Economic Analysis of Proposed Revised Definition of Waters of the United States

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US EPA assembled this report and is primarily responsible for the estimated benefits for CWA 404 compensatory mitigation and the estimated costs and benefits for non-CWA 404 programs.

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US ACE provided expert technical and policy review and is primarily responsible for the estimated costs associated with CWA 404

Section 2: General Approach for the Economic Analysis

The definition of "waters of the U.S.," by itself, imposes no direct costs. The potential costs and benefits incurred as a result of this proposed action are considered indirect because the action involves a definitional change to a term that is used in the implementation of a variety of CWA programs. Each of these programs may subsequently impose direct or indirect costs as a result of implementation of their specific regulations.

Estimates of the economic costs and benefits that may indirectly be imposed on governments and regulated entities can help inform the public and policymakers of some of the implications associated with this proposal. Just over 10 years ago, almost all waters were considered "waters of the U.S." Following the *SWANCC* (2001) and *Rapanos* (2006) decisions, field practice changed to limit assertion of CWA jurisdiction for some types of waters. For purposes of identifying a set of potential costs and benefits associated with this action, this analysis compares the projected outcome of implementing the proposed rule to the best approximation of field practices during the 2009-2010 time period (post *SWANCC* and *Rapanos*), following issuance of program guidance in 2008. The agencies expect that the outcome of the proposed rule will be an approximate 3 percent increase in assertion of jurisdiction when compared to 2009-2010 field practices, but not as extensive as when the existing regulation went into effect.[1]

In April 2011, the agencies published revised draft guidance on policies for determining CWA jurisdiction to replace guidance issued in 2003 and 2008. The agencies expect that the outcome of the proposed rule would be similar to the outcome of fully implementing the April 2011 draft guidance. As such, this analysis builds on an analysis prepared in association with the April 2011 draft guidance, described in the *Potential Indirect Economic Impacts and Benefits Associated with Guidance Clarifying the Scope of Clean Water Act Jurisdiction* document. This document is available in the administrative record for the proposed rule and available at http://water.epa.gov/lawsregs/guidance/wetlands/upload/cwa_guidance_impacts_benefits.pdf.

The economic analysis is necessarily based on readily available information and the resulting cost and benefit estimates are incomplete. Nonetheless, the agencies have considered the effects on a variety of CWA programs and provide quantitative estimates for many potential impacts. Readers should be cautious in examining these results in light of the many data and methodological limitations, as well as the inherent assumptions in each component of the analysis.

[1] The existing regulations represent one appropriate baseline for comparison, and because the proposed rule is narrower in jurisdictional scope then the existing (1986) regulations, there would be no additional costs in comparison to this baseline. A comparison to field practice following the 2008 guidance is also an appropriate baseline, and the agencies believe that baseline is the most useful for purposes of comparing the potential outcome of the proposed rule.

Section 1: Overview of Proposed Rule

The U.S. Army Corps of Engineers (Corps) and the Environmental Protection Agency (EPA), collectively "the agencies", proposed a rule for public comment that that defines the scope of waters protected under the Clean Water Act (CWA), in light of the U.S. Supreme Court cases in *U.S. v. Riverside Bayview, Rapanos v. United States,* and *Solid Waste Agency v. U.S. Army Corps of `Engineers (SWANCC).* The effect of the *SWANCC* decision is primarily on so-called "isolated" (other) waters. These waters do not meet the agencies' definition of "adjacent" and often include vernal pools, prairie potholes and playa lakes that lie entirely within a single state and lack a direct, surface water connection to the river network. In practice, the effect of the *Rapanos* decision has been primarily on some small streams, rivers that flow for part of the year, and nearby wetlands. The agencies believe this proposal would enhance protection for the nation's public health and aquatic resources, and increase CWA program predictability and consistency by increasing clarity on the scope of "waters of the United States" protected under the Act.

Specifically, the agencies propose to define the waters of the United States for all sections of the Clean Water Act to mean: traditional navigable waters (TNWs); interstate waters, including interstate wetlands; the territorial seas; impoundments of waters otherwise defined as waters of the United States; tributaries, as defined, to traditional navigable waters, interstate waters, or the territorial seas; adjacent waters, including wetlands; and, on a case-specific basis, other waters that have a significant nexus to a traditional navigable water, interstate water, or the territorial seas.

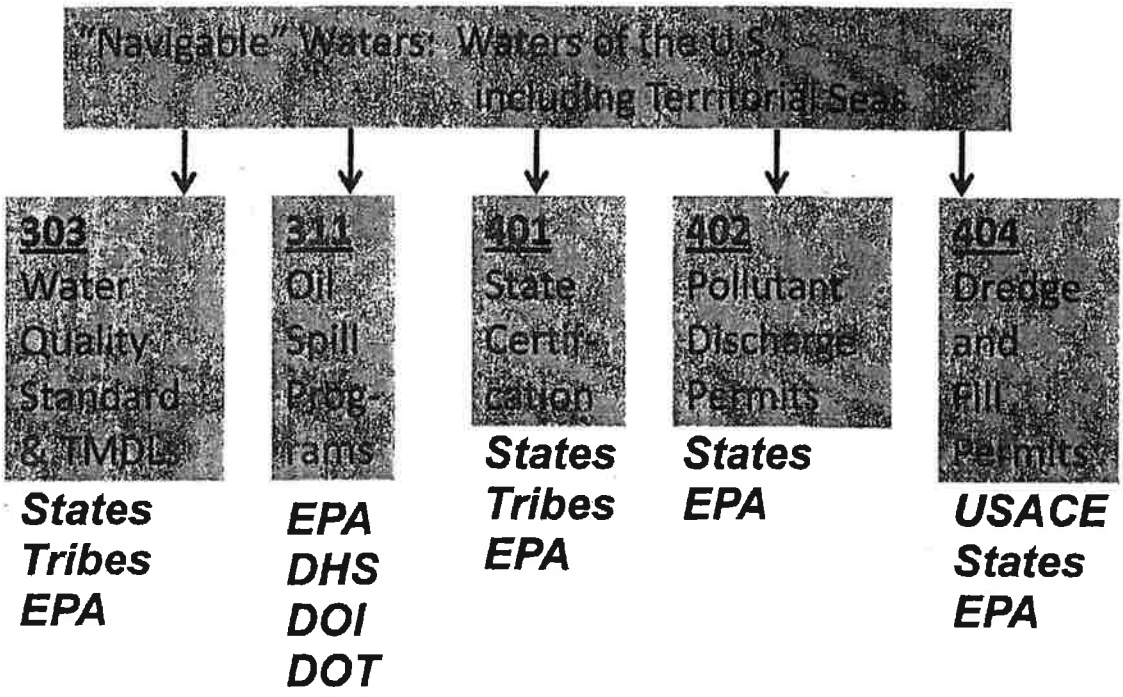
The agencies also propose to exclude specified waters from the definition of "waters of the United States." The agencies are not proposing changes to the existing exclusions for waste treatment systems designed consistent with the requirements of the Clean Water Act, nor are the agencies are proposing any changes for prior converted cropland. The agencies are, for the first time, proposing to exclude by regulation certain waters and features over which the agencies have as a policy matter generally not asserted CWA jurisdiction.

The agencies propose for the first time to define the term "neighboring" as it is used as a component of the existing term "adjacent", and in turn define the terms "riparian area" and "floodplain" that appear in the new definition of "neighboring". The agencies also define the terms "tributary" and "significant nexus." The goal is to ensure the regulatory definition is consistent with the CWA, as interpreted by the Supreme Court, to protect water quality, public health, and the environment.

Section 3: Programs Affected

Any water found not to be a "water of the U.S." generally is not subject to CWA requirements. Exhibit 1 depicts the CWA programs that are affected by the definition of "waters of the U.S.," along with the government entities that are responsible for administering the programs. Among its many provisions, the CWA establishes oil spill prevention programs (section 311); requires permits for pollutant discharges (section 402); requires permits for the placement of dredged or fill material in waters of the United States, including wetlands (section 404); calls for states to set standards for meeting water quality goals and develop plans to restore polluted waters (section 303); establishes state roles in certifying that federal permits will not violate state water quality standards (section 401); and allows the federal government, states, and communities to enforce the law.

Exhibit 1. Clean Water Act Programs Affected



As shown in Exhibit 1, states and tribes have a large role in administering many CWA programs. This economic analysis does not account for the possibility that some states may already be considering a broader set of waters to be subject to their implementation of certain CWA programs. Although the extent of their CWA jurisdiction may not be smaller than the definition of waters of the U.S., states and tribes may elect to implement CWA programs more broadly according to a definition of "waters of the state" or "waters of the tribe". To the extent states have elected to do this, the economic impacts may be smaller than presented here (because states may already be asserting jurisdiction over waters for

which this analysis presumed jurisdiction was not generally asserted in practice). The particulars of state laws and regulations are often complex and subject to change. At present, it is believed that approximately two-thirds of all states place some legal constraint on the authority of state and local government officials to adopt aquatic resource protections beyond waters of the U.S. These may be straightforward stringency limitations, property-based limitations, or combinations of the two. The provisions may be partial limitations, affecting only some applications. It is further believed that approximately half the states have some provisions that extend protections beyond waters of the U.S. Some of these provisions pre-date stringency limitations and may not be retro-active.

Section 4: Potential Areas of New Indirect Costs

CWA Section 404 and 401

This proposed rule could result in new indirect costs on regulated entities such as the energy, agricultural, and transportation industries; land developers, municipalities, industrial operations; and on governments administering regulatory programs, at the tribal, state and federal levels. The recent challenges to CWA jurisdiction have arisen from the CWA 404 program, and it is likely that this program has seen the greatest impact from the *SWANCC* and *Rapanos* decision and subsequent joint agency guidance. As such, the CWA 404 program would also see the greatest impact of a regulatory change that would result in broader assertion of CWA jurisdiction. These indirect costs may include application costs, associated environmental compliance costs, wetlands mitigation, stream mitigation, and project re-design and relocation expenses. In addition, there would be program management, training, and associated environmental compliance costs to government associated with administering the CWA. For example, the Corps may process more permit requests, conduct jurisdictional determinations (JDs) if needed, manage data, coordinate with federal and state resource agencies, and determine compensatory mitigation needs. These potential costs are described in detail below. Because most CWA 404 permits are issued by the Corps, states or tribes may incur additional costs of certifying that such permits do not violate their water quality standards under CWA 401. The impact on the CWA 404 program can be measured from data records of jurisdictional determination status of aquatic resources maintained by the Corps. There are no comparable data from other CWA programs. Nevertheless, the regulatory change to the definition of waters of the U.S. applies to all CWA programs and the potential impact to each of these programs should be assessed.

CWA Section 402

EPA does not believe that the *SWANCC* and *Rapanos* decisions have greatly affected traditional CWA 402 permits, such as those issued for municipal wastewater treatment plants or industrial facilities. Neither in its capacity as permitting authority, nor in fulfilling its oversight role of permitting programs delegated to states, has the EPA witnessed a large number of permit holders asserting they no longer required such a permit because of the non-jurisdictional status of a receiving water. While EPA is aware of occasional inquiries on this matter, no such inquiries have resulted in a permitting authority determining that a discharger no longer needed a permit. There are several potential explanations for this. The first is that the nature of a traditional discharge permit where a facility is seeking to have wastewater dispersed and carried away is different than a 404 permit where an entity is, for example, seeking to drain and fill a portion of a natural water for development. As such, it is possible that a CWA 402 permitted discharger may have the effect of creating a permanent water where there once was an intermittent or ephemeral water because of continuous discharge (i.e., an "effluent dependent" or "effluent dominated" water). In these cases, jurisdiction may not come under question. A second explanation is that EPA has authorized most (46) states to operate the CWA 402 permitting program, and states apply jurisdiction to "waters of the state" which must be as inclusive as "waters of the U.S" but may be more inclusive. In contrast, only two states (Michigan and New Jersey) have assumed the 404 program (to the extent it can be assumed for "non-navigable" waters). Additionally, facilities may

have invested the capital in treatment and simply be willing to continue operating under their permit and see no need to challenge jurisdiction.

Permitting for construction and development stormwater, concentrated animal feeding operations (CAFOs), and pesticide application are three areas of CWA 402 implementation where there may be potential new costs. This is because these activities relate to collection of runoff rather than disposal of wastewater, and EPA and states typically regulate them through CWA 402 general permits rather than individual permits. In addition, these newer requirements have changed in the last decade. Entities engaged in actions requiring general permit coverage can submit a Notice of Intent (NOI) to the permitting authority to obtain coverage. Under the existing CWA jurisdictional implementation, many of these entities may not believe their discharge affects a jurisdictional water and may not have applied for permit coverage. Under the proposed rule, a portion of these entities may be subject to an assertion of jurisdiction to a similar extent of those seeking 404 permits. Construction-related stormwater discharges, CAFO discharges, and application of pesticides likely occur in similar locations as CWA 404 dredge and fill discharge with respect to proximity to "isolated waters," small streams, and their adjacent wetlands. Indirect costs for these programs include implementing best management practices (BMPs) for regulated entities and administering permitting programs for government.

CWA Section 303 and 305

CWA Section 303 includes development of state water quality standards, monitoring and assessment of water quality, and development of total maximum daily loads (TMDLs) for impaired waters. These programs involve costs to states (standards development, monitoring and assessment, TMDL development). EPA's position on these costs is that an expanded assertion of jurisdiction would not have an effect on annual expenditures.

States typically develop water quality standards for general categories of waters, which have been and are inclusive of the types of waters where jurisdiction comes into question (e.g., for wetlands, the vast majority of which have been and are jurisdictional). Therefore, requirements for state water quality standards to be consistent with the CWA (designated uses, criteria to protect those uses, antidegradation policies) will not change as a result of this proposed action. What could change is whether or not those standards apply. To the extent a state believes there are needs for water quality standards development for specific types of waters, those needs would exist with or without this proposed rule.

CWA 305(b) requires a report from states that includes (among other items) a description of the water quality of all navigable waters in the state and an analysis of the extent to which they meet the 101(a)(2) goals of the Act. In practice, states typically have a set budget for these activities and make plans accordingly. Many states strive to be as comprehensive as possible and balance the needs to identify all impaired waters with probabilistic surveys designed to track general status and trends. To the extent that this proposed rule may increase the coverage where a state would wish to apply its monitoring resources, states are likely to adjust sampling locations or sampling frequency without a net cost increase.

States conduct assessments based on all existing and readily available monitoring data. States are required to list waters that are impaired, but have discretion to prioritize this list for TMDL development, which may proceed over a period of several years under EPA policy. Monitoring, assessment, and TMDL development tend to occur in water segments where the agencies assert jurisdiction under current practices. It is not clear that additional cost burdens for TMDL development would result from this action. In watersheds where there are impaired water segments, waters where the agencies may more clearly assert jurisdiction under the proposed rule are likely to lie upstream of existing impaired segments. Because tribal or state–initiated water quality pollution control strategies are typically applied throughout the watershed of an impaired segment, all upstream waters typically benefit. In addition, clarifying jurisdiction may reduce the cost of returning an impaired water to a condition of meeting water quality standards by allowing better control of upstream sources of pollution.

CWA Section 311

CWA Section 311 covers oil spill prevention and preparedness, reporting obligations, and response planning. These requirements apply to facilities engaged in production or storage of oil products based on total volume. In particular, inland non-transportation oil facilities of a certain size that have potential to discharge to navigable waters must prepare and implement Spill Prevention, Control, and Countermeasure (SPCC) plans. Similar to traditional 402 permits, these requirements have been in place since 1973 and it is not clear how regulated facilities have adjusted their behavior in response to *SWANCC* and *Rapanos*. However, EPA does have some limited anecdotal information from regional offices on facilities that have expressed no discharge potential relevant to jurisdictional water. Based on inferences from this information, EPA can present some potential cost implications, as described in section 9.

Section 5: Potential Areas of New Indirect Benefits

Although costs are a very important component of any economic analysis, the value of benefits received is equally important. Failure to account for the full economic values of ecosystems could result from a lack of recognition of benefits that 1) traditional market valuation techniques may not capture, 2) may be public goods that are not subject to any valuation reporting, or 3) may be intangible by their nature (these categories are not mutually exclusive). A common concern is that government agencies might not effectively manage what they do not measure, and they might undervalue resources that are not identified or quantified.

Ecosystem Services

The term "ecosystem services" refers to the many natural processes by which ecosystems, and the species they include, sustain and fulfill human life. A sufficient quantity and quality of water is important for public health, safety, and quality of life. Polluting or destroying waterways can affect drinking water, places where people recreate, the fish and shellfish people eat, the irrigation water used on food crops, and how floods affect people and property. Waters affected by this proposed rule also provide habitat and biodiversity, support recreational fishing and hunting, filter sediment and contaminants, reduce flooding, stabilize shorelines and prevent erosion, recharge ground water, and maintain biogeochemical cycling. Fishing and hunting expenditure estimates, major flood losses, and the value of wetlands for storm protection services all total in the tens of billions of dollars per year. Any economic valuation exercise would have to account for the incremental portion of these values attributable to the incremental number of waters affected by the proposed rule.

The ecosystem services identified in Exhibit 2 have no market values. Some are closely related to marketed goods, which may facilitate valuation, whereas others are far removed from the end product of market value or contribute to consumer value directly. There are basically two types of effects: 1) direct effects on non-market ecosystem goods and services, and 2) effects on hydrogeology and biochemical processes and on life support services that are valued for themselves as well as for their contribution to other ecosystem goods and services. Exhibit 2 is not an exhaustive list.

