Cost – Benefit Analysis of Proposed Changes to the Freshwater Wetlands Regulations

October 2020

1.0 Purpose

This document presents the required cost-benefit analysis pertaining to draft revisions to state regulations governing freshwater wetlands jointly proposed by the RI Department of Environmental Management (DEM) and the Rhode Island Coastal Resources Management Council (CRMC) within their respective agency authorities. It has been prepared to comply with Executive Order 15-07 as administered by the Office of Regulatory Reform and with related rule-making requirements of the RI Administrative Procedures Act (RIGL 42-35). The document provides background on the proposed freshwater wetland rule changes and options considered, description of methods for estimating cost and benefits associated with rule changes and the results of the analysis. Discussion of fiscal impacts to state and local agencies is also included. The cost-benefit analysis was developed using existing information that was available to the agencies. Estimates were made for a twenty-year period. Based on the analysis summarized as a Net Present Values (NPV), the Agencies, DEM and CRMC, have determined that the societal benefits accrued annually as various ecosystem services are significantly larger than the estimated societal costs. For Option 3 recommended by the Agencies, the estimated NPV of additional societal benefits ranged from $545,549,400 to $1,502,648,400. (See Section 8.0)

2.0 Background

2.1 Legislative Task Force & Statutory Mandates – Rhode Island's freshwater wetlands resources include its rivers, streams, lakes and ponds as well as swamps, marshes, bogs, fens and vernal pools. About sixteen percent (16%) of Rhode Island's land area consists of freshwater wetlands (including lakes and ponds) which are distributed throughout the state and often interconnected within the landscape although some, including certain vernal pools, exist in insolated locations. In 2015, state law (R.I. Gen. Laws §§ 2-1-18 through 2-1-28) was amended to strengthen the protection of freshwater wetland resources while streamlining the regulatory framework applicable to projects and activities taking place near wetlands. Implementation of the law required the agencies (DEM and CRMC) to undertake rulemaking. The new law was based on the findings and recommendations of a Legislative Task Force (LTF) previously established by R.I. Gen. Laws § 42-64.13-10 in 2013. The LTF was charged with evaluating the adequacy of protection of Rhode Island freshwater wetlands considering both the state and local level, evaluating if gaps in that protection exist based on current scientific data and recommending changes in law or regulation that could foster a business climate to grow the economy while ensuring protection of our natural resources. The LTF found that 25 of 39 municipalities in RI has adopted a local ordinance that imposed requirements related to

wetland buffers or onsite wastewater treatment system (OWTS) setbacks in addition to those imposed by state regulatory programs resulting in a system of overlapping regulations. In December 2014, the LTF issued its Final Report which documented its findings and made several recommendations to strengthen the protection of wetlands while also streamlining the duplicative permitting procedures among state and municipal government. The full report is available at:
http://www.planning.ri.gov/documents/LU/legtask/2015/LTF_Final_Report_2014.pdf

Among the key findings, the LTF found the following:

- The 1971 Wetlands Act contains significant gaps and was not adequate to protect some wetlands.
- In general, setbacks standards for OWTS are sufficiently protective.
- The State authority for regulating development and other alterations in proximity to wetlands should be expanded while eliminating the dual oversight of freshwater wetlands at the municipal level.
- The clarity and consistency of terminology used in State Regulations should be improved.

As noted above, building on the report, legislation to implement the LTF recommendations was adopted in 2015. The new law acknowledged the important functions and values of freshwater wetlands, the need to strengthen wetland protection and the need to protect and regulate the area adjacent to wetlands. The law also recognized the benefits of having a single set of wetland protection standards administered at the state level. Key provisions of the new law include:

- Strengthens wetland protection administered at the State Level while eliminating the duplication of effort at the local level.
- Expands the jurisdiction of state agencies and requires the promulgation by rule of standards for wetland buffer and setbacks.
- In establishing buffer standards, provides flexibility to assign variable levels of protection by considering existing land use and resource characteristics.
- Re-defines and clarifies terminology and promotes common terminology among DEM and CRMC programs.
- Maintains existing definition of “Farmer” and associated permitting exemptions.
- Establishes new requirements for state agencies to share information with municipalities.

In response to the amended law, DEM and CRMC undertook an extensive effort to develop proposed revisions to existing state wetland regulations to fulfill the statutory mandates.

2.2 Effect of Changes in Definitions - It is important to understand the changes in the definition of key terms and how these terms are used in the proposed rules and cost- benefit analysis.

Under the older law (before 2015 revisions), the land area adjacent to certain wetlands (bogs, fens, marshes ≥ 1 acre and swamps ≥ 3 acres as well as lakes, ponds, and streams were designated as "perimeter wetlands" and "riverbank wetlands". These areas were then captured under the definition of freshwater wetland. For the purpose of this cost-benefit analysis, perimeter and riverbank wetlands are considered the buffer zone areas associated with the current regulations. Under the revised law, new terms are defined and form the basis for a modified regulatory framework. This is applicable to projects and activities with an exception for certain farming activities. Under the new law, the new framework introduces the concept of a defined **Jurisdictional Area (JA)** which designates land areas to be regulated by either RIDEM or CRMC for the purposes of freshwater wetland protection. The JA, which is non-discretionary, includes freshwater wetlands, buffers, floodplains, areas subject to storm flowage, areas subject to flooding, and contiguous areas that extend outward:

1) Two hundred feet (200') from the edge of a river or stream;
2) Two hundred feet (200') from the edge of a drinking water supply reservoir; and
3) One hundred feet (100') from the edge of all other freshwater wetlands

The definition of **Freshwater Wetlands** is revised to refer to *only the wetland resources* (i.e. bog, marsh, swamp, vernal pool, pond, river, etc.). The use of the terms perimeter and riverbank wetland is eliminated with these areas now falling within the JA.

With respect to the land adjacent to wetland resources, the rules introduce and use new terms:

- **Buffer Zone** - An area of land within a jurisdictional area that is contiguous to a freshwater wetland and extending outward from the freshwater wetland to a distance that is established in regulation as part of the buffer standards.

- **Buffer** - An area of undeveloped vegetated land adjacent to a freshwater wetland that is to be retained in its natural undisturbed condition, or land that is to be created to resemble a naturally occurring vegetated area.

In accordance with the changes in the law, the proposed rules designate certain land adjacent to wetland resources as buffer zones and the buffer standard limits land disturbance within buffer zones to optimize protection of vegetated buffers including existing naturally vegetated areas or those that might be created. (Note: Due to existing development, not all land within designated *buffer zones* qualifies as vegetated *buffer*.)

2.3 Rhode Island Wetland Buffer Functions and Values –Collectively freshwater wetlands and their adjacent natural buffers perform functions in the landscape that are highly valued by society. (ELI, 2018; EPA,2002; Tompkins County, 2007; Young, N., 2016). Many of these functions constitute ecosystems services that humans derive from wetlands and their buffers as part of the Earth's "natural capital". Reflected in both state law and regulation, the benefits associated with the functions and values of wetland buffers are briefly described as follows:

***Flood Protection & Climate Resilience*:** Protection of freshwater wetlands and their buffers, as well as any additional floodplain area, is important to reducing financial losses associated with flooding. (Watson, 2016) Flooding is the most prevalent and frequent natural hazard that impacts Rhode Island. All Rhode Island communities are subject to flooding. About 12% of the state's area, excluding coastal waters, has been identified as high- risk flood hazard areas. (RIEMA, 2014) Flooding in Rhode Island can result from a variety of situations, including spring snow melt combined with heavy rains, coastal storms, "nor'easters", tropical storms or hurricanes. Both the Blackstone and Pawtuxet River watersheds have long histories of flooding. Wetlands and buffer vegetation provide flood storage, serve to slow the velocity of floodwaters and anchor shorelines to reduce erosion. (USEPA, 2006)

***Water Supply (Quantity and quality of drinking water supplies)*:** Wetlands and their buffers are important to sustaining and protecting the source waters society relies on for drinking water supplies. The vegetation and soils in buffers and wetlands do this by filtering, storing and providing natural treatment of pollutants including sediments and nutrients. (USEPA, 2006) In surface water reservoirs, excess nutrients can lead to eutrophic conditions characterized by algal blooms. Algae causes many issues with water treatment plant operations including but not limited to clogging of intake screens, fouling of weirs and disruption of floc settling among others. Poor source water conditions can lead to higher treatment costs. The proposed expansion of buffers on rivers and streams that are tributary to public drinking water supply reservoirs provides added protection of source water quality in Rhode Island. The public water systems utilizing these reservoirs service 884,020 customers including residential, workplace and transient needs. (RIDOH, 2016) The pollutant removal function of wetlands and their buffers also benefit water suppliers that rely on the withdrawal of groundwater. Rhode Island has 22 major sand and gravel aquifer that support wellfields for public water suppliers.

***Water Quality Protection*:** Wetlands and buffers function to protect the quality of all surface and groundwaters. The pollutant removal functions described above for drinking water also result in protection of the other beneficial uses of Rhode Island's water resources. These uses include swimming and other recreational activities, fish and wildlife habitat, fish consumption and other water supply uses including agricultural irrigation. In addition to the pollutant abatement function described above, wetland buffers provide shading which helps keep streams temperatures cool. This is important to sustaining valued native fisheries including brook trout.

***Fish and Wildlife Habitat and Biodiversity*:** Wetlands and their buffers provide important habitat for a diversity of plant and animal species. Many species depend entirely on wetlands to survive, while for others it may be critical for a specific life stage; e.g. breeding. Many animal species utilize wetlands and buffers for feeding, nesting and shelter(cover), reproduction, migration stop-overs or for wintering habitat. Nationally, nearly half of all federally recognized threatened and endangered species live only in wetlands or depend on wetlands for some portion of their lives. (US Fish and Wildlife, 2009).

***Recreation and Aesthetics*:** Outdoor recreation is important to the quality of life in Rhode Island. It contributes positively to public health and has been especially encouraged during the pandemic. Wetlands and buffers support a wide range of outdoor recreational uses valued by society and constitute an important component of Rhode Island's recreation based tourism industry. Wetlands (including surface waters) support water -dependent activities such as swimming, kayaking, canoeing, boating and fishing which occurs year-round. Additionally, wetlands and buffers may support hunting, hiking, bird watching, nature photography and similar activities which are made more desirable by the proximity to wetlands and waterways. Open spaces conserved by federal, state and local entities typically contain water features including wetlands. State law also recognizes the aesthetic value provided by wetlands including scenic views. Proximity to waterbodies and associated wetlands, especially when maintained in good condition, typically adds to local property values.

Carbon Sequestration: With the growing management concerns related to a changing climate, the role of wetlands in the sequestration of carbon is another recognized function of wetlands that is also a topic of recent research. Freshwater wetland soils contain some of the highest store of soil carbon in the biosphere. (Nahlik, A., 2016) Using EPA national survey data, an analysis by researchers found that freshwater wetlands in the Upper Midwest and Eastern Mountain region, which includes RI, stored the most carbon due in part to deep organic sediments and cool temperatures. Additional analysis suggested that anthropogenic disturbance negatively affected soil carbon and that efforts to mitigate climate change should address the role of wetlands as climate regulators and include measures for the conservation of their associated carbon stocks. (Nahlik, A., 2016) Enhancing buffer protection is consistent with this finding.

The factors affecting wetland functions include the type, size, location and hydrologic setting of the wetland as well as the nature of the surrounding land uses including natural buffers. (Novitzki,R.P.,1996) Most wetlands perform multiple functions with even small wetlands able to provide high value; e.g. vernal pools. Often the functions are also interrelated and may support each other; e.g. maintenance of streamflow supports fish habitat. With respect to wetlands, the Environmental Protection Agency notes that determining the value of individual wetlands is difficult because they differ widely, do not perform all the same functions or perform the functions equally well. Accordingly, this cost-benefit analysis addresses the value of wetland buffers on statewide or regional scales.

2.4 Valuation of Ecological Services – There is a growing body of work focused on developing improved techniques for placing monetary values on our natural resources and the services they provide humans often referred to as "ecosystem services." The figure below shows the linkage between ecosystem functioning and benefits being derived. Researchers have reported that "the value of ecosystems services typically goes unaccounted for in business and policy decisions and in market prices" and much environmental degradation has been associated with "widespread under-appreciation of the importance of environmental capital for human well-

being..” (Holzman, D., 2012). The failure of markets to reflect the full costs related to ecosystems is due in part to the facts that: (i) many ecosystems provide services that are public goods; (ii) many ecosystem services are affected by externalities; and (iii) property rights related to ecosystems and their services are often not clearly defined. http://www.ecosystemvaluation.org.

