The biological indicators examined by USEPA include chlorophyll *a*, benthic macroinvertebrates, and zooplankton. The chlorophyll *a* biological indicator shows the quantity of algae and cyanobacteria in a lake, which are naturally found in lakes. Benthic macroinvertebrates include organisms such as crayfish, small molluscs, and the larvae and nymphs of aquatic insects, and they provide information on the biological quality of lake shoreline habitats. Zooplankton are small animals that live in the water columns of lakes, are important components of lake food webs, and are sensitive to changes in lake ecosystems.

The chemical indicators examined by USEPA in their 2022 National Lake Assessment include acidification, dissolved oxygen, and nutrients, specifically total nitrogen and total phosphorous. Acidification relates to the addition of acidifying compounds to lake water, such from acid rain and acid mine drainage, which can change the acidity or alkalinity (i.e., pH) of that water and affect fish and other aquatic life in those waterbodies. USEPA also examined the presence or absence of atrazine (an agricultural herbicide) in lake water, and they found that atrazine was not detected in 58% of assessed lakes, but it was detected in 41% of assessed lakes. However, it was not assessed in 2% of surveyed lakes. Dissolved oxygen is an indicator of water quality because it is necessary to support aquatic communities, especially animals. Nutrients (i.e., total phosphorus and total nitrogen) are an important indicator because they represent nutrients that are needed for all aquatic life, including primary production that helps support lake food webs. High inputs of nutrients can cause eutrophication in lakes.

Physical indicators that were included in USEPA’s 2022 National Lake Assessment are lake drawdown exposure, lakeshore disturbance, riparian vegetation cover, shallow water habitat, and lake habitat complexity. Lake drawdown exposure refers to the fluctuation or lowering of lake water levels, which can affect conditions for littoral and riparian habitats, as well as biological communities. The lakeshore disturbance indicator relates to the extent and intensity of direct human alteration of lake shorelines, which can affect lake quality through excess sedimentation, loss of native plants, changes to vegetation structure and habitat complexity, changes to lake bottom materials, and effects on fish, wildlife and other aquatic communities. Riparian vegetation cover is comprised of the herbaceous, shrubs, and trees next to lakes, which can slow runoff, remove nutrients and sediments, reduce erosion along lake shorelines, shade water, and act as a source of leaf litter and woody debris that can act as food and habitat in lake ecosystems. The lake shallow water habitat indicator looks at the quality of the shallow habitats along the edge of lakes, such as the presence or absence of vegetation overhanging the water, aquatic plants, large wood, boulders and rock ledges. The habitat complexity indicator brings together the riparian vegetation cover and shallow water habitat indicators to assess the quantity and diversity of all cover types within land and water at the lake's edge, as habitat for macroinvertebrates and fish.

Table A-9. Summary of National Results for Biological, Chemical, and Physical Indicators for USEPA's 2022 National Lake Assessment.

Indicator	% good	% fair	% poor	% not assessed
Biological				
• Chlorophyll *a*	31	20	49	1
• Benthic macroinvertebrates	42	26	29	3
• Zooplankton	48	25	25	2
Chemical				
• Acidification	98	2	<1	<1
• Dissolved oxygen	72	20	7	<1
• Nutrients (total nitrogen)	34	19	47	<1
• Nutrients (total phosphorous)	37	13	50	<1
Physical				
• Lake drawdown exposure*	79	15	5	<1
• Lakeshore disturbance	16	50	34	<1
• Riparian vegetation cover	52	21	27	<1
• Shallow water habitat	55	26	19	<1
• Lake habitat complexity	51	19	30	<1

* For "lake drawdown exposure," "good" represents a small exposure condition, "fair" represents a medium exposure condition, and "poor" represents a large drawdown exposure condition.

USEPA's 2022 National Lake Assessment also examines human health indicators in lakes. These human health indicators include:

- Cyanotoxins, which are unicellular photosynthetic organisms (cyanobacteria). Some cyanobacteria can release toxins such as microcystins and cylindrospermopsin that can cause skin rashes, eye irritation, respiratory symptoms, and other adverse human health consequences.
- Enterococci, which are bacteria that live in the intestinal tracts of warm-blooded animals, including humans. Enterococci are used as indicators of possible fecal contamination from various sources such as wastewater treatment plant discharges, leaking septic systems, and storm water runoff containing pet and livestock waste.
- Fish tissue contamination via substances such as mercury, polychlorinated biphenyls, per- and polyfluoroalkyl substances, which can make fish unsafe for people to eat and may help cause cancer and perhaps developmental, neurological or other health impacts.

Table A-10 summaries the USEPA's 2022 results for its National Lakes Assessment for human health indicators.

Table A-10. Summary Results for USEPA's 2022 National Lakes Assessment for Human Health Indicators

Human health indicator	% at or below criterion	% above criterion	% not assessed
Cyanotoxins			
• Microcystins risk condition	98	2	0
• Cylindrospermopsin risk condition	100	0	0
Enterococci bacteria	92	7	1
Fish tissue contamination			
• Mercury	49	51	0
• Polychlorinated Biphenyls (PCBs)	94	6	0

Except for mercury contamination in fish tissues, high percentages of surveyed lakes were found to be at or below USEPA's benchmark criteria for cyanotoxins, enterococci bacteria, and PCB contamination. More than half of the sample fish tissues found mercury contamination concentrations above USEPA's benchmark for that indicator.

Discharges of dredged or fill material into waters of the United States and structures and work in navigable waters of the United States that may be authorized by the NWPs may affect the following indicators examined by the USEPA in their 2022 National Lakes Assessment: benthic macroinvertebrates, lakeshore disturbance, riparian vegetation cover, shallow water habitat, lake habitat complexity, These indicators may also be affected by activities that the Corps does not have the authority to regulate under section 404 of the Clean Water Act and section 10 of the Rivers and Harbors Act of 1899.

The remaining indicators used by USEPA to assess the condition of lakes are unlikely to be affected by activities authorized by the NWPs because they are influenced by releases of pollutants and other factors that the Corps does not have the authority to regulated under the two permitting authorities under which the NWPs are issued. Those indicators are: chlorophyll *a*, zooplankton, acidification, atrazine, dissolved oxygen, nutrients, lake drawdown exposure, cyanotoxins (including microcystins and cylindrospermopsin), enterococci bacteria, and fish tissue contamination via mercury, polychlorinated biphenyls (PCBs), and per- and polyfluoroalkyl substances (PFAS).

<u>A.2.4 Wetlands</u>

USEPA's 2021 National Wetland Condition Assessment[5] examined the ecological condition of wetlands across the conterminous United States, and ranked their condition as good, fair, or poor as a result of applying various biological, physical, chemical, and human heath indicators. The findings of that survey are summarized in Table A-11.

Table A-11. Results from USEPA's National Wetland Condition Assessment (2021)

Indicator	% good	% fair	% poor	% very poor	% not assessed
Biological indictors					
• Vegetation	45	20	34		<1
• Nonnative plants	48	27	13	11	<1
Physical indicators					
• Vegetation removal	42	31	26		2
• Vegetation replacement	42	23	33		2
• Flow obstruction	74	17	7		2
• Water addition or subtraction	79	15	4		2
• Soil hardening	49	38	12		2
• Surface modification	74	18	6		2
• Physical alterations (sum)	17	40	42		2
Chemical indicators					
• Soil heavy metals*					
• Water chemistry (phosphorous)	29	7	24		40
• Water chemistry (nitrogen)	29	14	17		40

* Results not available according to webpage viewed on February 4, 2025 (https://wetlandassessment.epa.gov/webreport/)

Biological indicators include vegetation (i.e., the composition of the plant community inhabiting the surveyed wetlands) and the presence of non-native plants. The plant species at a wetland site reflect environmental conditions such as hydrology, soil properties and water chemistry, and may be changed by anthropogenic disturbances. Those disturbances may degrade wetland condition, and cause changes in the composition of plant species within a wetland. The presence of non-native plants can have direct and indirect effects on the wetland plant community and wetland function, including the species of insects, amphibians, reptiles, birds, and mammals that might utilize the wetland for various stages of their life cycles. Less than half of the surveyed wetlands scored as "good" for the vegetation and non-native plants biological indicators.

[5] https://wetlandassessment.epa.gov/webreport/ (accessed January 31, 2025).

Physical indicators of wetland condition used for USEPA’s 2021 National Wetland Condition Assessment included vegetation removal (i.e., loss, removal or damage of vegetation due to human activity), vegetation replacement (i.e., the conversion of natural vegetation structure and composition due to human activity), flow obstruction (i.e., human activities that can impound water or impede its flow into, out of, or within wetlands, such as the construction of dams, dikes, berms, or railroad beds), water addition or subtraction (i.e., modifications that drain or add water to the site), soil hardening (i.e., soil compaction and the creation of impervious surfaces such as parking lots, roads, and buildings), surface modification (i.e., soil erosion or deposition), and the sum of physical alterations (i.e., considering combinations of multiple physical alterations). For the vegetation removal and vegetation replacement physical indicators, less than half of the surveyed wetlands were determined to be in “good” condition. Approximately three-quarters of the surveyed wetland were found to be in “good” condition for the flow obstruction, water addition or subtraction, and surface modification indicators.

Chemical stressors that can affect wetland condition include excess nutrients, metals, organic toxins and other chemicals. These chemical stressors can disrupt nutrient cycles, affect the growth of plants and animals, and have adverse consequences on human health. In their 2021 National Wetland Condition Assessment, USEPA examined soil heavy metals and water chemistry, in particular phosphorous and nitrogen. Regarding soil heavy metals, USEPA evaluated concentrations of EPA assessed concentrations the following heavy metals, which are closely associated with human activities: antimony, cadmium, chromium, cobalt, copper, lead, nickel, silver, tin, tungsten, vanadium and zinc. USEPA stated that the soil heavy metal results are not yet available from the laboratory, and that the webpage would be updated when that information becomes available. USEPA also evaluated levels of phosphorous and nitrogen, which can come from various sources such as urban stormwater runoff, agricultural runoff, atmospheric deposition, and septic systems. USEPA found that less than 30 percent of surveyed wetlands scored as “good” for the “water chemistry (phosphorous)” and “water chemistry (nitrogen)” indicators. Wetland condition with respect to the soil heavy metals indicator was not reported in USEPA’s 2021 National Wetland Condition Assessment report when it was viewed for the preparation of this section of the environmental assessment.

The composition of wetland plant communities and the presence of non-native plants in wetlands may be influenced to some degree by activities authorized by the NWPs. For example, activities authorized by NWPs may disturb plant communities by removing or harming individual plants, and when plants grow back in areas disturbed by NWP activities, the plant community species composition may change. Changes to plant community composition may also be caused by activities that disturb plant communities that do not involve activities regulated under the Corps’ permitting authorities. For example, in wetlands plants may be disturbed by hand clearing or mowing or by inputs of nutrients and sediments from point and non-point sources. Invasive species may also become more prevalent in wetlands subject to inputs of debris, sediments, water, and nutrients that increase the potential for the replacement of native wetland plants by invasive plant species (Zedler and Kercher 2004).

For the physical indicators used in USEPA's National Wetland Condition Assessment, vegetation removal, vegetation replacement, flow obstruction, water addition and subtraction, soil hardening and surface modifications may be caused by discharges of dredged or fill material into waters of the United States authorized by the NWPs, but they may also be caused by activities the Corps does not have the authority to regulate. For example, land use changes in uplands can alter watershed hydrology, including the movement of water through wetland catchments, to alter wetland hydrology and wetland hydroperiods (Wright et al. 2006). Some water flow obstructions may authorized by NWPs, but other flow obstructions could be constructed without Department of the Army authorization (e.g., flow obstructions in upland swales that drain to wetlands). Water addition and subtraction may or may not involve activities authorized by NWPs. The construction or modification of features that increase or decrease water drainage and affect wetland hydrology could be authorized by NWPs, but they could also occur as a result of activities that do not require Corps authorization, such as the construction of drainage ditches in jurisdictional wetlands that do not involve a discharge of dredged material into those wetlands (see 33 CFR 323.2(d)) that the Corps can regulate under Clean Water Act section 404. Soil hardening may be caused by activities authorized by NWP, such as the construction of a road crossing through wetlands. Soil hardening may also be caused by activities that the Corps does not have the authority to regulate, such as driving heavy equipment through wetlands that causes wetland soils to become compacted.

The chemical stressors that can affect wetland condition (e.g., excess nutrients, metals, organic toxins and other chemicals) are typically not subject to regulation by the Corps under its permitting authorities that apply to the NWP Program (i.e., section 404 of the Clean Water Act and section 10 of the Rivers and Harbors Act of 1899). Inputs of these pollutants to wetlands may be regulated under different authorities (e.g., section 402 of the Clean Water Act, which is administered by USEPA and states) or they might not be regulated at all. These chemical stressors may reach wetlands through the movement of through watersheds and wetland catchments (e.g., non-point sources), or they may accumulate in wetlands through inadvertent releases or intentional releases.

A.3 Human Activities Affecting the Quantity and Quality of Aquatic Ecosystems in the United States

The Corps Regulatory Program issues the NWPs under two of its four permitting authorities: section 404 of the Clean Water Act and section 10 of the Rivers and Harbors Act of 1899. Under section 404 of the Clean Water Act, the Corps has the authority to regulate discharges of dredged or fill material into waters of the United States. The Corps' two permitting authorities that are not used for the issuance of NWPs are section 9 of the Rivers and Harbors Act and section 103 of the Marine Research, Protection, and Sanctuaries Act of 1972, as amended. Section 9 of the Rivers and Harbors Act of 1899 prohibits the construction of any dam or dike across any navigable water of the United States in the absence of Congressional consent and approval of the plans by the Chief of Engineers and the Secretary of the Army. Under section 103 of the Marine Research, Protection, and Sanctuaries Act of 1972, the Corps has the authority to issue permits, after notice and opportunity for public hearing, for the transportation of dredged material for the purpose of disposal in the ocean. The activities authorized by DA permits, including the NWPs, under these four permitting authorities comprise a small subset of the human activities that can directly and indirectly affect the structure and functions of aquatic ecosystems, including waters and wetlands regulated by the Corps under its permitting authorities. Examples of other human activities that can directly and indirectly affect the structure and functions of aquatic ecosystems are listed in Table A-12.

Table A-12. Human activities that directly and indirectly affect the structure and functions of aquatic ecosystems

Aquatic ecosystem category	Human activities that directly and indirectly affect aquatic ecosystem structure and function	Reference(s)
wetlands and waters (generally)	• land use/land cover changes • alien species introductions • species overexploitation • pollution • eutrophication • resource extraction (e.g., water withdrawals)	MEA (2005a)

Aquatic ecosystem category	Human activities that directly and indirectly affect aquatic ecosystem structure and function	Reference(s)
rivers and streams	• agriculture • urban development • industrial development • deforestation • mining • water removal • flow alteration • invasive species • point source and non-point source pollution • dams (hydroelectric, water supply) and navigational aids such as locks • dredging • erosion • filling • overfishing • road construction • drainage and channelization • sediment deposition • boating	Palmer et al. (2010) Carpenter et al. (2011) Allan (2004) NRC (1992)
river-floodplain systems	• dam construction • levee construction • floodplain drainage • river regulation • reservoir operations • urbanization • agriculture • biological invasions • navigation improvements • recreational activities • channelization • beaver removal • logging • removal of logjams • mining activities • stabilizing single-thread channels	Petsch et al. (2023) Wohl et al. (2021)
lakes	• point and non-point sources of pollutants, including nutrients and contaminants • invasive species • land use and land cover changes in catchments • overharvesting • modifications of hydrologic regime • sediment loading • eutrophication • water level regulation	Schalleberg et al. (2013)

Aquatic ecosystem category	Human activities that directly and indirectly affect aquatic ecosystem structure and function	Reference(s)
wetlands	• wetland conversion through drainage, dredging, and filling • hydrologic modifications that change wetland hydrology and hydrodynamics • pollutants (point source and non-point source), including nutrients and contaminants • waterfowl and wildlife management activities • agriculture and aquaculture activities • flood control and stormwater protection (e.g., severing hydrologic connections between rivers and floodplain wetlands) • silvicultural activities • agricultural activities • urban development • mining activities • water withdrawals, aquifer depletion • river management (e.g., channelization, navigation improvements, dams, locks, weirs) • altered sediment transport • introductions of non-native species • activities that cause land subsidence, erosion	Mitsch and Gosselink (2015) Mitsch and Hernandez (2013) Wright et al. (2006) Zedler and Kercher (2005) Brinson and Malvárez (2002)
seagrass beds	• dredging • coastal development activities • degradation of water quality • sediment and nutrient runoff from adjacent lands • physical disturbances • natural processes, such as herbivore grazing, physical disturbances caused by waves and tidal currents • invasive species • diseases • commercial fishing activities • aquaculture • algal blooms • reduced light availability • nutrient limitations	Borum et al. (2013) Waycott et al. (2009) Orth et al. (2006)

Aquatic ecosystem category	Human activities that directly and indirectly affect aquatic ecosystem structure and function	Reference(s)
coral reefs	• overexploitation/overfishing • dredging • destructive fishing practices (e.g., blast or cyanide fishing) • nutrients, sediments, pesticides, and other pollutants (point source and non-point source) • ocean acidification • coastal land uses, including development and agriculture • coral mining • introduction of invasive or non-native species • diseases	Sheppard (2014) MEA (2005a) Barbier et al. (2011)
coastal areas	• development activities, including the construction of residences, commercial buildings, industrial facilities, resorts, and port developments • agricultural and forestry activities • point source and non-point source pollution (nutrients, organic matter, other pollutants) • aquaculture • fishing activities • overharvesting of species • intentional and unintentional introductions of non-native species • dredging • reclamation • shore protection and other structures • habitat modifications • structures that change hydrology and hydrodynamics • shoreline erosion • pathogens and toxins • debris and litter	Korpinen and Andersen (2016) Robb (2014) Day et al. (2013) Lotze et al. (2006) MEA (2005b) NRC (1994)

Aquatic ecosystem category	Human activities that directly and indirectly affect aquatic ecosystem structure and function	Reference(s)
oceans	• pollution (point and non-point source) • fishing activities • aquaculture/mariculture • ultraviolet light • species invasions • commercial activities, including industrial activities • tourism • marine transportation • land-based activities, including urban and suburban development, agriculture, forestry, power generation, and mining • ports/marinas • benthic structures • offshore energy infrastructure and power generation (e.g., wind farms, pipelines)	Korpinen and Andersen (2016) Halpern et al. (2015) Clarke Murray et al. (2014) Halpern et al. (2008)

Human activities such as urbanization, agriculture, and forestry alter ecosystem structure and function by changing their interactions with other ecosystems, their biogeochemical cycles, and their species composition (Vitousek et al. 1997). Changes in land use reduce the ability of ecosystems to produce ecosystem services, such as food production, reducing infectious diseases, and regulating environmental conditions, including air quality (Foley et al. 2005). Despite the prevalence of human activities altering landscapes and seascapes and the ecosystems within those landscapes and seascapes over long periods of time, many of those ecosystems continue to provide ecological functions and services to varying degrees (Clewell and Aronson 2013).