Exhibit 2. Examples of Ecosystem Services Relevant to CWA Regulation

Input in Production of Marketed Goods & Services

- Flood storage & conveyance
- Support for commercial fisheries
- Water input and land productivity for agriculture and commercial & industrial production

Direct Use

- Municipal & home water supply
- Recreation & aesthetics (including fishing and hunting)

Hydrogeology and Biochemical Processes

- Sediment and contaminant filtering
- Nutrient cycling
- Groundwater recharge
- Shoreline stabilization and erosion prevention

Life Support (Ecological)

- Biodiversity
- Wildlife habitat (food chain, nursery, etc.)

One category of benefits includes goods and services that a proposed action or activity generates. Although potentially easier to identify than other categories, these benefits may or may not be easy to measure or ascribe value. In terms of protecting waters, an example benefit might be supporting fish and shellfish populations in downstream waters as well as protecting the waters themselves. Ponds, streams, and wetlands provide habitat for a robust and diverse assemblage of organisms that are necessary to support the whole aquatic community structure and ecological function. Some associated attributes may have market value (such as the fish themselves) and some may have non-market value (such as biodiversity).

Benefits also include costs avoided. Costs avoided represent what you don't have to pay because of the action you have taken. For example, floodplain preservation prevents costly damage from frequent flooding. Although dams and levees are built to control potential flooding, altering the natural hydrologic regime contributes to the potential for flooding. Waters affected by this proposed rule store water and slow down its movement across the landscape. When these systems no longer perform this function, the potential losses from flooding may increase.

Government Efficiency

Administration of government programs may also benefit from avoided costs. The federal government and states are currently spending resources on site-by-site evaluations of jurisdiction against a standard that is unclear and somewhat ambiguous. This represents an investment of resources that could be put to other use (and may in fact be needed to process additional CWA 404

permits) if the agencies articulated the decision criteria more clearly. While incurring additional costs to process additional permits, this proposed rule may reduce some permitting costs and speed the permit review process in the long-term by clarifying jurisdictional matters that have been time-consuming and cumbersome for field staff and the regulated community for certain waters. The two Supreme Court cases and subsequent guidance have, in some circumstances, required agency staff to spend resources to understand and apply complex jurisdictional standards. The uncertainty surrounding jurisdictional questions has increased the paperwork, costs, and time associated with jurisdictional determinations. However, any cost savings will be at least partially offset by reviews of additional mitigation plans, associated environmental compliance for larger permit areas, and implementation costs, including additional documentation and data management requirements.

Comprehensive Enforcement

Benefits may also be realized from more comprehensive enforcement efforts that could result from the proposed rule. Because it can be difficult to establish where the CWA applies after the Supreme Court's decisions in *SWANCC* in 2001 and *Rapanos* in 2006, EPA enforcement managers have indicated that enforcement efforts have shifted away from small streams high in the watershed where jurisdiction is a potential issue. In short, EPA is focusing efforts on larger streams and rivers, where there is more certainty of establishing jurisdiction. A rule that more clearly protects small streams may lead to more comprehensive enforcement and therefore greater compliance with CWA program regulations. This, in turn, could ultimately save the costs of additional drinking water filtration, stream restoration, and other costs of repairing damage caused by pollution.

Reduced Uncertainty

Land developers, the energy and transportation sectors, the agricultural community, and other businesses face uncertainty surrounding CWA jurisdiction that may lead to reduced willingness to invest in projects or lost investment when entities must alter or abandon project plans. Businesses operate best in an environment of regulatory certainty. Business professionals are equipped to plan accordingly for known factors. However, uncertainty can lead businesses to sit on capital rather than take unknown risks. The current lack of clarity in where the CWA applies can delay building roads and houses, developing natural resources, and engaging in other activities where CWA 404 permits are needed. A rule that more clearly identifies small streams and wetlands that require protection under the CWA may reduce uncertainty and the costs that go with it. Depending on how significant uncertainty-related costs are, this proposed rule might ultimately reduce net costs for people seeking CWA permits, and increase consistency, predictability, and timeliness of the permitting process.

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Section 6: Scope of Impact

To evaluate the extent to which EPA and the Corps may assert CWA jurisdiction as a result of this proposed rule, the agencies evaluated data records from FY2009-10 in the Corps' ORM2 (Operation and Maintenance Business information Link, Regulatory Module) database that documents Corps jurisdictional status decisions associated with various aquatic resource types. The aquatic resource data records include the following categories: isolated waters, relatively permanent waters, traditional navigable waters, non-relatively permanent waters, and wetlands associated with these categories. The isolated waters category is used in the Corps' ORM2 database to represent intrastate, non-navigable, waters that lack a direct surface connection to other waterways; these waters are hereafter referred to as "other waters."[2]

The data available in ORM2 allows for an evaluation of how decisions on jurisdictional determinations completed in the last two fiscal years (FY2009-10) may change under different jurisdictional policies. This analysis will allow for an estimation of a change in assertion of CWA jurisdiction as viewed through the lens of potential CWA 404 permitting activity during the baseline period of FY2009-10. Landowners and developers may assume that some waters are non-jurisdictional and not request a determination or engage in the permitting process. These waters would not be represented in the ORM2 FY2009-2010 data base. However, these waters are also likely to be the most isolated and the least connected to other waters and therefore the least likely to have their status changed under this proposed rule. To the extent the waters evaluated are representative of waters of the U.S. as a whole, the proportions of each water type that would change their jurisdictional status is more broadly representative.

The ORM2 aquatic resource records may be placed into three groups: streams (ORM2 categories of traditionally navigable waters, relatively permanent waters, and non-relatively permanent waters), wetlands (associated with the various above categories of streams), and other waters. Streams comprise 67 percent of the records and 98 percent were found jurisdictional in the FY2009-2010 baseline period. Wetlands comprise 27 percent of the records and 98.5% were found jurisdictional in the FY2009-2010 baseline period. Other waters comprise 6 percent of the records, none of which are considered to be jurisdictional for the FY2009-2010 baseline period. As was done for the economic analysis for the April 2011 draft guidance, the agencies assume that all streams and wetlands would be found jurisdictional under this proposed rule for purposes of this economic analysis. The agencies presume that all "streams" from the ORM2 grouping are presumed to meet the definition of "tributary" in the proposed rule, and all "wetlands" from the ORM2 grouping meet the definition of "adjacent" in the proposed rule. This represents a scenario that results in the highest estimates of costs for these groups of waters.

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[2] The "other waters" group of ORM2 records represents a more inclusive set of waters than would be considered "other waters" as the term is used in the proposed rule. The "other waters" group of ORM2 records includes many wetlands and some non-wetlands waters that would meet the definition of "adjacent" under the proposed rule.

To determine how jurisdiction might change for the "other waters" group from ORM2, a team of Corps experts examined a sample of 262 project files previously coordinated with Corps headquarters from June 2008 – January 2011, representing over 1,000 individual waters in 30 states. Of the waters that the Corps examined, 73 percent were wetlands, and the remaining waters were ponds, streams, or other resource types. Based on data available in the record files, the team judged whether or not the Agencies would determine the waters to be jurisdictional under the policies outlined in the April 2011 draft guidance. Overall, the team found that 17 percent of these other waters would be determined to be jurisdictional. An EPA team independently examined a sub-sample of 50 of these files and similarly estimated that 15 percent of these other waters would become jurisdictional.

Exhibit 3 depicts the results of the analysis of ORM2 FY2009-2010 records to estimate scope of impact with respect to CWA 404 permitting. Overall, assuming all tributary streams and adjacent wetlands as well as 17 percent of other waters (based on the ORM2 records grouping) are projected to be jurisdictional under the proposed rule increases overall jurisdiction under the CWA by 2.7 percent (95.2% - 92.5%), or roughly 3 percent, over current field practices.

Exhibit 3. Analysis of FY2009-2010 ORM2 Records Showing Jurisdictional Status of Aquatic Resources

	Number of ORM2 Records	Positive Jurisdiction Records (09-10)	Projected Positive Jurisdiction Records	Percent of Total ORM2 Records	Percent Positive Jurisdiction (09-10)	Projected Percent Positive Jurisdiction
Streams	95,476	93,538	95,476	67%	98.0%	100.0%
Wetlands	38,280	37,709	38,280	27%	98.5%	100.0%
Other Waters	8,209	0	1,396	6%	0.0%	17.0%
Total	141,965	131,247	135,152	100%	92.5%	95.2%

This representation may or may not accurately represent a proportional change for CWA program activity other than CWA 404 permitting. As described above, EPA is more comfortable with these data representing a proportional change for stormwater, CAFO, and pesticide application permitting than for other CWA 402 permitting and CWA 311 SPCC plan imposition, because the locations of these latter activities may not be similar to CWA 404 permitting and the regulatory history of these types of entities is different. For example, a large portion of traditional CWA 402 permit holders are located nearby large water sources to support their operations.

Section 7: Estimate of CWA 404 Program Costs

Under CWA Section 404, entities seeking to discharge dredge or fill material to waters of the U.S. must obtain a permit. A change in assertion of CWA jurisdiction could result in indirect costs of implementation of the CWA 404 program: a greater share of development projects would intersect with jurisdictional waters, thus requiring the sponsors of those additional projects to obtain and comply with CWA 404 permits. Exhibit 4 provides a descriptive overview of four types of CWA 404 permitting costs the regulated community would face —permit application costs, compensatory mitigation costs, permitting time costs, and impact avoidance and minimization costs.

Exhibit 4. Conceptual Overview of CWA Section 404 Permit Compliance Costs

Cost Category	Description (costs vary considerably by permit type and by region)
Permit Application Costs	Financial costs to finalize a permit application that the Corps deems to be complete. Includes costs for delineation and survey of jurisdictional waters; preparing project area and impact drawings and maps; alternatives analysis that investigates opportunities to avoid and minimize project impacts (on-site alternatives in the case of general permits, both on- and off-site alternatives in the case of individual permits); developing a Corps-approved compensatory mitigation plan; submitting a completed application that includes all notification and other requirements. In general, permit application costs increase with the size of the project area, size of impacts to jurisdictional waters, the number of separate impact locations, and any actions needed to comply with other Federal laws before a permit can be issued (e.g., Endangered Species Act, National Historic Preservation Act). The cost of the alternatives analysis often dominates application costs for individual permits in the case of projects involving relatively large impacts to jurisdictional waters.
Compensatory Mitigation Costs	Financial and opportunity costs to implement the Corps-approved compensatory mitigation plan that is written into the permit as a special condition. In the case of a mitigation plan that involves third-party mitigation providers (commercial mitigation banks or in-lieu fee programs), cost is driven by credit prices and the number of credits required. In the case of a permittee-responsible mitigation plan, includes opportunity costs of reserving a portion of development project lands for mitigation, and the financial costs of mitigation project implementation as well as mitigation monitoring, maintenance, and reporting until success criteria have been achieved. Could also include financial and opportunity costs of posting any required financial assurances for mitigation project success and/or providing any required endowment for long-term site management after mitigation success has been achieved.
Permitting Time Costs	Potential financial and opportunity costs associated with any delay in project implementation resulting from the time it takes to secure a permit. In the case of private sector, for-profit development projects, time costs could include financial or opportunity costs of carrying development capital for longer periods of time. In the case of public sector projects, time costs could include opportunity costs of foregone public services and benefits from not proceeding with the project sooner rather than later.
Impact Avoidance and Minimization Costs	Potential financial and opportunity costs associated with project redesign that may be required in order to avoid and minimize impacts on jurisdictional waters. Opportunity costs could include foregone net returns to development in the case of private sector, for-profit development projects, or lower levels of public service provision and benefits in the case of public sector projects (e.g., road construction and maintenance, repair of flood control infrastructure, etc.).

The sponsors of all projects subject to CWA 404 regulation incur costs to finalize a permit application (or a pre-construction notification in the case of general permits) that the Corps deems to be complete. Similarly, the sponsors of virtually all permitted projects also incur costs to implement compensatory mitigation actions required by permits to offset permitted impacts to jurisdictional waters. The analysis of incremental costs to the regulated community focused on the estimation of these two categories of compliance costs.

Depending on circumstances, the sponsors of many private sector as well as public sector projects that are subject to 404 permitting can also incur non-trivial permitting time costs and/or impact avoidance and minimization costs. Permitting time costs include potential financial and opportunity costs associated with delays in project implementation resulting from the time it takes to secure a permit. Impact avoidance and minimization costs include potential financial and opportunity costs associated with permit requirements to redesign projects so as to avoid and minimize project impacts on jurisdictional waters to the extent practicable. The agencies recognize that time and impact avoidance and minimization costs can be significant for some share of permit applicants. However, because there is not a defensible, ready basis for estimating these costs, the agencies did not estimate compliance costs for these categories as part of this economic analysis.

Estimate of Permit Application Costs

Estimated permit application costs relied on estimates of the number of additional permit applications, and the average impact per additional application, that would result from the proposed rule coupled with estimates of unit permit application costs. Exhibit 5 shows estimates of additional Individual Permits (IP) and General Permits (GP), and average per permit impact to jurisdictional waters (in acres) for each permit type.

Exhibit 5. Estimated Additional CWA 404 Permits and Impacts to Jurisdictional Waters

Permit Type	Permits Issued in FY2010 (Sec. 404 only)	Added Permits w/Rule (2.7% increase in Jurisdiction)	Average Impact Per Added Permit (Acres)	Total Added Impacts (Acres)
IP	2,766	75	12.81	960
GP	49,151	1,327	0.28	372

The Corps derived the total number of permits issued and associated impact totals by permit type (IP vs GP) from FY2010 ORM2 data, using only records from permits issued under CWA 404 authority (excluding data associated with permits issued under Section 9, 10, and 103 authority). The Corps system of tracking impacts has expanded over the past few years to include the ability to distinguish between permanent and temporary impacts, as well as different impact activity types (e.g. discharge of dredged material, discharge of fill material, excavation associated with fill, conversion, ecological restoration, and Section 10 impact types - structures and work). There are also fields to record area and/or linear values and activity specific fields for these impact activity types. To produce the table values for average impact per added permit, the Corps selected only records with permanent impacts associated with the discharge of dredged or fill material in FY2010, excluding ecological restoration and conversion activities, as well as temporary impacts. Non-zero records with values in the authorized area field were included (entries that contained just a linear feet impact value or null values

were excluded). Dividing these acreage totals by the number of CWA 404 permits produces estimates of the average impact acreage per permit. Multiplying the number of added permits by the average impact produces estimates of the total added impacts in acres (1,332 acres in total).

The agencies used two sets of estimates for unit permit application costs to calculate a range of incremental permit application costs associated with the estimated proposed rule-induced permitting changes shown in Exhibit 4. These were obtained from two separate 1999 estimates of permit application costs developed to calculate incremental permit application costs associated with the replacement of Nationwide Permit No. 26 (NWP 26) with a suite of new and modified nationwide permits in the year 2000 (hereafter referred to as the "NWP replacement package").

The Corps developed one set of estimates as part of its analysis of the incremental costs of the NWP replacement package.[3] This estimate relied on data and information obtained through informal phone interviews with permitting consulting firms (companies that help the regulated community to navigate the permitting process) and Corps district regulatory staff based around the country. The Corps asked interviewees to identify major components and component and total costs for finalizing a NWP 26 pre-construction notification and an IP application associated with a "typical" project involving up to three acres of impacts to jurisdictional waters.

The Corps analysis of unit permit application for the NWP replacement package explicitly noted that the cost estimates were developed for a "typical" project, and that IP application costs for some projects could be much higher than the estimates produced for the NWP replacement package (e.g., it noted that in the case of controversial projects, the costs for the alternatives analysis alone could be several times the Corps estimates of IP application costs for a typical project). Further, permit application costs can vary considerably by region, so the cost for a typical project in one region can be considerably different than the cost for a typical project in another region. Also, the Corps analysis of permit application costs for the NWP replacement package was limited to projects affecting up to three acres of jurisdictional waters, whereas the proposed rule considered here could involve new permit application costs for projects involving significantly greater impacts to jurisdictional waters (which is relevant since permit application costs generally increase as the impact size increases). For these reasons, the agencies used the highest Corps estimates of unit permit application costs for the NWP replacement package as a lower bound on total added permit application costs associated with the proposed rule.

To calculate an upper bound on incremental permit application costs associated with the proposed rule, the agencies used estimates of permit application costs produced by a study of the costs of the NWP replacement package conducted by two academic economists in 1999 (hereafter referred to as the "SZ study").[4] The SZ study was commissioned by two groups representing public and private

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[3] U.S. Army Corps of Engineers. 2001. *Cost analysis for the 2000 issuance and modification of nationwide permits.* Institute for Water Resources. (August)

[4] D. Sunding and D. Zilberman. 2000. *Analysis of the Army Corps of Engineers' NWP 26 Replacement Permit Proposal.* Prepared for the National Association of Counties and the Foundation for Environmental and Economic Progress. (January).

segments of the regulated community: the National Association of Counties and the Foundation for Environmental and Economic Progress (whose members include large real estate development companies).

The SZ study relied on a survey of 103 NWP and IP applications for which the project sponsors were asked to report the costs they incurred in preparing and finalizing the applications. Two-thirds of the applications in the survey sample involved projects in western states and the remainder involved applications in eastern or mid-western states. The sample involved a roughly equal mix of public sector and private sector development projects, including school construction, quarry expansion, sediment containment, home building, road improvements, and flood control.[5]

The SZ study analysis of the survey data found a statistically-significant, positive relationship between the amount of permitted impacts on jurisdictional waters and the cost of preparing a NWP and an IP. The authors used the survey data to develop a relationship between impacts to jurisdictional waters (measured in acres) and the cost of preparing a NWP and an IP. For each permit type, the SZ study produced an estimate of a fixed cost component plus another cost component that varied based on the amount of impact acres.[6]

Exhibit 6 shows the unit permit application costs obtained from the two sources outlined above, and the range of total added permit application costs for individual permits and general permits using the permit change data from Exhibit 5. The unit NWP costs are used to represent unit costs for all types of general permits. Costs figures in Exhibit 6 are adjusted from 1999$ to 2010$ using the CPI-U (1999=166.6, 2010=218.056).