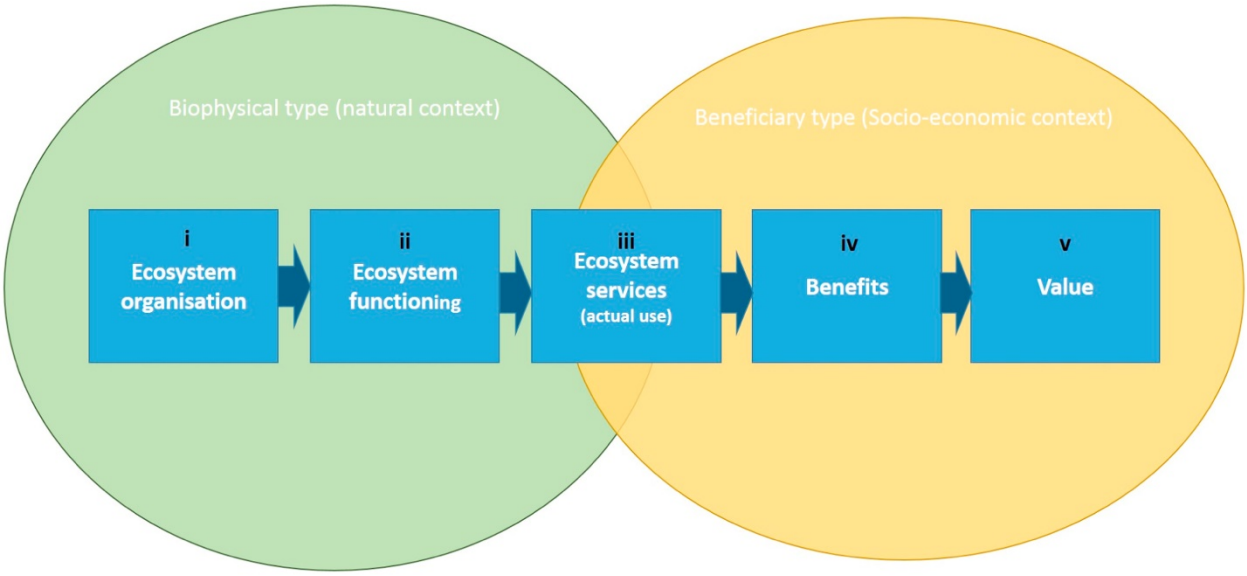


Figure 2-1. Source: Small, N., June 2016

Over the past two decades, ecosystem service science has emerged internationally as a promising framework for valuing ecosystem services. (Holzman, D. C.,2012) For example, initiated in 2007, the international initiative referred to as The Economics of Ecosystems and Biodiversity (TEEB) has produced a series of reports to guide decision-makers at the international, national and local levels. (www.teebweb.org). Stanford University has developed the InVEST model as tool for the integrated valuation of ecosystem services and tradeoffs. https://naturalcapitalproject.stanford.edu/invest/ For many individual ecosystem services, valuation approaches have been developed and applied to provide estimations of the value of the benefits being provided by the resource. Resource economists have developed and evaluated market and non-market valuation methods to characterize the benefits of ecosystem services that can be applied to the functions of buffers and wetlands. The topic remains an area of active research. A summary of approaches is found on the website: http://www.ecosystemvaluation.org Large-scale studies, development of models and continuing research have refined ecosystem valuation approaches and supported their broader application in policy and management decision-making. Studies to broadly document ecosystem services have been completed on a statewide scale in New Jersey, Delaware and Massachusetts.

Despite this progress, it remains a challenging, complex task to place a monetary value on the full range of benefits provided by wetlands and buffers. (Small, N., 2017) A recent economic

literature review specifically on buffers found that there are several gaps in our understanding of the economics of buffer management. It reported that "in general, vegetative buffers can have two opposing effects on property values." In some cases, improved water quality, habitat and aesthetics may increase property values on affected and nearby properties. In other cases, the lost development potential or degraded scenic views may reduce property value. The report noted that as "economic theory does not currently provide guidance on which effect will dominate and thus, it is not surprising the economic literature investigating the effect of buffers on housing prices have produced mixed results." (Bauer, D.M., 2017) Another gap in our understanding relates to the fact that not all ecosystem benefits have been equally evaluated. For example, while there is quite a bit of literature on water quality functions of buffers and estimates of their value at removing pollutants; e.g. pounds per acre of phosphorus, there are fewer studies that monetize the value of the biodiversity and wildlife habitat functions of wetland and their buffers. Bauer's review found no study that compared the costs and benefits of the full set of ecosystems serviced being provided by freshwater wetland buffers. This state of knowledge coupled with the limited resources available to conduct a cost-benefit analysis for these rules results in limitations that are further discussed in the methods section. In recognition of the limitations, ranges of estimated benefits and costs are presented.

3.0 Proposed Rule Changes

DEM and CRMC are proposing to repeal and replace the regulations governing freshwater wetlands. The changes in definitions affect the wording in all sections of the rules. Portions of the rules have been restructured to improve the organization of the regulations for the reader but have not been substantively modified. A summary of the changes in listed in Table 3-1. The major changes, which are the subject of the required cost-benefit analysis, are presented tin two sections: (3.1) establishment of statewide wetland buffer standards and (3.2) improvement to permit application processes are detailed below.

Table 3-1 Description of Key Changes in the Freshwater Wetland Rules

Section of Rule	**Description of Changes**
Applicability of Rules	Jurisdiction of the agencies expanded
Definitions	Definition of freshwater wetland was changed (in law); New terms introduced including jurisdictional area and buffer
Exemptions	Additional exemptions added or clarified
Protection Standards	New section created that consolidated wetland protection standards; New section specifying buffer standards;

	New rules specifying a variance procedure when certain standards cannot be met.
Application Types	New section authorizing general permits as part of streamlining regulatory process. (Specific general permits would be promulgated following adoption of new rules).
Fee Schedule	Simplified how certain fees are calculated.
Municipal notification and petition process	New rule required by law

3.1.0 Overall Approach to Buffer Standards - Within the jurisdictional areas authorized by law, the agencies were directed by statute to establish buffer standards. Consistent with the law and the LTF Report, in developing the requirements, including the buffer width, the agencies considered the resource characteristics, watershed protection needs and existing land use. Given the Rhode Island's existing land use pattern, it was apparent that applying the same protective buffer across all areas of the state, while administratively straightforward, would not always provide improved resource protection and would be considered burdensome in more densely urbanized areas on properties that lack an existing vegetated buffer to protect. The "one size fits all" approach was therefore rejected. It was further recognized that approaches with a significant amount of flexibility to better address ecological variability would result in greater complexity and higher administrative costs for the agencies. For example, an approach that involved site specific assessment in order to determine an appropriate buffer width was deemed impractical as well as not sufficiently clear and predictable for applicants. To devise an effective regulatory framework, the agencies conducted a number of analyses including but not limited to GIS analysis of watershed land use characteristics, e.g. extent of development, impervious cover, presence of cold water streams, etc., and categorization of wetland types relative to their ecological value, sensitivity and extent. Information from the 2015 RI State Wildlife Action Plan (RIDEM, 2015), including the mapping of Conservation Opportunity Areas (COAs), was considered and expert biologists were consulted within DEM as well as academia. A framework of tiered protection was identified as the preferred approach to establishing buffer standards. About 19% of vegetated wetland resources were prioritized for the greatest protection (100- foot buffer zones). This approach provides desired predictability while still allowing the buffer standards to generally account for some of the ecological variability that exists. The approach allows DEM and CRMC to direct their limited resources to areas where oversight is appropriate and most needed. It further provides the means to provide the benefit of reduced regulatory burdens on previously developed properties.

3.1.1 The Regional Framework for Tiered Protection -Under the tiered approach, the state was divided into three regions to facilitate the application of a range of buffer standards that reflect a gradient of watershed conditions. The regions consist of an urban region and two non-urban regions – the latter of which are used only to distinguish certain river buffers. In addition,

requirements in drinking water supply watersheds were incorporated as an overlay in both non-urban regions. See Figure 3-1. The tiered protective buffer distances were based on assessments of watershed resource protection needs, wetland resource characteristics and existing land use.

The resulting regions can be described as follows:

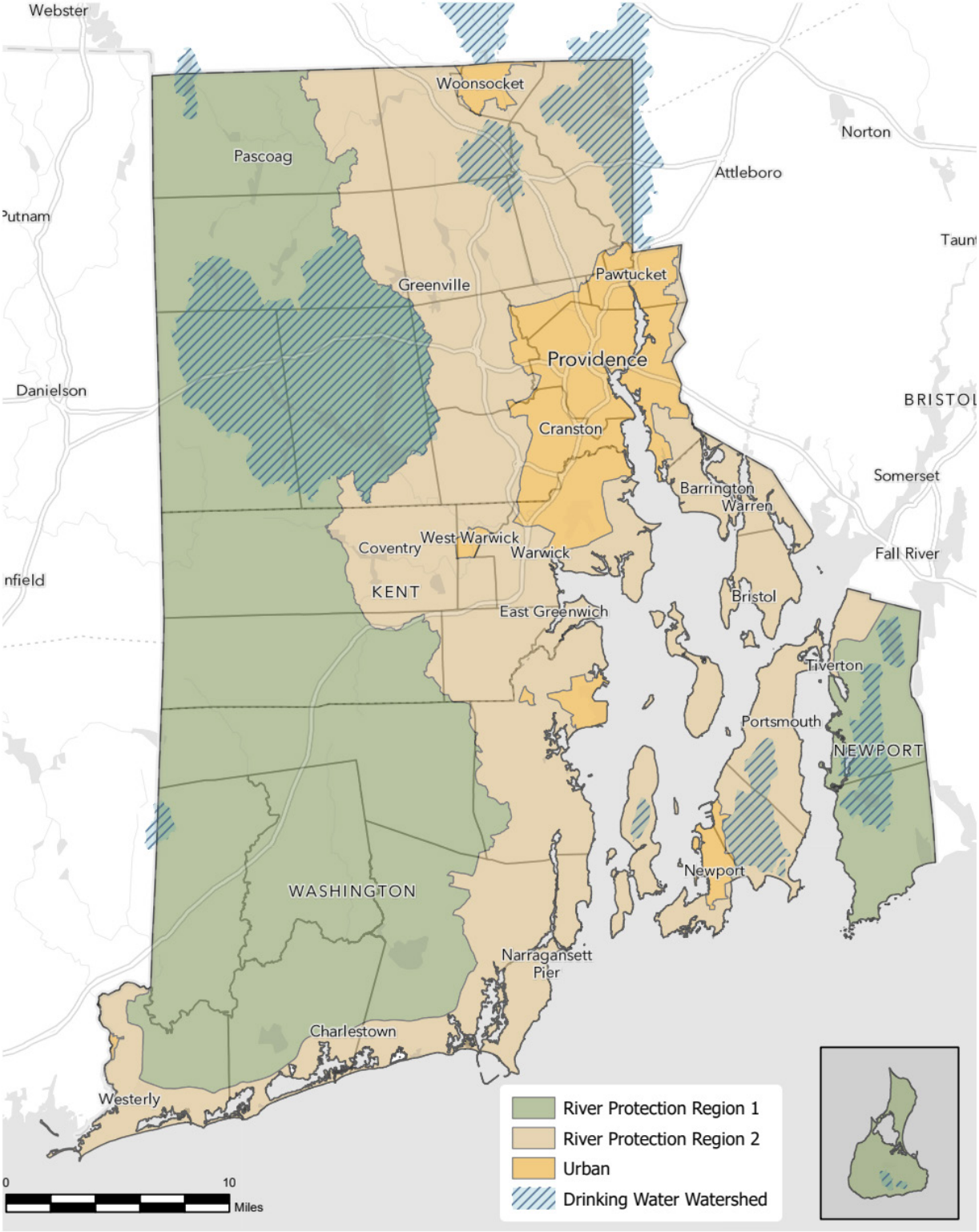
- **River Protection Region 1** - This Region includes watershed areas that are generally the highest priorities for conservation of fish and wildlife habitat. The region encompasses areas in the western and southeast portions of the state as well as Block Island. The watersheds exhibit low density of development, lower percentages of impervious cover and contain larger tracts of unfragmented habitat. Within this Region, in March 2019, a number of river segments in the Wood-Pawcatuck River watershed were federally designated as "wild and scenic". River Protection Region 1 covers 52% of Rhode Island's area (coastal waters excluded).
- **River Protection Region 2 -** This Region includes areas of the state that exhibit a mix of land uses and watershed characteristics including urban, suburban and rural settings. Existing land use patterns have resulted in greater fragmentation of buffers within the jurisdictional areas in this region including crossings of rivers. The region includes much of the suburban development the exists adjacent to the Urban Region areas. River Protection Region 2 covers 40 % of the Rhode Island's area (coastal waters excluded).
- **Urban Region (UR)** – This Region includes densely developed, urbanized areas of the state including portions of watersheds that contain high percentages of impervious cover and areas that are already developed or altered. This includes the Providence metropolitan area as well as portions of Woonsocket, Newport and West Warwick and Westerly. The Urban Region covers 8% of Rhode Island (excluding coastal waters).