Human activities and other disturbances to ecosystems, landscapes, and seascapes may result in those systems recovering to their original state through biotic and abiotic characteristics and processes that provide resilience, or those systems may be transformed to a different ecological state (i.e., an alternative stable state) (van Andel and Aronson 2012). Resilience is defined by Folke et al. (2010) as the capacity of a social-ecological system to withstand disturbance and undergo changes, while retaining its ability to exhibit similar structure, functions, and interactions. If the ecosystem, landscape, or seascape changes to an alternative stable state, the alternative stable state may be considered an improvement or degradation, depending on the perspective of the person evaluating the change (Backstrom et al. 2018, van Andel and Aronson 2012).

Wetlands, streams, and other aquatic ecosystems and the functions and services they provide are directly and indirectly affected by changes in land use and land cover, alien species introductions, overexploitation of species, pollution, eutrophication due to excess nutrients, resource extraction including water withdrawals, changing environmental conditions, and various types of natural disturbances (MEA 2005a). Freshwater ecosystems such as lakes, rivers, and streams are altered by changes to water flow, changes in environmental conditions, land use changes, additions of chemicals, resource extraction, and aquatic invasive species (Carpenter et al. 2011).

Most of the human activities that affect the structure and function of aquatic ecosystems do not involve activities regulated by the Corps under section 404 of the Clean Water Act or section 10 of the Rivers and Harbors Act of 1899. For example, changes in upland land use, such as the construction and expansion of upland developments, the conversion of upland forests to agricultural land, and mining activities in uplands, none of which the Corps Regulatory Program has the authority to regulate, can have substantial adverse effects on the ability of aquatic ecosystems to perform hydrologic, biogeochemical, and habitat functions because those upland activities alter watershed-scale processes that influence those functions. Those watershed-scale processes include water movement and storage, erosion and sediment transport, and the transport of nutrients and other pollutants. Inputs of sediments into aquatic ecosystems can result from erosion occurring within a watershed (Beechie et al. 2013, Gosselink and Lee 1989). As water moves through a watershed it carries sediments and pollutants to streams (e.g., Allan 2004, Dudgeon et al. 2005, Paul and Meyer 2001) and wetlands (e.g., Zedler and Kercher 2005, Wright et al. 2006). Non-point sources of pollution (i.e., pollutants carried in surface runoff from farms, roads, and urban areas) are largely uncontrolled (Brown and Froemke 2012) because the Clean Water Act only requires permits for point sources discharges of pollutants (i.e., discharges of dredged or fill material regulated under section 404 and point source discharges of other pollutants regulated under section 402). Habitat alterations as a cause or source of impairment may be the result of activities regulated under section 404 and section 10 because they involve discharges of dredged or fill material or structures or work in navigable waters that can change the structure and functions of aquatic ecosystems. But habitat alterations may also occur as a result of activities not regulated under those two statutes, such as the removal of vegetation from upland riparian areas and the removal of ecosystem engineers such as beavers and some tree species. Activities that may cause hydrologic modifications may or may not be regulated under section 404 or section 10.

Stream and river functions are affected by activities occurring in their watersheds, including the indirect effects of land uses changes (Beechie et al. 2013, Allan 2004, Paul and Meyer 2001). Booth at al. (2004) found riparian land use in residential areas also strongly affects stream condition because many landowners clear vegetation up to the edge of the stream bank. The removal of vegetation from upland riparian areas and other activities in those non-jurisdictional areas do not require DA authorization.

Wetland functions are also indirectly affected by activities in lands that drain to the wetlands (Zedler and Kercher 2005, Wright et al. 2006). Human activities within a watershed or catchment that have direct or indirect adverse effects on rivers, streams, wetlands, and other aquatic ecosystems are not limited to discharges of dredged or fill material into waters of the United States or structures or work in a navigable waters. Human activities in uplands may have substantial indirect effects on the structure and functions of aquatic ecosystems, including streams and wetlands, and their ability to sustain species populations. It is extremely difficult to distinguish between degradation of water quality caused by upland activities and degradation of water quality caused by the filling or alteration of wetlands (Gosselink and Lee 1989) because of the interactions among watershed components.

In addition to the disturbances caused by human activities that can alter ecosystem structure and functions, ecosystem structure and functions can also be affected by disturbances caused by natural events or processes. Examples of those natural events or processes include storms, floods, wildfires, earthquakes, tsunamis, changing environmental conditions, and changes in precipitation patterns.

It is also important to consider that many disturbances are crucial and necessary for ecosystems to maintain their structure and functions and ensure their long-term sustainability (Clewell and Aronson 2013). The “services to ecosystems” concept articulated by (Comberti et al. 2015) captures the reciprocal relationship between people and ecosystems through management strategies implemented by people, including indigenous and rural societies, to sustain cultural ecosystems and contribute to the production of ecosystem services. Comberti and others (2015) define “services to ecosystems” as “actions humans have taken in the past and currently that modify ecosystems to enhance the quality or quantity of the services they provide, whilst maintaining the general health of the cognized ecosystem over time.” It is likely that all ecosystems are maintained to some degree by disturbances (Clewell and Aronson 2013), which may be caused by humans or natural events, or both.

A.4 Ecological Functions and Services Performed by Aquatic Ecosystems

Ecosystems perform a variety of physical, chemical, and biological functions. Functions are the physical, chemical, and biological processes that occur in ecosystems (33 CFR 332.2). Wetland functions occur through interactions of their physical, chemical, and biological features (Smith et al. 1995). Stream functions occur through physical, chemical, and biological processes that interact in complex and dynamic ways within watersheds to form and maintain streams and riparian areas (Fischenich 2006).

Ecosystem services are the benefits that human populations receive from ecosystem functions (33 CFR 332.2). People can readily be aware of some ecosystem services, but they are unaware of other ecosystem services, especially those services that are generally available to the public at large (Costanza 2008). Ecosystem disservices are the negative effects of ecosystem functions on human well-being (Blanco et al. 2019). Examples of ecosystem disservices are the provisioning of habitat for insects and other organisms that can infect people with diseases, such as malaria, and water storage that can increase the risk of flooding nearby lands.

Ecosystems are not necessarily fragile because they have the ability to persist or change in response to disturbances, but the ecosystem services they provide to people may be considered fragile because those services may change or be lost when ecosystem structure and functions change (Levin 1999) in response to one or more disturbances or other drivers of change. Identifying and classifying the various ecosystem services performed by different ecosystems need to consider the complexity and dynamics of ecosystems, and the fact that ecosystems and the functions and services they provide cannot be neatly put into discrete categories (Costanza 2008). Ecosystem services can be classified in a number of ways, and multiple classification systems are needed to fulfill different purposes for considering ecosystem services (Costanza 2008).

As they are most commonly considered, ecosystem services focus on a unidirectional flow (i.e., from ecosystems to people), so this dominant perception of ecosystem services often fails to recognize the important role that people, including people from indigenous and traditional societies, have in maintaining and improving ecosystems (Comberti et al. 2015). In response to that common view, Comberti and others (2015) developed the concept of “services to ecosystems,” which they define as actions humans have taken in the past, and currently undertake, that modify ecosystems to enhance the quality or quantity of the services they provide, while maintaining the general health of those ecosystems over time. “Ecosystem health” relates to the ability of ecosystems to provide a range of ecosystem services in a sustainable manner over time (Costanza 2012), which should be a desired endpoint to ecosystem management. Taking actions to help sustain ecosystem services can provide an effective means of promoting conservation and helping to improve the living conditions of people (Kareiva and Marvier 2017).

The amounts of specific ecosystem services provided by a particular site is not necessarily proportional to the size of the ecosystem at that site (de Groot et al. 2012). Below a threshold size, smaller sites might not provide some ecosystem services (de Groot et al. 2012). In addition, management of ecosystems, such as estuaries, can result in trade-offs among various ecosystem services as management actions such as flood protection, habitat restoration and protection, and construction and maintenance of transport facilities (e.g., navigation channels, ports), are implemented (Boerema and Meire 2017).

The Millennium Ecosystem Assessment (MEA) (2005a) describes four categories of ecosystem services for wetlands and waters: provisioning services, regulating services, cultural services, and supporting services. Those categories are summarized in Table A-13. Provisioning services include the production of food (e.g., fish, fruits, game), fresh water storage, food and fiber production, production of chemicals that can be used for medicine and other purposes, and supporting genetic diversity for resistance to disease. Regulating services relating to open waters and wetlands consist of regulation of environmental conditions; control of hydrologic flows; water quality through the removal, retention, and recovery of nutrients and pollutants; erosion control; mitigating natural hazards such as floods; and providing habitat for pollinators. Cultural services that come from wetlands and open waters include spiritual and religious values, recreational opportunities, aesthetics, and education. Wetlands and open waters contribute supporting services such as soil formation, sediment retention, and nutrient cycling.

Table A-13. General categories of ecosystem services for wetlands and waters (MEA 2005a).

Category	Services	Examples
Provisioning	Food	Fish, wild game, fruits, grains
	Fresh water	Store and retain water for domestic, industrial, and agricultural use
	Fiber and fuel	Produce logs, firewood, fodder
	Biogeochemical	Medicines and other material from organisms
	Genetic materials	Genes for resistance to diseases
Regulating	Regulation of environmental conditions	Sources and sinks for greenhouse gases; influence local precipitation, temperatures
	Water regulation (hydrologic flows)	Groundwater recharge/discharge
	Water purification and waste treatment	Retention, recovery, and removal of nutrients and pollutants
	Erosion regulation	Retention of soils and sediments
	Natural hazard regulation	Flood control, storm protection
	Pollination	Habitat for pollinators
Cultural	Spiritual and inspirational	Spiritual and religious values of wetlands and waters
	Recreational	Opportunities for recreational activities
	Aesthetic	People finding beauty or aesthetic value
	Educational	Opportunities for formal and informal education
Supporting	Soil formation	Sediment retention and accumulation of organic matter
	Nutrient cycling	Storage, recycling, processing, and acquisition of nutrients

There is little national-level information on the current ecological state of the Nation’s wetlands, streams, and other aquatic ecosystems, or the general degree to which they perform various ecological functions and services. Reviews have acknowledged that most aquatic ecosystems are degraded to some degree (e.g., Holl 2020, Evans and Davis 2018, Zedler and Kercher 2005, Allan 2004) because of various human activities, natural disturbances, and other drivers of change. Therefore, the analysis in this environmental assessment is a qualitative analysis.

A.4.1 Ecosystem Functions and Services of Estuaries and Oceans

Marine and coastal waters can be influenced by environments (e.g., coastal zones) and activities that extend up to 60 miles inland (Barbier 2017). Estuarine and coastal ecosystems are located where coastal waters, coastal lands, and watersheds meet and interact with each other, which results in their production of more substantial and matchless ecological benefits compared any single ecosystem (Barbier et al. 2011). The functions and services provided by estuaries are the product of their hydrology, morphology, habitats, and water and sediment quality (Boerema and Meire 2017). They are also influenced by energy flows, biogeochemical processes, biological processes and functions (Barbier et al. 2011). Table A-14 lists examples of ecosystem services provided by estuaries.

Table A-14. Ecosystem services provided by estuaries. (Boerema and Meire 2017, Barbier et al. 2011)

Service category	Ecosystem services
Provisioning	• Production of animals and plants • Maintenance of fisheries • Water • Production of raw materials • Transportation
Regulating	• Nutrient cycling • Regulation of environmental conditions • Erosion and sedimentation regulation • Flood protection • Storm protection • Coastal protection • Water current reduction • Wave reduction • Water quality regulation
Cultural	• Aesthetics • Cultural heritage • Recreation • Tourism • Education • Research

Anthropogenic and natural disturbances affect the functions and services performed by estuarine habitats. Management activities also affect the ecosystem functions and services provided by estuaries (Boerema and Meire 2017). The principal drivers of direct change to estuarine and marine wetlands include the conversion of saltwater marshes, mangroves, seagrass meadows, and coral reefs to other land uses, diversions of freshwater flows, increased inputs of nitrogen, overharvesting various species, water temperature changes, and species introductions (MEA 2005a). These changes are indirectly driven by increases in human populations in coastal areas (MEA 2005a). Robb (2014) identified a number of threats to estuaries and estuarine habitats, such as the construction and operation of port facilities, dredging, pollution, aquaculture activities, resource extraction activities, species introductions, recreational activities, shoreline development and stabilization, waterway impairments, inputs of debris and litter, freshwater diversions, and land-based activities in surrounding watersheds (e.g., development activities, agricultural activities, forestry activities). Changing environmental conditions such as sea level rise, changing water temperatures, ocean acidification, and changing precipitation patterns also affect the functions and services performed by estuaries (Robb 2014).

Marine ecosystems interact with coastal lands within a seascape, where there is connectivity among various habitats in marine waters and estuarine waters (e.g., coral reefs, seagrasses, salt marshes, mangroves) and coastal lands (Barbier 2017). How those habitats interact with each other helps determine what ecosystem functions and services they will provide. Table A-15 lists examples of ecosystem services provided by oceans and marine waters.

Table A-15. Marine ecosystem services provided by oceans. (Barbier 2017).

Service category	Ecosystem services
Provisioning	• Food production • Fish harvests • Wild plant and animal resources • Water • Production of raw materials • Genetic materials • Transportation • Breeding and nursery habitats, including for economically important fish species
Regulating	• Nutrient cycling (e.g., nitrogen, carbon) • Erosion and sedimentation regulation • Flood control • Storm protection • Pollution control • Shoreline stabilization and erosion control
Cultural	• Aesthetics • Religious significance • Cultural heritage • Recreation • Tourism

	• Education • Scientific research

Coastal ecosystems exhibit substantial natural variations in space and time, which affects the functions and services they provide (Barbier et al. 2011). Marine and estuarine waters are also affected by human activities in ocean waters, coastal areas, and watersheds that drain to those marine and coastal waters (Korpinen and Andersen 2016). In marine and coastal environments, human activities and other disturbances that affect natural resources in those waters can come from a variety of sources, including water-based activities (e.g., transportation, fishing, mariculture, power generation, and tourism) and land-based activities (e.g., urban and suburban development, agriculture, non-point source pollution, forestry activities, power generation, and mining activities) (Clark Murray et al. 2014).

A.4.2 Ecosystem Functions and Services of Riverine Systems

Riverine systems, including rivers, streams, and their riparian area and floodplains provide various physical, chemical, and biological functions. Rivers, streams, and their riparian areas store water, which can reduce downstream flooding and subsequent flood damage (NRC 2002, MEA 2005a). These ecosystems also maintain populations of economically important fish, wildlife, and plant species, including valuable fisheries (MEA 2005a, NRC 2002). The nutrient cycling and pollutant removal functions they perform help maintain or improve water quality for surface waters (NRC 2002, MEA 2005a). Streams and riparian areas also provide important recreational opportunities. Rivers and streams also provide water for agricultural, industrial, and residential use (MEA 2005a).

The basic functions that riverine systems perform were placed in five categories by Fischenich (2006), and those five categories are: (1) system dynamics, (2) hydrologic balance, (3) sediment processes and character, (4) biological support, and chemical processes and landscape pathways. Those categories and their functions, components and processes are summarized in Table A-16.

Table A-16. River and stream corridor functions (Fischenich 2006).

System dynamics	Hydrologic balance	Sediment processes and character	Biological support	Chemical processes and pathways
Stream evolution processes	Surface water storage processes	Sediment continuity	Biological communities and processes	Water and soil quality
Energy management	Surface / subsurface water exchange	Substrate and structural processes	Necessary habitats for life cycles	Chemical processes and nutrient cycles

Riparian succession	Hydrodynamic character	Quality and quality of sediments	Trophic structures and processes	Landscape pathways

Petsch and others (2023) and Hornung and others (2019) identified 23 ecosystem services performed by rivers and their floodplains. Those ecosystem services are listed in Table A-17.

Table A-17. Ecosystem functions services provided by river-floodplain corridors (Petsch et al. 2023, Hornung et al. 2019).

Service category	Ecosystem services
Provisioning	• Food production • Water supply • Genetic resources • Hydropower generation • Production of wild animals and fish • Fibers and other plant materials • Plant production • Agricultural production
Regulating	• Nutrient cycling (e.g., nitrogen, phosphorous, carbon) • Water regulation • Erosion control • Water purification and waste treatment • Disease regulation • Regulation of environmental conditions • Sediment • Flood risks • Drought risks • Temperature regulation • Habitat maintenance
Supporting	• Primary production • Soil formation • Habitat provisioning
Cultural	• Aesthetics • Spiritual and religious significance • Cultural heritage • Recreation • Tourism • Education • Scientific research

Most ecosystem services performed by, or provided by, river-floodplain ecosystems are primarily controlled by flood pulses that maintain spatial and temporal habitat variability, biotic and abiotic interactions, and high biodiversity (Petsch et al. 2023). Management measures such as constructing or upgrading wastewater treatment plants, reducing water withdrawals, restoring natural flow regimes, restoring floodplains, restoring longitudinal connectivity, controlling adverse impacts of recreational activities, removing or relocating levees, and constructing flood retention areas can influence the ecosystem services performed by rivers and their floodplains (Hornung et al. 2019).

The benefits that river-floodplain systems provide to people depend on whether there are people living near that river and its floodplain and are able to receive those benefits (Petsch et al. 2023). River-floodplain functions also have the potential to adversely affect people or communities (e.g., by providing habitat that supports populations of disease carrying organisms), and those adverse effects would be considered disservices rather than services. Rivers and streams that do not have floodplains (e.g., because of channel downcutting or incision) are likely to lose the ability to perform functions and services that are dependent on periodic flood events (Petsch et al. 2023). Activities that affect river-floodplain ecosystems often result in losses of ecosystem services, and the most common impacts are those that change flood pulses and connectivity within those systems, which can affect biological productivity, water regulation, nutrient retention, and flood control (Petsch et al. 2023).

River-wetland corridors (e.g., anastomosing river channels interspersed with wetlands and floodplains) in the United States have been substantially degraded or lost because of channel instability and changes in planform (e.g., from multiple thread channels to single thread channels) because of a variety of anthropogenic causes such as stream channelization, dam construction, erosion control activities, floodplain drainage, urbanization, and removing beavers, as well as land use changes in watersheds such as forest clearing and agricultural activities that may have caused large amounts of sediment to accumulate and bury these river-wetland corridors (Wohl et al. 2021). The loss or alteration of river-wetland corridors, such as their transitioning from anastomosing stream channels to single-thread stream channels because of deforestation, conversion of lands to agricultural use, and other factors, has reduced the amounts and types of ecosystem services performed by these ecosystems (Cluer and Thorne 2013).

A.4.3 Ecosystem Functions and Services of Lakes

Lakes provide various ecological functions and services. Many of those ecological functions related to the assimilation and sequestration of nutrients and contaminants, which can help enhance water quality and various habitats, but invasive species and large inputs of nutrients can cause declines in lake ecosystem services (Schallenberg et al. 2013). Table A-18 summarizes the lake ecosystem services identified by Schallenberg and others (2013).

Table A-18. Ecosystem services provided by lakes (Schallenberg

et al. 2013).