Exhibit 6. Estimated Annual Additional CWA 404 Permit Application Costs

Permit Type	Added Permits w/Rule	Avg. Impact per permit (acres)	Unit Costs from NWP Analysis (2010$)	Unit Costs from Sunding & Zilberman Study (2010$)	Additional Annual Cost (2010$ millions)
IP	75	12.81	$31,400	$57,180 plus $15,441 per acre impact	$2.4 – $19.1
GP	1,327	0.28	$13,100	$22,079 plus $12,153 per acre impact	$17.4 – $33.8
Total	1,402	-	-	-	$19.8 - $52.9

Estimate of Compensatory Mitigation Costs

A portion of costs to applicants will result from compensatory mitigation of wetlands and streams. The cost of compensatory mitigation depends upon land prices and varies substantially across

[5] These details on the projects included in the survey sample are reported in: D. Sunding and D. Zilberman. 2002. "The economics of environmental regulation by licensing: An assessment of recent changes in the wetland permitting process." *Natural Resources Journal*. V. 42, Winter.

[6] The range of NWP application costs in the survey was between $2,000 and $140,076; the median cost was $11,800, and the mean cost was $28,915. The range of IP application costs in the survey was between $7,000 and $1,530,000; the median cost was $155,000 and the mean cost was $271,596. (All estimates are presumed to reflect 1999$)

and within states. Additionally, the scale of a project will impact costs as the amount of compensatory mitigation required is typically calculated as a multiple of acreage of wetlands or linear feet of streams to be filled.

To estimate state-specific per-acre costs of wetland mitigation and per linear foot estimates of stream mitigation, the Corps examined published studies and survey results, made phone inquiries to Corps Districts and mitigation banks, and researched web sites. A team of Corps experts agreed on a range of values for each state. These costs vary widely, with average costs nationwide ranging from $24,989 to $49,207 per acre of wetlands mitigated and from $177 to $265 per linear foot of stream mitigation. There is wider variation in costs from state to state (see Appendix A).

The Corps also provided an estimate of 43,000 acres of wetland mitigation and 530 miles of stream mitigation to represent activity in the baseline period. This estimate is based on approximately 32,500 acres of permittee-responsible mitigation documented in the ORM2 database in FY2010; approximately 8,200 acres of bank mitigation documented in the Regional Internet Bank Information Tracking System (RIBITS) database in FY2010, and 2,200 acres of in-lieu fee (ILF) mitigation estimated from the ratio of ORM2 entries for banks (26%) and ILF (7%) in FY2010. This total may be incomplete, but the agencies believe it is a close approximation of mitigation for FY2010, and that it is consistent with the level of mitigation the Corps has estimated for the past 10-15 years.

The agencies used the same methodology to estimate mitigation costs as used previously to estimate these costs for policies proposed in draft guidance in April 2011. The methodology assumes that all permits associated with projected additional jurisdictional waters would require mitigation at the same rate as the baseline permitting profile on a state-specific basis. The agencies assumed all non-isolated streams and wetlands in ORM2 classified as non-jurisdictional in the ORM2 data base in FY2009-10 would be considered jurisdictional under the proposed rule, and that 17 percent[7] of non-jurisdictional "other waters" would likewise be considered jurisdictional under the proposed rule (please see description under section 6 "Scope of Impact" above). The vast majority of these "other waters" among the 17 percent would be classified as "adjacent wetlands" under the proposed rule and thus, most appropriately associated with wetlands mitigation rates and costs on a state-by-state basis.

EPA and the Corps estimate that the proposed rule could result in an additional 2,042 acres of wetland compensatory mitigation annually, and an additional 49,075 linear feet of stream mitigation annually. Using a range of state-specific unit costs of mitigation, this translates to a total estimated cost of annual incremental mitigation ranging from $59.7 million to $113.5 million. Of this amount, the majority of costs ($51.0 – $100.5 million) are for wetlands. Exhibit 7 summarizes these results.

Exhibit 7. Estimated Annual Additional CWA 404 Compensatory Mitigation Costs

Water Body Type	Units of Mitigation[1]	Unit Cost[2]	Annual Cost (millions)[3]
Streams	49,075 feet	$200 - $300	$8.7 - $13.0
Wetlands	2,042 acres	$25,000 - $49,200	$51.0 - $100.5

[7] The sample analysis of "other waters" indicated that none of the 145 waters examined in the state of California would become jurisdictional. While the analysis suggested no change in jurisdictional status of "other waters" in the state of California, the agencies applied a 5 percent change in jurisdiction to be conservative.

Total	--	--	$59.7 - $113.5

1. Based on method described in EPA (2011).
2. Weighted average of varying unit costs across states.
3. Calculated by multiplying incremental mitigation with unit costs.

Estimate of Corps Administrative Costs

The Corps anticipates that it will incur additional administrative costs under the proposed rule associated with the increased permitting workload. The Corps is typically, but not always, the permitting authority for CWA 404 permits. Sources of administrative costs include: responding to additional requests for jurisdictional determinations; an overall increase in workload-related tasks such as permit actions, consultations, and compliance and enforcement actions; and additional time to conduct significant nexus analyses. The Corps will also likely face additional costs to provide program management, training, and compliance oversight associated with administering the program. Exhibit 8 briefly summarizes the principal cost categories for administering the CWA 404 program.

Exhibit 8. Overview of CWA 404 Permit Administrative Costs

Cost Category	Description (costs vary considerably by permit type and often by region)
Permitting Costs	Costs associated with the time needed to review additional permits (which may be more complex due to a larger scope of review, reduction in the ability to avoid and minimize impacts, requiring more project modifications and additional mitigation) additional compliance and enforcement costs, additional mitigation plan reviews, effort to conduct additional agency consultations and coordination and possible increase in permit appeal requests and litigation costs.
JD Review and Coordination Costs	Additional time needed to review additional JD requests, more coordination with Corps Headquarters for "other" (isolated) waters, additional time for District staff to prepare a significant nexus evaluation for "other" waters. More appeals of approved JDs may occur.
Automation Costs	Additional costs for automating new JD forms, updating the permit tracking system (ORM2) to reflect needed data elements, updating user documentation.
Training Costs	Additional costs for Corps districts to implement the new guidance/rule, includes webinars, field training, and outreach activities for the regulated public.

The increase in waters that the agencies consider jurisdictional from the 2008 guidance may result in an increase in requests for JDs. Some changes contained in the proposed rule, such as providing a definition of tributaries that are categorically jurisdictional, could reduce the administrative costs of establishing jurisdiction. If such changes balance the expected increase in JD requests, there would be no incremental change administrative costs related to jurisdictional determinations.

Because the agencies expect that most non-isolated waters will be jurisdictional under the policies under the proposed rule, applicants may find "preliminary JDs" (PJDs) more appealing. In a PJD a permit applicant elects to set aside the question of jurisdiction and voluntarily "opts in" to the permitting process and avoids a longer "approved JD" (AJD) process. In FY2010, 58 percent of JDs were PJDs (42 percent were AJDs). PJDs are less time-consuming to document than AJDs, but permit application processing may require more information describing jurisdictional waters (e.g., to assess impacts and formulate compensatory mitigation requirements). Alternatively, some applicants may

request an AJD as a means to potentially reduce mitigation requirements and associated costs. If more landowners elect to request AJDs, the workload and administrative costs will increase.

The agencies expect that permit applications will increase as the agencies determine that more waters are jurisdictional. This increase in permit activity may increase required consultations under the Endangered Species Act (ESA) and Section 106 of the National Historic Preservation Act. This could increase costs for other agencies, such as the Fish and Wildlife Service, National Marine Fisheries Service, Advisory Council on Historic Preservation, and Tribal and State Historic Preservation Officers.

Exhibit 9 depicts the broad categories and specific tasks related to Corps administration of the CWA 404 program. To derive an estimate of the incremental administrative costs, the Corps identified how many hours per year are devoted to each task at the headquarters and district office level and translated this into dollars using average fully loaded salary rates for the needed personnel. Applying the incremental percentage increase in CWA 404 permits of 2.7 percent, the Corps estimates that their additional administrative costs will range from $7.4 to $11.2 million annually. An increase in the Corps permitting budget of this amount would be necessary to maintain current levels of permitting efficiency with the rule in place.

Exhibit 9. Categories of Corps CWA 404 Administrative Tasks

Category	Tasks
Wetland Delineation and Jurisdictional Determination (JD)	Preliminary JD
	Office/Desk JD
	Field JD
Permit Related Tasks	Pre-Application Meetings
	Standard Permit (SP) Processing Base
	Letter of Permissions (LOP)
	Nationwide (NWP) Processing without a Pre-Construction Notification (PCN)
	NWP Processing with PCN
	Regional/Programmatic (RGP/PGP) Processing without PCN (issued by Regulatory)
	RGP/PGP Processing with PCN (Issued by Regulatory)
Consultation	Endangered Species Act (ESA) Formal Consultation Process
	ESA Informal Consultation Process
	Historic Properties
	Tribal
Environmental Impact Statement (EIS)	EIS as Lead
	EIS as Cooperating Agency
Compliance	Compliance
	Resolution of Non-Compliance
Enforcement	Unauthorized Activity

Section 8: Estimate of CWA 404 Program Benefits

The CWA establishes requirements for waters of the U.S., and a revised definition of waters of the U.S as proposed would result in additional waters over which the agencies would clearly assert jurisdiction. This in turn could lead to ecosystem service benefits through 1) avoidance and minimization of permit impacts and 2) compensatory mitigation requirements. This analysis focuses on benefits of incremental compensatory mitigation because the agencies lack reliable data and information to estimate benefits of avoidance and minimization. Further, this analysis focuses on the value of wetlands mitigation. Benefits associated with stream mitigation are not quantified.

Potential benefits of the proposed rule may also accrue from cost savings to federal and state agencies. The policies in the proposed rule may lower the level of effort required to complete a jurisdictional determination or pursue an enforcement case. The additional clarity resulting from the proposed rule may also ultimately reduce the workload associated with jurisdictional determinations for streams and adjacent wetlands in the longer term, resulting in a cost-savings to the Corps.

The agencies estimated the potential benefits from CWA 404 compensatory mitigation using a benefits transfer approach. Benefits transfer involves selecting study cases relevant to the policy case under consideration, and transferring values using a unit value or function-based approach. The major issue with benefits transfer is that economic values for ecosystem services are context (resource/region/user) specific. Thus, it is best suited for transferring estimates between comparable contexts. For example, there is uncertainty involved in completing a benefits transfer where waters vary greatly in their functionality and relative value based on the relative scarcity, location within a watershed, and the degree of human impacts in their vicinity, as do the waters under consideration in this analysis. To the extent that the waters valued in studies from the literature are more functional, and thus more highly valued than the additional resources subject to compensatory mitigation under this proposed rule, the contexts of the transfer would diverge. Also, the users of the services in the original valuation studies may not be comparable to users in other areas; that is, the WTP among service users in different areas could differ significantly. However, without knowing specifically where impacts will occur in the future, benefits transfer remains the only feasible option for quantifying potential benefits. Given these challenges, and the uncertainty as to specific sites that may be affected by this proposed regulatory action, the benefits values presented in this analysis should be viewed as only illustrative. This type of analysis would not be appropriate for a site-specific evaluation.

The specific benefits transfer approach used in this analysis also relies on contingent valuation and aggregation of household level estimates of willingness to pay (WTP). Contingent valuation elicits "stated preferences" rather than revealed (or actual) preferences, which is not ideal for quantifying benefits. Stated preference methods rely on surveys that assess respondents stated WTP for goods or services, such as ecosystem services provided by a natural landscape feature.

In using the household-level WTP information, there are no clear rules for aggregation (i.e., determining which households pay). For this analysis, the agencies attempted to make reasonable and credible choices, but it is important to recognize up front that there is uncertainty and limitations associated with the results.

The April 2011 draft guidance on *Identifying Waters Protected by the Clean Water Act* was accompanied by an assessment of potential benefits that may be indirectly realized from adoption of the jurisdictional policies proposed in the *Guidance*. To estimate benefits from additional mitigation, studies of ecosystem services that reported a monetized value on a per acre basis were examined. A few authors have attempted to value the majority of the services provided by a wetland, although the estimates developed are still considered fairly incomplete by their authors. A synthesis study relied upon for the *Guidance* economic assessment presents average wetland function values for fishing, fur trapping, hunting, recreation, water filtration, flood control, scenic value, and habitat values. Summing the values for each category yields a total "unit benefit" ranging from $129,000 to $292,000 per acre (2010$, capitalized using a 6 percent discount rate). Applying this unit benefit estimate to the estimated incremental number of wetland acres impacted for which mitigation is required yields a rough estimate of the potential indirect benefits. While this approach allows for quantification of many of the functions served by wetlands, combining these values leads to some uncertainty. Not all wetlands fully perform all of the functions evaluated in the literature.

For this economic analysis supporting the proposed rule, the agencies pursued an alternative approach to seek studies from the literature that provide value estimates for a suite of ecosystem services provided by a particular wetland or wetland complex as a whole (i.e., total resource values rather than stacked service-specific values). Wetlands under consideration for their value may provide varying degrees of particular services, or may not provide a particular service at all. A strength of this approach is the values elicited implicitly account for the varying degree and interrelationships among of services provided[8], assuming respondents are sufficiently informed. With a set of values representing a variety of wetlands that provide similar services as those likely to be incrementally protected by the proposed rule, the agencies can develop WTP estimates to apply to aggregate national-scale estimates of impacted acres.

In conducting the literature search, the agencies focused on studies that assess waters expected to provide services similar to the waters incrementally protected under the proposed rule. The economic valuation literature includes a large volume of studies that estimate the value of preserving, protecting, restoring, replacing (mitigation), and increasing the size of wetlands, including several meta-analysis studies (e.g., Moeltner and Woodward 2007).[9] Many of these studies provide values for overseas, tidal, or coastal wetlands that may not well represent waters likely be incrementally protected

[8] The value of a bundle of services is generally not the same as the sum of values for individual services that comprise the bundle estimated separately. The independent valuation and then aggregation of multiple service values can introduce systemic bias in total value estimates because independent valuation does not account for the potential interdependence (e.g., complementarily) among services. Use of CV to estimate total values for all services collectively avoids this problem by estimating values for resource changes while considering the potential interdependence among individual resource services.

[9] Moeltner, K. and R. Woodward. 2007. Meta-Functional Benefit Transfer for Wetland Valuation: Making Most of Small Samples. UNR Joint Economics Working Paper 07-012. Paper presented at the W1133 Annual Meetings, Richmond, VA, March 28-30, 2007.

by the proposed rule. For example, tidal wetlands are valued highly for fishery habitat, which is typically not provided to the same degree by wetlands adjacent to small tributaries or more isolated wetlands. However, the agencies identified 10 studies that provide estimates of WTP to preserve wetlands that provide a suite of services expected to be similar to those provided by waters incrementally protected under the proposed rule. These studies represent riverine or floodplain, forested, emergent, and depression or isolated wetlands in 12 states across the country. These studies are summarized in Appendix B of this report.

For this exercise, it is necessary to express values on a "per acre" basis rather than a "per acre per year" basis to be comparable to the cost figures presented in section VII. The cost figures are annual values, but they reflect an annual summation of one-time compensatory mitigation costs. These "unit costs" are established as the one-time cost per acre to maintain the services provided in perpetuity. Thus, a proper comparison would be to derive marginal benefits as the product of the estimated marginal number of acres affected each year and a "unit benefit" dollar value per acre. Dollar values expressed as "per acre per year" can be converted to a present value dollar value "per acre" by dividing by a discount rate (typically between 3 percent and 7 percent).

The agencies standardized WTP estimates across all studies in three ways: 1) household basis, 2) per acre basis, and 3) annual basis. For estimates reported as annual WTP for wetland preservation, the agencies derived the total present value over a period of 50 years using 3 percent and 7 percent discount rates. For estimates originally reported per individual rather than per household, the agencies assumed one individual per household. The agencies calculated WTP on a per household per acre basis by dividing the per household WTP value by the size of valued wetlands reported in a particular study. The agencies took the geometric mean of WTP values from the 10 studies, weighted by number of respondents in each study, to represent an overall WTP. The majority of the original studies modeled WTP using a log-normal distribution and reported geometric means. As shown in Exhibit 10, this methodology results in a WTP per household per acre of $0.016 using a 3% discount rate. The same approach with a 7% discount rate results in $0.012 WTP per household per acre.

Exhibit 10. Weighted-Average WTP per Acre per Household for Wetland Preservation

States Covered in the Sample Studies	WTP per HH per Acre (3% Discount Rate)	WTP per HH per Acre (7% Discount Rate)
CA, IA, MN, NE, SD, WI IL, IN, KY, MO, SC, and TN	$0.016	$0.012

Benefits values for compensatory mitigation were calculated using estimates of impacted acres rather than estimates of mitigation acres required. This is because the benefits associated with mitigation reflect the value of pre-project wetlands that will be impacted at the site. The Corps typically requires more mitigation acreage than impacted acres because it may take more mitigation acres to replace the functionality of the impacted acres at the site. To facilitate estimating permit application costs, the Corps estimated that there would be an additional 1,332 acres impacted across the nation each year as a result of the proposed rule (see Section VII, Subsection A, Table 4). The agencies

apportioned this estimate of acreage by state according to the number of positive wetland aquatic resource jurisdictional status records from ORM2 in FY2009-2010 (just as the agencies did to apportion mitigation acres by state for the cost analysis), assuming that this serves as a proxy for permitting activity in the state.