This approach is compatible and aligns with other statewide policies including State Guide Plan elements such as Land Use 2025 which aims to direct dense land use development to areas within the urban services boundary and designated growth centers; and reduce urban sprawl in other portions of the state – particularly those that lack public utilities. In addition, the tiered approach to buffer protection supports the goals expressed in statewide plans for outdoor recreation, open space and forestry. (RIDOA, 2006)

The agencies reviewed reports on housing needs during rule development. The agencies note that the need for more affordable housing is documented in reports such as "2018 Housing Fact Book" prepared by HousingWorksRI at Roger Williams University. The report assessed needs on a regional basis across the state and found "While the predominant housing type across most regions is single family homes, current demographic changes, including an ageing population and increased household formations of non-related adults, indicate the need for more variety in housing stock....These styles include courtyard apartments, town houses and live/work spaces, which rely on more density that single family homes." The report further

provides housing projections needs for 2025 which indicate the highest needs are for multi-family homes (86-87% of the statewide total need) and that these needs are heavily concentrated in the Providence metropolitan region. The designation of the Urban Region with reduced buffer standards in the proposed rules is aligned to support growth that addresses this housing need.

Figure 3-1. Proposed Freshwater Wetland Regions



3.1.2 Buffer Standards – Development of Options

Working with the regional framework, the agencies considered a variety of options in establishing buffer zones. The designation of a *buffer zone* is the mechanism by which the agencies will protect natural buffers and regulate future alteration of buffers (with limited exempt activities.) By setting buffer zones of varying widths, the level of protection was aligned to the watershed characteristics, existing land use and resource protection needs. In considering options for the buffer zones, the buffer protection provided by the current freshwater regulations is considered the baseline from which options for increased protection can be compared. However, with the mandate to strengthen protection, maintenance of the current regulations is not considered an acceptable policy option within this required rule-making process.

The tiered approach reflects the following considerations:

- All wetlands would be designated with a buffer. This addressed the gap in protection that exists within the current program with respect to small wetlands.
- On a statewide basis, the most sensitive wetland types were identified and assigned the highest level of protection (100 feet). These include unique and uncommon wetland types that are often sensitive to disturbance such as bogs, fens and marshes as well as evergreen swamps, swamps with Rhododendron understory and certain vernal pools. Bogs, marshes and evergreen swamps as mapped in GIS comprise about 19% of the total wetland resources excluding rivers and ponds.
- On a statewide basis, buffers were increased to strengthen protection in water supply reservoir watersheds.
- In non-urban portion of the state, buffer protection was strengthened by (1) increasing the buffer for headwater rivers including cold water rivers as recognized as a need in the LTF Report; (2) increasing the buffer on larger lakes and ponds that provide high recreational and habitat value and that currently have large amounts of intact shoreline buffer; and (3) increasing the buffer around larger swamps some of which are also part of valuable wetland complexes providing multiple habitats.
- Where practicable, the buffer applied to surface waters for water quality protection was maintained or strengthened to be at least 100 feet consistent with LTF recommendations.
- As practicable, buffer requirements were reduced in areas where existing land use has already resulted in the alteration or loss of vegetated buffer; e. g. urban region.

The differences among the options include varying the buffer width as well as the threshold size of the resource that will receive enhanced protection. The buffer protection provided by the current freshwater regulations is considered the baseline from which options for increased protection can be compared. However, with the mandate to strengthen protection, maintenance of the current regulations is not considered an acceptable policy option within

this rule-making process. The other options were considered by the Agencies including discussion and evaluation of the degree of additional protection being provided, implications for agency program implementation and impacts to property owners/potential applicants. The Options reflect a gradient of addition protection with Option 1 being the highest and Option 4 being the lowest.

Options considered by the Agencies are summarized as:

Option 1: Maximum Protection – All Wetland Resources

The first option, the Maximum Protection Option, consists of setting the buffer zone to be equivalent with the jurisdictional area (JA). This option represents the maximum extent of buffer zone that the Agencies could designate within their authorities. This adds protection in the form of larger buffer zones to almost all resources other than rivers already provided with a 200' riverbank wetland. This option was not recommended by the agencies as it is considered overly burdensome to landowners, particularly in areas with extensive existing development, and more costly to administer. The LTF report acknowledged that buffers may need to be set to be equivalent to the jurisdictional area in some instances, but it was not suggested that such an approach be applied broadly statewide.

Option 2: Enhanced Protection – Greater protection applied to a larger portion of wetland resources

The Enhanced Protection option reflects a tiered protection approach that ensures a minimum buffer for all resources and provides enhanced protection for most of the remaining wetland resources outside the Urban Region. The Option was developed by identifying areas to reduce the designated buffer zone from the JA while still enhancing protection where there were practicable opportunities to do so. It includes setting buffer zones equal to the JA for the most sensitive wetlands, most rivers in the non-urban portions of the state (River Protection Regions 1 & 2) and for many ponds and lakes greater than 5 acres. It also maximizes protection in drinking water supply reservoir watersheds. The protection of rivers gave greater emphasis to the protection of riverine corridors while discounting the degree of existing land alteration. The 5- acre threshold was chosen to extend 100 feet of water quality protection to a large number of ponds. In addition, this Option includes additional protection of larger deciduous swamps (5 acres of greater) by the adding 25 feet of buffer zone to existing protection. The rationale for this was primarily to protect the wildlife habitat and flood protection functions and values of these swamps as well as enhance their resiliency over time. The buffer area surrounding swamps is utilized by wildlife for nesting, shelter and other life supporting functions.

Option 3: Targeted Protection - Agencies Recommended Option

This option reflects a tiered protection approach to buffer standards developed and recommended by the Agencies. It reflects an approach that targets the greatest enhanced protection to prioritized resources needs and constitutes a meaningful strengthening of

protection that the Agencies find is responsive to the statutory mandate. It ensures a minimum buffer for all resources. It includes setting buffer zones equal to the JA for the most sensitive wetlands and maximizes protection in drinking water supply reservoir watersheds. With respect to rivers, this option reflects information obtained from a thorough review of rivers on a sub-watershed basis that prioritized the highest level of protection for both public drinking water watersheds and those rivers that currently have intact riverine buffers and limited alterations due to crossings, etc. DEM conducted a review of all rivers that entailed GIS analysis and best professional judgement drawing on lengthy experience with watershed conditions as well as public comment on the preliminary draft rules. Lists and criteria are used to identify by name those rivers assigned with buffer zones of either 200 feet or 150 feet. The river protection regions are then used to distinguish the buffer zone requirements for any remaining rivers; e.g. not listed or meeting criteria for a larger buffer. With respect to lakes, this Option raised the threshold for enhanced buffer protection for certain lakes to 10 acres. This size threshold is used in related water quality protection programs and includes lakes that have been sites of public investment; e.g. public boat ramps and which provide for greater recreational use. Additionally, in this Option, the threshold for a larger buffer for deciduous swamps was also set at 10 acres. This provides additional protection to the largest swamps which may include wetland complexes of ecological value. The rationale for Option 3 is discussed in more detail in Section 3.1.3. The Agencies are recommending this Option as an appropriate strengthening of protection that appropriately takes into greater account existing alteration of the landscape and by doing so reduces undue regulatory burdens resulting from the proposed rules.

Option 4: Limited Additional Protection

This Option constitutes a scaled-back protection option which provides for limited additional protection. It includes the protection of sensitive wetlands and drinking water resources similar to other options, but raises the threshold for increased protection of evergreen swamps from 1 acre to three acres. No additional protection is provided for large deciduous swamps. These swamps would instead be designated with a 50’ buffer which equates to no change in the current level of protection. The buffer zones for rivers remain the same as Option 3.

3.1.3 Discussion of Resource Specific Buffer Standards - Option 3

The descriptions below discuss the rationale underlying the buffer zone designations in the Option 3 recommended by the Agencies for rivers, lakes/ponds and other wetland resources.

<u>Rivers and Streams</u>

Rhode Island has 1,397 miles of rivers and streams mapped in RIGIS. Current regulations designate 200 feet around rivers 10 feet or greater in width (referred to as large rivers) and 100 feet around narrower rivers and streams as protected riverbank wetland. The new JA authorizes the agencies to regulate the area within 200 feet of a river of any width. In developing buffer standards, DEM compiled known data on river and stream width, considered water quality classifications including the designation of cold-water streams and evaluated watershed characteristics including extent of existing development using GIS. To strengthen

protection of public drinking water supplies, the buffer zone on all tributary streams to listed reservoirs were set at 200 feet. (See water supply discussion below). In River Protection Region 1, the Agencies minimized reductions from existing perimeter wetland protection in recognition of riverine corridors with intact habitat. Overlap with floodplain was considered on larger rivers. Reductions were made where existing land uses had altered the perimeter wetland. Buffer protection was generally increased from 100 to 150 on smaller rivers due to the presence of quality intact habitat and watershed protection needs; e.g. water quality. In River Protection Region 2, similar criteria were used to identify rivers that merited the maintenance of or increase to the maximum protection (200 feet). Reflecting the tiered protection approach, certain listed rivers were assigned a 150-foot buffer zone due to the greater degree of land development and crossings that fragments riparian habitat. Input from initial stakeholder meetings was also considered and adjustments to listed rivers were made for consistency where the Agencies concurred there was sufficient intact buffer The Agencies applied 100 feet buffer as a desired *minimum* for water quality protection but recognized the existing alteration of buffer within Urban Region and therefore set a lower buffer standard. A 150-foot buffer zone was set for the Blackstone River and portions of the Pawtuxet Rivers in the Urban Region. The Agencies also desired to simplify the application of a buffer standard by eliminating its connection to river width which often triggers extra field work to verify widths. The proposed rules will utilize lists of named rivers to provide greater clarity.

The above analyses led the agencies proposed to increase or decrease buffer protection around rivers as follows:

Table 3-2: River Buffer Zone Standards

Drinking Water Supply Reservoirs Watersheds	• Increase the buffer to 200 feet on rivers which are tributary to named public drinking water supply reservoirs (applies statewide).
River Protection Region 1	• Maintain 200 feet buffer on listed large rivers (with exceptions for a limited number of developed areas). • Increase the buffer from 100 to 200 feet for listed rivers of high wildlife habitat value to provide stronger protection of habitat, water quality and other functions. • Increase the buffer to 150 feet for all other rivers to better protect headwaters in these watersheds. • Maintain the buffer of 100 feet for streams.
River Protection Region 2	• Maintain 200 feet buffer on select listed large rivers with intact existing buffer. • Increase the buffer from 100 to 150 feet for designated cold-water rivers and other listed rivers of high wildlife habitat value. • Reduce the buffer from 200 to 150 feet for other large rivers. • Maintain the 100-foot buffer on smaller rivers and streams

Urban Region	• Reduce buffer from 200 to 150 feet along the Blackstone River a and Pawtuxet Rivers as specified. • Reduce the buffer from 200 to 100 for other listed large rivers. • Reduce the buffer from 100 to 50 feet for other rivers in urbanized settings.