Service category	Ecosystem services
Provisioning	• Drinking water • Food production • Commercial and recreational fisheries • Waterfowl production • Hydroelectricity generation • Transportation
Regulating	• Nutrient cycling (e.g., nitrogen, phosphorous, carbon) • Sediment processing • Sequestration of nitrogen, phosphorous, sediments, and contaminants • Water storage • Hydrologic buffering
Cultural	• Scenic • Spiritual and religious significance • Historical • Recreation • Tourism

The types and degrees of ecosystems performed by lakes are influenced by lake morphology, land uses within the lake's catchment, and the environmental conditions in which the lake is located (Schallenberg et al. 2013). Human activities that affect the ability of lakes to provide ecosystem functions and services include hydrologic modifications, eutrophication, inputs of contaminants, increased sediment loads, invasive species, cyanobacteria, land use intensification, and overharvesting fish and other species (Schallenberg et al. 2013).

A.4.4 Ecosystem Functions and Services of Wetlands

Wetland functions depend on a number of factors, such as the movement of water through the wetland, landscape position, surrounding land uses, vegetation density within the wetland, geology, soils, water source, and wetland size (NRC 1995). In its evaluation of wetland compensatory mitigation in the Clean Water Act section 404 permit program, the National Research Council (2001) recognized five general categories of wetland functions:

- Hydrologic functions
- Water quality improvement
- Vegetation support
- Habitat support for animals
- Soil functions

Table A-19 lists general categories of functions performed by wetlands. Hydrologic functions include short- and long-term water storage and the maintenance of wetland hydrology (NRC 1995). Water quality improvement functions encompass the transformation or cycling of nutrients, the retention, transformation, or removal of pollutants, and the retention of sediments (NRC 1995). Vegetation support functions include the maintenance of plant communities, which support various species of animals as well as economically important plants. Wetland soils support diverse communities of bacteria and fungi which are critical for biogeochemical processes, including nutrient cycling and pollutant removal and transformation (NRC 2001). Wetland soils also provide rooting media for plants, as well as nutrients and water for those plants. These various functions generally interact with each other, to influence overall wetland functioning, or ecological integrity (Smith et al. 1995; Fennessy et al. 2007). In addition, the Corps regulations at 33 CFR 320.4(b) list wetland functions that are important for the public interest review during evaluations of applications for DA permits, and for the issuance of general permits.

Table A-19. Wetland functions. General categories of wetland functions and their general effects (NRC 1995).

Function category	Function	Effects
Hydrologic	short-term water storage	reduce downstream peak flows
	long-term water storage	maintain base flows, seasonal flow distribution
	maintain high water table	maintain wetland plant community
Biogeochemical cycling	transformation, cycling of elements	maintain nutrient stocks
	retention, removal of dissolved substances	reduce downstream transport of nutrients
	accumulation of peat	retention of nutrients, metals, etc.
	accumulation of inorganic sediments	retention of sediments, nutrients
Habitat and food web support	maintenance of characteristic plant community	food, nesting cover for animals
	maintenance of characteristic energy flow	support for vertebrate populations

Not all wetlands perform the same functions, nor do they provide functions to the same degree (Smith et al. 1995). Therefore, it is necessary to account for individual and regional variation when evaluating wetlands and the functions and services they provide. The types and levels of functions performed by a wetland are dependent on its hydrologic regime, the plant species inhabiting the wetland, soil type, and the surrounding landscape, including the degree of human disturbance of the landscape (Smith et al. 1995).

Examples of services provided by wetland functions include flood damage reduction, maintenance of populations of economically important fish and wildlife species, maintenance of water quality (NRC 1995, MEA 2005a) and the production of populations of wetland plant species that are economically important commodities, such as timber, fiber, and fuel (MEA 2005a). Wetlands can also provide important services regarding the regulation of environmental conditions and storm protection services (MEA 2005a).

Activities that may affect wetland quantity and quality, as well as the functions and services they provide, include: land use changes that alter local hydrology (including water withdrawal), clearing and draining wetlands, constructing levees that sever hydrologic connections between rivers and floodplain wetlands, constructing other obstructions to water flow (e.g., dams, locks), constructing water diversions, inputs of nutrients and contaminants, and fire suppression (Brinson and Malvárez 2002). Wetland loss and degradation is caused by hydrologic modifications of watersheds, drainage activities, logging, agricultural runoff, urban development, conversion to agriculture, aquifer depletion, river management activities (e.g., channelization, navigation improvements, dams, weirs), oil and gas development activities, levee construction, peat mining, and wetland management activities (Mitsch and Hernandez 2013). Upland development activities may adversely affect wetlands and reduce wetland functions because those activities can: (1) change surface water flows and alter wetland hydrology, (2) contribute stormwater and associated sediments, nutrients, and pollutants, (3) cause increases in invasive plant species abundance, and (4) decrease the diversity of native plants and animals (Wright et al. 2006). Many of the remaining wetlands in the United States are degraded (Zedler and Kercher 2005). Wetland degradation and losses are caused by changes in water movement and volume within a watershed or contributing drainage area, altered sediment transport, drainage, inputs of nutrients from non-point sources, water diversions, fill activities, excavation activities, invasion by non-native species, land subsidence, and inputs of pollutants (Zedler and Kercher 2005). As discussed in Mitsch and Gosselink (2015), categories of activities that alter wetlands include: wetland conversion through drainage, dredging, and filling; hydrologic modifications that change wetland hydrology and hydrodynamics; highway construction and its effects on wetland hydrology; peat mining; waterfowl and wildlife management; agriculture and aquaculture activities; water quality enhancement activities; and flood control and stormwater protection.

Appendix B– Public Interest Review

B.1 Public Interest Review Factors (33 CFR 320.4(a)(1))

For each of the 20 public interest review factors, the extent of the Corps' consideration of expected impacts resulting from the use of this NWP is discussed, as well as the reasonably foreseeable cumulative adverse effects that are expected to occur. The Corps' decision-making process involves consideration of the benefits and detriments that may result from the activities authorized by this NWP.

(a) Conservation: The activities authorized by this NWP may modify the natural resource characteristics of the project area. Compensatory mitigation may be required for impacts to waters of the United States authorized by this NWP. The required compensatory mitigation will offset losses of those waters and wetlands through restoration, enhancement, establishment, or preservation activities and ensure that the net adverse environmental effects are no more than minimal. The rehabilitation or enhancement of streams may also be required as compensatory mitigation for stream impacts. Mined land reclamation may restore some of the conservation values of the area after the mining activity is completed. The adverse effects of the mining activities authorized by this NWP on conservation are likely to be minor.

(b) Economics: Mining activities are likely to have positive impacts on the local economy. These activities are likely to generate jobs and revenue for local mining companies as well as revenue to building supply companies who sell aggregates and building materials made from aggregates or the metals extracted from metalliferous ores. Revenue may be also created through the selling of other products that result from the mining activities authorized by this NWP. Mining activities may also change the value of the mined land.

(c) Aesthetics: Mining activities may alter the visual character of some waters of the United States. The extent and perception of these changes will vary, depending on the size and configuration of the mining operation, the method of mining, the nature of the surrounding area, and the public uses of the area. Mining activities authorized by this NWP may also modify other aesthetic characteristics, such as air quality and noise levels. The increased human use of the project area and surrounding land may also alter local aesthetic values.

(d) General environmental concerns: Activities authorized by this NWP may affect general environmental concerns, such as water, air, noise, and land pollution. The authorized activities may also affect the physical, chemical, and biological characteristics of the environment. The adverse effects of the activities authorized by this NWP on general environmental concerns are likely to be minor. Adverse effects to the chemical composition of the aquatic environment will be controlled by general condition 6, which states that the material used for construction must be free from toxic pollutants in toxic amounts. General condition 23 requires mitigation to minimize adverse effects to the aquatic environment through avoidance and minimization at the project site. Compensatory mitigation may be required by district engineers to ensure that the net adverse environmental effects are no more than minimal. Specific environmental concerns are addressed in other sections of this document.

(e) Wetlands: Mining activities in waters of the United States may result in the loss or alteration of wetlands. This NWP does not authorize mining activities in tidal wetlands. Depending on the method of mining, the wetland loss will be either permanent or temporary. Some wetlands may be converted to open waters as a result of the mining activity. As a result of support activities for mining operations, some wetlands will be permanently filled, especially where processing facilities, buildings, roads, utilities, and other permanent fills are located, resulting in the permanent loss of aquatic resource functions and services. Wetlands may also be converted to other uses and habitat types. Some wetlands may be temporarily impacted by the activity through the use of temporary staging areas and access roads. These wetlands will be restored, unless the district engineer authorizes another use for the area, but the plant community may be different, especially if the site was originally forested. Compensatory mitigation may be required to offset impacts to wetlands and ensure that the adverse environmental effects are no more than minimal.

Wetlands provide habitat, including foraging, nesting, spawning, rearing, and resting sites for aquatic and terrestrial species. The loss or alteration of wetlands may alter natural drainage patterns. Wetlands reduce erosion by stabilizing the substrate. Wetlands also act as storage areas for stormwater and flood waters. Wetlands may act as groundwater discharge or recharge areas. The loss of wetland vegetation may adversely affect water quality because these plants trap sediments, pollutants, and nutrients and transform chemical compounds. Wetland vegetation also provides habitat for microorganisms that remove nutrients and pollutants from water. Wetlands, through the accumulation of organic matter, act as sinks for some nutrients and other chemical compounds, reducing the amounts of these substances in the water.

General condition 23 requires avoidance and minimization of impacts to waters of the United States, including wetlands, at the project site. Compensatory mitigation may be required to offset losses of waters of the United States so that the net adverse environmental effects are no more than minimal. General condition 22 prohibits the use of this NWP to discharge dredged or fill material in designated critical resource waters and adjacent wetlands, which may include high value wetlands. Division engineers can add regional conditions to this NWP to restrict or prohibit the use of this NWP in high value non-tidal wetlands. District engineers will also exercise discretionary authority to require an individual permit if the wetlands to be filled are high value and the activity will result in more than minimal adverse environmental effects. District engineers can also add activity-specific special conditions to the NWP authorization to reduce impacts to wetlands or impose specific compensatory mitigation requirements to offset losses of wetlands.

(f) Historic properties: General condition 20 states that in cases where the district engineer determines that the activity may affect properties listed, or eligible for listing, in the National Register of Historic Places, the activity is not authorized, until the requirements of section 106 of the National Historic Preservation Act have been satisfied.

(g) Fish and wildlife values: This NWP authorizes activities in non-tidal waters of the United States, including streams, and wetlands, which provide habitat for many species of fish and wildlife. Activities authorized by this NWP may alter the habitat characteristics of streams and wetlands, decreasing the quantity and quality of fish and wildlife habitat. Wetland and riparian vegetation provides food and habitat for many species, including foraging areas, resting areas, corridors for wildlife movement, and nesting and breeding grounds. Open waters provide habitat for fish and other aquatic organisms. Fish and other motile animals are likely to avoid areas where mining is occurring. Woody riparian vegetation shades streams, which reduces water temperature fluctuations and provides habitat for fish and other aquatic animals. Riparian vegetation provides organic matter that is consumed by fish and aquatic invertebrates. Woody riparian vegetation creates habitat diversity in streams when trees and large shrubs fall into the channel, forming snags that provide habitat and shade for fish. The morphology of a stream channel may be altered by activities authorized by this NWP, which can affect fish populations. However, pre-construction notification is required for all activities authorized by this NWP, which provides the district engineer with the opportunity to review the proposed activity and assess potential impacts on fish and wildlife values and ensure that the authorized activity results in no more than minimal adverse environmental effects. Compensatory mitigation may be required by district engineers to restore, enhance, establish, and/or preserve wetlands to offset losses of jurisdictional wetlands. Stream rehabilitation, enhancement, and preservation activities may be required as compensatory mitigation for impacts to streams. The establishment and maintenance of riparian areas adjacent to open and flowing waters may also be required as compensatory mitigation. These methods of compensatory mitigation will provide fish and wildlife habitat values.

General condition 2 will reduce the adverse effects to fish and other aquatic species by prohibiting activities that substantially disrupt the movement of indigenous aquatic species, unless the primary purpose of the activity is to impound water. Compliance with general conditions 3 and 5 will ensure that the authorized activity has no more than minimal adverse effects on spawning areas and shellfish beds, respectively. The authorized activity cannot have more than minimal adverse effects on breeding areas for migratory birds, due to the requirements of general condition 4.

For an NWP activity, compliance with the Bald and Golden Eagle Protection Act (16 U.S.C. 668(a)-(d)), the Migratory Bird Treaty Act (16 U.S.C. 703; 16 U.S.C. 712), and the Marine Mammal Protection Act (16 U.S.C. 1361 et seq.) is the responsibility of the project proponent. General condition 19 states that the permittee is responsible for contacting appropriate local office of the U.S. Fish and Wildlife Service to determine applicable measures to reduce impacts to migratory birds or eagles, including whether “incidental take” permits are necessary and available under the Migratory Bird Treaty Act or Bald and Golden Eagle Protection Act for a particular activity.

Consultation pursuant to the essential fish habitat provisions of the Magnuson-Stevens Fishery Conservation and Management Act will occur as necessary for proposed NWP activities that may adversely affect essential fish habitat. Consultation may occur on a case-by-case or programmatic basis. Division and district engineers can impose regional and special conditions to ensure that activities authorized by this NWP will result in no more than minimal adverse effects on essential fish habitat.

(h) Flood hazards. The activities authorized by this NWP may affect the flood-holding capacity of 100-year floodplains, including surface water flow velocities. Changes in the flood-holding capacity of 100-year floodplains may impact human health, safety, and welfare. To minimize these adverse effects, general condition 10 requires the activity to comply with applicable FEMA-approved state or local floodplain management requirements. The requirements of general condition 10 will help ensure that the activities authorized by this NWP will have no more than minimal adverse effects on flood hazards. Compliance with general condition 9 will also reduce flood hazards. This general condition requires the permittee to maintain, to the maximum extent practicable, the pre-construction course, condition, capacity, and location of open waters, except under certain circumstances. Much of the land area within 100-year floodplains is upland, and outside of the Corps’ control and responsibility.

Mining activities may increase the flood-holding capacity of the 100-year floodplain if areas within the 100-year floodplain are excavated to extract the desired materials, and the excavated material is moved off-site. Such increases in flood-holding capacity may benefit local communities by reducing flood hazards. The mining of aggregates from streams may increase the capacity of the waterbody by increasing the depth of the stream channel. This increase in capacity may also help reduce flooding.

(i) Floodplain values: Activities authorized by this NWP may adversely affect floodplain values. The fish and wildlife habitat values of floodplains may be adversely affected by activities authorized by this NWP, by modifying or eliminating areas used for nesting, foraging, resting, and reproduction. The water quality functions of floodplains may also be adversely affected by these activities. Modification of the floodplain may also adversely affect other hydrological processes, such as groundwater recharge. Certain mining activities may increase the flood-holding capacity of 100-year floodplains and may reduce downstream flood peaks, if materials are excavated from the substrate and moved off-site. Aggregate mining activities in streams may increase the water storage capacity of those streams, thereby decreasing flooding.

Compensatory mitigation may be required for activities resulting in the loss of wetlands, which will provide water quality functions and wildlife habitat. District engineers may require other types of compensatory mitigation, such as stream restoration, to offset losses of other waters of the United States. General condition 23 requires avoidance and minimization of impacts to waters of the United States to the maximum extent practicable at the project site, which will reduce losses of floodplain values. The mitigation requirements of general condition 23 will help ensure that the adverse effects of these activities on floodplain values are no more than minimal. The requirements of general condition 10 will help minimize adverse effects to floodplain values, such as flood storage capacity, wildlife habitat, fish spawning areas, and nutrient cycling for aquatic ecosystems. Compliance with general condition 9 will also help ensure that activities in 100-year floodplains will not cause more than minimal adverse effects on flood storage and conveyance.

(j) Land use: Activities authorized by this NWP may change land use. Mining activities, including support activities, may destroy some natural characteristics of the land. Reclamation of the mined land may be required, which may affect future land use. The mined land may be put to another use, such as a residential development or recreational facility, if it is not restored to natural habitat. Since the primary responsibility for land use decisions is held by state, local, and tribal governments, the Corps' control and responsibility is limited to significant issues of overriding national importance, such as navigation and water quality (see 33 CFR 320.4(j)(2)).

(k) Navigation: Activities authorized by this NWP may have some adverse effects on navigation, when these activities occur in non-tidal navigable waters of the United States. These activities must comply with general condition 1. This NWP requires notification for all authorized activities, which will allow district engineers to determine if proposed activities will have any adverse effects on navigation. The navigability of some rivers may be improved by aggregate mining activities, since these activities will remove sediments, thereby increasing water depth.

(l) Shore erosion and accretion: The activities authorized by this NWP may have minor direct effects on shore erosion and accretion processes, since the NWP is limited to mining activities in non-tidal waters of the United States. Nationwide permit 13, regional general permits, or individual permits may be used to authorize bank stabilization projects associated with a mining support facility, which may affect shore erosion and accretion.

(m) Recreation: Activities authorized by this NWP may change the recreational uses of the area. Certain recreational activities, such as bird watching, hunting, and fishing may no longer be available in the area, if the mining activity causes substantial changes in the natural resource characteristics of the area. In some cases, the mined land may be put to other uses, which may provide for other recreational uses in that area.

(n) Water supply and conservation: Activities authorized by this NWP may adversely affect both surface water and groundwater supplies. Mining activities authorized by this NWP may affect the amount of potable water available in the region. Mining activities may result in excavated areas that increase local storage of surface water, which can be used for a variety of purposes. Areas excavated through mining activities may also store surface runoff and increase its rate of infiltration into the soil, replenishing groundwater supplies. Water supplies may be consumed during the extraction and processing of aggregates and minerals. Activities authorized by this NWP may also affect the quality of water supplies by adding pollutants to surface waters and groundwater, but many causes of water pollution, such as discharges regulated under section 402 of the Clean Water Act, are outside the Corps' control and responsibility. Other federal, state, or local laws may address these pollution concerns. Some water pollution concerns may be addressed through water quality management measures that may be required for activities authorized by this NWP. Division and district engineers can prohibit the use of this NWP in watersheds for public water supplies, if it is in the public interest to do so. General condition 7 prohibits discharges in the vicinity of public water supply intakes. Compensatory mitigation may be required for activities authorized by this NWP, which may help improve the quality of surface waters.

(o) Water quality: Mining activities in wetlands and waterbodies may have adverse effects on water quality. During mining activities, small amounts of oil and grease from mining equipment may be discharged into the waterway. Mining activities may also cause increases in sediments and pollutants in the water. The loss of wetland and riparian vegetation may adversely affect water quality because these plants trap sediments, pollutants, and nutrients and transform chemical compounds. Wetland and riparian vegetation also provides habitat for microorganisms that remove nutrients and pollutants from water. Wetlands, through the accumulation of organic matter, act as sinks for some nutrients and other chemical compounds, reducing the amounts of these substances in the water column. Wetlands and riparian areas also decrease the velocity of flood waters, removing suspended sediments from the water column and reducing turbidity. Riparian vegetation also serves an important role in the water quality of streams by shading the water from the intense heat of the sun. Compensatory mitigation may be required to offset losses of wetlands authorized by this NWP, to ensure that the activities do not have more than minimal adverse environmental effects, including water quality. Compensatory mitigation may also be required to offset losses of other waters of the United States, such as streams, to ensure that adverse effects on water quality are no more than minimal. Wetlands and riparian areas restored, established, enhanced, or preserved as compensatory mitigation may provide local water quality benefits.