As stated above, there are no clear rules for aggregating households to determine a total willingness to pay. One option would be to use the total number of households in the nation and the total incremental impact acreage estimate for the nation. Another option would be to use the total number of households in the state and the incremental impact acreage estimate apportioned by state. The agencies selected an intermediate option of grouping states into similar "wetland regions", assuming that per acre benefits values accrue to all citizens in the region. The USDA Economic Research Service has used a set of eight wetland regions in the contiguous U.S.: Central Plains, Delta and Gulf, Mountain, Midwest, Northeast, Pacific, Prairie Potholes, and Southeast (Heimlich et al. 1998).[10] The agencies assumed that the benefits in Alaska and Hawaii accrue only to households residing in those states. Using the incremental impact acreage estimate apportioned by state and the total number of households in each state, the agencies calculated wetland compensatory mitigation benefits for the proposed rule in each wetland region. As shown on Exhibit 11, the illustrative estimate of present value of wetland mitigation ranges from $257.6 million to $345.1 million annually, using a 7 percent and 3 percent discount rate respectively.

In terms of WTP per household, the annual WTP for all regional acres ranges from $0.36 to $3.86 depending on the region, with an overall average of $2.30. On a per acre basis, benefits vary by region, ranging from approximately $26,000 to $287,000 per year with an overall average of $193,000 (7% discount rate). In comparison, the stacked service-specific approach used in the Guidance benefit assessment yielded per acre benefit ranging from $129,000 to $292,000 (6% discount rate).

Exhibit 11. Estimated Annual CWA 404 Wetland Compensatory Mitigation Benefits

Region	Incremental Impact Acreage Estimate	Number of Households	Present Value of Incremental Benefit Per Year (2010$ millions)	
			7% Discount Rate	3% Discount Rate
Central Plains	30	3,201,336	$1.2	$1.5
Delta and Gulf	85	14,521,178	$14.8	$19.8
Mountain	145	7,390,812	$12.9	$17.3

[10] Heimlich, R.E., R. Claassen, K.D. Wiebe, D. Gadsby, and R.M. House. 1998. Wetlands and Agriculture: Private Interests and Public Benefits. AER-765, U.S. Dept. Agr. Econ. Res. Serv., Aug.

Midwest	322	23,909,088	$92.3	$123.7
Northeast	240	23,839,690	$68.7	$92.1
Pacific	79	16,163,714	$15.3	$20.5
Prairie Potholes	241	2,176,626	$6.3	$8.4
Southeast	187	20,485,107	$46.1	$61.7
Other	3	234,779	$0.0	$0.0
National	1,332	111,922,330	$257.6	$345.1

Another way to evaluate the results is to look at inferences of the relative proportion of total value for "use" and "non-use" values. The WTP studies evaluated ecosystem services that may be categorized as "use" values such as flood protection and recreation and services that may be categorized as "non-use" values such as wildlife habitat or "bequest" or "existence" values. It is reasonable to suggest that one may value wetlands very far from their home for their "non-use" values more than they would for their "use" values. Because of the holistic valuation approach, the agencies cannot discern "use" or "non-use" components of the WTP estimates. However, the agencies can consider a scenario where the full WTP applies to state households, and a discounted WTP applies to out-of-state households for the impact acreage in each state. To achieve the same totals as the regional approach, the discounted rate for out-of-state households would be approximately 12 percent of the full WTP. If this discounted out-of-state WTP is considered to account for "non-use values" only (which is not necessarily the case because many "use" values, notably flood protection value, may accrue more on a watershed basis that cross state lines), then this implies a "non-use" to "use" ratio of 0.14 (12/88) or a "non-use" to total ratio of 0.12. This is considerably on the lower end of the range for "non-use" to total WTP ratios in the literature. Brown (1993) summarizes 31 studies measuring "use" and "non-use" WTP, finding a range of "non-use" to "use" ratio of 0.11 to 10.74 with a median ratio of 1.92 (equivalent to a "non-use" to total ratio of 0.1 to 0.91, median of 0.66).[11] Carson and Mitchell (1993), used in past EPA regulations, report an out-of-state to total WTP ratio of 0.33.[12] The relatively small contribution (0.12) from out-of-state households lends credibility to the selection of the regional approach to household aggregation.

Section 9: Costs and Benefits to Other Programs

As discussed above in section III, the definition of waters of the U.S. affects several CWA programs. As further discussed above, EPA anticipates that this proposed rule would be cost neutral or minimal with respect to CWA Section 303 program implementation, as well as for traditional CWA

[11] Brown, T. C., Measuring nonuse value: A comparison of recent contingent valuation studies, W-133 Sixth Interim Rep., Dep. of Agric. and Appl. Econ., Univ. of Ga., Athens, 1993.

[12] Carson, R.T., Mitchell, R.C., 1993. The value of clean water: the public's willingness to pay for boatable, fishable, and swimmable quality water. Water Resources Research 29 (7), 2445–2454

Section 402 discharge permits such as those for municipal wastewater treatment facilities or industrial operations. However, there may be additional indirect costs may be incurred for CWA Section 401 state certification, CWA Section 402 stormwater permits for construction and development and municipalities, and CWA Section 311 oil spill prevention plans. Across the board, EPA may incur enforcement program savings.

CWA Section 401 State Certification

Under the CWA, tribes and states have the authority to review the issuance of federal permits and certify if they will meet applicable tribal/state water quality standards. Tribes and states may also condition federal permits to ensure they will not cause or contribute to a violation of tribal/state water quality standards. There is no uniform level of implementation of CWA Section 401 across all states.[13] Different states dedicate various levels of resources to CWA 401 certification. Based on program experience, EPA estimates that a representative distribution of effort would be 25 states dedicating 0.5 FTE (full time employees) equivalent, 20 states dedicating 10 FTE, and 5 states dedicating 20 FTE for CWA 401 implementation. This tallies to 312.5 FTE nationally. Based on Bureau of Labor Statistics occupational employment statistics (OES) categories, an even mix of scientists, engineers, economists, and managers (representing a team involved in prioritizing and reviewing permits) employed by state government would have an average fully-loaded salary rate of $42 per hour. Assuming an eight hour day, five days a week, 52 weeks a year, this would be $87,360 per year per FTE. Multiplying by a total of 312.5 FTE, this yields an annual estimate of approximately $27.3 million. Although this would represent effort for reviews of all federal permits, applying the incremental percentage increase in CWA 404 permits of 2.7 percent results in a projected incremental costs to states of about $737,100 annually. Exhibit 12 summarizes additional cost information.

Exhibit 12. Estimated Annual Additional CWA 401 Administrative Costs to States

FTE Amount for 401	Number of States	Total FTE	Total Costs (2010$)
0.5	25	12.5	$ 1,092,000
10	20	200	$ 17,472,000
20	5	100	$ 8,736,000
	TOTAL:	312.5	$ 27,300,000
	2.7% INCREMENT:	8.44	$737,100

To the extent that states condition permits, added costs to permittees and environmental benefits associated with compensatory mitigation would be accounted for in the methodology for assessing those incremental impacts: they would accrue to the same extent as represented in the baseline. Any added costs to permittees and environmental benefits associated with avoidance and minimization that result from state certification are not quantified.

CWA Section 402 NPDES Permits

Under the CWA, the term "discharge of a pollutant" and the term "discharge of pollutants" generally each means any addition of any pollutant to navigable waters from any point source.

[13] EPA focused this estimate on state implementation and did not attempt to quantify potential impacts on tribes.

NPDES permits all address discharge of a pollutant, yet may reflect different statutory and regulatory requirements depending on the type of point source.

Polluted stormwater runoff is commonly transported through Municipal Separate Storm Sewer Systems (MS4s), from which it is often discharged untreated into local waters. To prevent harmful pollutants from being washed or dumped into an MS4, operators must obtain a NPDES permit and develop a stormwater management program. Phase I, issued in 1990, requires medium and large cities or certain counties with populations of 100,000 or more to obtain NPDES permit coverage for their stormwater discharges. Phase II, issued in 1999, requires regulated small MS4s in urbanized areas, as well as small MS4s outside the urbanized areas that are designated by the permitting authority, to obtain NPDES permit coverage for their stormwater discharges. Generally, Phase I MS4s are covered by individual permits and Phase II MS4s are covered by a general permit. Each regulated MS4 is required to develop and implement a stormwater management program (SWMP) to reduce pollutant discharge from stormwater to the "maximum extent practicable" (MEP) and eliminate non-stormwater discharges.

It is unclear specifically how a broader assertion of CWA jurisdiction under this proposed rule would affect MS4 permits. An MS4 may have several different outflows within its service area, and some may be to waters where CWA jurisdiction may not apply. However, in implementing a SWMP, operators likely implement BMPs uniformly across their area without regard to the specific location of a specific outfall, and thus the jurisdictional status of a portion of the receiving water would not matter in terms of costs. In addition, MS4 outfalls tend not to be in wetlands, which represent a large portion of the CWA 404 program aquatic resource records and the most incremental waters where increased assertion of CWA jurisdiction is expected under this proposed rule. Thus, the true cost impact is considered to be negligible.

Stormwater runoff from construction activities can have a significant impact on water quality. As stormwater flows over a construction site, it can pick up pollutants like sediment, debris, and chemicals and transport these to a nearby storm sewer system or directly to a river, lake, or coastal water. Polluted stormwater runoff can harm or kill fish and other wildlife. Sedimentation can destroy aquatic habitat, and high volumes of runoff can cause stream bank erosion. Debris can clog waterways and potentially reach the ocean where it can kill marine wildlife and impact habitat.

The NPDES stormwater program requires construction site operators engaged in clearing, grading, and excavating activities that disturb one acre or more, including smaller sites in a larger common plan of development or sale, to obtain coverage under an NPDES permit for their stormwater discharges. EPA has authorized most states to implement the stormwater NPDES permitting program. EPA used information from the *Economic Analysis of Final Phase II Storm Water Rule* (October 1999, see Exhibit ES-4) to estimate potential incremental indirect costs for construction stormwater permit holders. The process is to 1) take the costs (in 1988 $/yr) for construction, 2) determine the 2.7 percent increment to account for increased jurisdictional assertion from this proposed rule, 3) account for program growth of 30% representing the increase from 130 thousand "construction starts" in 1994 cited in the 1999 Economic Analysis to 169 thousand construction sites with permit coverage in 2011 cited in

EPA's GPRA management measures tracking (any *SWANCC* and *Rapanos* effect would be implicit in this calculation step), and 4) convert to 2010 dollars. This results in incremental costs of $25.6 – 31.9 million annually for construction. The same process applied to benefits calculation yields a range of $25.4 - $32.3 million per year.

Exhibit 13 summarizes costs and benefits for construction and development stormwater CWA 402 permitting. The same process for estimating indirect permitting authority administrative costs for both MS4s and construction yields incremental costs of approximately $250 thousand annually. These costs would generally accrue to states as the typical permitting authority. The original analysis did not adjust the universe of affected entities based on CWA jurisdiction so the incremental impacts are components of costs and benefits previously identified for past rules, not new costs and benefits associated with this proposed rule.

Exhibit 13. Estimated Annual Additional CWA 402 Stormwater Permitting Impacts ($ millions)

	Administrative Costs (States)	Implementation Costs (low)	Implementation Costs (high)	Benefits (low)	Benefits (high)
1998 Values	5.3	545.0	678.7	540.5	686.0
(1) 2.7% Increment	0.143	14.7	18.3	14.6	18.5
(2) Program Growth	0.186	19.1	23.8	19.0	24.1
(3) 2010 Dollars	0.249	25.6	31.9	25.4	32.3

Concentrated Animal Feeding Operations (CAFOs) are point sources under the CWA and are regulated under the NPDES permitting program. Most current permit holders are covered under state-issued general permits. EPA promulgated regulations for Concentrated Animal Feeding Operations (CAFOs) in 2003 that expanded the number of operations covered by the CAFO regulations and included requirements to address the land application of manure from CAFOs (develop and implement nutrient management plans). EPA revised this regulation in 2008 to reflect changes requested by the Second Circuit Court in its decision in response to litigation. However, the basic cost and benefit information from the supporting economic analysis (see Table 8.1 and 8.4 in Federal Register volume 68 number 29 from February 12, 2003) is useful for estimating potential indirect impacts in a similar manner as above for stormwater. The process is to 1) take the costs (in 2001 $/yr) for CAFO operators and permit authority administrators (typically states), 2) determine the 2.7 percent increment to account for increased jurisdictional assertion from this proposed rule, 3) adjust for a program size decrease of 50 percent comparing the approximate 15,000 CAFOs considered in the 2003 Economic Analysis to 7,318 CAFO permit holders in 2011 cited in EPA's GPRA management measures tracking (any *SWANCC* and *Rapanos* effect would be implicit in this calculation step), and 4) convert to 2010 dollars. This results in incremental costs of $5.5 million annually for CAFO operators and $150 thousand annually for administrative costs to permitting authorities. The same process applied to benefits calculation yields a range of $3.4 - $5.9 million per year, although the benefits are only calculated for large CAFOs which comprise 85 percent of the operator costs and 66 percent of the administrative costs. Exhibit 14 summarizes costs and benefits for CAFO CWA 402 permitting. The original analysis did not adjust the universe of affected entities based on CWA jurisdiction so the incremental impacts are components of

costs and benefits previously identified for past rules, not new costs and benefits associated with this proposed rule.

Exhibit 14. Estimated Annual Additional CWA 402 CAFO Permitting Impacts ($ millions)

	Administrative Costs (States)	Implementation Costs	Benefits (low)	Benefits (high)
2001 Values	9.0	326.0	204.0	355.0
(1) 2.7% Increment	0.243	8.8	5.5	9.6
(2) Program Size Adjustment	0.122	4.4	2.8	4.8
($) 2010 Dollars	0.151	5.5	3.4	5.9

On October 31, 2011, EPA issued the final NPDES general permit for point source discharges to waters of the United States from the application of (1) biological pesticides, or (2) chemical pesticides that leave a residue. This permit, also known as the Pesticide General Permit (PGP), was developed in response to a decision by the Sixth Circuit Court of Appeals (National Cotton Council, et al. v. EPA). The Agency's final PGP covers operators that apply pesticides that result in discharges from the following use patterns: (1) mosquito and other flying insect pest control; (2) weed and algae control; (3) animal pest control; and (4) forest canopy pest control. The permit requires permittees to minimize pesticide discharges through the use of pest management measures and monitor for and report any adverse incidents. The general permit will provide coverage for discharges in the areas where EPA is the NPDES permitting authority. In the remaining areas (44 states and the Virgin Islands), states are authorized to develop and issue the NPDES pesticide permits.

PGP cost information from the supporting economic analysis is useful for estimating potential indirect impacts in a similar manner as above for stormwater and CAFOs. The process is to 1) take the identified PGP costs, 2) determine the 2.7 percent increment to account for increased jurisdictional assertion from this proposed rule, and 3) scale up from 35,376 affected entities where EPA is the permitting authority to the approximate 365,000 potentially affected entities nationwide once states develop their own general permits for these dischargers (assuming costs will be similar). This results in incremental costs of between $2.9 and $3.2 million annually for operators. EPA did not generate estimates for government costs, nor did EPA attempt to quantify benefits. Exhibit 15 summarizes costs and benefits for CWA 402 PGP. The original analysis did not adjust the universe of affected entities based on CWA jurisdiction so the incremental impacts are components of costs previously identified, not new costs associated with this proposed rule.

Exhibit 15. Estimated Annual Additional CWA 402 PGP Impacts ($ millions)

	Costs (low)	Costs (high)	Notes
2010 Costs	10.4	11.4	Table ES-6 of Economic Analysis of the Pesticide General Permit (PGP) for Point Source Discharges from the Application of

			Pesticides (2009$ adjusted to 2010$ using CPI)
(1) 2.7% Increment	0.3	0.3	Projected increment attributable to proposed rule
(2) Scale Up for States	2.9	3.2	Scale up from 35,376 affected entities under federal permit to potential universe of 365,000

CWA Section 311 Oil Spill Prevention Plans

CWA Section 311 covers oil spill prevention and preparedness, reporting obligations, and response planning. These requirements apply to facilities that produce or store oil products based on total volume. In particular, inland non-transportation oil facilities of a certain size that have potential to discharge to navigable waters must prepare and implement Spill Prevention, Control, and Countermeasure (SPCC) plans. Potential costs of this proposed rule associated with CWA Section 311 include SPCC plan development and implementation for oil storage and production facilities. In its 2009 *Regulatory Impact Analysis for the Final Amendments to the Oil Pollution Prevention Regulations*, EPA developed compliance unit costs for SPCC-regulated facilities, including plan preparation and maintenance, secondary containment, integrity testing, drainage, monthly inspections, security, and training. There are four categories of production and storage facilities, with the great majority (more than 80 percent) comprising the lowest two categories in terms of capacity, and the lowest unit costs for compliance. The weighted average annual cost is $9,128 for production facilities (about 35% of total facilities) and $13,038 for storage facilities (values adjusted from 2007 $/year to 2010 $/year).