Lakes and Ponds

Rhode Island has 21, 575 acres of lakes and ponds mapped in RIGIS. Current regulations designate 50 feet around lakes and ponds greater than ¼ acre for protection. The new JA authorizes the agencies to regulate the area within 100 feet of lakes and pond and within 200 feet of a drinking water reservoir. To establish buffer zones for lakes and ponds, the agencies first considered applying a minimum of 100 feet to be protective of water quality. In recognition that existing development along certain lake shorelines has eliminated much of the natural buffer, the agencies conducted analyses to identify lakes where 50 percent or more of the desired buffer zone was altered, thereby limiting the opportunity to be more protective. In such cases, the existing level of protection of 50 feet was left in place which averted additional regulatory burdens for property owners; e.g. a larger buffer would be likely to trigger more variances in the permitting process. The lakes where this applies are listed by name for clarity. Additionally, the agencies evaluated a size threshold for the increased protection (e.g. 5-acre, 10-acre minimum size). Consistent with other water quality programs, a 10-acre minimum size as specified in Option 3 was selected as reflective of those lakes that support more recreational use as well as providing larger habitat areas. Finally, the agencies include a buffer for previously unprotected ponds < ¼ acre and also assigned this buffer to ponds located within highway systems.

Table 3-3: Pond and Lake Buffer Zone Standards

Drinking Water Supply Reservoirs	• Increase the buffer to 200 feet around named public drinking water supply reservoirs (applies statewide)
Non-Urban Regions (River Protection Regions 1 & 2)	• Increase buffer on lakes > or = to 10 acres from 50 to 100 feet (excluding listed lakes) • Maintain 50-foot buffer for lakes > ¼ acre and < 10 acres • Add a 25-foot buffer to small ponds (< ¼ acre)
Urban Region	• Maintain the 50-foot buffer for listed lakes. • Require a 25-foot buffer for all other ponds.

Special Considerations – Public Drinking Water Supply Surface Water Reservoirs

The proposed expansion of buffers on both the 29 public drinking water supply reservoirs and the rivers and streams which are tributary to them provides added protection of source water quality in Rhode Island. The drinking water reservoirs cover about 5,935 acres (about 27% of total lake acreage in RI) and 211 miles of rivers and streams, about 15% of total river miles in RI, are tributary to these reservoirs. The additional buffer protection within the water supply watersheds reduces the transport of pollutants into the reservoirs. This helps preserve high

quality source water conditions, such as those in the Scituate Reservoir, which is in turn protective of public health and averts additional future treatment costs. In other reservoir watersheds, prior development and on-going human activities are known to have already degraded water quality. For example, the nine drinking water reservoirs located on Aquidneck Island and in Tiverton and Little Compton which are the source waters for the regional Newport Water System exhibit poor water quality due to nutrient enrichment. Cyanobacteria and algal blooms have been documented in these reservoirs. DEM has undertaken water quality studies and related work to develop a water quality restoration plan to abate nutrient enrichment in the reservoirs as well as their tributary streams. Newport has incorporated advanced treatment into its facilities to produce safe drinking water.

Wetlands – Swamps, Marshes and Others

Rhode Island freshwater wetlands have been mapped in RIGIS using a standardized classification scheme. For the purposes of this report, it is estimated that RI has 87,933 acres of freshwater wetlands including vernal pools. The most common wetland type is deciduous swamp which are located throughout Rhode Island. Other wetland types are much less common including bogs. See Table 3-4.

Current regulations provide a 50-foot perimeter wetland around certain wetlands of certain sizes. Smaller wetlands were not protected by buffers which was noted as a deficiency in protection by the LTF. In devising buffer standards for wetlands, the agencies first developed a tiered listing that prioritized certain categories of wetlands for the greatest protection due to an assessment of their functions and values as well as their sensitivity to disturbance. The analysis was developed using best professional judgement of experienced biologists and GIS

Table 3-4. Wetland Acreage in RI (excludes lakes and rivers)

Wetland Classification	**Acreage**	**Data source**
Deciduous Swamps	60,888	RIGIS
Coniferous Swamps	10,904	RIGIS
Shrub Swamp	9,587	RIGIS
Marshes	2,972	RIGIS
Bogs/Fens	2,289	RIGIS
Wet meadows	813	RIGIS
Isolated Vernal Pools	480	DEM Estimate
Total	87,933	

analysis to characterize the extent of certain types of wetland resources. It led to several wetland types being targeted for the maximum protection (100 feet buffer) regardless of their location; e.g. urban, non-urban. These included: bogs (and fens), marshes, coniferous swamps (Atlantic White Cedar Swamps) and deciduous swamps with Rhododendron understory which are very uncommon. These comprise about 19% of the total acreage of wetland resources in RI of which 40% or more is estimated to have been protected through permanent land

conservation. Bogs, fens and coniferous swamps have unique characteristics, provide habitat for rare species and are sensitive to disturbances in water quality. Marshes swamp are recognized as important habitat for migratory birds. In addition, the agencies identified shrub-scrub swamps and large deciduous swamps as appropriate for additional buffer protection to enhance their functions and better prevent disturbance in the buffer that is utilized and relied upon by various wildlife species. A buffer zone of 75 feet is proposed for these resources outside the Urban Region.

The Agencies also identified a need to improve protection around vernal pools which was noted in the LTF Report. Vernal pools and their surrounding upland provide critical habitat for amphibians and other wildlife. The Agencies are proposing to provide the maximum buffer allowed under the law (100 feet) for those pools with intact surrounding forested habitat. The draft rules are providing an accommodation for vernal pools in developed settings and allowing 50' Buffer.

Table 3-5: Wetland Buffer Zone Standards

Bogs, Marshes[1], Evergreen forested swamps > 1 acre, Swamp with Rhododendron > 1 acre	• Increase buffer to 100 feet • (statewide)
Vernal Pools	• Increase from 0 to 100 feet where 50%or more of the land around the pool is undeveloped vegetated land. • Increase from 0 to 50 feet where 50% or more of the land is developed.
Shrub Scrub Swamp	• Increase 75 feet for swamps > o r= to 1 acre • Add a 25-foot buffer for swamps < 1 acre
Deciduous Swamps	• Increase buffer from 50 feet to 75 feet for swamps of 10 acres or more in Non-urban regions • Maintain 50 feet for smaller swamps in non-urban areas (1- <10 acres) • Reduce the buffer from 50 to 25 feet around swamps in Urban Region • Add a 25- foot buffer to swamps < 1 acre

[1]Excepting phragmites dominated marshes and wet meadows.

3.2 Proposed Rule Changes – Permit Processes

In addition to the buffer standards, the agencies are proposing changes to the permit process. Because of the expanded jurisdictional area in the law, a larger number of projects will be subject to the Freshwater Wetlands permitting program. Given this fact, the Agencies

undertook a review of the regulatory process. As a result of this comprehensive review, a number of changes (referred to as "process changes") are proposed to reduce the regulatory burdens for applicants by means of new permit types and other changes to improve clarity, readability and predictability. The Agencies have created several new permitting mechanisms to reduce the potential burden on applicants and on the Agencies of the expanded jurisdictional area.

More specifically, the proposed rules include the following changes related to permit application processing:

- Expanded list of exempt activities
- General Permit
- Infill Lot Standard
- Revised Wetlands Application and New Variance Process
- Elimination of Duplicative Municipal Review
- Improvements in Clarity, Predictability

4.0 Scope of the Analysis

4.1 Overview - The cost benefit analysis focuses on the rule changes associated with the two key objectives of the proposed regulations that involved agency discretionary decision-making and that may result in benefits and costs greater than $500,000 annually for affected stakeholders. These objectives are strengthening wetland resource protection via buffer standards and streamlining the regulatory permitting process. These topics are addressed with different cost – benefit methodologies that are described in detail Sections 5 and 6. As the proposed rule changes apply statewide, the scope of the cost-benefit analysis is also statewide in scale. Excluded from the analysis are rule changes that constitute language updates to reflect new definitions, other language clarifications and minor technical updates that do not trigger the required cost-benefit analysis.

Quantifying the benefits of enhanced protection of wetland buffers required estimating the land area that will be ***newly*** protected as buffer zone. Areas currently protected; e.g. conservation lands, were excluded from the estimates. It is presumed that the benefits of enhanced buffer protection primarily accrue to the public rather than the individual property owner and the agencies drew from relevant economic literature to estimate these societal benefits by transferring appropriate values. In contrast, the costs resulting from enhanced buffer protection are assumed to be primarily associated with affected property owners and were estimated using Rhode Island property assessment values. With respect to permit process changes, the costs and benefits were estimated based on assumed average costs related to steps in the permitting process and projected changes in permitting workload. The affected stakeholders for process changes are applicants.

4.2 Affected Stakeholders – DEM has identified the following groups of stakeholders that may be affected by the proposed regulations:

General Public – Societal benefits of improved wetland protection generally accrue to the general public. The general public includes interested stakeholders such as watershed councils and conservation organizations that value wetland protection.

Property Owners/Applicants – Includes persons or entities that own property within jurisdictional area that desire to undertake new construction, redevelopment or other site improvements.

Public Water Suppliers – includes public water suppliers that will benefit from improved protection of wetlands and which own or control property subject to regulation for new projects or activities.

Agricultural Entities – includes farmers, as defined by the law, and other person or entities carrying out new agricultural activities. Note: There was no change in the law regarding provisions for qualified farmers carrying out certain farming activities.

State Agencies – RIDEM and RICRMC – See Section 6.0

Municipalities - Municipal governments including the 25 that currently administer ordinances overlapping with state wetland and OWTS regulations. The law requires the Towns repeal certain ordinances following promulgation of state rules. Elimination of the administration of local wetland ordinances will relieve municipal staff or retained municipal planning consultants of a limited workload and allow their time to be directed to other work. The elimination of application fees for municipalities will also provide modest savings overtime to municipalities undertaking projects. These are not quantified in this analysis.

Small Business Impacts - With respect to small businesses, the agencies have determined that the regulations may result in a range of cost impacts to small businesses. The rules which apply statewide do not impose any requirements that are particular to any sector of small businesses or groups of small businesses. Rather, a small business of any type may be affected if it elects to undertake a new project on a property regulated within a jurisdictional area. The rules have no impact on existing small business operations and their applicability is dependent on the geographic location of the business. Those small businesses that are located in newly regulated jurisdictional area may incur costs associated with having to apply and obtain a permit from the Agencies for *new* applicable projects and activities. Costs could range from minimal to thousands of dollars in application costs dependent on the site conditions, wetland resources potentially affected and scope of the project. In certain communities, this cost impact would be partially offset by the elimination of the costs associated with complying with existing municipal wetland specific ordinances. These ordinances will be eliminated following state rulemaking. Additionally, some small businesses may obtain a cost benefit from other permit streamlining measures including proposed general permit processes, expanded exemptions that support

small business operations and reduced buffer requirements in certain urban areas. For purposes of the cost benefit analysis, the impacts for small business owners are considered the same as those of the property owner/applicant.

4.3 Limitations - DEM and CRMC relied on existing data and available literature to formulate this cost-benefit evaluation. The analysis required making numerous assumptions in the face of uncertainties and data limitations. Relative to societal benefits, in researching the available data, the agencies did not find studies specific to Rhode Island which could provide estimated valuations of wetland buffer ecosystem services. As noted earlier, with respect to potential property value impacts, the various studies reported in the literature reveal mixed results which is a source of uncertainty within the assumptions used in the methodology. The agencies believe it is also important to acknowledge that the current economic analysis tools available do not fully account for or value all the societal benefits of the additional buffer protection provided by the proposed rules. The USEPA and US Army Corps of Engineers reached a similar finding when analyzing the societal benefits, measured as the foregone benefits of wetland protection, in proposed rule changes related to "waters of the United States". (USEPA, 2017)

The agencies also identified limitations in the wetlands data available to support the analysis. Geographic information system (GIS) data was used extensively as part of methods to estimate costs and benefits related to buffer standards. The Agencies used existing data layers available via the Rhode Island Geographic Information System and carried out work to develop other data layers needed for the analysis. The Agencies acknowledge that the following limitations exist with the available GIS data sources: (1) missing wetland data (small wetlands, vernal pools and all small ponds are not mapped in GIS), (2) missing stream data; (3) potential inaccuracies in the geo-positioning of resources as mapped on the landscape; (4) potential misclassification of wetlands or land uses due to recent changes including development and land conservation actions, (5) missing parcel data and inaccuracies in certain plat/lot information and (6) tax assessment data which may not reflect the most recent changes in lot configurations, re-assessments, etc. Information is generally derived from 1:24,000 scale GIS data layers.