This NWP requires Clean Water Act section 401 water quality certification, since it authorizes discharges of dredged or fill material into waters of the United States. Most water quality concerns are addressed by the state or tribal certifying authority. The district engineer may require water quality management measures to ensure that the authorized activity results in no more than minimal adverse effect to water quality. Water quality management measures may involve the installation of retention ponds facilities to trap sediments and pollutants. The establishment and maintenance of riparian areas next to open waters may be required if there are streams or other open waters on the project site. The riparian areas will help protect downstream water quality and enhance the aquatic habitat.

(p) Energy needs: The mining activities authorized by this NWP may increase energy consumption in the area, especially electricity, natural gas, and petroleum products. Increased energy consumption associated with mining activities is beyond the Corps' control and responsibility. Existing infrastructure (i.e., utility lines) may have to be expanded to provide energy to the mining operation.

(q) Safety: The mining activities authorized by this NWP will be subject to federal, state, and local safety laws and regulations. Therefore, the activities authorized by this NWP are not likely to adversely affect the safety of the project area.

(r) Food and fiber production: Activities authorized by this NWP may adversely affect food and fiber production, if the mining activity occurs on farmland. Changes in use of agricultural land reduces the amount of available farmland in the nation, unless that farmland is replaced by converting other land, such as forest, to agricultural land. The loss of farmland is more appropriately addressed through the land use planning and zoning authority held by state and local governments.

(s) Mineral needs: Activities authorized by this NWP will help satisfy demand for the mined materials. Aggregate mining activities will produce materials that may be used to construct buildings and roads. Hard rock/mineral mining activities will also provide metalliferous ores that will be used to make building materials and other items.

(t) Considerations of property ownership: The NWP complies with 33 CFR 320.4(g), which states that an inherent aspect of property ownership is a right to reasonable private use. The NWP provides expedited Corps authorization for mining activities (except for coal mining) in non-tidal waters of the United States, provided the activity complies with the terms and conditions of the NWP and results in no more than minimal adverse environmental effects.

B.2 Additional Public Interest Review Factors (33 CFR 320.4(a)(2))

B.2.1 Relative extent of the public and private need for the proposed structure or work

This NWP authorizes discharges of dredged or fill material into non-tidal waters of the United States, excluding non-tidal wetlands adjacent to tidal waters, for mining activities, except for coal mining, provided those activities have no more than minimal individual and cumulative adverse environmental effects. These activities satisfy public and private needs for aggregates, metals, and other materials. The need for this NWP is based upon the number of these activities that occur annually with no more than minimal individual and cumulative adverse environmental effects.

B.2.2 Where there are unresolved conflicts as to resource use, the practicability of using reasonable alternative locations and methods to accomplish the objective of the proposed structure or work

Most situations in which there are unresolved conflicts concerning resource use arise when environmentally sensitive areas are involved (e.g., special aquatic sites, including wetlands) or where there are competing uses of a resource. The nature and scope of the activity, when planned and constructed in accordance with the terms and conditions of this NWP, reduce the likelihood of such conflict. In the event that there is a conflict, the NWP contains provisions that are capable of resolving the matter (see section 1.0 of this document).

General condition 23 requires permittees to avoid and minimize adverse effects to waters of the United States to the maximum extent practicable on the project site. Consideration of off-site alternative locations is not required for activities that are authorized by general permits. General permits authorize activities that have no more than minimal individual and cumulative adverse effects on the environment and the overall public interest. The district engineer will exercise discretionary authority and require an individual permit if the proposed activity will result in more than minimal adverse environmental effects on the project site. The consideration of off-site alternatives can be required during the individual permit process.

B.2.3 The extent and permanence of the beneficial and/or detrimental effects which the proposed structure or work is likely to have on the public and private uses to which the area is suited

The nature and scope of the activities authorized by the NWP will most likely restrict the extent of the beneficial and detrimental effects to the area immediately surrounding the mining activity. Activities authorized by this NWP will have no more than minimal individual and cumulative adverse environmental effects.

The terms, conditions, and provisions of the NWP were developed to ensure that individual and cumulative adverse environmental effects are no more than minimal. Specifically, NWPs do not obviate the need for the permittee to obtain other federal, state, or local authorizations required by law. The NWPs do not grant any property rights or exclusive privileges (see 33 CFR 330.4(b) for further information). Additional conditions, limitations, restrictions, and provisions for discretionary authority, as well as the ability to add activity-specific or regional conditions to this NWP, will provide further safeguards to the aquatic environment and the overall public interest. There are also provisions to allow suspension, modification, or revocation of the NWP.

Appendix C – Clean Water Act Section 404(b)(1) Guidelines Analysis

The 404(b)(1) Guidelines compliance criteria for general permits are provided at 40 CFR 230.7. This 404(b)(1) Guidelines compliance analysis includes analyses of the direct, secondary, and cumulative effects on the aquatic environment caused by discharges of dredged or fill material authorized by this NWP.

For activities authorized by general permits, the analysis and documentation required by the 404(b)(1) Guidelines are to be performed at the time of issuance of a general permit, such as an NWP. The analysis and documentation will not be repeated when activities are conducted under the NWP. The 404(b)(1) Guidelines do not require reporting or formal written communication at the time individual activities are conducted under an NWP, but a particular NWP may require appropriate reporting. [40 CFR 230.6(d) and 230.7(b)]

C.1 Evaluation Process (40 CFR 230.7(b))

C.1.1 Alternatives (40 CFR 230.10(a))

The consideration of alternatives is not directly applicable to general permits (see 40 CFR 230.7(b)(1)).

C.1.2 Prohibitions (40 CFR 230.10(b))

This NWP authorizes discharges of dredged or fill material into waters of the United States, which require water quality certification. Water quality certification requirements will be met in accordance with the procedures at 33 CFR 330.4(c). See general condition 25. The water quality certification process protects against the permitted activity violating any applicable state water quality standard.

No toxic discharges will be authorized by this NWP. General condition 6 states that the material must be free from toxic pollutants in toxic amounts.

This NWP does not authorize discharges of dredged or fill material into waters of the United States that are likely to jeopardize the continued existence of any listed threatened or endangered species or result in the destruction or adverse modification of critical habitat. Reviews of pre-construction notifications, regional conditions, and local operating procedures for endangered species will ensure compliance with the Endangered Species Act. Refer to general condition 18 and to 33 CFR 330.4(f) for information and procedures.

This NWP will not authorize discharges of dredged or fill material into waters of the United States that violate any requirement to protect any marine sanctuary. Refer to general condition 22 and section C.2.3(j)(1) of this Appendix for further information.

C.1.3 Findings of Significant Degradation (40 CFR 230.10(c))

Potential impact analysis (Subparts C through F): The potential impact analysis specified in Subparts C through F is discussed in section C.2.3 of this Appendix. Mitigation required by the district engineer will help ensure that the adverse effects on the aquatic environment are no more than minimal.

Evaluation and testing (Subpart G): Because the terms and conditions of the NWP specify the types of discharges that are authorized, as well as those that are prohibited, individual evaluation and testing for the presence of contaminants will normally not be required. If a situation warrants, provisions of the NWP allow division or district engineers to further specify authorized or prohibited discharges and/or require testing. General condition 6 requires that materials used for construction be free from toxic pollutants in toxic amounts.

Based upon Subparts B and G, after consideration of Subparts C through F, and because NWPs can authorize only those discharges of dredged or fill material into waters of the United States that result in no more than minimal individual and cumulative adverse environmental effects, the discharges authorized by this NWP will not cause or contribute to significant degradation of waters of the United States.

C.1.4 Factual determinations (40 CFR 230.11)

The factual determinations required in 40 CFR 230.11 are discussed in section C.2.3 of this Appendix.

C.1.5 Appropriate and practicable steps to minimize potential adverse impacts (40 CFR 230.10(d))

As demonstrated by the information in this document, as well as the terms, conditions, and provisions of this NWP, actions to minimize adverse effects (Subpart H) have been thoroughly considered and incorporated into the NWP. General condition 23 requires permittees to avoid and minimize discharges of dredged or fill material into waters of the United States to the maximum extent practicable on the project site. Compensatory mitigation may be required by the district engineer to ensure that the net adverse effects on the aquatic environment are no more than minimal.

C.2 Evaluation Process (40 CFR 230.7(b))

C.2.1 Description of permitted activities (40 CFR 230.7(b)(2))

As indicated by the text of this NWP in section 1.0 of this document, and the discussion of potential impacts in section 4.0, the activities authorized by this NWP are sufficiently similar in nature and environmental impact to warrant authorization under a single general permit. Specifically, the purpose of the NWP is to authorize discharges of dredged or fill material for mining activities, such as aggregate mining, hard rock/mineral mining, clay mining, and peat mining. This NWP does not authorize coal mining activities. The nature and scope of the impacts are controlled by the terms and conditions of the NWP.

The activities authorized by this NWP are sufficiently similar in nature and environmental impact to warrant authorization by a general permit. The terms of the NWP authorize a specific category of activity (i.e., discharges of dredged or fill material for mining activities) in a specific category of waters (i.e., non-tidal waters, except for non-tidal wetlands adjacent to tidal waters). The restrictions imposed by the terms and conditions of this NWP will result in the authorization of discharges of dredged or fill material into waters of the United States that have similar impacts on the aquatic environment, namely the replacement or modification of aquatic habitats, such as certain categories of non-tidal wetlands, where mining and reclamation activities occur.

If a situation arises in which the activity requires further review, or is more appropriately reviewed under the individual permit process, provisions of the NWPs allow division and/or district engineers to take such action.

C.2.2 Cumulative effects (40 CFR 230.7(b)(3))

The 404(b)(1) Guidelines at 40 CFR 230.11(a) define cumulative effects as "…the changes in an aquatic ecosystem that are attributable to the collective effect of a number of individual discharges of dredged or fill material." For the issuance of general permits, such as this NWP, the 404(b)(1) Guidelines require the permitting authority to "set forth in writing an evaluation of the potential individual and cumulative impacts of the categories of activities to be regulated under the general permit." [40 CFR 230.7(b)] More specifically, the 404(b)(1) Guidelines cumulative effects assessment for the issuance or reissuance of a general permit is to include an evaluation of "the number of individual discharge activities likely to be regulated under a general permit until its expiration, including repetitions of individual discharge activities at a single location." [40 CFR 230.7(b)(3)] If a situation arises in which cumulative effects are likely to be more than minimal and the proposed discharge of dredged or fill material into waters of the United States requires further review, or is more appropriately reviewed under the individual permit process, provisions of the NWPs allow division and/or district engineers to take such action.

Based on reported use of this NWP during the period of March 15, 2021, to March 14, 2024, the Corps estimates that this NWP will be used approximately 15 times per year on a national basis, resulting in impacts to approximately 6 acres of waters of the United States, including jurisdictional wetlands. All activities authorized by this

NWP require pre-construction notification to the district engineer.

Based on reported use of this NWP during that time period, the Corps estimates that 9 percent of the NWP 44 verifications will require compensatory mitigation to offset the authorized impacts to waters of the United States and ensure that the authorized activities result in only minimal adverse effects on the aquatic environment. The verified activities that do not require compensatory mitigation will have been determined by Corps district engineers to result in no more than minimal individual and cumulative adverse effects on the aquatic environment without compensatory mitigation. During the period of 2026 to 2031, the Corps expects little change to the percentage of NWP 44 verifications requiring compensatory mitigation, because there have been no substantial changes in the mitigation general condition or the NWP regulations for determining when compensatory mitigation may be required for NWP activities. The Corps estimates that approximately one acre of compensatory mitigation will be required each year to offset authorized impacts. The demand for these types of activities could increase or decrease during the five year period this NWP is anticipated to be in effect.

Based on these annual estimates, the Corps estimates that approximately 75 activities could be authorized until this NWP expires, resulting in impacts to approximately 30 acres of waters of the United States, including jurisdictional wetlands. Approximately 5 acres of compensatory mitigation would be required to offset those impacts. During the period this NWP is in effect, the individual and cumulative impacts on the aquatic environment caused by activities authorized by this NWP are expected to result in only minor changes to the current environmental setting at the scale at which this NWP is issued (i.e., the United States and its territories), which is described in Appendix A of this document. Division engineers have the authority to modify, suspend, or revoke this NWP in a particular geographic region (e.g., a Corps district, state, watershed, or seascape) if they believe those discharges of dredged or fill material into waters of the United States are likely to result in more than minimal individual and cumulative adverse environmental effects in the identified geographic region (see 33 CFR 330.5(c)). District engineers have the authority to modify, suspend, or revoke this NWP on a case-by-case basis if they determine those discharges of dredged or fill material into waters of the United States are likely to result in more than minimal individual and cumulative adverse environmental effects on the project site (see 33 CFR 330.5(d)).

Compensatory mitigation is the restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved (33 CFR 332.2). For discharges of dredged or fill material into waters of the United States authorized by NWPs, compensatory mitigation and other forms of mitigation may be used to ensure that the adverse environmental effects are no more than minimal, individually and cumulatively (33 CFR 330.1(e)(3); NWP general condition 23). Restoration is usually the first compensatory mitigation option considered because the likelihood of ecological success is greater (33 CFR 332.3(a)(2)). As discussed below, restoration of wetlands, streams, and other aquatic ecosystems can increase the ecological functions and services provided by those aquatic ecosystems.

The ecological outcomes of restoration projects are exceeding unpredictable (Brudvig et al. 2017), which is why monitoring, taking corrective actions, and adaptive management are important tools for attempting to achieve the desired outcomes of those projects, usually gains in ecosystem functions and services. Because of that unpredictability and for other reasons, such as greater ecosystem resilience, restoration activities should allow for a range of acceptable outcomes (Hiers et al. 2016). Restoration activities typically cannot return a degraded wetland, stream, or other aquatic ecosystem to a prior historic condition because of changes in environmental conditions and other drivers that occur at various scales over time (e.g., Moreno-Mateos et al. 2017, Higgs et al. 2014, Jackson and Hobbs 2009, Zedler and Kercher 2005; Palmer et al. 2014). In addition, many of the drivers of ecosystem change are beyond the control of a mitigation provider. Therefore, it is important to establish realistic goals and objectives for ecosystem restoration projects (e.g., Hobbs 2007, Ehrenfeld 2000), including the restoration of wetlands, streams, and other types of aquatic ecosystems.

Rey Banayas et al. (2009) concluded that restoration activities can increase biodiversity and the level of ecosystem services provided. However, such increases do not approach the amounts of biodiversity and ecosystem services performed by undisturbed reference sites. The ability to restore ecosystems to provide levels of ecological functions and services similar to historic conditions or reference standard conditions is affected by human impacts (e.g., urbanization, agriculture) to watersheds or other landscape units and to the processes that sustain those ecosystems (Zedler et al. 2012, Hobbs et al. 2014). Those changes need to be taken into account when establishing goals and objectives for restoration projects (Zedler et al. 2012), including compensatory mitigation projects. The ability to reverse ecosystem degradation to restore ecological functions and services is dependent on the degree of degradation of that ecosystem and the surrounding landscape, and whether that degradation is reversible (Hobbs et al. 2014). Most studies of the ecological performance of compensatory mitigation projects have focused solely on the ecological attributes of the compensatory mitigation projects, and few studies have also evaluated the aquatic resources impacted by permitted activities (Kettlewell et al. 2008), so it is difficult to assess whether compensatory mitigation projects have fully or partially offset the lost functions provided by the aquatic resources that are impacted by permitted activities.

Wetland restoration, enhancement, and establishment projects can provide wetland functions, as long as the wetland compensatory mitigation project is placed in an appropriate landscape position, has appropriate hydrology for the desired wetland type, and the watershed condition will support the desired wetland type (NRC 2001). Tomscha and others (2021) used a number of methods to evaluate whether wetland restoration activities improve ecosystem functions and services and they found that wetland restoration activities produced gains in soil organic carbon, increases in native plant species richness, gains in saturated hydraulic connectivity, declines in plant-available phosphorous, gains in nitrogen and phosphorous retention, and small increases in sediment retention. Site selection is critical to find a site with appropriate hydrologic conditions and soils to support a replacement wetland that will provide the desired wetland functions and services (Mitsch and Gosselink 2015).

In a meta-analysis of 70 wetland restoration studies, Meli et al. (2014) concluded that wetland restoration activities increase biodiversity and ecosystem service provision in degraded wetlands, but the degree of recovery is context dependent. They identified the following factors as influencing wetland restoration outcomes: wetland type, the main cause of degradation, the type of restoration action conducted, and the assessment protocol used to evaluate restoration outcomes. Moreno-Mateos et al. (2015) reviewed the recovery trajectories of 628 wetland restoration and creation projects and concluded that restoring or establishing wetland hydrology is of primary importance, and is more likely to be ecologically successful if wetland hydrology can be achieved by re-establishing water flows instead of extensive earthwork. In addition, they determined that, with respect to the plant community, natural revegetation is sufficient for recovery and development of most wetland types after wetland hydrology is restored or established. Adams and others (2024) found that short-term performance criteria that focus on target plant species are not useful for predicting the long-term outcomes of wetland restoration projects, and stress related performance criteria (e.g., hydrological dissimilarity, invasive species canopy cover) are more effective a predicting long-term outcomes.

The ecological performance of wetland restoration, enhancement, and establishment is dependent on practitioner's understanding of wetland functions, allowing sufficient time for wetland functions to develop, and allowing natural processes of ecosystem development (self-design or self-organization) to take place, instead of over-designing and over-engineering the replacement wetland (Mitsch and Gosselink 2015). The likelihood of ecological success in wetland restoration varies by wetland type, with the higher rates of success for coastal, estuarine, and freshwater marshes, and lower rates of success for forested wetlands and seagrass beds (Lewis et al. 1995). In its review, the NRC (2001) concluded that some wetland types can be restored or established (e.g., non-tidal emergent wetlands, some forested and scrub-shrub wetlands, seagrasses, and coastal marshes), while other wetland types (e.g., vernal pools, bogs, and fens) are difficult to restore and should be avoided where possible. Restored riverine and tidal wetlands achieved wetland structure and function more rapidly than depressional wetlands (Moreno-Mateos et al. 2012). Because of its greater potential to provide wetland functions, restoration is the preferred compensatory mitigation mechanism (33 CFR 332.3(a)(2)). Bogs, fens, and springs are considered to be difficult-to-replace resources and compensatory mitigation should be provided through in-kind rehabilitation, enhancement, or preservation of these wetlands types (33 CFR 332.3(e)(3)).

In its review of outcomes of wetland compensatory mitigation activities, the NRC (2001) stated that wetland functions can be replaced by wetland restoration and establishment activities. They discussed five categories of wetland functions: hydrology, water quality, maintenance of plant communities, maintenance of animal communities, and soil functions. It is difficult to restore or establish natural wetland hydrology, and water quality functions are likely to be different than the functions provided at wetland impact sites (NRC 2001). Reestablishing or establishing the desired plant community may be difficult because of invasive species colonizing the mitigation project site (NRC 2001). The committee also found that establishing and maintaining animal communities depends on the surrounding landscape. Soil functions can take a substantial amount of time to develop, because they are dependent on soil organic matter and other soil properties (NRC 2001). The NRC (2001) concluded that the ecological performance in replacing wetland functions depends on the particular function of interest, the restoration or establishment techniques used, and the extent of degradation of the compensatory mitigation project site and its watershed.