Anecdotal information from EPA Regional Office program managers and enforcement specialists reveal that some potentially regulated facilities believe that they are not covered by the applicable SPCC regulations because they do not have the potential to discharge to a water of the U.S. Although there is not corresponding jurisdictional determination information as available for the CWA 404 permit program, it is reasonable to assume that a broader assertion of CWA jurisdiction may affect some of these facilities. Each EPA Region inspects approximately 100 facilities per year for compliance. Upon closer inspection, some of these facilities conclude they do need to comply. Generally, less arid EPA Regions report that their facilities do not question CWA jurisdiction, whereas EPA regions that include more arid (western) areas more frequently encounter this claim. Some EPA Regions report that a handful (one to five) facilities claim non-jurisdiction and that some of these facilities report there are a dozen others that are similarly situated. One EPA Region reports that at least 20 have asserted non-jurisdiction. Supposing that 100 of these facilities nationally are correct in their claim, and that there are 10 times more facilities that would also be correct in this claim, and that none of these 1,000 facilities has incurred compliance costs (either for the SPCC rule or to meet self-imposed industry standards), this would result in approximately $11.7 million per year in incremental costs.

One of the benefits of compliance is avoiding risk of incurring cleanup costs should there be a spill. The national average spill volume (2000-2005 data from NRC) is 1,290 gallons. The average clean up costs for a spill of this size is $221 per gallon in 2010 dollars, or a total of $285 thousand in clean up costs per average spill. A bigger spill can cost more. Essentially, complying facilities expend about $10 thousand dollars a year to avoid clean up costs of several hundred thousand dollars (plus fines that range from 4, 400 to 230,400 on average). If the incremental risk associated with taking no steps to

prevent a spill is 1 in 10 per year, this would represent an annual benefit of $28,509 (not including fines). If the risk is more like 1 in 20, the annual benefit is $14,255. Applying the lower benefit per facility per year value, incremental benefits for 1,000 non-complying facilities would total approximately $14.3 million annually. This does not consider ecological benefits of avoiding oil spills. Although the precise number of affected facilities is highly uncertain, it does appear that reasonable assumptions with respect to costs and benefits suggest that benefits would justify costs.

EPA Enforcement Savings

EPA has experienced increased resource burden associated with enforcement of CWA 402, 404, and 311 as a result of the decisions in *SWANCC* and/or *Rapanos* and the agencies' implementing guidance. The proposed rule should reduce these impacts by providing clarity on federal CWA jurisdiction. Compared to current practices, the proposed rule will establish jurisdiction for more waters, and increase the certainty regarding CWA program applicability. Although some cases may still require site-specific "significant nexus" analyses, the costs associated with proving federal jurisdiction in the majority of cases should decrease.

The costs associated with enforcement efforts include the time of federal and state staff to conduct the needed jurisdictional analyses in prosecuting civil and criminal cases against CWA violators, primarily under CWA 402, 404, and 311. The staff includes environmental scientists, environmental engineers, and attorneys. Under the current system, EPA often needs to hire contractors to provide support in hydrology, wetlands ecology, etc. Appendix A includes the average labor costs for such staff that are expected to be involved in JD enforcement efforts.

EPA identified a number of representative cases to characterize the potential magnitude of costs or cost savings at the case level. These examples illustrate the incremental level of resources needed to assert jurisdiction post *SWANCC* and *Rapanos*. For example, EPA's Region 9 expended thousands of hours to establish jurisdiction in the case of an Arizona rancher who bulldozed 2,000 acres within the floodplain of the lower Santa Cruz River, filling in over 100 acres of the River and its tributaries. The rancher asserted that the area filled was not subject to CWA jurisdiction, since it was not itself navigable.

In another example, the government filed criminal charges against a pipe manufacturer (as well as several managers with knowledge of and control over the discharges) and won convictions. However, the discharger appealed, arguing that the receiving water is not navigable and is thus not jurisdictional pursuant to *Rapanos*. The 11th Circuit Court rejected the convictions because EPA had not sufficiently demonstrated the "significant nexus," despite the fact that the convictions had occurred before the *Rapanos* decision. Although they ultimately obtained convictions in the case, EPA and DOJ expended thousands of hours in preparation for both the appeal and the retrial, including an extensive demonstration of CWA jurisdiction. The DOJ alone reported spending over 2,400 hours after the reversal, and EPA likely spent approximately half that amount working on the appeal.

Similarly, in a case involving a dairy farm in Texas, the operator discharged a large quantity of wastewater (up to about 43,000 gallons) from a waste lagoon through a hose to the ground of the dairy's property where it flowed to a neighboring property and then entered a creek that flows to Lake Fork Reservoir, a large navigable-in-fact waterbody. Although EPA expended over 300 hours on

Rapanos-related jurisdictional analyses, the Assistant United States Attorney declined to prosecute the case because of concerns about establishing jurisdiction in light of *Rapanos*.

Although they are likely to be only a subset of cases affected by *SWANCC* and/or *Rapanos*, these three cases may be representative of the resource burdens associated with enforcement under the CWA that has been increased as a result of *SWANCC* and/or *Rapanos*. For example, as an estimate for trial cases, federal resource costs would be approximately $79,100 per case for 1,200 hours, based on a weighted average labor cost of federal environmental scientists and engineers (75%) and federal lawyers (25%). An estimate of non-trial cases would be 300 incremental hours,with federal resource cost at approximately $19,780 based on the same labor rates. These estimates may be conservative in some respects because they do not include additional expenses such as travel, per diem, or equipment utilized in the jurisdictional determination.

EPA pursues enforcement actions though the judicial system and through the administrative enforcement process. The labor costs associated with proving jurisdiction in these cases is on the order of thousands of hours of environmental scientist and attorney labor. Many more judicial cases are settled before trial, and because EPA must still prove CWA jurisdiction in those cases, the associated labor costs are only slightly less than for cases going to trial. The majority of EPA's CWA enforcement cases are resolved through the administrative enforcement process. Many administrative cases involve CWA jurisdictional issues. EPA also conducts inspections and investigations to develop CWA jurisdiction in hundreds of other potential enforcement cases that are never formally pursued and the case file is closed.

Section 10: Summary of Estimated Costs and Benefits

The agencies project that this proposed action to change the definition of waters of the U.S. would increase assertion of CWA jurisdiction when compared to a baseline of current practices under the existing regulation. CWA jurisdiction does not mean that waters must always be preserved in their natural state and never receive discharges of pollutants. Instead, CWA jurisdiction means water quality must be maintained to meet established water quality standards; discharges must meet minimum technology-based controls (or reduced to the maximum extent practicable); impacts must be avoided (if there is a practicable alternative), minimized, or compensated; and facilities must take actions to prevent oil spills.

As a result of this proposed action, costs to regulated entities will likely increase for permit application expenses, compensatory mitigation (if applicable), and installation of best management practices. Costs are also likely to increase to state and federal governments for permit program administration. Most of the projected costs would likely accrue to landowners and development companies, state and local governments investing in infrastructure, and industries involved in resource extraction. These types of entities are affected by additional need for CWA 404 dredge and fill permits and CWA 402 construction stormwater permits. Any incremental costs for routine maintenance of waterways (such as drainage ditches that might newly meet the definition of tributary as proposed in this rule) incurred by local, state, or federal authorities would likely be minimal because of the general permits that the Corps issues to reduce the regulatory requirements for these minor activities.

Benefits that accrue from this action include the value of the many ecosystem services provided by the small streams, wetlands, and other open waters protected by the many CWA provisions that would apply to them. These waters provide habitat and biodiversity, support recreational fishing and hunting, filter sediment and contaminants, reduce flooding, stabilize shorelines and prevent erosion, recharge ground water, and maintain biogeochemical cycling. Other benefits include government savings on enforcement expenses through reduced need for costly jurisdictional determinations where jurisdiction has been unclear under the current interpretation of the existing regulation. Business and government may also achieve savings from reduced uncertainty in where CWA jurisdiction applies.

Exhibit 16 displays a summary of costs and benefits. It includes costs and benefits derived from original analysis to support this proposed rule and costs and benefits derivative from previous economic assessments for other rules. Some values reflect a greater number of assumptions than others, as described in previous sections of this document. The values are not intended to be definitive, but merely illustrative. In addition, there are both costs and benefits that are not quantified in this analysis. The table includes costs and benefits that accrue to both private and public entities. For example, information presented in the table suggests that incremental costs to state governments in total would be approximately $1.1 million annually (CWA 401 and 402 Administration). Overall, a comparison indicates that the benefits justify the costs of this proposed action.

Exhibit 16. Estimated Incremental Annual Indirect Costs and Benefits (2010$ in millions).[1]

	COSTS		BENEFITS	
	low	*high*	*low*	*high*
CWA 404 Mitigation - Streams [2]	$8.7	$13.0		
CWA 404 Mitigation - Wetlands	$51.0	$100.5	$257.6	$345.1
CWA 404 Permit Application [3]	$19.7	$52.9		
CWA 404 Administration	$7.4	$11.2		
CWA 401 Administration [4]	$0.7			
CWA 402 Construction Stormwater	$25.6	$31.9	$25.4	$32.3
CWA 402 Stormwater Administration	$0.2			
CWA 402 CAFO Implementation [5]	$5.5		$3.4	$5.9
CWA 402 CAFO Administration	$0.2			
CWA 402 Pesticide General Permit [6]	$2.9	$3.2		
CWA 311 Implementation	$11.7		$14.3	
Total	$133.7	$231.0	$300.7	$397.6

(1) Section 303 impacts are assumed to be cost-neutral; Section 402 impacts are components of costs and benefits previously identified for past actions, not new costs and benefits associated with this proposed rule.

(2) Benefits of stream mitigation are not quantified.

(3) Costs of potential delayed permit issuance and costs and benefits of avoidance/minimization are not quantified, nor are any benefits from reduced uncertainty.

(4) Costs to permittees and benefits of any additional requirements as a result of 401 certification are reflected in the mitigation estimates to the extent additional mitigation is the result, yet not calculated to the extent avoidance/minimization is the result.

(5) Benefits apply to large CAFOs only, which account for 85% of implementation costs and 66% of administrative costs.

(6) PGP benefits and government administrative costs are not available.

Section 11: Additional Considerations for Other Waters

"Other waters" is a regulatory term for wetlands and non-wetlands waters that do not fall into the category of waters susceptible to interstate commerce (e.g., a "traditional navigable waters" or TNWs), interstate waters, the territorial sea, tributaries, or waters adjacent to waters in one of the first four categories on this list. The Corps of Engineers ORM2 data base includes a category of aquatic resource type that represents "other waters" for purposes of determining the potential impacts of proposed new policies regarding assertion of CWA jurisdiction. All of the ORM2 FY2009-2010 "other waters" records are considered outside of assertion of CWA jurisdiction under current policies.

In the April 2011 draft guidance, EPA and the Corps (the agencies) suggested that "adjacent" wetlands and "proximate non-wetlands" are similarly situated and could be aggregated on a watershed scale for a significant nexus determination. An analysis of samples of "other waters" indicated that the agencies would assert jurisdiction for 17 percent of "other waters" under new policies proposed in the April 2011 draft guidance. Most of these (14 of the 17 percent) waters would be jurisdictional because they would be considered adjacent waters under the draft guidance. The sample review analysis indicated that an additional 3 percent were TNWs themselves, tributaries to TNWs, or proximate non-wetlands with a significant nexus. The sample review analysis indicated that the agencies would not assert jurisdiction under the April 2011 guidance policies for waters considered to be non-adjacent wetlands or non-proximate non-wetlands. These more remote or more isolated waters may include prairie potholes, vernal pools, playa lakes, and Carolina/Delmarva inland bays that have generally been considered "isolated, intrastate, non-navigable" and not under CWA jurisdiction since the 2001 SWANCC Supreme Court decision.

In the proposed rule, wetlands and non-wetlands that meet the definition of adjacent are considered jurisdictional per se because they have a significant nexus. Adjacent waters include those that are in a floodplain or riparian area, or have a surface or shallow sub-surface connection to jurisdictional waters. The proposed rule would have a result that is consistent with the sample review analysis that estimated the agencies would assert jurisdiction for 17 percent "other waters". However, the April 2011 draft guidance policies differ from the policies in the proposed rule with respect to aggregation of the remaining "other waters" (i.e., non-adjacent wetlands and non-proximate non-wetlands) for a significant nexus evaluation. In the April 2011 draft guidance, the agencies stated that non-adjacent wetlands and non-proximate non-wetlands should only be aggregated if there is compelling science to do so. In the proposed rule, remaining other waters may be aggregated for a significant nexus determination if they perform similar functions and are located sufficiently close together to be evaluated as a single landscape unit in the same watershed. The policy articulated in the proposed rule could be more inclusive of waters in the ORM2 "other waters" group with respect to CWA coverage depending on how it is interpreted and applied.

It is not clear from examining the aforementioned sample review analysis results (that produced the 17 percent estimate) how the policy differences between the draft guidance and the proposed rule would affect the percent of non-adjacent "other waters" considered jurisdictional. The results of the

sample review analysis were primarily driven by adjacency rather than the manner of aggregation within a watershed, and there is not sufficient information in the files that supported the analysis to consider watershed aggregation in a rigorous manner. It would take actual field experience to know the effect of the aggregation approach in the proposed rule with any precision.

In the proposed rule, aggregation of residual other waters (waters not meeting the definition of adjacent) can occur if 1) they perform similar functions and 2) they are located sufficiently close together (or close to a water of the U.S.) so that they can be evaluated as a single landscape unit with regard to their effect on the physical, chemical, or biological integrity of a TNW, interstate water, or territorial sea. In the preamble to the proposed rule, the agencies identify functions as including habitat, water storage, sediment retention, and pollution sequestration. They identify common soils, vegetation, and landforms as factors to be considered in understanding appropriate hydrologic and ecological bases for aggregation as well as the geographic distribution, distance between water bodies, and proximity to jurisdictional waters. Once aggregated, the group must then have a significant nexus to a traditional navigable water, interstate water, or territorial sea to be considered jurisdictional. Collectively, this is a multistep process that the agencies expect to be sufficiently documented. The intent of the policy is to focus on select areas where isolated waters are most concentrated and play an important role in watershed scale functions.

To ascertain the full potential impact of the proposed rule, an important question is what percent of the residual "other waters" (i.e., above and beyond the 17 percent which meet the definition of adjacent or are otherwise jurisdictional) would the agencies be likely to assert jurisdiction over. These residual "other waters" represent 83 percent of non-adjacent "other waters" in the sample review analysis. Thus, the total percent of "other waters" where the agencies would likely assert jurisdiction would be 100 percent of 17 percent (all "other waters" meeting the definition of adjacent or otherwise jurisdictional) plus "X" percent of 83 percent (a portion of the residual "other waters" that were not clearly adjacent in the sample review analysis). The following three-stage process can help identify "X":

1. Examine Information on Extent of Isolated Wetlands in a Watershed
2. Examine Models to Describe Probability of Aggregation and the Probability of Significant Nexus for Isolated Waters (these are two independent steps)
3. Select Model and Apply to Distribution of Extent of Isolated Wetlands

Step 1: Examine Information on Extent of Isolated Wetlands in a Watershed

The U.S. Fish and Wildlife Service published a study called *Geographically Isolated Wetlands: A Preliminary Assessment of Their Characteristics and Status in Selected Areas of the United States* on the extent and characteristics of isolated wetlands (Tiner *et al*, 2002).[14] This report focused on 72

[14] Tiner, R.W., H.C. Bergquist, G.P. DeAlessio, and M.J. Starr. 2002. Geographically Isolated Wetlands: A Preliminary Assessment of their Characteristics and Status in Selected Areas of the United States. U.S. Department of the Interior, Fish and Wildlife Service, Northeast Region, Hadley, MA.

study areas throughout the country. Although not statistically designed, it can offer some insight on the relative proportion of watersheds that have a significant amount of isolated wetlands. Each study area lies within a watershed boundary. The sites for this study represented two types of areas: 1) areas with an expected high concentration of isolated wetlands and 2) areas from major physiographic regions. The latter may or may not be typical of those regions, but in total there are representatives from each regions and the data set are inclusive of areas expected to contain a large amount of isolated wetlands. However, this group of study areas may be somewhat biased toward over-representation of areas with high concentrations of isolated wetlands. The isolated wetlands in these study areas could also lie within the floodplain or riparian area and thus be considered adjacent. Therefore, this information may also over-represent the residual "other waters" fraction the agencies seek to evaluate.

Tiner *et al* (2002) present information on the number of study areas by the proportion of the total number of wetlands that are isolated in the study area (Exhibit 17) and the number of study areas by the proportion of the total wetlands acreage that are isolated in each study area (Exhibit 18). The isolated proportion of the total number of wetlands is often large because there tend to be a large number of small isolated wetlands and relatively smaller number of larger non-isolated wetlands in the study areas. A better indicator of the extent of isolated wetlands relevant to their relative importance in a watershed is the isolated proportion of total wetland acreage. The greater the proportion of isolated wetlands, the more likely there would be groups of isolated wetlands that are sufficiently close together to be evaluated as a single landscape unit for a case-specific significant nexus evaluation. The greater the proportion of isolated wetlands or groups of isolated wetlands in a watershed, the higher the likelihood of finding isolated wetlands, or groups of isolated wetlands, with a significant nexus.