5.0 Methodology for Evaluation of Benefits and Costs related to Buffer Standards

5.1 Societal benefits

Following a review of available literature and data, the Agencies, in consultation with the Office of Regulatory Reform, selected a value transfer method to estimate the value of societal benefits. The value transfer method is an accepted economic method that can be used to estimate economic values for ecosystem services by transferring available information from studies already completed in another location and/or context. As noted earlier, it is recognized that this approach carries with it certain uncertainties. Adopting this approach was necessary

due to the lack of specific economic studies of the valuation of RI freshwater wetland resources and the lack of resources to support new studies. Two methods are utilized to estimate the societal benefits of additional buffer protection as related to vegetated wetlands and surface waterbodies (rivers, ponds). The estimated values of the benefits are then added to obtain an overall total estimate, projected over a twenty-year time period and a present value is calculated. Given uncertainty associated with the assumptions, a range of values are presented.

Freshwater Wetlands – Societal Benefits:

Resource economists have developed techniques for estimating the value of the ecosystems services of natural resources including wetlands. A few northeast states have conducted large studies to produce **wholistic** estimates of the value of ecosystem services. These studies involve compiling all available economic literature and other documented work that can provide information to value one or more ecosystem service provided by a category of natural resources. Agency review of these studies and other relevant literature found estimated values of freshwater wetlands were available but similar estimates for buffer in relation to wetlands were generally not reported. Outside of these wholistic estimates, the literature did not allow for the Agencies to easily segregate and generate estimates for the different wetland functions and values; e.g. flood protection, water quality etc. DEM's literature review on buffer science also found disparities in the amount of available information describing the different functions and values of wetlands. (ELI, 2018). Similarly, the literature did not provide sufficient information to segregate the valuation of different types of vegetated wetland ecosystems (swamps, marshes, vernal pools etc.). With guidance from ORR, this led to development of a method that would rely on utilizing the wholistic valuation of freshwater wetland values to provide a benefit estimate as further explained below. Several studies have published estimated ecosystem values per acre per year for freshwater wetlands in the northeast and adjacent mid-Atlantic regions. Wetlands were often assigned the among the highest per acre ecosystem values in comparison to other resource types which is reflective of their multiple functions and values. RIDEM used a range derived from these values representing minimum and median estimates based on available studies conducted in Massachusetts, Delaware and New Jersey. As an example, in the 2003 Massachusetts study entitled "Losing Ground", the economic analysis was developed by academic personnel from the University of Vermont including its Gund Institute for Ecological Economics and involved research into nine categories of ecosystem services which reasonably reflect the functions of wetlands not just in MA but also in RI. These services include: Climate regulation, freshwater regulation and supply, waste assimilation, nutrient regulation, habitat refugium, soil retention and formation, disturbance prevention (flood prevention), pollination and recreation and aesthetics. The research revealed that within the available economic literature, not all these functions are equally represented. The agencies believe the value of the wildlife habitat function may be underestimated as a result of this limitation. To create a range of values, RIDEM averaged the reported minimum and median ecosystem values and adjusted them to 2019 dollar values. The resulting values range from **$9,069** to **$16,279** dollars/acre/year.

Table 5-1 Ecosystem Values of Freshwater Wetlands

Ecosystem Values for Freshwater Wetlands ($/Acre/Year) Adjusted to 2019 Dollars			
	Minimum	Mean	Median
Massachusetts (MA Audubon, 2003)	$10,742	$21,601	21,544 (*)
New Jersey (NJ, 2007)	N/A	$11,845	$11,217
Delaware (Kaufman, 2010)	$7,397	N/A	$16,075
Average Values Used for Analysis	**$9,069**		**$16,279**

(*) Estimated figure based on adjustment by RIDEM using ratio of mean to median from NJ.

The approach to estimating benefits relies on the assumption that it is reasonable to equate the value of enhanced buffer protection for wetlands with the value of the ecosystems services that would be lost if the buffer protection were not implemented. In other words, the benefits are reflected as the valuation of the avoided loss of wetland ecosystem services achieved through strengthened buffer protection.

The steps, assumptions and inputs in the methodology are as follows:

1. Estimate Total Acreage of Wetlands: The statewide estimated acreage of freshwater wetland is derived from RIGIS data. Limitations of note with this data include missing small wetlands including vernal pools and potential misclassification of wetland types including phragmites dominated marshes. The statewide total of wetland acreage was adjusted by adding estimated acreage of vernal pools. Vernal pools, which are typically small, are not mapped as part of the RIGIS wetlands data layer. DEM developed an estimated acreage of 480 acres for ***isolated*** vernal pools based on an assumed average size of 0.32 acres. This was done by extrapolation using information that was available for the Wood-Pawcatuck watershed in consultation with experienced biologists. Overall, DEM estimated 3,000 vernal pools exist in the non-urban regions of the state. It was estimated that 50% of these are embedded in other wetland as documented with from mapping work in the Wood-Pawcatuck watersheds. These are excluded from the additional acreage estimate. The average size of 0.32 acres per vernal pool was estimated from work by RI researchers that reported on the size of 124 RI vernal pools with a size range of <.12 acres to > 2.47 acres. (Egan, R. and Paton, P., 2004) The revised estimated total statewide freshwater acreage used in this analysis is 87,933 acres.

Table 5-2. Wetland Resources in Rhode Island

Wetland Type	**Non-Urban Regions (acres)**	**Urban Region (Acres)**	**Total (Acres)**

Bogs, Fens	2,289	0	2,289
Marshes	2,764	208	2972
Wet Meadows	792	21	813
Coniferous Swamps	10,902	2	10,904
Scrub-shrub Swamp	9,239	348	9,587
Deciduous	59,925	963	60,888
Vernal Pools	480	0	480
Totals	**86,391**	**1,542**	**87,933**

2. Identify the portion of freshwater wetland resource that will be designated with additional buffer (of any width) as provided by the proposed buffer standards. In this step, the portion of wetland resources that will benefit from enhanced wetland protection is estimated by adding the acres for each qualifying wetland category. This includes wetlands currently designated with a perimeter wetland for which a larger buffer area is proposed and those wetlands which currently lack any buffer protection (mostly small wetlands) for which a new buffer is proposed. For the maximum protection option, the acreage is equivalent to the statewide acreage of wetlands as all wetlands would gain additional protection from the buffer zone being set at the JA limit. For the other options, the estimates follow the descriptions provided earlier. In developing these estimates, the statewide totals for each option exclude wetland acreage for which buffer distances are either not changing or are being decreased from existing level of protection. In preparation for the next step, these acreages are then apportioned into two categories based on the level of protection in place under current rules: those wetlands designated with a perimeter wetland under current rules versus those with no buffer protection currently required.

Table 5-3a. Wetland Resources with Proposed Increased Buffer Protection – Option 1 - Maximum Protection

Wetland Type	Perimeter buffer in existing rules	No buffer protection in existing rules	Non-Urban Regions w/existing protection	Non-Urban Regions - Resources with no protection	Urban Region w/existing Protection	Urban Region - all new protection	Resource Total
Bogs any size	any size	NA	2,289		0	0	2,289
Marshes any size	> 1 acre	< 1 acre	1,544	1,220	156	52	2,972
Wet Meadow	>1 acre	< 1 acre	124	668	19	2	813
Shrub Swamp - any size	> 3 acres	< 3 acres	4,602	4,637	188	160	9,587
Coniferous swamp - any size	> 3 acres	< 3 acres	8,811	2,091		2	10,904
Deciduous Swamp < 3 acres	NA	< 3 acres		8,839		328	60,888
Deciduous Swamp > to 3 acres	> 3 acres	NA	51,086		635		
Vernal Pools - any size	NA	any size	480				480
Sub-Totals			68,936	17,455	998	544	
Regional Totals			**86,391**		**1,542**		
Statewide Total			**87,933**				

Under this scenario: 100% of wetland resources above are gaining protection (excludes lake and rivers).

Table5-3b. Wetland Resources with Proposed Increased Buffer Protection – Option 2 - Enhanced Protection

Wetland Type	Perimeter buffer in existing rules	No buffer protection in existing rules	Non-Urban Regions w/existing protection	Non-Urban Regions - Resources with no protection	Urban Region w/existing Protection	Urban Region - all new protection	Resource Total
Bogs any size	any size	NA	2,289		0	0	2,289
Marshes any size	> 1 acre	< 1 acre	1,544	1,220	156	52	2,972
Wet Meadow	>1 acre	< 1 acre	124	668	19	2	813
Shrub Swamp - any size	> 3 acres	< 3 acres	4,602	4,637	188	160	9,587
Coniferous swamp - any size	> 3 acres	< 3 acres	8,811	2,091		2	10,904
Deciduous Swamp < 3 acres	NA	< 3 acres		8,839		328	60,888
Deciduous Swamp > to 5 acres	> 3 acres	NA	46,089				
Vernal Pools - any size	NA	any size	480				480
Sub-Totals			63,939	17,455	363	544	
Regional Totals – Gaining Protection			**81,394**		**907**		
Statewide Total – Gaining Protection			**82,301**				

Under this scenario: 93% of wetland resources above are gaining protection (excludes rivers and ponds).

Table 5-3c. Wetland Resources with Proposed Increased Buffer Protection – Option 3 - Targeted Protection - Recommended by the Agencies

Wetland Type	Perimeter buffer in existing rules	No buffer protection in existing rules	Non-Urban Regions w/existing protection	Non-Urban Regions - Resources with no protection	Urban Region w/existing Protection	Urban Region - all new protection	Resource Total
Bogs any size	any size	NA	2,289		0	0	2,289
Marshes any size	> 1 acre	< 1 acre	1,544	1,220	156	52	2,972
Wet Meadow	>1 acre	< 1 acre	124	668	19	2	813
Shrub Swamp - any size	> 3 acres	< 3 acres	4,602	4,637	188	160	9,587
Coniferous swamp - any size	> 3 acres	< 3 acres	8,811	2,091		2	10,904
Deciduous Swamp < 3 acres	NA	< 3 acres		8,839		328	60,888
Deciduous Swamp > to 10 acres	> 10 acres	NA	38,358				
Vernal Pools - any size	NA	any size	480				480
Sub-Totals			56,208	17,455	363	544	
Regional Total- Gaining Protection			**73,663**		**907**		
Statewide Total -Gaining Protection			**74,570**				

Under this scenario: 84% of wetland resources above are gaining protection (excludes rivers and ponds).

Table 5-3d. Wetland Resources with Proposed Increased Buffer Protection –Limited Protection Option

Wetland Type	Perimeter buffer in existing rules	No buffer protection in existing rules	Non-Urban Regions w/existing protection	Non-Urban Regions - Resources with no protection	Urban Region w/existing Protection	Urban Region - all new protection	Resource Total
Bogs any size	any size	NA	2,289		0	0	2,289
Marshes any size	> 1 acre	< 1 acre	1,544	1,220	156	52	2,972
Wet Meadow	>1 acre	< 1 acre	124	668	19	2	813
Shrub Swamp - any size	> 3 acres	< 3 acres	4,602	4,637		160	9,587
Coniferous swamp - any size	> 3 acres	< 3 acres	8,811	2,091		2	10,904
Deciduous Swamp < 3 acres	NA	< 3 acres		8,839		328	60,888
Vernal Pools - any size	NA	any size	480				480
Sub-Totals			17,850	17,455	175	544	
Regional Totals- Gaining Protection			**35,305**		**719**		
Statewide Total – Gaining Protection			**36,024**				

Under this scenario: 41% of wetland resources above are gaining protection (excludes rivers and ponds).