The ecological performance of wetland restoration and enhancement activities is affected by the amount of changes to hydrology and inputs of pollutants, nutrients, and sediments within the watershed or contributing drainage area (Wright et al. 2006). Wetland restoration is becoming more effective at replacing or improving wetland functions, especially in cases where monitoring and adaptive management are used to correct deficiencies in these efforts (Zedler and Kercher 2005). Wetland functions take time to develop after the restoration or enhancement activity takes place (Mitsch and Gosselink 2015, Gebo and Brooks 2012), and different functions develop at different rates (Moreno-Mateos 2012, NRC 2001). Irreversible changes to landscapes, especially those that affect hydrology within contributing drainage areas or watersheds, cause wetland degradation and impede the ecological performance of wetland restoration efforts (Zedler and Kercher 2005). Gebo and Brooks (2012) evaluated wetland compensatory mitigation projects in Pennsylvania and compared them to reference standards (i.e., the highest functioning wetlands in the study area) and natural reference wetlands that showed the range of variation due to human disturbances. They concluded that most of the wetland mitigation sites were functioning at levels within with the range of functionality of the reference wetlands in the region, and therefore were functioning at levels similar to some naturally occurring wetlands. The ecological performance of mitigation wetlands is affected by on the landscape context (e.g., urbanization) of the replacement wetland and varies with wetland type (e.g., riverine or depressional) (Gebo and Brooks 2012). Moreno-Mateos and others (2012) conducted a meta-analysis of wetland restoration studies and concluded that while wetland structure and function can be restored to a large degree, the ecological performance of wetland restoration projects is dependent on wetland size and local environmental setting. They found that wetland restoration projects that are larger in size and in less disturbed landscape settings achieve structure and function more quickly.

Process-based approaches may be used for wetland restoration, enhancement, and establishment activities. For wetlands, the focus would be on re-establishing or establishing appropriate hydrological conditions (Mitsch and Gosselink 2015) that drive wetland ecosystem development and the functions and services they provide. Appropriate hydrological conditions include the hydroperiod, which is the hydrologic signature of a wetland that establishes and maintains a wetland's structure and function (Mitsch and Gosselink 2015). The hydrologic signature consists of hydrologic inputs and outputs, such as water depth, flow patterns, and the duration and frequency of flooding. A wetland's hydrologic signature influences abiotic factors, including soil anaerobiosis, nutrient availability, and in coastal wetlands, salinity, and those abiotic factors determine which plant and animal species and other organisms will inhabit a wetland (Mitsch and Gosselink 2015). Wetland restoration, enhancement, and establishment activities that focus on providing an appropriate hydrologic signature would allow natural energy, self-organization, and physical, chemical and biological processes to drive the development of wetland structure and function. Focusing on restoring wetland processes and giving the wetland the ability and space to respond to changing environmental conditions and other anthropogenic and natural disturbances may result in more resilient and sustainable wetlands.

Under the Corps' regulations, streams are considered to be difficult-to-replace resources and compensatory mitigation should be provided through stream rehabilitation, enhancement, and preservation since those techniques are most likely to be ecologically successful (see 33 CFR 332.3(e)(3)). It is difficult to achieve good ecological outcomes from river and stream rehabilitation projects because rivers and streams and their catchments are complex systems with multiple stressors and cross scale interactions, and we have limited knowledge about the dynamics of these systems (Harris and Heathwaite 2012). For the purposes of this section, the term "stream restoration" is used to cover river and stream rehabilitation and enhancement activities. Restoration can be done on large rivers and small streams, and sometimes entire stream networks (Wohl et al. 2015), in a variety of watershed land use settings, including urban and agricultural areas.

River and stream restoration activities can improve the functions performed by these aquatic ecosystems, and the ecosystem services they provide (Wohl et al. 2015, Beechie et al. 2010). Because of changes in land use and other changes in the watershed that have occurred over time, stream restoration can improve stream functions but cannot return a stream to a historic state (Wohl et al. 2015, Roni et al. 2008). Improvements in ecological performance of stream restoration projects is dependent on the restoration method and how outcomes are assessed (Palmer et al. 2014). The ability to restore the ecological functions of streams is dependent on the condition of the watershed draining to the stream being restored because human land uses and other activities in the watershed affect how that stream functions (Palmer et al. 2014). Ecologically successful stream restoration activities depend on addressing the factors that most strongly affect stream functions, such as water quality, water flow, and riparian area quality, rather than focusing solely on restoring the physical habitat of streams (Palmer et al. 2010, Roni et al. 2008), especially the stream channel.

To be effective, stream restoration activities should address the causes of stream degradation, which are often within the watershed and outside of the stream channel (Palmer et al. 2014). Actions that focus on restoring physical, chemical, and biological processes and connectivity, and giving the stream space to adjust to changing environmental conditions and physical and biological drivers of change are more likely to be successful that channel reconfiguration efforts (Ciotti et al. 2021, Hawley 2018, Kondolf 2011). Stream restoration projects, including the restoration and maintenance of riparian areas, can improve the functions collectively performed by rivers and streams and their riparian areas (e.g., Allan and Castillo 2007, NRC 2002). Ecologically effective stream restoration activities can be conducted by enhancing riparian areas, removing dams, reforestation, and implementing watershed best management practices that reduce storm water and agricultural runoff to streams (Palmer et al. 2014).

Process-based river and stream restoration attempts to reestablish the rates and degrees of physical, chemical, and biological processes that sustain riverine ecosystems, including their floodplains (Beechie et al. 2010). They identify four principles for process-based restoration of rivers and streams: (1) focusing on addressing the root causes of ecosystem change; (2) tailoring restoration actions to local potential; (3) matching the scale of restoration to the scale of the problem causing ecosystem change; and (4) establishing explicit expectations for restoration outcomes (Beechie et al. 2010). Under a process-based restoration approach, rivers and streams are not just seen as channels, but as complex and changing systems within a valley floor where fluvial processes occur (Ciotti et al. 2021). Process-based stream restoration can also reduce long-term restoration costs, including maintenance costs (Ciotti et al. 2021, Beechie et al. 2013, Hawley 2018).

Restoration of incised streams to reconnect the streams to their floodplains (and thus provide greater amounts of functions and services) can be accomplished through low-tech river or stream corridor restoration activities, such as the use of beaver dams, beaver dam analogs (BDAs), or post-assisted log structures (PALS), to restore incised streams and their floodplains (e.g., Wheaton et al. 2019, Pollock et al. 2014, DeVries et al. 2012). Another approach to reconnecting incised streams with their floodplains involves the use of native materials such as large wood harvested on-site to construct wood jams (e.g., Ciotti et al. 2021) that promote sediment accumulation, the establishment of vegetation, and increases in water levels.

Process-based stream restoration activities may improve the dynamism and diversity of these systems (Powers et al. 2018). They may also attempt to improve habitat for native fish species, other species that utilize river and stream channels and riparian areas, and improve or protect water quality (Flitcroft et al. 2022). Some process-based stream restoration approaches attempt to restore anastomosing river-wetland corridors that were common in various regions of the United States (e.g., Merritts et al. 2011, Walter and Merritts 2008). In the eastern United States, these multi-channel stream-floodplain-wetland systems were disturbed by the accumulation of sediment in valleys caused by the construction of mill dams, clearing forests, and the development of agricultural land (Walter and Merritts 2008), which often changed multi-threaded channels into single threaded channels as the stream eroded the substantial depths of sediment that accumulated in the valley over many years. Anastomosing river-wetland corridors have the potential to provide greater ecological diversity, complexity, richness, and functionality (Cluer and Thorne 2013), as well as ecosystem services.

Examples of stream restoration techniques include: dam removal and modification, culvert replacement or modification, fish passage structures when connectivity cannot be restored or improved by dam removal or culvert replacement, levee removal or setbacks, reconnecting floodplains and other riparian habitats, road removal, road modifications, reducing sediment and pollution inputs to streams, replacing impervious surfaces with pervious surfaces, restoring adequate in-stream or base flows, restoring riparian areas, fencing streams and their riparian areas to exclude livestock, improving in-stream habitat, recreating meanders, and replacing hard bank stabilization structures with bioengineering bank stabilization measures (Roni et al. 2013). Miller and Kochel (2010) recommend that stream restoration projects allow the stream channel to self-adjust in response to changing hydrologic and sediment regimes in the watershed, and include other restoration actions such as re-establishing riparian areas next to the stream channel and excluding livestock from the riparian area and stream channel. Large and medium sized rivers can be restored through various approaches, including levee setbacks, levee removal, or creating openings in levees, to restore or improve connectivity between the river and the floodplain, as well as other ecological and geomorphic processes (Wohl et al. 2015). Dam removal, as well as changes in dam operations that provide environmentally-beneficial flows of water and sediment, can also restore functions of rivers and larger streams (Wohl et al. 2015).

Hydrologic restoration can be more effective than in-stream habitat restoration projects (Hawley 2018) because they can help address alterations in watershed hydrology through land use and other watershed changes. Examples of hydrologic restoration approaches include reforestation, floodplain restoration, bankfull wetlands, detention basins, beaver reintroduction, and placement of large woody debris into the stream channel. Restoration actions outside of the stream channel, such as constructed wetlands, storm water management ponds, and revegetating riparian areas, can result in significant improvements in the biodiversity, community structure, and nutrient cycling processes of downstream waters (Smucker and Detenbeck 2014). Non-structural and structural techniques can be used to rehabilitate and enhance streams, and restore riparian areas (NRC 1992). Examples of non-structural stream restoration practices include removing disturbances to allow recovery of stream and riparian area structure and function, restoring natural stream flows by reducing or eliminating activities that have altered stream flows, preserving or restoring floodplains, and restoring and protecting riparian areas, including fencing to exclude livestock and people that can degrade riparian areas (NRC 1992).

Attempting to restore streams by constructing specific channel forms or shapes, instead reinstating ecological processes that allow for variability and responding to changing environmental conditions, can reduce stream habitat variability and ecological resilience (Hiers et al. 2016), and may result in the affected streams providing fewer ecological functions than restoration actions that allow rivers and streams to flood and self-adjust (Kondolf 2011). Form-based stream restoration efforts, such as channel reconfiguration, can cause substantial adverse impacts to riverine systems through earthmoving activities (which can cause substantial increases in sediment loads) and the removal of riparian trees and other vegetation, with little demonstrable improvements in stream functions (Palmer et al. 2014). In-stream habitat enhancement activities, such as channel reconfiguration and adding in-stream structures, have resulted in limited effectiveness in improving biodiversity in streams (Palmer et al. 2010). In an evaluation of 644 stream restoration projects, Palmer et al. (2014) concluded that stream channel reconfiguration does not promote ecological recovery of degraded streams, but actions taken within the watershed and in riparian areas to restore hydrological processes and reduce pollutant inputs to streams can improve stream functions and ecological integrity. Form-based stream restoration activities may be more likely to fail as hydrology and sediment loads change, because those approaches make riverine systems less resilient to such changes (Tullos et al. 2021). Stream restoration activities should also include consideration of social factors, especially the people that live in the floodplain or near the river or stream (Wohl et al. 2015). These social factors may also impose constraints on what restoration actions can be taken.

Seagrass beds are dynamic ecosystems that can persist for long periods of time or change from season to season (Fonseca et al. 1998). Seagrass beds can be restored, but these restoration activities generally have lower rates of ecological success than the restoration of other wetland types, such as estuarine and freshwater marshes (Lewis et al. 1995). The restoration and natural recovery of seagrasses requires consideration of addressing impediments that occur at various scales, including larger scale problems such as water quality and land use practices (Orth et al. 2006). The ecological success of seagrass restoration can be influenced by the dynamics of coastal environments and various stressors (e.g., reduced water quality/eutrophication, construction activities, dredging, other direct impact, natural disturbances) that affect seagrasses (van Katwijk et al. 2016). Realistic expectations should be established for seagrass restoration activities because of our limited understanding of seagrasses and the challenges of controlling conditions in open coastal waters (Fonseca 2011).

Site selection is critical for successful restoration of seagrasses (Fonseca 2011, Fonseca et al. 1998). Ecologically successful seagrass restoration is dependent on finding sites where seagrass beds recently existed (Fonseca et al. 1998). The ecological outcomes of seagrass restoration activities is also affected by the size of the restoration project, with larger restoration efforts more likely to be ecologically successful and sustainable because larger projects can produce positive feedbacks that facilitate the establishment and persistence of seagrasses (van Katwijk et al. 2016). At some proposed seagrass restoration sites, it may be infeasible to change the site from a stable unvegetated state to a stable vegetated state through seagrass planting efforts (Fonseca 2011). Small scale restoration activities may be overwhelmed by natural processes that prevent seagrasses from becoming reestablished (Fonseca 2011). Another impediment to ecologically successful seagrass restoration is bioturbation, which can impede natural seagrass recruitment (Fonseca 2011) or disturb plantings. Bioturbation can be caused by animals such as shrimp, crabs, ducks, fish, and urchins, and result in stable, unvegetated benthic habitats (Fonseca 2011).

Fonseca (2011) recommends locating seagrass restoration activities in areas with water depths similar to nearby natural seagrass beds, at a sufficient size to achieve restoration goals, with characteristics that are similar to those at other ecologically successful seagrass restoration projects, and where anthropogenic disturbances can be reduced or removed. Restoration of submersed aquatic vegetation beds requires taking actions to reduce inputs of sediment, nutrients, and organic matter into estuarine waters and avoiding physical damage from boating activities and fishing gear (Waycott et al. 2009). Controlling these stressors has been more effective at restoring seagrass beds than seagrass transplantation efforts (Waycott et al. 2009). Potential restoration sites need to have sufficient light, moderate nutrient loads, suitable salinity and water temperatures, available seeds and other propagules, and an absence of mechanical disturbances that will destroy or degrade plants (Fonseca et al. 1998). Seagrass recovery is affected by numerous factors, such as the characteristics of the target seagrass species, disturbance intensity, disturbance characteristic(s), environmental conditions, disturbance history, the condition of existing seagrass beds, population structure, reproductive capacity, timing, and feedbacks between biotic and abiotic components at the site (O'Brien et al. 2018).

As discussed in Appendix A of this document, the ecological condition of waters and wetlands in the United States varies, and assessments conducted by USEPA for rivers and streams, estuaries, the Great Lakes, other lakes, and wetlands categories ecological condition as “good,” “fair,” or “poor.” One of the criteria that district engineers consider when they evaluate proposed NWP activities is the “degree or magnitude to which the aquatic resources perform these functions” (see paragraph 2 of Section D, “District Engineer’s Decision.” The quality of the affected waters is considered by district engineers when making decisions on whether to require compensatory mitigation for proposed NWP activities to ensure no more than minimal adverse environmental effects (see 33 CFR 330.1(e)(3)), and amount of compensatory mitigation required (see 33 CFR 332.3(f)). The quality of the affected waters also factors into the determination of whether the required compensatory mitigation offsets the losses of aquatic functions caused by the NWP activity.

The compensatory mitigation required by district engineers in accordance with general condition 23 and through activity-specific conditions added to NWP authorizations is expected to provide aquatic resource functions and services to offset some or all of the losses of aquatic resource functions caused by the activities authorized by this NWP, and reduce the incremental contribution of those activities to the cumulative effects on the Nation’s wetlands, streams, and other aquatic resources. Compensatory mitigation required by district engineers must be conducted in accordance with the applicable provisions of 33 CFR part 332, which requires development and implementation of approved mitigation plans, as well as monitoring to assess whether the objectives and ecological performance standards of compensatory mitigation projects are being achieved, or whether corrective measures or adaptive management are needed to address deficiencies that may occur. The district engineer will evaluate monitoring reports to determine if the compensatory mitigation project has fulfilled its objectives, has achieved its ecological performance standards, and offsets the permitted impacts. If the monitoring efforts indicate that the compensatory mitigation project is failing to meet its objectives and ecological performance standards, the district engineer may require additional measures, such as corrective measures and/or adaptive management or alternative compensatory mitigation, to address the compensatory mitigation project’s deficiencies. [33 CFR 332.7(c)]

The individual and cumulative adverse effects on the aquatic environment resulting from the discharges of dredged or fill material into waters of the United States authorized by this NWP, including compliance with all applicable NWP general conditions as well as regional conditions imposed by division engineers and activity-specific conditions imposed by district engineers, are expected to be no more than minimal. The Corps expects that the convenience and time savings associated with the use of this NWP will encourage applicants to design their projects within the scope of the NWP, including its limits, rather than request individual permits for projects that could result in greater adverse impacts to the aquatic environment. Division and district engineers will restrict or prohibit this NWP on a regional or case-specific basis if they determine that these discharges of dredged or fill material into waters of the United States will result in more than minimal individual and cumulative adverse effects on the aquatic environment.

C.2.3 Section 404(b)(1) Guidelines Impact Analysis, Subparts C through F

(a) Substrate: Discharges of dredged or fill material into waters of the United States may alter the substrate of those waters, usually replacing the aquatic area with dry land, and changing the physical, chemical, and biological characteristics of the substrate. The original substrate may be removed or covered by other material, such as soil, gravel, etc. In riverine systems, sediment transport from upstream river or stream segments may restore substrate characteristics after a period of time. Temporary fills may be placed upon the substrate, but must be removed upon completion of the activity (see general condition 13). Higher rates of erosion may result during mining activities, but general condition 12 requires the use of appropriate measures to control soil erosion and sediment.

(b) Suspended particulates/turbidity: Depending on the mining method, soil erosion and sediment control measures, equipment, composition of the bottom substrate, and wind and current conditions during mining, fill material placed in open waters may temporarily increase water turbidity. Pre-construction notification is required for all discharges of dredged or fill material into waters of the United States authorized by this NWP, which will allow the district engineer to review each proposed mining activity and ensure that adverse effects on the aquatic environment are no more than minimal. Particulates may be resuspended in the water column during removal of temporary fills. The turbidity plume will normally be limited to the immediate vicinity of the disturbance and should dissipate shortly after each phase of the construction activity. General condition 12 requires the permittee to stabilize exposed soils and other fills, which will help reduce turbidity. In many localities, contractors are required to develop and implement sediment and erosion control plans to minimize the entry of soil into the aquatic environment. Nationwide permit activities cannot create turbidity plumes that smother important spawning areas downstream (see general condition 3).

(c) Water: Mining activities involving discharges of dredged or fill material into waters of the United States may affect some characteristics of water, such as water clarity, chemical content, dissolved gas concentrations, pH, and temperature. Mining activities may change the chemical and physical characteristics of the waterbody by introducing suspended or dissolved chemical compounds or sediments into the water. Changes in water quality can affect the species and numbers of organisms inhabiting the aquatic area. Water quality certification is required for activities authorized by this NWP that result in discharges of dredged or fill material into waters of the United States, which will help ensure that the authorized discharges do not violate applicable water quality requirements. Permittees may be required to implement water quality management measures to ensure that the authorized activities do not result in more than minimal degradation of water quality. Retention ponds may be required to prevent or reduce the input of harmful chemical compounds into the waterbody. The district engineer may require the establishment and maintenance of riparian areas next to open waters, such as streams. Riparian areas help improve or maintain water quality, by removing nutrients, moderating water temperature changes, and trapping sediments.