Exhibit 17. Isolated Wetlands in Proportion to Total Number of Wetlands in a Watershed

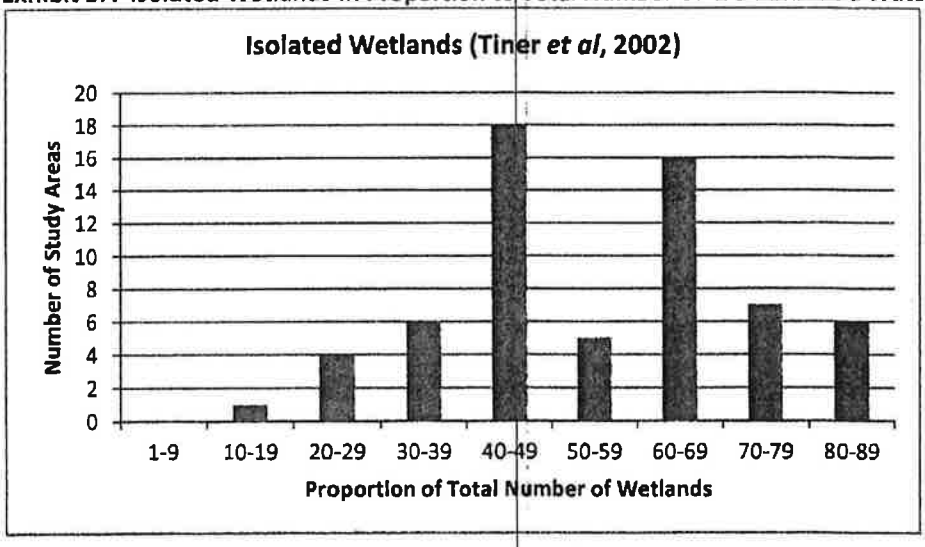
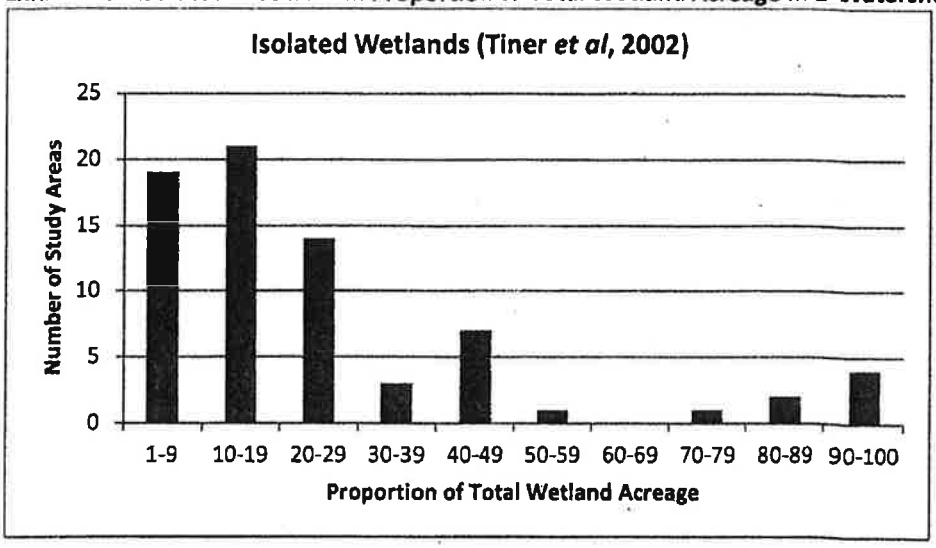


Exhibit 18. Isolated Wetlands in Proportion to Total Wetland Acreage in a Watershed

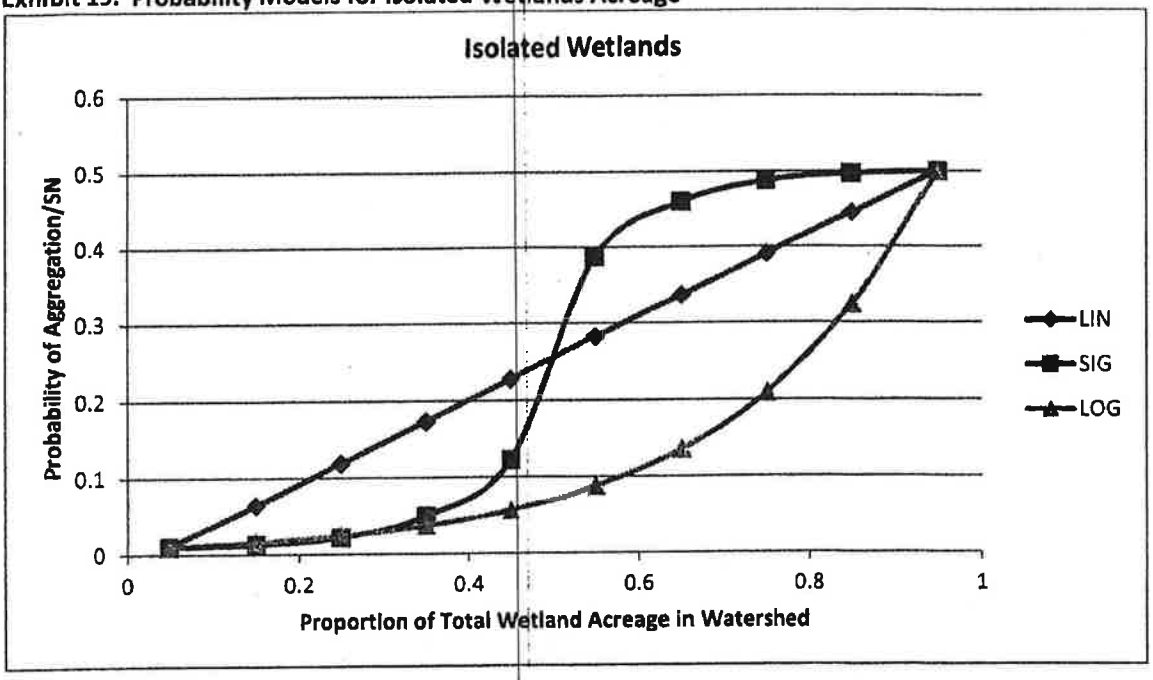


Approximately 55 percent of the study areas have less than 20 percent of their wetland acreage as isolated wetlands, another approximate 35% percent of the study areas have between 20-50 percent of their wetlands as isolated wetlands. The remaining 10 percent of the study areas have a relatively high proportion (greater than 70 percent, with most greater than 90 percent) of their wetlands as isolated wetlands. These are study areas that would be most likely representative of watersheds with a large amount and a high density of isolated wetlands necessary to meet the aggregation requirements and then the significant nexus test in the proposed rule.

Step 2: Examine Models to Describe Probability of Aggregation and Significant Nexus

There are various mathematical relationships (models) that could describe the probability that a watershed with a given proportion of isolated wetlands will include wetlands that meet aggregation requirements and pass the significant nexus test. Each model should have the highest probability associated with the highest proportion of isolated wetlands, and the lowest probability with the lowest proportion of isolated wetlands. Exhibit 19 presents four such model relationships. The simplest model is where the probability increases at the same rate as the proportion isolated (LIN model). However, it is more likely that the probability increases at an increasing rate as the proportion isolated becomes larger (LOG model). It is also possible that the relationship starts in LOG model fashion, then hits a critical point where a critical mass of isolated wetlands (say 50 percent) makes aggregation/significant nexus more likely and the remaining incremental increases are small (SIG model).

Exhibit 19. Probability Models for Isolated Wetlands Acreage



A feature of these models is that they all key off a top level probability of aggregation and significant nexus (0.5 or 50 percent probability as shown in Exhibit 19). One may select alternative top level probabilities to see different outcomes once applied to the distribution of extent of isolated wetlands in step 3. In selecting the top level probability, it is important to recognize the bias toward watersheds with isolated wetlands in the distribution from step 1, the potential for adjacent wetlands to be included in the proportion isolated, and that application of a probability to a watershed implies that all isolated wetlands in the watershed would be jurisdictional. It is also important to recognize that aggregation and the significant nexus test are reliant on functional similarities (e.g., physical, chemical, and biological connections and processes) as well as location within the watershed. While proportion of total wetland acres is a good proxy for the likelihood of these similarities and connections, it is not the sole arbiter. For these reasons, the top level probability should be far less than 100 percent.

Step 3: Select Model and Apply to Distribution of Extent of Isolated Wetlands

Applying a probability model (from step 2) to a distribution of extent of isolated wetlands (from step 1) yields an estimate of the percent of residual other waters where the agencies would assert jurisdiction. Exhibit 20 depicts this final step as a graph and Exhibit 21 shows the calculation for each category in the distribution for the sigmoidal (SIG model) and log (LOG model) relationships with a top level probability of 50 percent.

Exhibit 20. Application of Probability Model to Distribution of Extent of Isolated Waters

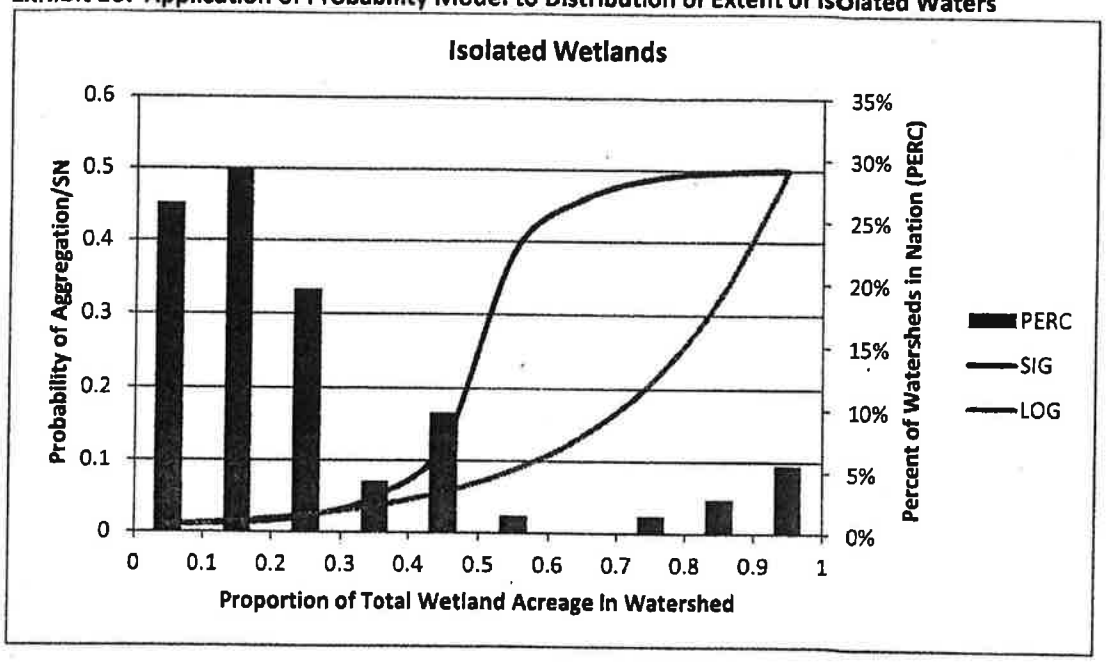


Exhibit 21. Calculation of National Estimate of Percent of Jurisdictional Residual Other Waters Under Proposed Rule

Proportion of Isolated Wetlands	Number of Study Areas (Tiner et al 2002)	Estimated Percent of National Watersheds[1]	Model Probability of Aggregation/Significant Nexus		
			LOG Model	SIG Model	LIN Model
90-100	4	6%	0.5	0.5	0.5
80-89	2	3%	0.323739	0.497198	0.445556
70-79	1	1%	0.209614	0.48812	0.391111
60-69	0	0%	0.135721	0.46026	0.336667
50-59	1	1%	0.087876	0.387231	0.282222
40-49	7	10%	0.056898	0.122769	0.227778
30-39	3	4%	0.03684	0.04974	0.173333
20-29	14	19%	0.023853	0.02188	0.118889
10-19	21	29%	0.015445	0.012802	0.064444
1-9	19	26%	0.01	0.01	0.01
TOTAL[2]	**72**	**100%**	**6%**	**8%**	**12%**

(1) Derived from the number of Tiner *et al,* 2002 study areas for each category of proportion of isolated wetlands.

(2) Model probability totals are the sum of probability multiplied by the estimated percent of national watersheds for each category of proportion of isolated wetlands

As described above, the top level probability can be changed. Exhibit 22 presented the results of each probability model for various top level probabilities. Not all these outcomes are considered likely, and not all outcomes are considered equally likely. The most likely estimates are for the LOG and SIG models with top level probabilities of aggregation/significant nexus between 0.4 and 0.6.

Exhibit 22. Various National Estimates of Percent of Jurisdictional Residual Other Waters Under Proposed Rule

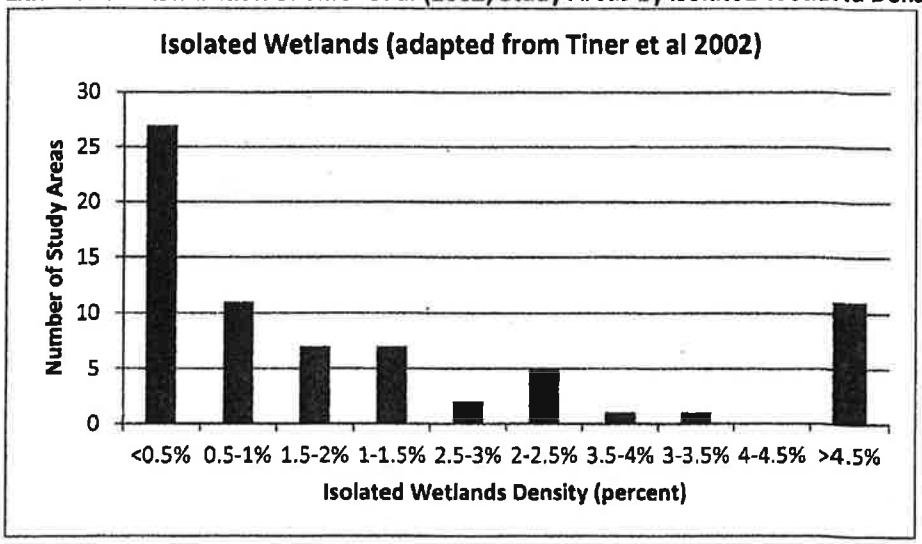
Top Level Probability	Total Model Probability of Aggregation/Significant Nexus		
	LOG Model	SIG Model	LIN Model
0.1	2%	2%	
0.2	3%	4%	
0.3	4%	5%	
0.4	5%	6%	
0.5	6%	8%	
0.6	7%	9%	
0.7	8%	11%	
0.8	9%	12%	
0.9			
1.0			

gray shading represents unrealistic assumptions,
orange shading represents best estimates

Alternative Model for Estimating Additional Incremental Other Waters

The approach described above uses the proportion of total wetland acreage in a watershed that are isolated as the proxy for both aggregation and significant nexus. However, additional information in Tiner *et al* (2002) allows consideration of a separate proxy for aggregation. Tiner *et al* (2002) present total acreage for each study area. A measure of isolated wetland density can thus be calculated as the quotient of isolated wetland acreage divided by total watershed acreage. The greater this "density", the more likely isolated waters that perform similar functions would be sufficiently close to be evaluated as a single landscape unit. Exhibit 23 shows the distribution of isolated wetland density for the 72 study areas. Isolated wetland density ranges from less than a tenth of a percent to nearly 11 percent.

Exhibit 23. Distribution of Tiner et al (2002) Study Areas by Isolated Wetland Density in Watershed



The same generalized probability models used above for proportion of total wetlands can be applied to these density categories for the aggregation step alone (see Exhibits 24 and 25). Without specific knowledge of a threshold density where aggregation would be more likely, a linear model may be most appropriate.

Exhibit 24. Probability Models for Isolated Wetlands Density

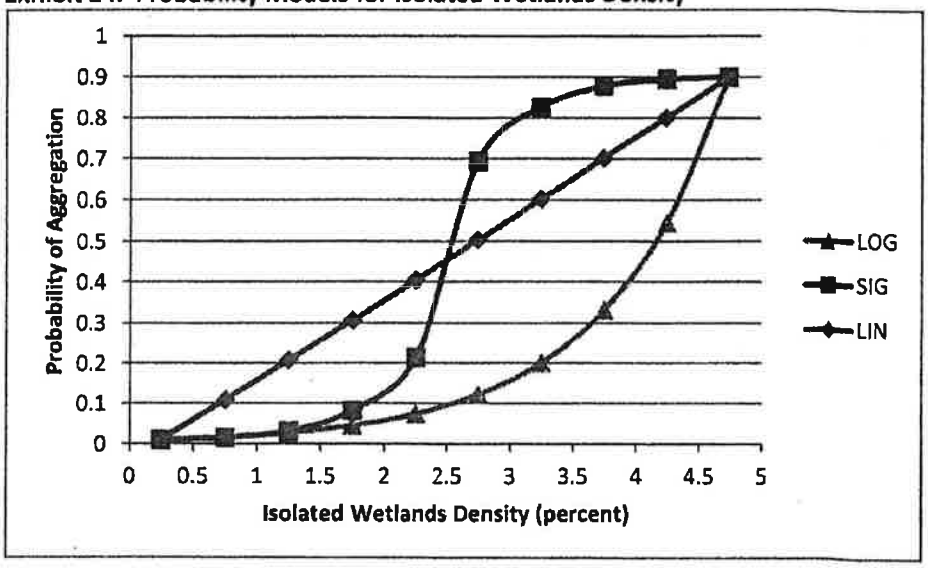
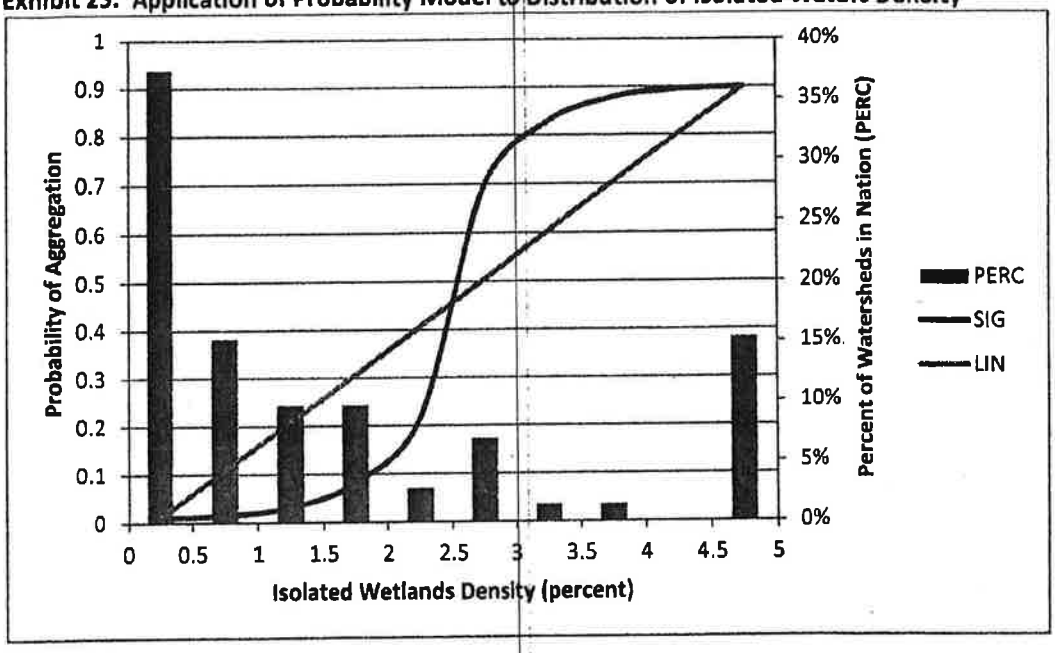


Exhibit 25. Application of Probability Model to Distribution of Isolated Waters Density



Calculation of the overall estimate of the percent of residual other waters where the agencies would assert jurisdiction using this alternative model pairs the probability of aggregation using isolated wetlands density with the probability of significant nexus using proportion of total wetland acreage for each watershed. After normalizing for the fraction of all watersheds that each study area watershed represents (one out of 72, or approximately 1.4 percent), the products of each probability are summed for a national total. This approach is more complex because it requires selection of a probability model for density and for proportion of total wetland acreage and a selection of top level probability for each step. However, this added complexity offers the analyst greater flexibility and the ability to independently assess each step. The approach may better represent watersheds where density and proportion of total wetland acreage diverge, and can help further identify an appropriate range of percent of residual other waters for the impact analysis.