3. Quantify the Net New Buffer Zone Associated with Enhanced Protection of Wetlands: In this step, GIS is utilized to estimate the ***net*** new buffer zone area associated with those wetlands for which protection has been enhanced. (Identified in Step 2). The acreage of new buffer zone was derived from GIS analysis and adjusted to exclude the following: wetland resources located within a designated wetland buffer zone, existing areas designated as perimeter wetlands and those portions of the new buffer zone area that consist of permanently conserved natural lands. These areas were excluded as they are already considered in a protected status and the intent of this portion of the analysis is

to provide an estimate of the benefits of the new protection associated with proposed new buffer standards. Drinking water supply system land holdings were included in the conserved lands. The acreages derived from GIS analysis were then adjusted by adding an estimated area of additional buffer zone for the isolated vernal pools identified in step 2. Because the locations of vernal pools area not mapped on a statewide basis, DEM assumed a percent of this acreage would be conserved based on the overall proportion of conserved lands within each region; 32% for River Protection Region 1 and 23% for River Protection Region 2. The statewide total of additional buffer zone associated with 480 acres of isolated vernal pools was estimated to be 2,556 acres and added to the new buffer zone identified via GIS analysis. The vernal pool estimate was based on the 100-foot buffer zone being a concentric circle around a pool. The analysis over-estimates for Options 3 and 4 by not accounting for those vernal pools in urbanized settings which will have a lesser buffer zone. It is important to note the methodology does not remove all overlaps among buffer zones; e.g. the buffer zone for a river overlaps that of another wetland, and therefore overestimates the total net buffer acres. DEM estimates the error due to the overlaps is about +4%.

Table 5-4. Net New Wetland Buffer Zone Associated with Options

Option		Buffer Zone acres* (Ac)	Less Existing Protected Area* (Ac)	Net New Buffer Zone (Ac)*
1	Maximum Protection	58,226	21,337	36,899
2	Enhanced Protection	47,033	21,337	25,696
3	Agency Proposed	44,959	21,337	23,622
4	Limited Additional Protection	33,766	21,337	12,429
	Current Rules (No Change)	21,337		

(*) Wetland resources and lake overlaps and conserved properties removed.

4. <u>Quantify the Portion of the Resource that would Degrade Absent New Buffer Protection.</u> As a simplifying assumption, it is assumed that one acre of new buffer zone protects a minimum equivalent area of wetland (1:1 ratio). While a conservative approach, this assumption accounts for the fact that the buffer will have less direct influence on the interior of large wetlands. The acreage is assumed to be representative of that portion of the wetland resource that will be degraded and therefore provide less ecosystem services in the absence of added buffer protection; e.g. be degraded. For each option, the total net new buffer zone acres are then apportioned based on the categorization of wetland resources in (2) above: with or without some protection of upland under current regulation. The resources without any protection represent small wetlands and comprise about 20% of the total wetland resources (rivers and lakes excluded). The

differences among the options are reflected in the additional buffer zone protection applied to wetland resources that have current "perimeter wetland" protection.

Table 5-5. Allocation of Net New Buffer Zone Area to Prior Protection Status

Option	New Buffer Zone on wetlands with existing protection enhanced (acres)	New Buffer Zone Buffer on Wetlands with no prior protection (acres)	Total New Buffer Acres (Freshwater wetlands only)
Option 1	30,363	6526	36,899
Option 2	19,120	6526	25,696
Option 3	17,096	6526	23,622
Option 4	5,903	6526	12,429

(*)

5. Quantify the Extent of Impact – Having estimated and categorized the portion of wetland resources directly benefiting from enhanced buffer protection in Step 4, the next step in the method is to estimate the extent to which a wetland would be degraded by the absence of a buffer and therefore deliver reduced ecosystem services. Rhode Island has developed a Rhode Island Rapid Assessment Method that utilizes field data to produce a wetland conditions score between 0-100. Using the data from 154 wetlands monitored statewide, factors were derived factors to prorate the extent of degradation to a percent reduction in wetland condition based RIRAM condition scores and assessing developed land uses (cultural cover) within 100' of buffer area surrounding the vegetated wetland which corresponds to the extent of the agencies jurisdiction area for these resources. Application of the factors accounts for the fact that degraded wetlands continue to provide some lower level of ecosystem services unless completely destroyed; e.g. filled in. DEM is assuming the linear relationship established by the data analysis is applicable to varying buffer widths (50 to 100 feet). DEM used the regression equation derived from the data to establish the factors: y= -47.504x + 89.083. Factors were calculated at thresholds of .5 (assumes 50% of desired buffer zone is not protected as buffer but is presumed to be developed (cultural cover) and 1.0 (assumes none of buffer zone is protected) in comparison to highest condition score. The resulting factors are: .26 and .47. The .26 factor is applied to those wetlands which currently are designated with perimeter wetland. The .47 factor is applied to those wetlands (primarily small in area) that have no buffer protection under current rules.

6. Estimate of Societal Benefits- Freshwater Wetlands: For each option, the value of the societal benefits of additional buffer protection is estimated by multiplying the transferred values for wetland ecosystem services in per acre/yr units by the acreage from Step 4 and then adjusting this value by multiplying by factors determined in Step 5. Range results from applying wetland ecosystem values of $9,069/acre/year -

$16,279/ac/year. This leads to a range of societal benefits for each option. The figures are rounded to the nearest hundred.

Table 5-6 Estimates of Societal Benefits – Wetlands (Rivers/lakes excluded)

Option 1 – Maximum Protection		
Estimate of Degraded Resource (acres)	Estimated Annual Value of Adjusted Loss of Ecosystem Services	
	50% buffer degradation (.26)	100% buffer degradation (.47)
6526		$27,816,600 - $49,931,300
30,363	$86,982,000 - $128,512,600	
Total	**$114,798,600 - $178,443,900**	

Option 2 – Enhanced Protection		
Estimate of Degraded Resource (acres)	Estimated Annual Value of Adjusted Loss of Ecosystem Services	
	50% buffer degradation (.26)	100% buffer degradation (.47)
6526		$27,816,600 - $49,931,300
19,170	$45,201,700 - $81,137,800	
Total	**$73,018,300 - $131,069,100**	

Option 3 – Targeted Protection		
Estimate of Degraded Resource (acres)	Estimated Annual Value of Adjusted Loss of Ecosystem Services	
	50% buffer degradation (.26)	100% buffer degradation (.47)
6526		$27,816,600 - $49,931,300
17,096	$40,311,300 - $72,359,500	
Total	**$68,127,900 - $122,290,800**	

Option 4 – Limited Additional Protection		
Estimate of Degraded Resource (acres)	Estimated Annual Value of Adjusted Loss of Ecosystem Services	
	50% buffer degradation (.26)	100% buffer degradation (.47)
6526		$27,816,600 - $49,931,300
5903	$13,918,900 - $24,984,700	
Total	**$41,735,500 - $74,916,000**	

7. Rivers and Lakes- Societal Benefits: In contrast to the buffer for wetlands, a review of literature was able to identify values of the ecosystem service benefits for a riparian buffer. This allows for a more straight-forward methodology for estimating the societal benefits from enhanced buffer protection around rivers and ponds. Specifically, NJ has reported an ecosystem value for riparian buffers that was developed for rivers. ($1,085-$4,605/ac/yr as adjusted for inflation to 2019 dollars). (NJ DEP, 2007). A separate estimate for the Delaware basin with respect to water quality benefits related to nutrient removal provided values of $1,440-$4,905/ac/year as adjusted to 2019 dollars. (Industrial Economics, 2014). The analysis relies an average of these values to produce a range of potential benefits acknowledging the limitation that the full range of riparian buffer benefits may not be fully reflected. In addition, the following simplifying assumptions are made: (1) that the functions of a buffer around a river in NJ and DE are sufficiently similar to those around rivers in RI and (2) that the ecosystem services provided by a riverine buffer are sufficiently similar to that of a buffer around a lake. With these assumptions, and lacking any further detailed studies in RI, the Agencies used the value transfer approach to provide a general estimate of societal benefits of buffers associated with rivers and ponds in RI. The estimate can be made by transferring and applying the value of riparian buffer to the net new buffer zone acreage around both rivers and lakes. Similar to wetlands, the net buffer zone acreage excludes wetland resources, existing riverbank wetland areas and conserved properties. Figures are rounded off to the nearest hundred.

Table 5-7 Societal Benefits for Strengthened Buffer for Rivers and Lakes

Option	Resource Type	Net New Buffer Zone* (Acres)	$/acre/year $1,423	$/Acre/yr $4,755
1	Rivers	34,822	$49,551,700	$165,578,600
	Lakes	5410	$7,698,400	$25,724,500
	Option 1 Total		**$57,250,100**	**$191,303,100**
2	Rivers	9783	$13,921,200	$46,518,200
	Lakes	1865	$2,653,900	$8,868,100
	Option 2 Total		**$16,575,100**	**$55,386,300**
3	Rivers	3607	$5,132,800	$17,151,300
	Lakes	1541	$2,192,800	$7,327,500
	Option 3 Total		**$7,325,600**	**$24,478,800**
4	Rivers	3607	$5,132,800	$17,151,300
	Lakes	1541	$2,192,800	$7,327,500
	Option 4 Total		**$7,325,600**	**$24,478,800**

(*) freshwater wetland, existing riverbank wetlands and conserved lands excluded. These make up a significant portion of the total acres within riparian buffer zones.

The values for wetlands, rivers and lakes are added to provide a range of the overall estimate of societal benefits of strengthened buffer protection. These figures are annual figures ($/year)

Table 5-8. Societal Benefits of Proposed Wetlands Buffer Standards ($/year)

Option	Wetlands	Rivers	Lakes/ponds	Totals
1	$114,798,600 - $178,443,900	$49,551,700 - $165,578,600	$7,698,400 - $25,724,500	$172,048,700 - $369,747,000
2	$73,018,300 - $131,069,100	$13,921,200- $46,518,200	$2,653,400- $8,868,100	$89,592,900 – $186,455,400
3	$68,127,900 - $122,290,800	$5,132,800 - $17,151,300	$2,192,800 - $7,327,500	$75,453,500 – $146,769,600
4	$41,735,500 - $74,916,000	$5,132,800 - $17,151,300	$2,192,800 - $7,327,500	$49,061,100 – $99,394,800

Twenty Year Projection:

To project the societal benefits of stronger buffer protection in over twenty years, it was deemed appropriate to phase in the benefits over a ten- year period to reflect the fact that in some situations buffer restoration will be pursued. The length of time to restore a buffer will vary based on the objective, e.g. types of plants being established. A ten- year phase period was selected through best professional judgement as a reasonable period the common types of buffer restoration to become well established and mature to provide desired diversity of habitat, e.g. grasses, shrubs, certain trees. For options 2-4, the value of benefits is phased in using equal increments that accumulate for ten years after which the value is unchanged. The maximum protection option was not projected as it is not under consideration as a management option. Figures are rounded to the nearest hundred.

Table 5-9. Twenty Year Estimated Range of Societal Benefits of Wetland Buffer Standards

Year	Option 2 (Low end of range)	Option 2 (High end of range)	Option 3 (Low end of range)	Option 3 (High end of range)	Option 4 (Low end of range)	Option 4 (High end of range)
1	$8,959,300	$18,645,500	$7,545,400	$14,677,000	$4,906,100	$9,939,500
2	$17,918,600	$37,291,100	$15,090,700	$29,354,000	$9,812,200	$19,879,000
3	$26,877,900	$55,936,600	$22,636,100	$44,030,900	$14,718,300	$29,818,400
4	$35,837,200	$74,582,200	$30,181,400	$58,707,800	$19,624,400	$39,757,900
5	$44,796,500	$93,227,700	$37,726,800	$73,384,800	$24,530,500	$49,697,400
6	$53,755,700	$111,873,200	$45,272,100	$88,061,700	$29,436,700	$59,636,900
7	$62,715,000	$130,518,800	$52,817,500	$102,738,700	$34,342,800	$69,576,400
8	$71,674,300	$149,164,300	$60,362,800	$117,415,600	$39,248,900	$79,515,800
9	$80,633,600	$167,809,900	$67,908,150	$132,092,600	$44,155,000	$89,455,300
10	$89,592,900	$186,455,400	$75,453,500	$146,769,600	$49,061,100	$99,394,800
11	$89,592,900	$186,455,400	$75,453,500	$146,769,600	$49,061,100	$99,394,800
12	$89,592,900	$186,455,400	$75,453,500	$146,769,600	$49,061,100	$99,394,800
13	$89,592,900	$186,455,400	$75,453,500	$146,769,600	$49,061,100	$99,394,800
14	$89,592,900	$186,455,400	$75,453,500	$146,769,600	$49,061,100	$99,394,800
15	$89,592,900	$186,455,400	$75,453,500	$146,769,600	$49,061,100	$99,394,800
16	$89,592,900	$186,455,400	$75,453,500	$146,769,600	$49,061,100	$99,394,800
17	$89,592,900	$186,455,400	$75,453,500	$146,769,600	$49,061,100	$99,394,800
18	$89,592,900	$186,455,400	$75,453,500	$146,769,600	$49,061,100	$99,394,800
19	$89,592,900	$186,455,400	$75,453,500	$146,769,600	$49,061,100	$99,394,800
20	$89,592,900	$186,455,400	$75,453,500	$146,769,600	$49,061,100	$99,394,800
Totals	$1,388,690,000	$2,890,058,700	$1,169,529,500	$2,274,922,100	$760,447,000	$1,540,619,400

Present Value Estimates: The Agencies used a Present Value calculation to describe the present-day value of the societal benefits for three of options as estimated above. These are presented below and were calculated using a 3% social discount rate that places more weight on future benefits and is appropriate to the analysis.