(d) Current patterns and water circulation: Discharges of dredged or fill material into waters of the United States authorized by this NWP may adversely affect the movement of water in the aquatic environment. All discharges of dredged or fill material into waters of the United States authorized by this NWP require pre-construction notification to the district engineer, which will help ensure that adverse effects to current patterns and water circulation are no more than minimal. General condition 9 requires the authorized activity to be designed to withstand expected high flows, including tidal flows, and to maintain the pre-construction course, condition, capacity, and location of open waters to the maximum extent practicable. General condition 10 requires activities to comply with applicable FEMA-approved state or local floodplain management requirements, which will help reduce adverse effects to surface water flows.

(e) Normal water level fluctuations: The discharges of dredged or fill material into waters of the United States authorized by this NWP will not adversely affect normal patterns of water level fluctuations due to tides and flooding. This NWP does not authorize activities in tidal waters. To ensure that the NWP does not authorize discharges of dredged or fill material into waters of the United States that adversely affect normal flooding patterns, general condition 10 requires NWP activities to comply with applicable FEMA-approved state or local floodplain management requirements. General condition 9 requires the permittee to maintain the pre-construction course, condition, capacity, and location of open waters, to the maximum extent practicable.

(f) Salinity gradients: The discharges of dredged or fill material into waters of the United States authorized by this NWP are unlikely to adversely affect salinity gradients, since the NWP is restricted to discharges of dredged or fill material into non-tidal waters, excluding non-tidal wetlands adjacent to tidal waters.

(g) Threatened and endangered species: No activity is authorized by any NWP if that activity is likely to jeopardize the continued existence of a threatened or endangered species as listed or proposed for listing under the Endangered Species Act of 1973, as amended, or to destroy or adversely modify the critical habitat of such species. See 33 CFR 330.4(f) and paragraph (a) of general condition 18. For NWP activities, compliance with the Endangered Species Act is discussed in more detail in Appendix D of this document.

(h) Fish, crustaceans, molluscs, and other aquatic organisms in the food web. All discharges of dredged or fill material into waters of the United States authorized by this NWP require pre-construction notification to the district engineer, which will allow review of each activity to ensure that adverse effects to fish and other aquatic organisms in the food web are no more than minimal. Fish and other motile animals are likely to avoid the project site during construction. Sessile or slow-moving animals in the path of discharges, equipment, and building materials may be destroyed. Some aquatic animals may be smothered by the placement of fill material. Motile animals are likely to return to those areas that are temporarily impacted by the activity and restored or allowed to revert back to pre-construction conditions. Aquatic animals might not return to sites of permanent fills. Benthic and sessile animals are expected to recolonize sites temporarily impacted by the activity, after those areas are restored. Discharges of dredged or fill material into waters of the United States that alter the riparian zone, especially floodplains, may adversely affect populations of fish and other aquatic animals, by altering stream flow, flooding patterns, and surface and groundwater hydrology. Some species of fish spawn on floodplains, which could be inhibited or prevented if the discharge of dredged or fill material into waters of the United States involves clearing or filling the floodplain. Mining activities in the vicinity of streams may alter habitat features by increasing surface water flow velocities, which can increase erosion and reduce the amount of habitat for aquatic organisms and destroy spawning areas. Mining activities in the vicinity of streams may also cause more unstable flow regimes, such as higher peak flows, more frequent dry periods, and more frequent flooding, which may decrease the amount of habitat for aquatic animals.

Division and district engineers can place conditions on this NWP to prohibit discharges of dredged or fill material into waters of the United States during important stages of the life cycles of certain aquatic organisms. Such time of year restrictions can help reduce or prevent adverse effects to these aquatic organisms during reproduction and development periods. General conditions 3 and 5 address protection of spawning areas and shellfish beds, respectively. General condition 3 states that activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. In addition, general condition 3 also prohibits activities that result in the physical destruction of important spawning areas. General condition 5 prohibits activities in areas of concentrated shellfish populations. General condition 9 requires the maintenance of pre-construction course, condition, capacity, and location of open waters to the maximum extent practicable, which will help minimize adverse impacts to fish, shellfish, and other aquatic organisms in the food web.

(i) Other wildlife: Discharges of dredged or fill material into waters of the United States authorized by this NWP may result in adverse effects on other wildlife associated with aquatic ecosystems, such as resident and transient mammals, birds, reptiles, and amphibians, through the destruction of aquatic habitat, including breeding and nesting areas, escape cover, travel corridors, and preferred food sources. This NWP does not authorize discharges of dredged or fill material into waters of the United States that are likely to jeopardize the continued existence of federally-listed endangered and threatened species or result in the destruction or adverse modification of critical habitat. Compensatory mitigation, including the establishment and maintenance of riparian areas next to open waters, may be required for discharges of dredged or fill material into waters of the United States authorized by this NWP, which will help offset losses of aquatic habitat for wildlife. General condition 4 states that activities in breeding areas for migratory birds must be avoided to the maximum extent practicable.

(j) Special aquatic sites: The potential impacts to specific special aquatic sites are discussed below:

(1) Sanctuaries and refuges: The discharges of dredged or fill material into waters of the United States authorized by this NWP may result in adverse effects to within sanctuaries or refuges designated by Federal or state laws or local ordinances. General condition 22 prohibits the use of this NWP to discharge dredged or fill material in NOAA-managed marine sanctuaries and marine monuments and National Estuarine Research Reserves. All discharges of dredged or fill material into waters of the United States authorized by this NWP require pre-construction notification, and district engineers will evaluate potential impacts to sanctuaries and refuges caused by discharges of dredged or fill material into waters of the United States. District engineers may add conditions to the NWP authorization to minimize adverse effects to sanctuaries and refuges. District engineers will exercise discretionary authority and require individual permits for specific projects in waters of the United States in sanctuaries and refuges if those activities will result in more than minimal adverse effects on the aquatic environment.

(2) Wetlands: The discharges of dredged or fill material into waters of the United States authorized by this NWP may have adverse effects on wetlands. All activities authorized by this NWP require pre-construction notification, and district engineers will evaluate potential impacts to wetlands caused by discharges of dredged or fill material into waters of the United States. District engineers may add conditions to the NWP authorization to minimize adverse effects to wetlands. Division engineers can add regional conditions to this NWP to restrict or prohibit its use in certain high value wetlands. See paragraph (e) of section B.1 of Appendix B of this document for a more detailed discussion of impacts to wetlands.

(3) Mud flats: The discharges of dredged or fill material into waters of the United States authorized by this NWP may have adverse effects on mud flats in non-tidal waters. This NWP does not authorize discharges of dredged or fill material into tidal waters. All discharges of dredged or fill material into waters of the United States authorized by this NWP require pre-construction notification, and district engineers will evaluate potential impacts to mud flats caused by discharges of dredged or fill material into waters of the United States. District engineers may add conditions to the NWP authorization to minimize adverse effects to mud flats.

(4) Vegetated shallows: The discharges of dredged or fill material into waters of the United States authorized by this NWP may have adverse effects on vegetated shallows in non-tidal waters. It is unlikely that these discharges of dredged or fill material will adversely affect vegetated shallows in tidal waters, since the NWP does not authorize activities in tidal waters. All discharges of dredged or fill material into waters of the United States authorized by this NWP require pre-construction notification, and district engineers will evaluate potential impacts to vegetated shallows caused by discharges of dredged or fill material into waters of the United States. District engineers may add conditions to the NWP authorization to minimize adverse effects to vegetated shallows. If the non-tidal vegetated shallows are high value and the proposed activity will result in more than minimal adverse effects on the aquatic environment, the district engineer will exercise discretionary authority to require the project proponent to obtain an individual permit.

(5) Coral reefs: The discharges of dredged or fill material into waters of the United States authorized by this NWP are unlikely to have adverse effects on coral reefs, since this NWP does not authorize discharges in tidal waters. All discharges of dredged or fill material into waters of the United States authorized by this NWP require pre-construction notification, and district engineers will evaluate potential impacts to coral reefs caused by the discharges of dredged or fill material into waters of the United States authorized by this NWP. District engineers may add conditions to the NWP authorization to minimize adverse effects to coral reefs.

(6) Riffle and pool complexes: Discharges of dredged or fill material into waters of the United States authorized by this NWP may have adverse effects on riffle and pool complexes. All discharges of dredged or fill material into waters of the United States authorized by this NWP require pre-construction notification, and district engineers will evaluate potential impacts to riffle and pool complexes caused by these discharges. District engineers may add conditions to the NWP authorization to minimize adverse effects to riffle and pool complexes. If the riffle and pool complexes are high value and the proposed activity will result in more than minimal adverse effects on the aquatic environment, the district engineer will exercise discretionary authority to require the project proponent to obtain an individual permit.

(k) Municipal and private water supplies: See paragraph (n) of section B.1 of Appendix B of this document for a discussion of potential impacts to water supplies.

(l) Recreational and commercial fisheries, including essential fish habitat: The discharges of dredged or fill material into waters of the United States authorized by this NWP may adversely affect waters of the United States that act as habitat for populations of economically important fish and shellfish species. Division and district engineers can add conditions to this NWP to prohibit discharges during important life cycle stages, such as spawning or development periods, of economically valuable fish and shellfish. All discharges of dredged or fill material into waters of the United States authorized by this NWP require pre-construction notification to the district engineer, which will allow review of each activity in open waters to ensure that adverse effects to economically important fish and shellfish are no more than minimal. Compliance with general conditions 3 and 5 will help ensure that the authorized activity does not adversely affect important spawning areas or concentrated shellfish populations. As discussed in paragraph (g) of section B.1 of Appendix B of this document, there are procedures to help ensure that individual and cumulative impacts to essential fish habitat are no more than minimal. For example, division and district engineers can impose regional and special conditions to ensure that discharges of dredged or fill material into waters of the United States authorized by this NWP will result in no more than minimal adverse effects on essential fish habitat.

(m) Water-related recreation: See paragraph (m) of section B.1 of Appendix B of this document.

(n) Aesthetics: See paragraph (c) of section B.1 of Appendix B of this document.

(o) Parks, national and historical monuments, national seashores, wilderness areas, research sites, and similar areas: General condition 22 prohibits the use of this NWP to authorize discharges of dredged or fill material in designated critical resource waters and adjacent wetlands, which may be located in parks, national and historical monuments, national seashores, wilderness areas, and research sites. This NWP can be used to authorize discharges of dredged or fill material into waters of the United States in parks, national and historical monuments, national seashores, wilderness areas, and research sites if the manager or caretaker wants to conduct activities in waters of the United States and those discharges result in no more than minimal adverse effects on the aquatic environment. Division engineers can add regional conditions to this NWP to prohibit its use in designated areas, such as national wildlife refuges or wilderness areas.

Appendix D – Endangered and Threatened Species

No activity is authorized by any NWP if that activity is likely to jeopardize the continued existence of a threatened or endangered species as listed or proposed for listing under the Federal Endangered Species Act (ESA), or to destroy or adversely modify the critical habitat of such species (33 CFR 330.4(f)). If the district engineer determines a proposed NWP activity may affect listed species or designated critical habitat, he or she will conduct ESA section 7 consultation with the U.S. Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Services (NMFS) as appropriate. The proposed NWP activity is not authorized until the ESA section 7 consultation process is completed or the district engineer determines the proposed NWP activity will have no effect on listed species or designated critical habitat. Current local procedures in Corps districts are effective in ensuring compliance with section 7 of the ESA. Those local procedures include regional programmatic consultations, including the development of Standard Local Operating Procedures for Endangered Species (SLOPES) and Effects Determination Guidance for Endangered and Threatened Species (EDGES). The issuance or reissuance of an NWP, as governed by NWP general condition 18 (which applies to every NWP and which relates to endangered and threatened species and critical habitat) and 33 CFR 330.4(f), results in “no effect” to listed species or critical habitat, because no activity that “may affect” listed species or critical habitat is authorized by NWP unless ESA section 7 consultation with the USFWS and/or NMFS has been completed. If the non-federal project proponent does not comply with 33 CFR 330.4(f)(2) and general condition 18, and does not submit the required PCN, then the activity is not authorized by NWP. In such situations, it is an unauthorized activity and the Corps district will determine an appropriate course of action under its regulations at 33 CFR part 326 to respond to the unauthorized activity. Unauthorized activities may also be subject to the prohibitions of section 9 of the ESA.

Each activity authorized by an NWP is subject to general condition 18, which states that “[n]o activity is authorized under any NWP which is likely to directly or indirectly jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will directly or indirectly destroy or adversely modify designated critical habitat or critical habitat proposed for such designation.” In addition, general condition 18 explicitly states that the NWP does not authorize “take” of threatened or endangered species, which will ensure that permittees do not mistake the NWP authorization as a federal authorization to take threatened or endangered species. General condition 18 also requires a non-federal permittee to submit a pre-construction notification to the district engineer if any listed species or designated critical habitat (or proposed species or proposed critical habitat) might be affected or is in the vicinity of the project, or if the project is located in designated or proposed critical habitat. The Corps established the “might affect” threshold in 33 CFR 330.4(f)(2) and paragraph (c) of general condition 18 because it is more stringent than the “may affect” threshold for section 7 consultation in the USFWS’s and NMFS’s ESA section 7 consultation regulations at 50 CFR part 402. The word “might” is defined as having “less probability or possibility” than the word “may” (Merriam-Webster’s Collegiate Dictionary, 10th edition). Since “might” has a lower probability of occurring, it is below the threshold (i.e., “may affect”) that triggers the requirement for ESA section 7 consultation for a proposed federal action This general condition also states that, in such cases, non-federal permittees shall not begin work on the activity until notified by the district engineer that the requirements of the ESA have been satisfied and that the activity is authorized.

Under the Corps’ current regulations at 33 CFR 325.2(b)(5), the district engineer must review all permit applications for potential impacts on threatened and endangered species or critical habitat. For the NWP program, this review occurs when the district engineer evaluates the NWP pre-construction notification or a request for an NWP verification for an NWP activity that does not require a PCN. NWP general condition 18 requires a non-federal applicant to submit a pre-construction notification to the Corps if any listed species (or species proposed for listing) or designated critical habitat (or critical habitat proposed for such designation) might be affected or is in the vicinity of the project, or if the project is located in designated critical habitat (or critical habitat proposed for such designation). Based on the evaluation of all available information, the district engineer will initiate consultation with the USFWS or NMFS, as appropriate, if he or she determines that the proposed activity may affect any threatened and endangered species or designated critical habitat. Consultation may occur during the NWP authorization process or the district engineer may exercise discretionary authority to require an individual permit for the proposed activity and initiate section 7 consultation during the individual permit process. If the district engineer determines a proposed NWP activity is likely to jeopardize the continued existence of any proposed species or result in the destruction or adverse modification of proposed critical habitat, he or she will initiate a conference with the USFWS or NMFS. If ESA section 7 consultation or conference is conducted during the NWP authorization process, then the applicant will be notified that he or she cannot proceed with the proposed NWP activity until section 7 consultation is completed.

If the district engineer determines that the proposed NWP activity will have no effect on any threatened or endangered species or critical habitat, then the district engineer will notify the applicant that he or she may proceed under the NWP authorization as long as the activity complies with all other applicable terms and conditions of the NWP, including applicable regional conditions. When the Corps district makes a “no effect” determination, that determination is documented in the record for the NWP verification.

In cases where the Corps makes a “may affect” determination for a proposed NWP activity, formal or informal section 7 consultation is conducted before the activity is authorized by NWP. A non-federal permit applicant cannot begin work until notified by the Corps that the proposed NWP activity will have “no effect” on listed species or critical habitat, or until ESA section 7 consultation has been completed (see also 33 CFR 330.4(f)). Federal permittees are responsible for complying with ESA section 7(a)(2) and should follow their own procedures for complying with those requirements (see 33 CFR 330.4(f)(1)). Therefore, permittees cannot rely on complying with the terms of an NWP without considering ESA-listed species and critical habitat, and they must comply with the NWP conditions to ensure that they do not violate the ESA. General condition 18 also states that district engineers may add activity-specific conditions to the NWPs to address ESA issues as a result of formal or informal consultation with the USFWS or NMFS.

Each year, the Corps conducts thousands of ESA section 7 consultations with the USFWS and NMFS for activities authorized by NWPs. These section 7 consultations are tracked in ORM. During the period of January 1, 2022, to December 31, 2024, Corps districts conducted 990 formal consultations and 7,785 informal consultations under NWP PCNs where the Corps verified that the proposed activities were authorized by NWP. During that time period, the Corps also used regional programmatic consultations for 15,937 NWP verifications to comply with ESA section 7. During those three years, 309 ESA section 7 conferences were conducted for NWP activities. Therefore, each year an average of 8,340 formal, informal, programmatic ESA section 7 consultations and conferences are conducted with the USFWS and/or NMFS in response to NWP PCNs, including those activities that required PCNs under paragraph (c) of general condition 18. In a study on ESA section 7 consultations tracked by the USFWS, Malcom and Li (2015) found that during the period of 2008 to 2015, the Corps conducted the most formal and informal section 7 consultations, far exceeding the numbers of section 7 consultations conducted by other federal agencies.

Section 7 consultations are often conducted on a case-by-case basis for activities proposed to be authorized by NWP that may affect listed species or critical habitat, in accordance with the USFWS’s and NMFS’s interagency regulations at 50 CFR part 402. Instead of activity-specific section 7 consultations, compliance with ESA section 7(a)(2) may also be achieved through formal or informal regional programmatic consultations. Compliance with ESA section 7 may also be facilitated through division engineers adding regional conditions to the NWPs to address the requirements of ESA section 7. In some Corps districts SLOPES or EDGES have been developed through consultation with USFWS and NMFS regional offices to make the process of complying with ESA section 7 more efficient.

Corps districts have, in most cases, established informal or formal procedures with regional or local offices of the USFWS and NMFS, through which the agencies share information regarding threatened and endangered species and their critical habitat. This information helps a district engineer determine if a proposed NWP activity may affect listed species or their critical habitat and, when a “may affect” determination is made, initiate ESA section 7 consultation. Corps districts may utilize maps or databases that identify locations of populations of threatened and endangered species and their critical habitat. Where necessary, regional conditions are added to one or more NWPs by division engineers to require pre-construction notifications for NWP activities that occur in known locations of threatened and endangered species or designated critical habitat. Any information provided by local maps and databases and any comments received during the pre-construction notification review process will be used by the district engineer to make a "no effect" or "may affect" determination for the pre-construction notification.

Based on the safeguards discussed in this Appendix, especially general condition 18 and the NWP regulations at 33 CFR 330.4(f), the Corps believes that the activities authorized by this NWP comply with the requirements of the ESA. Although the Corps continues to believe that these procedures ensure compliance with the ESA, the Corps has taken some steps to provide further assurance. Corps district offices meet with local representatives of the USFWS and NMFS to establish or modify existing procedures, such as regional conditions and coordination procedures, where necessary, to ensure that the Corps has the latest information regarding the existence and location of any threatened or endangered species or their critical habitat. Corps districts can also establish, through SLOPES, EDGES, or other tools, additional safeguards that ensure compliance with the ESA.