Exhibit 26 shows the results for various model combinations and for various top level probability combinations. The overall top level probability is the product of the two component top level probabilities, as each applies sequentially. To be most comparable to the previous estimates, the overall top level probability should align with the top level probability associated with the most likely estimates derived from the simpler approach presented in Exhibit 22 (i.e., approximately 0.4 to 0.6).

Exhibit 26. Various National Estimates of Percent of Jurisdictional Residual Other Waters Under Proposed Rule Using Alternative Approach

Top Level Probability		Total Model Probability of Aggregation and Significant Nexus (Model Used for Density/Proportion Isolated)								
Dens./Prop.	Overall	LOG/LOG	LOG/SIG	SIG/LOG	LIN/LOG	SIG/SIG	LIN/SIG	LOG/LIN	SIG/LIN	LIN/LIN
0.5/0.5	0.25	1.1%	1.3%	1.5%	1.6%	1.8%	2.0%	2.1%	2.6%	2.9%
0.7/0.5	0.35	1.5%	1.8%	2.1%	2.3%	2.5%	2.7%	2.8%	3.6%	4.0%
0.9/0.5	0.45	1.9%	2.3%	2.7%	2.9%	3.2%	3.5%	3.5%	4.6%	5.1%
0.7/0.7	0.49	2.0%	2.5%	2.9%	3.2%	3.5%	3.8%	3.9%	5.0%	5.5%
0.9/0.7	0.63	2.6%	3.1%	3.7%	3.8%	4.4%	4.8%	4.9%	6.4%	7.0%
0.9/0.9	0.81	3.2%	4.0%	4.6%	4.8%	5.6%	6.1%	6.3%	8.1%	9.0%
1.0/1.0	1.00	3.9%	4.8%	5.5%	5.8%	6.9%	7.5%	7.7%	10.0%	11.0%

gray shading represents unrealistic assumptions, orange shading represents best estimates

This alternative approach tempers some of the previous estimates and indicates an upper bound estimate of 5 percent may be most likely. This analysis also further indicates that the agencies should not consider estimates beyond 10 percent. The agencies caution that the proxy values used in this analysis simply represent the best available information for this exercise, and should not be considered the means of determining aggregation or significant nexus in a case specific analysis.

Impacts of Additional Incremental Other Waters

The estimated impacts of asserting jurisdiction for 5 and 10 percent of residual other waters (non-adjacent waters) under the proposed rule are reflected in the scenarios described in Exhibit 27 below. Recall that residual other waters (non-adjacent waters) represent approximately 83 percent of other waters (the sample review exercise found 17 percent of other waters would be considered adjacent under the proposed policies).

The agencies also considered impacts from potential regulatory activity under the policies proposed that is not represented by ORM2 FY2009-2010 records. If a significant amount of waters are not included in the FY2009-2010 data because of presumed non-jurisdiction on the part of landowners and developers, then the overall percent increase in waters that become jurisdictional would be somewhat greater (other waters would represent more than 6 percent of the total records). To illustrate the effects of including waters not represented in ORM2 because potential applicants considered them non-jurisdictional and did not seek a jurisdictional determination, the agencies present the effect of doubling the number of other waters (effectively raising the share from 6 percent to 11 percent).

Exhibit 27 summarizes the various scenarios considered. Exhibits 28 and 29 present the results in terms of the effect on the range of total costs and benefits. The potential impact on all categories of costs and benefits are considered, not just the effect on mitigation, although those reflect the greatest degree of impact.

Exhibit 27. Scenarios for Consideration of Other Waters

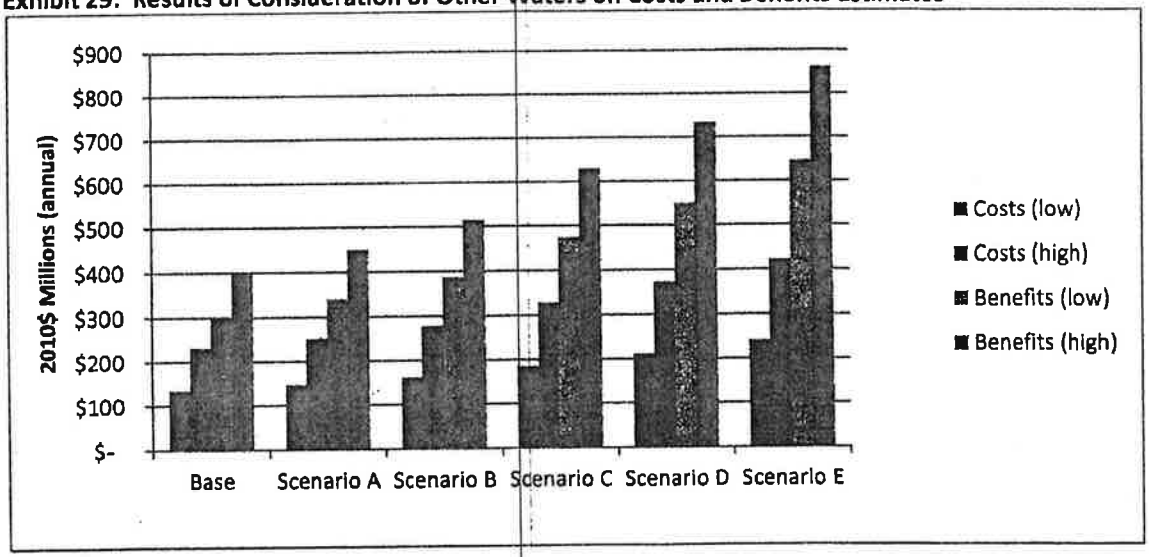
Scenario	Description
Scenario A	5% of non-adjacent other waters are jurisdictional under the proposed rule
Scenario B	10% of non-adjacent other waters are jurisdictional under the proposed rule
Scenario C	There are double the number of other waters
Scenario D	There are double the number of other waters AND 5% of non-adjacent other waters are jurisdictional under the proposed rule
Scenario E	There are double the number of other waters AND 10% of non-adjacent other waters are jurisdictional under the proposed rule

Exhibit 28. Results of Scenarios for Other Waters on Costs and Benefits Estimates

Scenario	Percent of Other Waters Jurisdictional	Overall Percent Increment in Regulatory Actions	Low Range of Costs (2010$ millions)	High Range of Costs (2010$ millions)	Low Range of Benefits (2010$ millions)	High Range of Benefits (2010$ millions)
Base	17%	2.7%	$ 134	$ 231	$ 301	$ 398
Scenario A	21%	2.9%	$ 146	$ 251	$ 339	$ 449
Scenario B	26%	3.2%	$ 162	$ 278	$ 388	$ 514
Scenario C	17%	3.5%	$ 185	$ 328	$ 474	$ 629
Scenario D	21%	4.0%	$ 211	$ 372	$ 551	$ 733
Scenario E	26%	4.5%	$ 241	$ 422	$ 647	$ 861

This assumes for scenarios C, D, and E that the doubling of records includes both adjacent other waters and non-adjacent other waters in the same proportions as the original set of records.

Exhibit 29. Results of Consideration of Other Waters on Costs and Benefits Estimates



The difference in costs between scenario E and scenario C from Exhibit 28, the highest estimate of the effect of asserting jurisdiction over residual other waters, is between $56-94 million per year. As shown on Exhibit 28 and 29, because estimated benefits would also rise with more wetland protection, benefits would continue to justify costs.

An alternative way of calculating the impact on costs and benefits is to assume that the doubling of other water records (scenarios C, D, and E) do not include any additional "adjacent other waters" (assuming these types of waters are adequately represented in the Corps records), and that only the additional percentages for residual "non-adjacent other waters" apply to the doubling of other water records for scenarios D and E. In this way, scenario C simply becomes equal to the base because no residual non-adjacent other waters are assumed jurisdictional under this scenario. Exhibit 30 presents these results.

Exhibit 30. Alternative Results of Scenarios for Other Waters on Costs and Benefits Estimates

Scenario	Percent of Other Waters Jurisdictional	Overall Percent Increment in Regulatory Actions	Low Range of Costs (2010$ millions)	High Range of Costs (2010$ millions)	Low Range of Benefits (2010$ millions)	High Range of Benefits (2010$ millions)
Base	17%	2.7%	$ 134	$ 231	$ 301	$ 398
Scenario A	21%	2.9%	$ 146	$ 251	$ 339	$ 449
Scenario B	26%	3.2%	$ 162	$ 278	$ 388	$ 514
Scenario C	8.5%	2.7%	$ 134	$ 231	$ 301	$ 398
Scenario D	13%	3.2%	$ 162	$ 278	$ 388	$ 514
Scenario E	18%	3.6%	$ 189	$ 325	$ 482	$ 640

This assumes for scenarios C, D, and E that the doubling of records includes only non-adjacent other waters, and that adjacent other waters are only represented in the original set of records.

These alternative results may represent the more likely outcomes. Using 5 percent as a most likely upper bound on percent of non-adjacent other waters, scenario D from Exhibit 30 (orange shading) represents the agencies best estimate of the total costs and benefits that can be quantified. The difference in costs between scenario D and scenario C, the most likely estimate of the effect of asserting jurisdiction over non-adjacent other waters, is between $28-47 million per year.

Appendix A: Supplemental Cost Analysis Information

Exhibit 31. State-Level Unit Costs for Wetland and Stream Mitigation

State	Incremental Wetland Mitigation (Acres)	Unit Cost Per Acre of Wetland Mitigated		Incremental Stream Mitigation (Linear Feet)	Unit Cost Per Linear Foot of Stream Mitigated	
		Low	High		Low	High
AK	5	$500	$15,250	25.5	$170	$243
AL	8.2	$10,000	$15,000	580	$350	$619
AR	7.1	$2,000	$3,500	680.2	$170	$243
AZ	0	$9,000	$16,000	4.5	$170	$243
CA	102.8	$18,500	$159,250	6514.4	$170	$243
CO	93	$32,000	$66,000	307.4	$170	$243
CT	4.4	$124,000	$142,000	0	$170	$243
DE	3.9	$40,000	$40,000	0	$170	$243
FL	87.3	$35,000	$90,000	194.9	$170	$243
GA	43.3	$12,000	$67,000	1718.1	$106	$200
IA	14.6	$15,000	$15,000	470.4	$170	$243
ID	8.8	$40,000	$40,000	787.1	$170	$243
IL	64	$40,000	$120,000	294.6	$170	$243
IN	78	$40,000	$60,000	2680	$170	$243
KS	7.1	$50,000	$50,000	8746.1	$170	$243
KY	12.4	$30,000	$30,000	854.8	$170	$283
LA	38.5	$15,000	$32,500	912.2	$170	$243
MA	0.2	$124,000	$142,000	0	$170	$243
MD	92.2	$11,000	$34,500	25.1	$250	$442
ME	2.3	$125,000	$137,000	73.8	$170	$243
MI	4.9	$40,000	$60,000	16.6	$170	$243
MN	73.7	$4,000	$47,500	17.9	$170	$243
MO	18.3	$15,000	$20,000	825.2	$90	$145
MS	4.2	$3,000	$14,000	252.4	$170	$243
MT	9.5	$40,000	$40,000	150.4	$170	$243
NC	18.3	$23,000	$42,500	743.5	$256	$297
ND	279.3	$15,000	$15,000	123.7	$170	$243
NE	32.7	$15,000	$15,000	89.4	$170	$243
NH	2.3	$138,000	$168,000	5616.6	$170	$243
NJ	6.6	$80,000	$240,000	0	$170	$243
NM	2.7	$40,000	$50,000	196.4	$170	$243
NV	45.9	$55,000	$60,000	124.6	$170	$243
NY	134.7	$50,000	$60,000	852.6	$170	$243

State	Incremental Wetland Mitigation (Acres)	Unit Cost Per Acre of Wetland Mitigated		Incremental Stream Mitigation (Linear Feet)	Unit Cost Per Linear Foot of Stream Mitigated	
		Low	High		Low	High
OH	159.6	$15,000	$15,000	1526.6	$170	$243
OK	6.1	$12,000	$31,000	793.9	$170	$243
OR	11.7	$43,000	$84,000	23.1	$170	$243
PA	83	$12,000	$13,500	4151.3	$170	$243
RI	0.4	$124,000	$142,000	0	$170	$243
SC	107.9	$25,000	$62,500	52.7	$75	$138
SD	65.8	$15,000	$15,000	0	$170	$243
TN	10.6	$7,000	$13,500	878.7	$50	$125
TX	69.8	$15,000	$30,000	3491.5	$80	$142
UT	19.4	$55,000	$60,000	280.8	$170	$243
VA	22.2	$16,000	$78,000	1107.4	$300	$600
VT	4.6	$110,000	$121,000	0	$170	$243
WA	6	$100,000	$175,000	130.6	$170	$243
WI	81.9	$40,000	$40,000	0	$170	$243
WV	33.7	$30,000	$45,000	2759	$400	$600
WY	54	$15,000	$15,000	1	$170	$243
National	**2,042**	**$24,989**	**$49,207**	**49,075**	**$177**	**$265**

Exhibit 32. Labor Rates for Private Industry and Local, State, and Federal Government Positions

Position	Occupational Code[1]	Mean Hourly Wage[1]	Benefits Adjustment Factor[2]	Year Adjustment[3]	Total Hourly Adjusted Wage
Private Industry					
Environmental Scientist	19-2041	$35.32	1.292	1.0198	$46.54
Environmental Engineer	17-2081	$39.89			$52.56
Administrative Assistant	43-6011	$23.16			$30.52
Lawyer	23-1011	$65.65			$86.50
Economist	19-3011	$59.48			$78.37
Local Government					
Environmental Scientist	19-2041	$28.86	1.319	1.0258	$39.05
Environmental Engineer	17-2081	$35.89			$48.56
Administrative Assistant	43-6011	$22.03			$29.81
Lawyer	23-1011	$43.77			$59.22
Economist	19-3011	$34.27			$46.37
State Government					
Environmental Scientist	19-2041	$27.15	1.319	1.0258	$36.73
Administrative Assistant	43-6011	$18.82			$25.46
Environmental Engineer	17-2081	$31.96			$43.24
Lawyer	23-1011	$39.78			$53.82
Economist	19-3011	$27.38			$37.05
Federal Government					
Environmental Scientist	19-2041	$45.05	1.3	1.0224	$59.88
Administrative Assistant	43-6011	$26.76			$35.57
Environmental Engineer	17-2081	$46.35			$61.60
Lawyer	23-1011	$61.32			$81.50
Economist	19-3011	$51.04			$67.84

1. Occupational codes and mean hourly wage from BLS (2009). Bureau of Labor Statistics (BLS), United States Department of Labor. 2009. Occupational Employment and Wages, December 2010. http://bls.gov/oes/2009/may/oes_nat.htm

2. Adjusted for benefits according to the Employment Cost for Employee Compensation Index for professional and related for private industry, local and state employees, and civilian workers.

3. Escalated to 2010 dollars using the Employment Cost Index for private industry (September 2010 = 113.3; June 2009 = 111.1), state and local employees (September 2010 = 115.3; June 2009 = 112.4) and civilian workers (September 2010 = 114.1; June 2009 = 111.6).