Table 5-10: Present Value of Estimated Societal Benefits

Option	Present Value of Societal Benefits – Low End of Range (3%)	Present Value Societal Benefits – High End of Range (3%)
2 – Enhanced Protection	$961,697,700	$2,019,530,400
3 – Agency Proposed	$817,250,000	$1,589,682,400
4 – Limited Additional Protection	$531,389,100	$1,076,281,000

* Rounded to nearest hundred.

5.2 Societal Costs Related to Buffer Standards

The societal cost of the new buffers standards was estimated in terms of the potential effect on property value and the related capacity for borrowing. As noted earlier, the societal cost impact is challenging to characterize due to the differing effects it may have on property values and the various factors that contribute to property values. The proximity to naturally vegetated open space may be beneficial for property owners by providing aesthetic and privacy values that result in higher property values. Alternatively, preserving buffers may restrict some use of a property and potentially lower its value. That said, the regulatory framework does not prohibit alteration in a buffer zone but rather requires permitting oversight and the application of policies to avoid and minimize buffer disturbance. In current practice, it is very infrequent for the agencies to deny a permit for construction on any property that has adequate buildable area. It is expected that the designation of larger buffer zones will influence future site design, including for new subdivisions. However, any impacts are likely to partially or wholly mitigated by the application of conservation development principles which allow for same or higher density levels as conventional subdivisions while preserving green open spaces. Additionally, in general, conserved buffer zone areas can be counted toward meeting minimum lot sizes which is the rural portions of RI may be 2 acres or more. Research has also shown the homes in conservation developments sell faster and at higher property values when compared to similar homes. (NCSU, undated). Of note, during rule development, DEM conducted an evaluation to compare a large subset of existing actual permit applications, filed between 2016 and 2018, against proposed expanded buffer protection. The results indicated most projects would have been able to be permitted with minimal or no site plan changes.

Given the uncertainties, the Agencies estimated a range of impact in its methodology. Lacking any RI specific studies, the Agencies relied on relevant literature which was limited with respect to the cost impacts of buffers. Relevant available research was summarized in a literature review from 2017 that reported on studies that evaluated the effect on property price due to adjacent riparian buffers. (Bauer, 2017) This review found across the country that impacts were both positive and negative and ranged from -11% to +27% with two studies of riverine buffers finding no impact. Additional available research related to the impact of *wetlands* on property values from a study in Massachusetts was also considered. (Kiel, K., 2007) After reviewing the available research, the methods to estimate societal costs were developed using the following assumptions:

- The additional designation of buffer zone on a property is assumed to have a range of impact on property value on average ranging between a minimal effect (0.5%) and three percent (positive or negative) that is proportional to the percent of buffer zone on the parcel being added or reduced.
- For parcels being newly designated as buffer zone, it was *assumed* for this analysis that the further land use restriction would result in a loss of value in proportion to the extent of the restriction. Conversely, for those parcels in which the new buffer zone was

reduced from current regulation as “perimeter” or “riverbank” wetland, it was assumed that the effect would be a positive gain for the property owner.

The steps taken to conduct this portion of the cost analysis are described below:

1.Estimate the existing value of land parcels in RI

The analysis involves estimates of property values compiled on a statewide basis and assessed with GIS relative to the options described earlier. It is noted that the method provides a generalized estimate of societal cost and is not intended to estimate the impact to value of an individual parcel given the site- specific factors that will govern the actual effect of the rule. The approach taken by the Agencies required a data compilation effort to acquire readily available GIS parcel and tax assessor data from municipalities in order to assign a value to each parcel (reflecting both land and buildings). The data able to be collected was used to assign most parcels a value although certain limitations required values for some parcels to be estimated.

- West Greenwich did not have parcel data available in a GIS compatible format and therefore required estimated values be developed based on values in surrounding rural non-coastal communities, e.g. Exeter, Hopkinton and Richmond. Specifically, the cost estimate for these communities for the maximum protection option was used to produce a per acre cost ($4,816/ac) that was applied to the net new JA in West Greenwich for an additional cost of $6,478,000 and applied as an adjustment to the total costs (pro-rated for the other options.)
- Tax data for nine municipalities was not readily available for the analysis for various reasons: Central Falls, Johnston, Little Compton, Narragansett, New Shoreham, Newport, North Smithfield, West Greenwich and Woonsocket. In these municipalities, the Agencies applied the median value/acre of surrounding or similar communities. Analysis was conducted separately on parcels less than ten acres and parcels greater than or equal to ten acres. A similar approach was used in other communities for any missing individual values.
- An additional limitation is that even in those communities with both parcel and tax data, it was often found that a one to one match did not exist between the two datasets. In other words, some parcels will not have an assessed value and one must be assumed/calculated based on available data. The median value per acre for each municipality was used for these parcels. Median data was split out by parcels less than ten acres and parcels greater than or equal to ten acres.

2. Identify that portion of a parcel that is designated with new buffer zone areas.

The next step in the method was to use GIS to estimate the portion of the parcel that was overlain by ***new*** regulated area, e.g. JA or buffer zone. Two methods were applied.

Parcels less than 10 acres: For parcels less than 10 acres, estimates of new buffer zone were identified using GIS. Existing wetland resources and protected areas, including riverbank and

perimeter wetland, were excluded from counting as new buffer as they represent an existing baseline of protection. Permanently conserved lands were also removed to be consistent with the assumptions for societal benefits.

Parcels 10 acres and larger: Parcels of 10 acres and up were addressed separately with a method primarily intended to represent more fairly the impact on large parcels many of which would be expected to be subdivided for development. Unlike the smaller parcels, within the method it was deemed inappropriate to use the entire assessed value of the property given the variability of how much of parcel may actually be regulated within the JA. The large parcel method involves using GIS to estimate the new jurisdictional area (JA) being designated on the large parcels. By using the new JA, the initial analysis is presumed to represent the maximum protection option in which 100% of the new JA is designated buffer. It is assumed that the new JA would otherwise have been available for development. This is considered a conservative assumption given other constraints to construction are not considered, e.g. steep slopes, zoning etc.

Estimates for the remaining options were obtained by applying the ratio of new buffer acreage (covering all resources; wetlands, lakes, existing buffer and conserved lands removed) to the JA option results in the next step.

Table 5-11 New Buffer Acreage for All Resource Types by Region (acres)

Option	River Region 1 (acres)	River Region 2 (acres)	Urban Region (acres)	Total* (acres)	% of Maximum Protection Option
Maximum Protection	26,800	22,700	1,700	51,200	-
Enhanced Protection	16,400	11,300	400	28,100	55%
Agency Proposed	14,400	9,200	300	23,900	47%
Less Protection	9,500	5,500	300	15,300	30%

* Overlaps with wetland resources, existing protected area and conservation land excluded.

3. Estimate the Property Value Loss/Gain Associated with Revised Regulations for Wetland Buffers

The estimated societal cost in terms of property value impact was compiled on a statewide basis and generally reflects property assessment data from around 2016. The resulting potential statewide societal costs were estimated in part using GIS analysis. Two approaches were employed:

3a. For Parcels less than 10 acres:

Loss factors were derived to represent the estimated loss in property value attributable to the proposed policy options for parcels less than 10 acres. The loss or gain was estimated as the *total assessment value of the parcel x loss/gain factor* assigned to the parcel based on the percent of parcel area designated as new buffers. The loss factors were equally arrayed into classes at 25, 50, 75 and 100 percent. These represent the % of the parcel for which designated buffer zone is increasing or decreasing. Each class was then assigned a loss/gain factor ranging from -3% to 0 to +3% based on the percentage of new buffer overlap on the parcel. In areas where existing protection was relaxed (primarily in the Urban Region), the loss is negative and represents a gain in value that off-sets other losses. As noted above, loss/gain factors were assigned based on a review of literature and are established within the 4% loss in value related to wetlands that was reported in a MA study.

More specifically, the loss factors used for parcels less than 10 acres are as follows:

Table 5-12. Property Value Loss Factors

Percent of the parcel area change due to newly designated within zone (+/-)	-75 to -100%	-50 to -74%	-25 to -49%	-1 to -24%	0- -24%	25 – 49%	50-74%	75-100%
% factor applied to parcel assessment value	+3	+2	+1	+0.5	-0.5	-1	-2	-3

Table 5-13. Estimated Cost (Property Loss Value) on Parcels less than 10 acres

Option	River Region 1	River Region 2	Urban Region	Total Cost
1	$33,386,000	$139,835,200	(-$24,397,400)	$148,823,800
2	$28,529,900	$76,909,400	(-$13,185,600)	$92,253,700
3	$15,691,400	$65,722,100	(-$11,466,800)	$69,948,800
4	$10,015,800	$41,950,560	(-$7,319,220)	$44,647,100

3b. *Parcels 10 acres and larger –*

For parcels 10 acres and up, an alternate method was employed that involves a range of impacts. This was deemed appropriate due to complexity and therefore uncertainty inherent in predicting estimated impacts on property values. To obtain a property value of the new JA area, one of the following was done:

1. Where parcel specific data exists, calculate the *per acre parcel value* using the assessed land value of the entire parcel. This captures the variability in the % of JA

across large parcels. Multiply the per acre parcel land value to the acreage of new JA for each parcel, OR

2. Where assessment data is missing, apply the median assessed land value for the region (median per acre land value x acreage of new JA for the parcel). These calculated as River Region 1 - $4,000/acre, River Region 2 - $10,000/acre; and Urban Region - $70,000/acre.

The values for new JA estimated as above were then summed across all parcels 10 acres or greater. This produces the total value of the land being newly regulated as buffer for the maximum protection option assuming 100% of the value is lost. This total was then adjusted by subtracting the value of the new JA that is retained by the property owner assumed to be $1,000/acre (property assessment reflective of open space designation). The result represents the high end of the range of total estimated loss in property value for the maximum protection option (Option 1). The other options were estimated by applying the ratio of net new buffer acres across the options. The new buffer zone acreage excludes overlapping wetland resources, existing buffer and conservation lands.

Table 5-14: New Buffer Acreage (all resource types) Associated with Options

Option	New Buffer Acres	% of Maximum Protection Option
1	51,200	100%
2	28,100	55%
3	23,900	47%
4	15,300	30%

Table 5-15: Area of Parcels 10 Acres or Greater and Estimated Loss in Property Value (Upper Endo f Range)

Region	Acres of New JA*	Maximum Protection **	Enhanced Protection **	Agency Proposal**	Less Protection **
River Region 1	28,106	$ 91,772,000	$50,474,600	$43,132,800	$27,531,600
River Region 2	11,725	$209,073,900	$114,990,600	$98,264,700	$62,722,200
Urban Region	3,400	$ 98,327,900	$54,080,300	$46,214,100	$29,498,400
Total	**43,231**	**$339,173,800**	**$219,545,500**	**$187,611,600**	**$119,752,200**

(*) Estimated as described above. (**) Figures rounded to nearest hundred.