Through ESA section 7 formal or informal consultations, including regional programmatic consultations, the Corps ensures that no activity is authorized by any NWP if that activity is likely to jeopardize the continued existence of a threatened or endangered species as listed or proposed for listing under the ESA, or to destroy or adversely modify the critical habitat of such species. Other tools such as ESA section 7 conferences, SLOPES, EDGES, the development of regional conditions added to the NWP by division engineers, and conditions added to specific NWP authorizations by district engineers help ensure compliance with section 7 of the ESA.

If informal section 7 consultation is conducted, and the USFWS and/or NMFS issues a written concurrence that the proposed NWP activity may affect, but is not likely to adversely affect, listed species or designated critical habitat based on conservation measures incorporated in the NWP activity to avoid or minimize potential effects to listed or proposed species or designated or proposed critical habitat, the district engineer will add conditions for those conservation measures to the NWP authorization. If the USFWS and/or NMFS does not issue a written concurrence with the district engineer's determination that the proposed NWP activity "may affect, but is not likely to adversely affect" listed species or critical habitat, the district engineer will initiate formal section 7 consultation if he or she changes the effects determination to "may affect, likely to adversely affect." The project proponent might also be able to modify the proposed NWP activity to a sufficient extent so that a "no effect" determination could be made by the district engineer.

If formal section 7 consultation is conducted and a biological opinion is issued, the district engineer will add conditions to the NWP authorization to incorporate appropriate elements of the incidental take statement of the biological opinion into the NWP authorization, if the biological opinion concludes that the proposed NWP activity is not likely to jeopardize the continued existence of listed species or adversely modify or destroy critical habitat. If the biological opinion concludes that the proposed NWP activity is likely to jeopardize the continued existence of listed species or adversely modify or destroy critical habitat, the proposed activity cannot be authorized by NWP and the district engineer will instruct the applicant to apply for an individual permit. The incidental take statement includes reasonable and prudent measures and terms and conditions such as mitigation, monitoring, and reporting requirements that minimize incidental take. To fulfill its obligations under section 7(a)(2) of the ESA, the Corps will determine which elements of an incidental take statement are appropriate to be added as permit conditions to the NWP authorization (see 33 CFR 325.4(a)). The appropriate elements of the incidental take statement are those reasonable and prudent measures and terms and conditions that: (1) apply to the activities over which the Corps has control and responsibility through its permitting authorities (i.e., structures or work in navigable waters and/or the discharges of dredged or fill material into waters of the United States), and (2) the Corps has the authority to enforce under its permitting authorities. Incorporation of the appropriate elements of the incidental take statement into the NWP authorization through binding, enforceable permit conditions may provide the project proponent an exemption from the “take” prohibitions in ESA section 9 (see section 7(o)(2) of the ESA).

The Corps can modify this NWP at any time that it is deemed necessary to protect listed species or their critical habitat, either through: (1) national general conditions or national-level modifications, suspensions, or revocations of the NWPs; (2) regional conditions or regional modifications, suspensions, or revocations of NWPs; or (3) activity-specific permit conditions (modifications) or activity-specific suspensions or revocations of NWP authorizations. Therefore, although the Corps has issued the NWPs, the Corps can address any ESA issue at any time, if one should arise. The NWP regulations also allow the Corps to suspend the use of some or all of the NWPs immediately, if necessary, while considering the need for permit conditions, modifications, or revocations. These procedures are provided at 33 CFR 330.5.

Appendix E – Public Comments and Responses

For a summary of the public comments received in response to the June 18, 2025, issue of the Federal Register (90 R 26100), refer to the preamble in the Federal Register notice announcing the reissuance of this NWP. The substantive comments received in response to the proposed rule published in the Federal Register on June 18, 2025, were used to improve the NWP by changing NWP terms and limits, pre-construction notification requirements, and/or NWP general conditions, as necessary.

Many commenters stated that the Corps should maintain and not decrease the current 1/2-acre impact limit on this NWP. One commenter stated that 1/2-acre of impacts to a small stream is not minimal. One commenter recommended using a sliding acreage cap for impacts based on project size. One commenter stated that the 1/2-acre impact limit should be expanded to at least 3 acres. One commenter recommended a new NWP permit only for aggregates with a higher acreage impact limit.

The terms and conditions of this NWP, including the 1/2-acre limit and the requirement that all activities require PCNs, will ensure that the activities authorized by this NWP will result in no more than minimal individual and cumulative adverse environmental effects. District engineers will review these PCNs, and can add conditions to the NWP authorization, including mitigation requirements, to ensure that the authorized activity will cause no more than minimal adverse environmental effects. If a proposed activity will result in more than minimal adverse environmental effects, after considering the mitigation proposal provided by the prospective permittee, the district engineer will exercise discretionary authority and require an individual permit.

Division engineers may also add regional conditions to this NWP to change the PCN threshold or restrict activities in sensitive waters or locations. This NWP authorizes aggregate mining activities, and the Corps does not believe a separate NWP for those activities is warranted. Activities that are not authorized by this NWP may be authorized by a regional general permit or individual permit.

One commenter stated that mining activities, especially within a fish bearing stream, should not be covered under an NWP. One commenter objected to the use of this NWP when activities occur in streams, floodplains, or are adjacent to non-tidal waters occupied by anadromous salmon.

All activities authorized by this NWP require a PCN. District engineers will review PCNs for case specific activities and determine whether they may affect ESA-listed species (or species proposed for listing) or designated critical habitat (or habitat proposed for such designation). If the district engineer determines a proposed NWP activity may affect listed species (or species proposed for listing) or designated critical habitat (or habitat proposed for designation), he or she will conduct ESA

Section 7 consultation with the U.S. Fish and Wildlife Service's (FWS) or National Marine Fisheries Service's (NMFS) as appropriate. If, during the review of a PCN, the district engineer determines the proposed activity may adversely affect EFH, she or he will initiate EFH consultation with the NMFS. Division engineers may add regional conditions to this NWP to protect other special status species.

Appendix F – References

Adams, M., D.J. Cooper, R. Juanatre, J.-C. Clément, and S. Gaucherand. 2024. Wetland restoration: can short-term success criteria predict long-term outcomes? Restoration Ecology 32, e14231.

Allan, J.D. 2004. Landscapes and Riverscapes: The Influence of Land Use on Stream Ecosystems. Annual Review of Ecology, Evolution, and Systematics. 35:257–284.

Allan, J.D. and M.M. Castillo. 2007. Stream Ecology: Structure and Function of Running Waters, 2nd edition. Springer (The Netherlands). 436 pp.

Backstrom, A.C, G.E. Garrard, R.J. Hobbs, and S.A. Bekessy. 2018. Grappling with the social dimensions of novel ecosystems. Frontiers in Ecology and the Environment 16:109-117, doi: 10.1002/fee.1769

Barbier, E.B. 2017. Marine ecosystem services. Current Biology 27:R507-R510.

Barbier, E.B., S.D. Hacker, C. Kennedy, E.W. Koch, A.C. Stier, and B.R. Silliman. 2011. The value of estuarine and coastal ecosystem services. Ecological Monographs 81:169-193.

Beechie, T.J., D.A. Sear, J.D. Olden, G.R. Pess, J.M. Buffington, H. Moir, P. Roni, and M.M. Pollock. 2010. Process-based principles for restoring river ecosystems. Bioscience 60:209-222.

Beechie, T., J.S. Richardson, A.M. Gurnell, and J. Negishi. 2013. Watershed processes, human impacts, and process-based restoration. In, Stream and Watershed Restoration: A Guide to Restoring Riverine Processes and Habitats. Edited by P. Roni and T. Beechie. Wiley and Sons, Inc. (West Sussex, UK), pp. 11-49.

Benstead, J.P. and D.S. Leigh. 2012. An expanded role for river networks. Nature Geoscience 5:678-679.

Bigelow, D.P. and A. Borchers. 2017. Major Uses of Land in the United States, 2012. EIB-178. U.S. Department of Agriculture, Economic Research Service. 62 pp.

Blanco, J., N. Dendoncker, C. Barnaud, and C. Sirami, 2019. Ecosystem disservices matter: Towards their systematic integration within ecosystem service research and policy, Ecosystem Services, 36, 100913, https://doi.org/10.1016/j.ecoser.2019.100913.

Boerema, A. and P. Meire. 2017. Management for estuarine ecosystem services: a review. Ecological Engineering 98:172-182.

Booth, D.B., J.R. Karr, S. Schauman, C.P. Konrad, S.A. Morley, M.G. Larson, and S.J. Burges. 2004. Reviving urban streams: Land use, hydrology, biology, and human behavior. Journal of the American Water Resources Association. 40:1351-1364.

Borum, J., R.K. Gruber, and W.M. Kemp. 2013. Seagrass and related submersed vascular plants. In: Estuarine Ecology (2nd edition). Edited by J.W. Day, Jr., B.C. Crump, W.M. Kemp, and A. Yáñez-Arancibia. Wiley-Blackwell. Chapter 5, pp. 111-127.

Brinson, M.M. and A.I. Malvárez. 2002. Temperate freshwater wetlands: type, status and threats. Environmental Conservation 29:115-133.

Brooks, R.T. and E.A. Colburn. 2011. Extent and channel morphology of unmapped headwater stream segments of the Quabbin watershed, Massachusetts. Journal of the American Water Resources Association 47:158-168.

Brown, T.C. and P. Froemke. 2012. Nationwide assessment of non-point source threats to water quality. Bioscience 62:136-146.

Brudvig, L.A., R.S. Barak, J.T. Bauer, T.T. Caughlin, D.C. Laughlin, L. Larios, J.W. Matthews, K.L. Stuble, N.E. Turley, and C. Zirbel. 2017. Interpreting variation to advance predictive restoration science. Journal of Applied Ecology 54:1018-1027. doi: 10.1111/1365-2664.12938.

Butman, D. and P.A. Raymond. 2011. Significant efflux of carbon dioxide from streams and rivers in the United States. Nature Geoscience 4:839–842.

Canter, L.W. 1996. Environmental Impact Analysis. 2nd edition. McGraw-Hill (Chapter 4).

Carpenter, S.R., E.H. Stanley, and J.M. Vander Zanden. 2011. State of the world's freshwater ecosystems: Physical, chemical, and biological changes. Annu. Rev. Environ. Resources. 36:75-99.

Ciotti, D.C., J. McKee, K.L. Pope, G.M. Kondolf, and M.M. Pollock. 2021. Design criteria for process-based restoration of fluvial systems. Bioscience 71:831-845.

Clarke Murray, C., M.E. Mach, and R.G. Martone, R.G. 2014. Cumulative effects in marine ecosystems: scientific perspectives on its challenges and solutions. WWF-Canada and Center for Ocean Solutions. 60 pp.

Clewell, A.F. and J. Aronson. 2013. Ecological Restoration: Principles, Values, and Structure of an Emerging Profession. 2nd edition. Island Press (Washington, DC).

Cluer, B. and C. Thorne. 2013. A stream evolution model integrating habitat and ecosystem benefits. River Research and Applications DOI: 10.1002/rra.2631

Cocklin, C., S. Parker, and J. Hay. 1992. Notes on cumulative environmental change I: Concepts and issues. Journal of Environmental Management 35:31-49.

Comberti, C., T.F. Thornton, V. Wyllie de Echeverria, and T. Patterson. 2015. Ecosystem services or services to ecosystems? Valuing cultivation and reciprocal relationships between humans and ecosystems. Global Environmental Change 34:247-262.

Costanza, R. 2008. Ecosystem services: Multiple classification systems are needed. Biological Conservation 141:350-352.

Côté, I.M., E.S. Darling, and C.J. Brown. 2016. Interactions among ecosystem stressors and their importance to conservation. Proceedings of the Royal Society B 283: 20152592 http://dx.doi.org/10.1098/rspb.2015.2592

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service. FWS/OBS-79-31. 131 pp.

Crain, C.M., K. Kroeker, and B.S. Halpern. 2008. Interactive and cumulative effects of multiple human activities in marine systems. Ecology Letters 11:1304-1315.

Dahl, T.E. 2011. Status and trends of wetlands in the conterminous United States 2004 to 2009. U.S. Department of the Interior, Fish and Wildlife Service, Washington, DC. 108 pp.

Dahl, T.E. 1990. Wetlands losses in the United States 1780s to 1980s. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. 21 pp.

Dahl, T.E. and C.E. Johnson. 1991. Status and Trends of Wetlands in the Conterminous United States, Mid-1970s to Mid-1980s. U.S. Department of the Interior, Fish and Wildlife Service, Washington, DC. 28 pp.

Day, J.W., Jr., A. Yáñez-Arancibia, and W.M. Kemp. 2013. Human impact and management of coastal and estuarine ecosystems. In Estuarine Ecology, 2nd edition. Edited by J.W. Day, Jr., B.C. Crump, W.M. Kemp, and A. Yáñez-Arancibia. Wiley-Blackwell. Chapter 19, pp. 483-495.

Deegan, L.A., D.S. Johnson, R.S. Warren, B.J. Peterson, J.W. Fleeger, S. Fagherazzi, and W.M. Wollheim. 2012. Coastal eutrophication as a driver of salt marsh loss. Nature 490:388-392.

DeVries, P., K.L. Fetherston, A. Vitale, and S. Madsen. 2012. Emulating riverine landscape controls of beaver in stream restoration. Fisheries 37:246-255.

Diaz, S. and 29 others. 2018. Assessing nature’s contributions to people. Science 359:270-272.

Dubé, M.G. 2003. Cumulative effect assessment in Canada: a regional framework for aquatic ecosystems. Environmental Impact Assessment Review 23:723-745.

Dudgeon, D. A.H. Arthington, M.O. Gessner, Z.-I. Kawabata, D.J. Knowler, C. Lévêque, R.J. Naiman, A.-H. Prieur-Richard, D. Soto, M.L.J. Stiassny, and C.A. Sullivan. 2005. Freshwater biodiversity: importance, threats, status and conservation challenges. Biological Reviews 81:163-182.

Duinker, P.N., E.L. Burbidge, S.R. Boardley, and L.A. Greig. 2013. Scientific dimensions of cumulative effects assessment: toward improvements in guidance for practice. Environmental Review 21:40-52.

Duinker, P.N. and L.A. Greig. 2006. The impotence of cumulative effects assessment in Canada: ailments and ideas for redeployment. Environmental Management 37:153-161.

Ehrenfeld, J.G. 2000. Defining the Limits of Restoration: The Need for Realistic Goals. Restoration Ecology 8:2-9.

Ellis, E.C. 2021. Land use and ecological change: A 12,000-year history. Annual Review of Environment and Resources 46:1-33.

Ellis, E.C. and 18 others. 2021. People have shaped most of terrestrial nature for at least 12,000 years. Proceedings of the National Academy of Sciences 118, No. 17 e2023483118

Elmore, A.J., J.P. Julian, S.M. Guinn, and M.C. Fitzpatrick. 2013. Potential stream density in mid-Atlantic watersheds. PLOS ONE 8:e74819

Elmqvist, T. C. Folke, M. Nystrom, G. Peterson, J. Bengtsson, B. Walker, and J. Norberg. 2003. Response diversity, ecosystem change, and resilience. Frontiers in Ecology and Environment 1:488-494.

Evans, N.M. and M.A. Davis. 2018. What about cultural ecosystems? Opportunities for cultural considerations in the “International Standards for the Practice of Ecological Restoration.” Restoration Ecology 26:612-617.

Federal Geographic Data Committee. 2013. Classification of wetlands and deepwater habitats of the United States. FGDC-STD-004-2013. Second Edition. Wetlands Subcommittee, Federal Geographic Data Committee and U.S. Fish and Wildlife Service, Washington, DC.

Fennessy, M.S., A.D. Jacobs, and M.E. Kentula. 2007. An evaluation of rapid methods for assessing the ecological condition of wetlands. Wetlands 27:543-560.

Fischenich, J.C. 2006. Functional objectives for stream restoration. EMRRP Technical Notes Collection (ERDC TN-EMRRP-SR-52). Vicksburg, MS: U.S. Army Engineer Research and Development Center. 18 pp.

Flitcroft, R.L. and 18 others. 2022. Rehabilitating valley floors to a Stage 0 condition: A synthesis of opening outcomes. Frontiers in Environmental Science. Volume 10, article 892268

Foley, J.A., and 18 others. 2005. Global consequences of land use. Science 309:570-574.

Foley, M.M. and 9 others. 2015. Using ecological thresholds to inform resource management: current options and future possibilities. Frontiers in Marine Science. Volume 2, Article 95. doi: 10.3389/fmars.2015.00095

Folke, C. S. Carpenter, B. Walker, M. Scheffer, T. Elmqvist, L. Gunderson, and C.S. Holling. 2004. Regime shifts, resilience, and biodiversity in ecosystem management. Annual Review of Ecology, Evolution, and Systematics. 35:557–81.

Folke, C., S.R. Carpenter, B. Walker, M. Scheffer, T. Chapin, and J. Rockstrom. 2010. Resilience thinking: Integrating resilience, adaptability, and transformability. Ecology and Society, volume 15, article 20.

Fonseca, M.S. 2011. Addy Revisited: What Has Changed with Seagrass Restoration in 64 Years? Ecological Restoration 29:73-81.

Fonseca, M.S., J.W. Kenworthy, and G.W. Thayer. 1998. Guidelines for the conservation and restoration of seagrasses in the United States and adjacent waters. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Coastal Ocean Office. Decision Analysis Series Report Number 12. 230 pp.

Frayer, W.E., T.J. Monahan, D.C. Bowden, F.A. Graybill. 1983. Status and Trends of Wetlands and Deepwater Habitats in the Conterminous United States: 1950s to 1970s. Department of the Interior, U.S. Fish and Wildlife Service. Washington, DC. 32 pp.

Gann, G.D. and 15 others. 2019. International principles and standards for the practice of ecological restoration. Second edition. Restoration Ecology 27:S1-S46.

Gebo, N.A. and R.P. Brooks. 2012. Hydrogeomorphic (HGM) assessments of mitigation sites compared to natural reference wetlands in Pennsylvania. Wetlands 32:321-331.

Gittman, R.K, F.J. Fodrie, A.M. Popowich, D.A. Keller, J.F. Bruno, C.A. Currin, C.H. Peterson, and M.F. Piehler. 2015. Engineering away our natural defenses: an analysis of shoreline hardening in the United States. Frontiers in Ecology and the Environment 13:301-307.

Gosselink, J.G., G.P. Shaffer, L.C. Lee, D.M. Burdick, D.L. Childers, N.C. Leibowitz, S.C. Hamilton, R. Boumans, D. Cushman, S. Fields, M. Koch, and J.M. Visser.

1990. Landscape conservation in a forested wetland watershed: Can we manage cumulative impacts? Bioscience 40:588-600.

Gosselink, J.G. and L.C. Lee. 1989. Cumulative impact assessment in bottomland hardwood forests. Wetlands 9:83-174.

Greenhill, S., H. Druckenmiller, S. Wang, D.A. Keiser, M. Girotto, J.K. Moore, N. Yamaguchi, A. Todeschini, and J.S. Shapiro. 2024. Machine learning predicts which rivers, streams, and wetlands the Clean Water Act regulates. Science 383:406-412.