Appendix B: Supplemental Benefit Estimate Information

Exhibit 33. Summary of Environmental Benefits by Wetland Types and Other Isolated Waterbodies Potentially Affected

Wetland Type	Distribution	Region	Environmental Benefits	Primary Threats
Rainwater Basin Wetlands	Southern Nebraska	Interior West	Very important habitat for waterfowl, Food chain support, Nutrient retention, Flood storage, Sediment trapping and shoreline anchoring	Agricultural activities such as drainage, clearing, and groundwater pumping
Sandhills Wetlands	North-Central and Northwestern Nebraska	Interior West	Habitat for migratory waterfowl and many threatened and endangered species	Ditching of wet meadows and cattle grazing
Prairie Potholes	North-Central U.S. (Iowa/South Dakota into Canada)	Midwest	Recharge and discharge areas for local groundwater flow and regional surface water flow; A great deal of storm water storage and flood protection; Concentric rings of vegetation zones create unique habitat areas; Waterfowl habitat (10% of breeding area; half of waterfowl); availability of large numbers of small wetlands allows dispersal	Agriculture, irrigation, and flood control projects
Alvar Wetlands	Great Lakes region	Midwest	Provide habitat to rare species and a variety of hydrophytes	Quarrying, rural development, all-terrain vehicles, and construction of cottages, vacation homes, and trailer parks
Woodland Vernal Pools	Northeastern U.S.	Northeast	Fluctuating water level prohibits establishment of fish populations, providing excellent breeding ground for amphibians and other species that spend most of their lives in the wooded areas around the pools	Often destroyed for development (since they are small and surrounded by upland), and are sometimes used as storm water detention basins. Drainage from agricultural fields or residential areas.

Wetland Type	Distribution	Region	Environmental Benefits	Primary Threats
Delmarva Potholes	Delmarva Peninsula (Maryland, Delaware)	Northeast	Support populations of large quantities of amphibians and rare and endangered plants; Temporary storage of surface water and flood protection; Recharge regional groundwater supplies during dry periods	Drainage associated with agriculture or silviculture, and some development
Kettle-hole Wetlands	New England and Midwest, north to Canada and Alaska	Northeast/ Midwest/ Alaska	Habitat for unique boreal plant species	Peat mining, drainage, and conversion to open waterbodies or commercial cranberry bogs; introduction of nutrients from lawn runoff
Wetlands of Washington's Channeled Scablands	Eastern Washington (Cascade Mountains)	Pacific Coast	Habitat and staging grounds for migratory waterfowl; Habitat for resident waterfowl and some endangered plants	Impacts from livestock (cattle use as wallow) and overgrazing; some are drained and converted to hayfield or pasture.
Former Floodplain Wetlands	Alaska	Alaska	Important havens for waterfowl	
West Coast Vernal Pools	Southern Oregon to Northern Baja Mexico	Pacific Coast	Unpredictable flooding patterns promote endemism, creating unique flora and fauna, including many endangered species	Increasing urbanization and agricultural impacts
Pocosins	Atlantic-Gulf Coastal Plain, from Virginia to Florida	Southeast	Temporary storage of surface water to avoid quick runoff in estuaries (giving them time to assimilate freshwater); Habitat for many rare and endangered animal species	Ditching for drainage to increase timber production; agricultural conversion
Cypress Domes	Florida and Southern Georgia	Southeast	Maintain regional biodiversity by providing important breeding grounds (especially for amphibians); Surface water storage, flood prevention, and groundwater recharge	Development, including conversion to residential subdivisions, commercial sites, and gold courses; drying out increases susceptibility to fire.

Exhibit 34. Types of Benefits Associated with Environmental Policies

Category	Examples	Valuation Methods
Human Health Improvements		
Mortality risk reductions	Reduced risk of fatality from cancer and acute health risks	Averting behavior, hedonics, stated preference
Morbidity risk reductions	Reduced risk of nonfatal illness	Averting behavior, hedonics, stated preference, cost of illness
Ecological Improvements		
Market products	Harvests or extraction of food, fuel, fiber, timber, fur, and leather	Production function
Recreation activities and aesthetics	Wildlife viewing, fishing, boating, swimming, hiking, scenic views	Production function, averting behaviors, hedonics, recreation demand, stated preference
Valued ecosystem functions	Climate moderation, flood moderation, groundwater recharge, sediment trapping, soil retention, nutrient cycling, pollination by wild species, biodiversity, water filtration, soil fertilization, pest control	Production function, averting behaviors, stated preference, hedonics
Nonuse values	Relevant species populations, communities, or ecosystems	Stated preference
Other Benefits		
Aesthetic improvements	Visibility, taste, odor	Averting behaviors, hedonics, stated preference
Reduced materials damage	Reduced soiling and corrosion	Averting behaviors, production function, cost function, hedonics

Source: U.S. EPA (2010b; Table 7.1)

Summaries of Holistic Wetland Benefit Studies Used to Generate WTP Estimates

Azevedo et al. (2000) conducted a survey to understand how residents of Iowa value wetlands, specifically with regard to the following functions: wildlife viewing, fishing, biking, hiking, waterfowl and upland hunting. The 5-part survey collected information regarding wetland visitation patterns, perceived benefits and costs associated with wetlands, socioeconomic characteristics of respondents, and their WTP for preservation of existing wetlands and restoration of additional wetlands via two specific programs: the Prairie Pothole Joint Venture (PP) and the Iowa River Corridor Project (IRCP). The authors used contingent valuation to evaluate WTP for restoring additional wetlands through PP and ICRP. Results indicated that approximately 50% of Iowans would pay $25 in support of PP and less than $10 for ICRP (2000 dollars).

Mullarkey and Bishop (1999) conducted a study of WTP for a hypothetical rerouting of a highway expansion that would preserve 110 acres of wetlands in Wisconsin. The wetlands in question provide a range of services including flood control, water purification, bird/wildlife habitat, and for a portion of the affected wetlands, fish habitat. The study reported six estimates of WTP ranging from $13.68 to $57.83 (1999 dollars) depending upon whether respondents were informed that mitigation would be taking place if the wetland were destroyed and the degree of certainty respondents expressed in their answers.

Poor (1999) examined WTP to increase the area of wetlands in Nebraska's rainwater basin by an average of 41,000 acres across multiple survey versions. The basin is a large complex of 34,000 wetland acres, and a plan is already in place to create an additional 25,000 wetland acres. Wetland services in this study included flood control, water quality improvement, wildlife production and habitat, and bird watching/hiking. Median and mean household WTP were $4.17 and $21.05 (1995 dollars), respectively.

Blomquist and Whitehead (1998) conducted a contingent valuation study to estimate the value of four wetlands in Western Kentucky with differing characteristics. One was a freshwater marsh, one was a temporarily flooded bottomland hardwood forest, one was a seasonally flooded bottomland hardwood forest, and one was a bald cypress swamp. Wetland functions included flood control, water quality improvements, and wildlife production/habitat. WTP ranged from $1.69 (1990 dollars) for Flat Creek, a freshwater marsh, to $11.21 (1990 dollars) for Cypress Creek, a cypress swamp.

Roberts and Leitch (1997) conducted a contingent valuation study of the value of Mud Lake, a managed lacustrine wetland on the border of Minnesota and South Dakota. This study used a discrete choice survey to determine use, option/bequest, and existence values for Mud Lake. Use values, defined as WTP for management for water related recreation and fish/wildlife habitat ranged from $22,699 to more than $44,736 (1997 dollars) for all respondents in the sample. Option/bequest values ranged from $25,795 to more than $52,750 (1997 dollars) for all respondents in the sample. Existence values ranged from $18,508 to more than $40,451 (1997 dollars) for all respondents in the sample. Total overall median willingness to pay for the sample was estimated to be $102,000 (1997 dollars).

Dillman et al. (1993) estimated the WTP for preservation of 2,500 acres of wetlands in the Francis Biedler forest of South Carolina using dichotomous choice contingent valuation method. The study examined three types of wetland: frequently flooded bottomland (cypress-tupelo swamp), infrequently flooded bottomland hardwood forest, and nonbottomland pine plantation with hardwood runners.

Wetland Type	Distribution	Region	Environmental Benefits	Primary Threats
Sinkhole Wetlands	Karst landscapes (Southern U.S.)	Southeast	Productive amphibian breeding grounds, including for some endangered species; Unique habitat for cave-adapted animals	Water pollution from runoff or direct discharge, groundwater withdrawal, impoundment of local streams, timber harvest, fish stocking, and agricultural and residential development.
Carolina Bay Wetlands	Atlantic-Gulf Coastal Plain, from Virginia to Florida	Southeast	Habitat for abundant amphibian populations; Critical aquatic habitat for many species during droughts	Drainage for crop production
Coastal Zone Dune Swale and Deflation Plain Wetlands	U.S. Coastlines	Southeast/ Northeast/ Pacific Coast	Support a variety of hydrophytic plants (since they intersect groundwater tables); Food and habitat for migrating waterfowl; Habitat for a variety of species, including some unique	Residential housing, golf courses, and resort development
Coastal Plain Ponds	Atlantic-Gulf Coastal Plain	Southeast/ Northeast	Fluctuating water levels and vegetation in concentric rings provide habitat supporting unique species	Coastal development, waste dumping, all-terrain vehicles, water withdrawal, and pollution from adjacent development.
Playas	Deserts, semi-arid prairies in Southwest (Texas and New Mexico)	Southwest	Characteristic fluctuating water levels promote nutrient cycling and biological productivity; Wintering grounds for waterfowl and shorebirds; Vital habitat for amphibians.	Poor water quality from adjacent crop land, discharge of water from oilfields, and effluent from livestock operations such as cattle feedlots; sedimentation from farmland, pit construction, and overgrazing
Salt Flat and Salt Lake Wetlands	Great Basin region – Nevada and Utah	Southwest	Food and habitat for wildlife in an otherwise arid area	Road and utility construction; development pressures in urban areas

Wetland Type	Distribution	Region	Environmental Benefits	Primary Threats
Desert Springs and their Wetlands	Southwest (California, Arizona, Nevada)	Southwest	Isolated populations of endemic species	Pumping of groundwater for agriculture and energy development lowers water levels

Source: USFWS (2002)

These wetlands served the following functions: flood control, wildlife habitat, recreational activities, water supply, and aesthetic value. The mean WTP estimated was $16.74 (1993 dollars) per household (ranging from $6.82 for infrequently flooded bottomland hardwood forests to $19.57 for pine plantations with scattered hardwood runners).

Whitehead and Blomquist (1991) utilized contingent valuation to examine Kentucky residents' WTP for preservation of the Clear Creek wetland, a large natural wetland with hardwood trees, standing water, and nonwoody vegetation. The wetland provides a range of services including water quality maintenance, fish and wildlife habitat, flood and sediment control, groundwater recharge, biological productivity and outdoor recreation. The study used three different survey versions consisting of two WTP questions each, with the difference in each case reflecting a difference in information presented about the wetland quality that would result if Clear Creek is not preserved. WTP values ranged from $5.09 to $16.61 (1991 dollars) under the scenario discussing preservation and reclamation of Clear Creek itself, and from $3.75 to $8.13 (1991 dollars) under scenarios discussing preservation of other wetlands concurrent with reclamation of Clear Creek.

Johnson and Linder (1986) conducted a contingent valuation study to estimate the value of wetlands in South Dakota as a recreational resource for resident hunters. The study examined wetlands statewide, the majority of which are located in the eastern part of the state. Their results indicated that the total value for waterfowl, upland, big game, and predator hunting in South Dakota wetlands in 1986 dollars was $34 million, and that the average total per user value of wetlands was $289.90 for a single hunting season.

Loomis et al. (1991) studied California residents' willingness to pay additional taxes to preserve and restore wetlands in California's San Joaquin Valley. The study's focus was wetlands as a habitat for migratory birds. The study found that average annual household willingness to pay for a program to prevent further degradation of an existing 85,000 acres of wetlands was $174 in the San Joaquin Valley and $152 in the rest of the state, and willingness to pay for a program including both maintenance of existing acreage plus the restoration of an additional 40,000 acres was $286 in the San Joaquin Valley and $251 in the rest of the state (1990 dollars). The study also examined a program to reduce and prevent further pollution of wildlife habitat in the region, and to increase Chinook salmon populations.

Lant and Tobin (1989) studied willingness to pay higher state sales tax to improve water quality of riparian corridors in Iowa and Illinois. The study examined three river corridors utilizing face-to-face interviews: the Edwards River in Illinois, the South Skunk River in Iowa, and the Wapsipinicon River in Iowa. Value per person for improvement of quality in the Edwards River to that in the South Skunk was $8.85 per year, and value per person for improvement of quality in the South Skunk River to that in the Wapsipinicon was $20.37 per year. This study had a very small sample size.

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Exhibit 35. Studies of WTP for Preservation of Wetlands with Characteristics of Isolated Wetlands

Study	Publication Type	Year of Reported Dollar Values[2]	Location	Study Type	Survey Population	Response Rate
Azevedo et al. (2000)	Report	2000	IA	CVM, travel cost[3]	Random sample of Iowa residents statewide, additional random sample of a targeted group of hunters/anglers	58.1%[4]
Mullarkey and Bishop (1999)	Presentation	1999	WI	CVM	Random sample of Wisconsin residents statewide	43.5%
Poor (1999)	Journal article	1995	NE	CVM	Random statewide sample of Nebraska households	46%
Blomquist and Whitehead (1998)	Journal article	1990	KY, IN, TN, IL, MO	CVM	Random dialing of households in Western Kentucky and nearby areas of Indiana, Tennessee, Illinois and Missouri from phone directories	66.7%
Roberts and Leitch (1997)	Report	1997	MN, SD	CVM	Minnesota and South Dakota households within a 30-mile radius of Mud Lake	62%
Dillman et al. (1993)	Report	1993	SC	CVM	Random sample of South Carolina households statewide	21%
Loomis et al. (1991)	Book chapter	1991	CA	CVM	Random telephone samples of California households statewide including random sample of targeted group, San Joaquin Valley residents	51%
Whitehead and Blomquist (1991)	Journal article	1991	KY	CVM	Random cluster sample of Western Kentucky households from phone directories	31%
Lant and Tobin (1989)	Journal article	1989	IA, IL	CVM	In person interviews with residents of towns near the three rivers surveyed	Not available

Study	Publication Type	Year of Reported Dollar Values[2]	Location	Study Type	Survey Population	Response Rate
Johnson and Linder (1986)	Journal article	1986	SD	CVM	One percent random sample of a targeted group, South Dakota anglers and hunters statewide	61%

1. Excludes studies of tidal wetlands or wetlands adjacent to navigable waters.
2. Where studies provided only the year a survey was conducted and did not specify dollar value years, we assumed publication year dollars rather than data year dollars, as this is the more conservative assumption.
3. Non-CVM methodology estimates were excluded from meta-analysis.
4. 58.1% represents average overall response rate for Azevedo et al. The response rate for the Prairie Pothole version of the survey was 58.9% and the response rate for the Iowa River Corridor version was 56.5%.

Exhibit 36. WTP for Preservation of Wetlands

Study	Wetland Type	Wetland Area (acres)	WTP [2,3]	WTP Description
Azevedo et al. (2000)	Depression/ isolated, Riverine/ floodplain	7,000 and 2,500 [4]	$12.66 - $31.66	Iowa residents' WTP to preserve and restore wetlands through the Prairie Pothole Joint Venture and Iowa River Corridor Project
Mullarkey and Bishop (1999)	Depression/ isolated, Riverine/ floodplain	110	$247.10 - $460.69	Individual WTP for a hypothetical rerouting of a highway expansion that would preserve 110 acres of wetlands in Wisconsin
Poor (1999)	Depression/ isolated	41,000	$415.86 - $774.98	WTP to increase the area of wetlands in Nebraska's rainwater basin by an average of 41,000 acres
Blomquist and Whitehead (1998)	Emergent, Forested	500	$38.92 - $481.20	Household WTP for four wetlands with differing characteristics in western Kentucky
Roberts and Leitch (1997)	Emergent	5,000	$124.59 – 232.29	Annual value to households of Mud Lake, a managed lacustrine wetland on the border of Minnesota and South Dakota
Dillman et al. (1993)	Forested	2,500	$26.02	South Carolina households' one-time WTP for preservation of one of three 2,500 acre wetlands in the Francis Biedler forest of South Carolina
Loomis et al. (1991)	Riverine/ floodplain	85,000 and 125,000 [5]	$243.35 - $278.57 and $401.85 – $457.89	Annual California household WTP taxes to protect and restore San Joaquin Valley wetlands
Whitehead and Blomquist (1991)	Forested	5,000	$112.46 - $684.23	Kentucky households' WTP for preservation of the Clear Creek wetland, a large natural wetland with hardwood trees, standing water, and nonwoody vegetation
Lant and Tobin (1989)	Riverine/ floodplain	1,406 and 1,663 [6]	$23.05 - $212.79	Individual WTP in Illinois and Iowa to improve water quality in the Edwards River to that in the South Skunk River, and to improve water quality in the South Skunk River to that in the Wapsipinicon River.

Study	Wetland Type	Wetland Area (acres)	WTP[2,3]	WTP Description
Johnson and Linder (1986)	Emergent	1,307,187	$576.77	South Dakota hunters' individual WTP for wetlands statewide for hunting, the majority of which are located in the eastern part of the state

1. Excludes studies of tidal wetlands or wetlands adjacent to navigable waters.
2. For studies that provide only the year a survey was conducted and did not specify dollar value years, EPA assumed publication year dollars rather than data year dollars, as this is the more conservative assumption.
3. If entity is not specified, EPA assumed WTP is on an individual basis. If frequency of payment is not specified, EPA assumed WTP is in terms of a one-time payment.
4. Azevedo et al. present WTP values for two different study areas, sized 7,000 acres and 2,500 acres.
5. Loomis et al. present WTP values to preserve existing wetlands of 85,000 acres and to preserve that acreage plus increase acreage by 40,000 to a total of 125,000.
6. Lant and Tobin present WTP values for two different riparian corridors with different acreage.