Groffman, P.M. and 15 others. 2006. Ecological thresholds: The key to successful environmental management or an important concept with no practical application? Ecosystems 9:1-13.

Hall, J.V., W.E. Frayer, and B.O. Wilen. 1994. Status of Alaska Wetlands. U.S. Department of the Interior, Fish and Wildlife Service, Washington, DC. 33 pp.

Halpern, B.S. and 10 others. 2015. Spatial and temporal changes in cumulative human impacts on the world's ocean. Nature Communications. 6:7615, doi: 10.1038/ncomms8615

Halpern, B.S., and 18 others. 2008. A global map of human impact on marine ecosystems. Science 319:948-952.

Hansen, W.F. 2001. Identifying stream types and management implications. Forest Ecology and Management 143:39-46.

Harris, G.P. and A.L. Heathwaite. 2012. Why is achieving good ecological outcomes in rivers so difficult? Freshwater biology 57:Suppl 1, 91-107.

Hawley, R.J. 2018. Making stream restoration more sustainable: A geomorphically, ecologically, and socioeconomically principled approach to bridge the practice with science. Bioscience 68:517-528.

Hiers, J.K., S.T. Jackson, R.J. Hobbs, E.S. Bernhardt, and L.E. Valentine. 2016. The precision problem in conservation and restoration. Trends in Ecology and Evolution 31:820-830.

Higgs, E., D.A. Falk, A. Guerrini, M. Hall, J. Harris, R.J. Hobbs, S.T. Jackson, J.M. Rhemtulla, and W. Throop. 2014. The changing role of history in restoration ecology. Frontiers in Ecology and the Environment 12:499-506.

Hobbs, R.J. 2007. Setting effective and realistic restoration goals: Key directions for research. Restoration Ecology 15:354-357.

Hobbs, R.J., and 27 others. 2014. Managing the whole landscape: historical, hybrid, and novel ecosystems. Frontiers in Ecology and the Environment 12:557-564.

Hodgson, E.E., B.S. Halpern, and T.E. Essington. 2019. Moving beyond silos in cumulative effects assessment. Frontiers in Ecology and Evolution volume 7, article 211. 8 pp. doi: 10.3389/fevo.2019.00211

Hodgson, E.E. and B.S. Halpern. 2018. Investigating cumulative effects across ecological scales. Conservation Biology 33:22-32.

Holl, K.D. 2020. Primer of Ecological Restoration. Island Press (Washington, DC). 202 pp.

Homer, C. and 11 others. 2020. Conterminous United States land cover change patterns 2001-2016 from the 2016 National Land Cover Database. ISPRS Journal of Photogrammetry and Remote Sensing. 162:184-199.

Hornung, L.K., S.A. Podschun, and M. Putsch. 2019. Linking ecosystem services and measures in river and floodplain management. Ecosystems and People 15:1, 214-231. doi: 10/1080/26395916.2019.1656287

Hughes, T.P., C. Linares, V. Dakos, I.A. van de Leemput, and E.H. van Nes. 2013. Living dangerously on borrowed time during slow, unrecognized regime shifts. Trends in Ecology and Evolution 28:149-155.

Hunsicker, M.E., C.V. Kappel, K.A. Selkoe, B.S. Halpern, C. Scarborough, L. Mease, and A. Amrhein. 2016. Characterizing driver-response relationships in marine pelagic ecosystems for improved ocean management. Ecological Applications 26:651-663.

Jackson, S.T. and R.J. Hobbs. 2009. Ecological restoration in the light of ecological history. Science 325:567-569.

Kareiva, P. and M. Marvier. 2017. Conservation Science: Balancing the Needs of People and Nature. W.H. Freeman (New York). 642 pp.

Kelly, R., A.L. Erickson, and L.A. Mease. 2014. How not to fall off a cliff, or using tipping points to improve environmental management. Ecology Law Quarterly 41:843-886.

Kelly, R.P., A.L. Erickson, L.A. Mease, W. Battista, J.N. Kittinger, and R. Fujita. 2015. Embracing thresholds for better environmental management. Philosophical Transactions Royal Society B 370:20130276

Kettlewell, C.I., V. Bouchard, D. Porej, M. Micacchion, J.J. Mack, D. White, and L. Fay. 2008. An assessment of wetland impacts and compensatory mitigation in the Cuyahoga River watershed, Ohio, USA. Wetlands 28:57-67.

Kondolf, G.M. 2011. Setting goals in river restoration: When and where can a river “heal itself”? In: Stream Restoration in Dynamic Fluvial Systems: Scientific

Approaches, Analyses, and Tools. Geophysical Monograph Series 194. 10.1029/2010/GM001020

Korpinen, S. and J.H. Andersen. 2016. A global review of cumulative pressure and impact assessment in marine environments. Frontiers in Marine Science. Volume 3, Number 153. doi: 10.3389/fmars.2016.00153

Lang, M.W., J.C. Ingebritsen, and R.K. Griffin. 2024. Status and trends of wetlands in the conterminous United States 2009 to 2019. U.S. Department of the Interior; Fish and Wildlife Service, Washington, D.C. 43 pp.

Leopold, L.B., M.G. Wolman, and J.P. Miller. 1964. Fluvial Processes in Geomorphology. Dover Publications, Inc. (New York). 522 pp.

Leopold, L.B. 1994. A View of the River. Harvard University Press (Cambridge). 298 pp.

Levin. S. 1999. Fragile Dominion: Complexity and the Commons. Perseus Publishing (Cambridge, Massachusetts) 250 pp.

Levin, P.S. and C. Mollmann. 2015. Marine ecosystem regime shifts: challenges and opportunities for ecosystem-based management. Philosophical Transactions Royal Society B. 370:20130275 http://dx.doi.org/10.1098/rstb.2013.0275

Lewis, R.R., J.A. Kusler, and K.L. Erwin. 1995. Lessons learned from five decades or wetland restoration and creation in North America. In: Bases Ecológicas para la Restaruación de Humedales en la Cuenca Mediterránea. Edited by C. Montes, G. Oliver, F. Monila, and J. Cobos. pp. 107-122.

Lotze, H.K., H.S. Lenihan, B.J. Bourque, R.H. Bradbury, R.G. Cooke, M.C. Kay, S.M. Kidwell, M.X. Kirby, C.H. Peterson, and J.B.C. Jackson. 2006. Depletion, degradation, and recovery potential of estuaries and coastal seas. Science 312:1806-1809.

Lui, J. et al. 2007. Complexity of coupled human and natural systems. Science 317:1513-1516.

MacDonald, L.H. 2000. Evaluating and Managing Cumulative Effects: Process and Constraints. Environmental Management 26:299–315.

Meli, P., J.M. Rey Benayas, P. Balvaneera, and M.M. Ramos. 2014. Restoration enhances wetland biodiversity and ecosystem service supply, but results are context-dependent: a metanalysis. PLOS ONE 9:e93507

Merritts, D. and 27 others. 2011. Anthropocene streams and base-level controls from historic dams in the unglaciated mid-Atlantic region, USA. Philosophical Transactions of the Royal Society A. 369:976-1009.

Meyer, J.L. and J.B. Wallace. 2001. Lost linkages and lotic ecology: rediscovering small streams. In Ecology: Achievement and Challenge. Ed. by M.C. Press, N.J. Huntly, and S. Levin. Blackwell Science (Cornwall, Great Britain). pp. 295-317.

Millennium Ecosystem Assessment (MEA). 2005a. Ecosystems and Human Well-Being: Wetlands and Water Synthesis. World Resources Institute, Washington, DC. 68 pp.

Millennium Ecosystem Assessment (MEA). 2005b. Ecosystems and Human Well-being: Current State and Trends, Chapter 19 – Coastal Ecosystems. World Resources Institute, Washington, DC. 37 pp.

Miller, J.R. and R.C. Kochel. 2010. Assessment of channel dynamics, in-stream structures, and post-project channel adjustments in North Carolina and is implications to effective stream restoration. Environment and Earth Science 59:1681-1692.

Mitsch, W.J. and J.G. Gosselink. 2015. Wetlands. 5th edition. John Wiley and Sons, Inc. (Hoboken, New Jersey) 736 pp.

Mitsch, W.J. and M.E. Hernandez. 2013. Landscape and environmental change threats to wetlands of North and Central America. Aquatic Sciences 75:133-149.

Moreno-Mateos, D., E.B. Barbier, P.C. Jones, H.P. Jones, J. Aronson, J.A. Lopez-Lopez, M.L. McCrackin, P. Meli, D. Montoya, and J.M. Rey Benayas. 2017. Anthropogenic ecosystem disturbance and the recovery debt. Nature Communications 8:14163, doi:10:1038/ncomms14163

Moreno-Mateos, D., P. Meli, M.I. Vara-Rodríguez, and J. Aronson. 2015. Ecosystem response to interventions: lessons from restored and created wetland ecosystems. Journal of Applied Ecology. 52:1528-1537.

Moreno-Mateos, D., M.E. Power, F.A. Comìn, R. Yockteng. 2012. Structural and functional loss in restored wetland ecosystems. PLoS Biol 10(1): e1001247. doi:10.1371/journal.pbio.1001247

National Research Council (NRC). 1992. Restoration of Aquatic Ecosystems. National Academy Press (Washington, DC). 552 pp.

National Research Council (NRC). 1994. Priorities for Coastal Ecosystem Science. National Academy Press (Washington, DC). 118 pp.

National Research Council (NRC). 1995. Wetlands: Characteristics and Boundaries. National Academy Press (Washington DC). 306 pp.

National Research Council (NRC). 2001. Compensating for Wetland Losses Under the Clean Water Act. National Academy Press (Washington, DC). 322 pp.

National Research Council (NRC). 2002. Riparian Areas: Functions and Strategies for Management National Academy Press (Washington, DC). 444 pp.

Noble, B. 2010. Cumulative environmental effects and the tyranny of small decisions: Towards meaningful cumulative effects assessment and management. Natural Resources and Environmental Studies Institute Occasional Paper No. 8, University of Northern British Columbia, Prince George, B.C. Canada. 20 pp.

O’Brien, K.R. and 17 others. 2018. Seagrass ecosystem trajectory depends on the relative timescales of resistance, recovery and disturbance. Marine Pollution Bulletin 134:166–176.

Orth, R.J., T.J.B. Carruthers, W.C. Dennison, C.M. Duarte, J.W. Fourqurean, K.L. Heck, Jr., A.R. Hughes, G.A. Kendrick, W.J. Kenworthy, S. Olyarnik, F.T. Short, M. Waycott, and S.L. Williams. 2006. A global crisis for seagrass ecosystems. Bioscience 56:987-996.

Palmer, M.A., H.L. Menninger, and E. Bernhardt. 2010. River restoration, habitat heterogeneity, and biodiversity: a failure of theory or practice? Freshwater Biology 55:205-222.

Palmer, M.A., K.L. Hondula, and B.J. Koch. 2014. Ecological restoration of streams and rivers: Shifting strategies and shifting goals. Annual Review of Ecology, Evolution, and Systematics. 45:247-269.

Petsch, D.K., V. de Mello Cionek, S.M. Thomaz, and N.C.L. dos Santos. 2023. Ecosystem services provided by river-floodplain systems. Hydrobiologia 850:2563-2584.

Pollock, M.M., T.J. Beechie, J.M. Wheaton, C.E. Jordan, N. Bouwes, N. Weber, and C. Volk. 2014. Using beaver dams to restore incised stream ecosystems. Bioscience 64:279-290.

Powers, P.D., M. Helstab, and S.L. Niezgoda. 2019. A process-based approach to restoring depositional river valleys to stage 0, an anastomosing channel network. River Research Applications 35:3-13.

Pungetti, G. 2012. Islands, culture, landscape and seascape. Journal of Marine and Island Cultures 1:51-54.

Reid, L.M. 1993. Research and cumulative watershed effects. U.S. Department of Agriculture, U.S. Forest Service General Technical Report PSW-GTR-141. 118 pp.

Rey Benayas, J.M., A.C. Newton, A. Diaz, and J.M. Bullock. 2009. Enhancement of biodiversity and ecosystems by ecological restoration: a meta-analysis. Science 325:1121-1124.

Robb, C.K. 2014. Assessing the impact of human activities on British Columbia's estuaries. PLOS ONE, Volume 9, Issue 6, e99578.

Roni, P., K. Hanson, and T. Beechie. 2008. Global review of the physical and biological effectiveness of stream habitat rehabilitation techniques. North American Journal of Fisheries Management 28:856-890.

Roni, P., G. Pess, K. Hanson, and M. Pearsons. 2013. Selecting appropriate stream and watershed restoration techniques. In, Stream and Watershed Restoration: A Guide to Restoring Riverine Processes and Habitats. Edited by P. Roni and T. Beechie. Wiley and Sons, Inc. (West Sussex, UK), pp. 144-188.

Schalleberg, M., M.D. de Winton, P. Verburg, D.J. Kelly, K.D. Hamill, and D.P. Hamilton. 2013. Ecosystem services of lakes. In: Dymond, J.R. 2013. Ecosystem services in New Zealand – conditions and trends. Manaaki Whenua Press, London, New Zealand.

Scheffer, M., S. Carpenter, J.A. Foley, C. Folke, and B. Walker. 2001. Catastrophic shifts in ecosystems. Nature 413:591-596.

Scheffer, M. and 9 others. 2009. Early-warning signals for critical transitions. Nature 461:53-59.

Scheffer, M. and S.R. Carpenter. 2003. Catastrophic regime shifts in ecosystems: linking theory to observation. Trends in Ecology and Evolution 18:648-656.

Selkoe, K.A. and 23 others. 2015. Principles for managing marine ecosystems prone to tipping points. Ecosystem Health and Sustainability. 1(5):17. http://dx.doi.org/10.1890/EHS14-0024.1

Sheppard, C. 2014. Coral Reefs: A Very Short Introduction. Oxford University Press (New York). 152 pp.

Smith, R.D., Ammann, A., Bartoldus, C., and Brinson, M.M. 1995. An approach for assessing wetland functions using hydrogeomorphic classification, reference wetlands, and functional indices. Technical Report WRP-DE-9, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Smucker, N.J. and N.E. Detenbeck. 2014. Meta-analysis of lost ecosystem attributes in urban streams and the effectiveness of out-of-channel management practices. Restoration Ecology 22:741-748.

Spaling, H. 1994. Cumulative effects assessment: concepts and principles. Impact Assessment 12:231-251.

Spaling, H. and B. Smit. 1993. Cumulative environmental change: Conceptual frameworks, evaluation approaches, and institutional perspectives. Environmental Management: 17:587-600.

Standish, R.J., and 12 others. 2014. Resilience in ecology: Abstraction, distraction, or where the action is? Biological Conservation 177:43-51.

Stein, E.D., M. Brinson, M.C. Rains, W. Kleindl, and F.R. Hauer. 2010. Wetland assessment alphabet soup: How to choose (or not choose) the right assessment method. Wetland Science and Practice 26:20-25.

Suding, K.N. and R.J. Hobbs. 2009. Threshold models in restoration and conservation: a developing framework. Trends in Ecology and Evolution doi:10.1016/j.tree.2008.11.012

Tiner, R.W. 2003. Estimated extent of geographically isolated wetlands in selected areas of the United States. Wetlands 23:636-652.

Tiner, R.W. 2017. Wetland Indicators: A Guide to Wetland Formation, Identification, Delineation, Classification, and Mapping. 2nd edition. CRC Press (Boca Raton, FL) 606 pp.

Tullos, D., D.W. Baker, J.C. Curran, M. Schwar, and J. Schwartz. 2021. Enhancing resilience of river restoration design in systems undergoing change. Journal of Hydraulic Engineering 147(3): 03121001

Tomscha, S.A., S. Bentley, E. Platzer, B. Jackson, M. De Roiste, S. Hartley, K. Norton, and J.R. Deslippe. 2021. Multiple methods confirm wetland restoration improves ecosystem services. Ecosystems and People 17:25-40, doi: 10.1080/26395916.2020.1863266

U.S. Department of Agriculture (USDA). 2020. Summary Report: 2017 National Resources Inventory, Natural Resources Conservation Service, Washington, DC, and Center for Survey Statistics and Methodology, Iowa State University, Ames, Iowa.
https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/nra/nri/results/

U.S. EPA. 2021. National coastal condition assessment: A Collaborative Survey of the Nation’s Estuaries and Great Lakes Nearshore Waters. EPA 841-R-21-001 (87 pp.)

Van Andel, J. and J. Aronson (editors). 2012. Restoration Ecology: The New Frontier. Second Edition. Blackwell Publishing, Ltd. (West Sussex, UK) 334 pp.

van Katwijk, M.M. and 25 others. 2016. Global analysis of seagrass restoration: the importance of large-scale planting. Journal of Applied Ecology 53:567–578.

Vitousek, P.M., H.A. Mooney, J. Lubchenco, and J.M. Melillo. 1997. Human domination of the Earth’s ecosystems. Science 277:494-499.

Walker, B. and D. Salt. 2006. Resilience Thinking: Sustaining Ecosystems and People in a Changing World. Island Press (Washington DC) 174 pp.

Wallington, T.J., R.J. Hobbs, and S.A. Moore. 2005. Implications of Current Ecological Thinking for Biodiversity Conservation: a Review of the salient issues. Ecology and Society 10:15 http://www.ecologyandsociety.org/vol10/iss1/art15/

Walter, R.C. and D.J. Merritts. 2008. Natural streams and the legacy of water-powered mills. Science 319:299-304.

Waycott, M. and 13 others. 2009. Accelerating loss of seagrasses across the globe threatens coastal ecosystems. Proceedings of the National Academy of Sciences 106:12377–12381.

Wheaton, J.M., S.N. Bennett, N. Bouwes, J.D. Maestas, and S.M. Shahverdian (editors). 2019. Low-tech process-based restoration of riverscapes: Design manual. Version 1.0. Utah State University Restoration Consortium. Logan, UT. http://lowtechpbr.restoration.usu.edu/manual

Wohl, E., S.N. Lane, and A.C. Wilcox. 2015. The science and practice of river restoration. Water Resources Research 10.1002/2014WR016874

Wohl, E., J. Castro, B. Cluer, D. Merritts, P. Powers, B. Staab, and C. Thorne. 2021. Rediscovering, reevaluating, and restoring lost river-wetland corridors. Frontiers in Earth Science . Volume 9, Article 653623 doi: 10.3389/feart.2021.653623

Wright, T., J. Tomlinson, T. Schueler, K. Cappiella, A. Kitchell, and D. Hirschman. 2006. Direct and indirect impacts of urbanization on wetland quality. Wetlands and Watersheds Article #1. Center for Watershed Protection (Ellicott City, Maryland). 81 pp.

Zedler, J.B. and S. Kercher. 2004. Causes and Consequences of Invasive Plants in Wetlands: Opportunities, Opportunists, and Outcomes. Critical Reviews in Plant Sciences 23:431–452.

Zedler, J.B. and S. Kercher. 2005. Wetland resources: Status, trends, ecosystem services, and restorability. Annual Review Environmental Resources. 30:39-74.

Zedler, J.B., J.M. Doherty, and N.A. Miller. 2012. Shifting restoration policy to address landscape change, novel ecosystems, and monitoring. Ecology and Society 17:36.