To establish the lower end of a range of impacts, an adjustment factor of 10% to the total estimated property loss for large parcels was developed. This factor was derived from a DEM evaluation of potential impact on actual DEM subdivision permit applications submitted between 2016 and the beginning of 2018. Nine subdivisions of 5 or more lots all located in non-urban regions were reviewed in comparison to the Agency option. The total number of lots

proposed in these applications was 223. DEM found the new rules would have had no effect on the number of lots in 8 of the 9 subdivisions, with some requiring minor changes for the site plans to comply. In one case, it was estimated 1-2 lots might be adversely affected (presumed loss). The explanation for the relatively low degree of impact is that the incremental increase in buffer zone width, in most cases adding additional width to existing perimeter or riverbank wetland, does not unduly constrain the configuration of lots on large parcels, particularly in communities with larger lot zoning; e.g. 1-2+ acres. This finding is consistent with DEM's experience and results from the following factors:

1) The configuration of new buffers along the resource on the property, e.g. typically a narrow strip of land adjacent to the resource or existing buffer.
2) Requirements of large lot zoning, particularly in River Region 1, which provide flexibility to lay out houses on individual lots and accommodate larger buffers.
3) Ability to count the buffer when satisfying large lot zoning calculations.
4) Ability to use clustering and conservation development to achieve same number of housing units on the parcel while avoiding intrusion into buffer.

The 10% represents the highest reduction in lots that DEM identified in its review of the subdivisions relative to the agency option.

Table 5-16: Area of Parcels 10 Acres or Greater and Estimated Loss in Property Value (Lower End of Range)

Region	Acres of New JA*	Maximum Protection **	Enhanced Protection **	Agency Proposal**	Less Protection **
River Region 1	28,106	$ 9,177,200	$5,047,400	$4,312,800	$2,753,200
River Region 2	11,725	$20,907,300	$11, 499,100	$9,826,500	$6,272,200
Urban Region	3,400	$ 9,832,800	$5,409,000	$4,621,200	$2,949,800
Total	**43,231**	**$39,917,300**	**$21,955,500**	**$18,760,500**	**$11,975,200**

(*) Estimated as described above. (**) Property value figures rounded to nearest hundred.

4. Estimate Overall Societal Costs Due to Loss in Property Value-

The range of estimated societal costs is summarized below. The potential loss in value is viewed as a one-time societal cost reflected in changes to property value that occur once.

Table 5-17. Total Estimated Societal Costs – Loss in Property Value

Option		Range of Estimated Societal Cost (in property value)		
		Cost - Parcels > 10 acres	Cost – Parcels less than 10 acres	Total Cost *
1.	Maximum Protection	$39,917,300 - $339,173,800	$148,823,800	$ 195,219,100 - $494,475,600
2.	Enhanced Protection	$21,955,500- $219,545,500	$92,253,700	$117,812,100 - $315,362,100
3.	Targeted Protection	$18,760,600 - $187,611,600	$69,946,800	$91,752,100- $260,603,100
4.	Lesser Protection	$11,975,200 - $119,752,200	$44,647,100	$58,565,700 - $166,342,700

* Includes adjustment to add estimated costs for West Greenwich: Option 1 = $6,478,000, Option 2 = $3,562,900, Option 3 = $3,044,700 and Option 4 =$1,943,400

5. Estimate the Societal Cost of Reduced Home Equity Borrowing Capacity -Associated with the loss in property value is the potential reduced borrowing capacity with respect to home equity. Equity is drawn out of home either by home equity line of credit or cash-out refinance. The typical percentage nationwide of equity withdrawn annually is about 1.5 percent. To arrive at an annual number the estimated total loss in property value is multiplied by 1.5 %. Figures are rounded to the nearest hundred.

Table 5-18. Estimated Societal Cost – Reduced Borrowing Capacity

Option		Loss in Property Value	1.5% of Loss Value per year	Loss over 20 years
1.	Maximum Protection	$ 195,219,100 - $494,475,600	$2,928,300 – $7,417,100	$58,566,000 – $148,342,000
2.	Enhanced Protection	$117,812,100 - $315,362,100	$1,767,200 – $4,730,400	$35,344,000 – $94,608,000
3.	Targeted Protection	$91,752,100- $260,603,100	$1,376,300 – $3,909,000	$27,526,000 – $78,180,000
4.	Lesser Protection	$58,565,700 - $166,342,700	$878,500 – $2,495,100	$17,570,000 – $49,902,000

Summary of Costs and Net Present Value

The societal costs are summarized for a twenty- year period by combining the estimated loss in property value and borrowing capacity. The property value is assigned as a loss in year 1. The borrowing capacity is a recurring loss assigned each year over twenty year. The projection is limited to options 2-4.

Table 5-19. Twenty Year Estimated Range of Societal Costs of Wetland Buffer Standards

Year	Option 2 (Low end of range)	Option 2 (High end of range)	Option 3 (Low end of range)	Option 3 (High end of range)	Option 4 (Low end of range)	Option 4 (High end of range)
1	$119,579,300	$320,092,500	$93,128,400	$264,512,100	$59,442,200	$168,837,800
2	$1,767,200	$4,730,400	$1,376,300	$3,909,000	$878,500	$2,495,100
3	$1,767,200	$4,730,400	$1,376,300	$3,909,000	$878,500	$2,495,100
4	$1,767,200	$4,730,400	$1,376,300	$3,909,000	$878,500	$2,495,100
5	$1,767,200	$4,730,400	$1,376,300	$3,909,000	$878,500	$2,495,100
6	$1,767,200	$4,730,400	$1,376,300	$3,909,000	$878,500	$2,495,100
7	$1,767,200	$4,730,400	$1,376,300	$3,909,000	$878,500	$2,495,100
8	$1,767,200	$4,730,400	$1,376,300	$3,909,000	$878,500	$2,495,100
9	$1,767,200	$4,730,400	$1,376,300	$3,909,000	$878,500	$2,495,100
10	$1,767,200	$4,730,400	$1,376,300	$3,909,000	$878,500	$2,495,100
11	$1,767,200	$4,730,400	$1,376,300	$3,909,000	$878,500	$2,495,100
12	$1,767,200	$4,730,400	$1,376,300	$3,909,000	$878,500	$2,495,100
13	$1,767,200	$4,730,400	$1,376,300	$3,909,000	$878,500	$2,495,100
14	$1,767,200	$4,730,400	$1,376,300	$3,909,000	$878,500	$2,495,100
15	$1,767,200	$4,730,400	$1,376,300	$3,909,000	$878,500	$2,495,100
16	$1,767,200	$4,730,400	$1,376,300	$3,909,000	$878,500	$2,495,100
17	$1,767,200	$4,730,400	$1,376,300	$3,909,000	$878,500	$2,495,100
18	$1,767,200	$4,730,400	$1,376,300	$3,909,000	$878,500	$2,495,100
19	$1,767,200	$4,730,400	$1,376,300	$3,909,000	$878,500	$2,495,100
20	$1,767,200	$4,730,400	$1,376,300	$3,909,000	$878,500	$2,495,100
Totals	$153,156,100	$409,970,100	$119,278,100	$338,783,100	$76,133,700	$216,244,700

Present Value Estimate:

The Agencies used a Present Value (PV) calculation to describe the present-day value of the societal costs for the options as estimated above. In the analysis, these are presented below as negative figures at a 7% discount rate for three of the same options assessed in the societal benefit analysis. The 7% rate equates to a return of investment which is appropriate to apply in this situation; e.g. property values that area affected by the market conditions.

Table 5-20. Present Value of Societal Cost Estimates

Option	Present Value of Societal Costs – Low End of Range (7%)	Present Value of Societal Cost – High End of Range (7)%
2 – Enhanced Protection	-$129,493,800	-$346,629,400
3 – Agency Proposed	-$100,330,200	-$284,966,300
4 – Limited Additional Protection	-$60,404,900	-$171,570,700

Values rounded to the nearest hundred.

6.0 Societal Benefits and Costs Associated with Permit Process Changes

6.1. Background -As described in earlier section, the amendments to the Freshwater Wetlands law in 2015 expanded the jurisdictional area for DEM and CRMC (the "Agencies") regulation of freshwater wetlands by nearly 50% over current jurisdiction. This non-discretionary expanded jurisdictional area is the baseline to estimate the number of future permit applications to the Agencies in the analyses that follow.

The Agencies have taken this opportunity to evaluate all aspects of the regulations. As a result of this comprehensive review of the regulations, many changes (referred to as "process changes") are proposed to reduce the regulatory burdens for applicants by means of new permit types and other changes to improve clarity, readability and predictability. The benefits and costs of these changes as described in the following are considered to apply equally to all the options previously discussed.

Because of the expanded jurisdictional area in the law, a larger number of projects will be subject to the Freshwater Wetlands permitting program. The Agencies have created several new permitting mechanisms to reduce the potential burden on applicants and on the Agencies of the expanded jurisdictional area. In addition, the proposed Rule expands the list of exempt activities not subject to permitting. These additional exemptions are incorporated into the tables herein. This analysis will use the current DEM Preliminary Determination application as the baseline for a comparison and determination of the benefits of the proposed two new application types described below. The analysis is based on DEM permitting data only. The Agencies note that the number of CRMC freshwater wetland applications issued permits annually over the last five years averages to about 10% of that of DEM. The potential cost savings related to this much lower number of permits was not included in the analysis and was not expected to significantly affect the result.

Freshwater Wetlands General Permit

Section 2.10 establishes the Freshwater Wetlands General Permit. This permitting option is currently not in the Agency Freshwater Wetland Rules. The following types of projects involving less than one acre of land disturbance are potentially eligible for applying to the Agencies under the General Permit:

- Individual residential construction on lots of record;
- Limited projects associated with existing developed property;
- New development outside of designated buffer zones; and
- Stormwater retrofits

Upon confirmation in writing from the Agency, and subject to all the terms and conditions in the General Permit, applicants are authorized to proceed with eligible projects.

The estimated cost savings for the use of a General Permit compared to a Freshwater Wetlands Permit includes the following:

- Reduced application preparation and submittal requirements:
- Reduced application fees for General Permits;
- Reduced Agency decision times, savings to applicants; and
- Cost savings to the Agencies for reduced permit application review time.

Freshwater Wetlands Permit

For DEM, the proposed Rules create a new Application for Freshwater Wetlands Permit (Section 2.11) and a Variance review process to replace the current Request for Preliminary Determination (Section 1.9). When all the standards in Section 2.7.1 can be met by the project, the application submittal requirements are reduced from what is currently required under a Request for Preliminary Determination. If the standards cannot be met, a variance must be submitted that addresses the avoidance and minimization requirements. These variance avoidance and minimization requirements are similar to the avoidance and minimization requirements that must be addressed in all current Requests for Preliminary Determination.

The estimated cost savings per application for Freshwater Wetlands Permit compared to the current DEM Request for a Preliminary Determination are:

- Reduced application preparation and submittal requirements:
- Reduced Agency decision times, savings to applicants; and
- Cost savings to the Agencies for reduced permit application review time.

6.2. Methodology For Benefits and Costs Related to Process Changes – The method for estimating benefits and costs related to process changes involves estimating the increase in permit workload and assigning that workload to the categories of permits, including the new permit options being proposed. Then the methods focused on estimating costs savings for the applicants in developing applications for certain permit types and placing a value of the time savings that may be achieved with process changes. The Agencies summarize the comparison

between the current rules and proposed rules (Option 3). Further analysis was not done as the process changes are applicable to all the other policy options considered in this cost-benefit analysis.

Number of New Applications -DEM estimated the numbers of increased permits for different application types using existing data as a basis for projections following the methods outlined below.

Assumptions:

- 2016 is being used as a representative year for application numbers/types. (Note that the application numbers for 2017 are on par with those from 2016.)
- The current number of applications will increase proportionally with the increased regulated area (30% from #7 Table II.A)
- 5% of PD applications are expected to meet the new exemptions = 12 projects.
- The 12 exempt projects are assumed to be associated with the following application types and are broken down as follows:
    - 5 single family General Permit (40%)
    - 5 commercial General Permit (40%)
    - 2 other projects (20%)
- The exemptions have been subtracted from the appropriate application types in the Table below – numbers in parentheses account for the exemptions.

Table 6-1. Freshwater Wetland Application Volumes (RIDEM)

Application Types	**Number of Applications in 2016 (Estimated by Type)**	**Expected Number of Applications Under the New Law (increase by 30%, except where noted)**
Current Process Preliminary Determination Applications Total o Minus 38 Other Projects that do not increase = 192 o 30% increase = 250 o Plus the 38 that did not increase = 288	230	288

Exemptions Total 12 of the current projects are expected to meet the new exemptions in the proposed rules. This would increase by 30% to 16.	12	16
PD Single Family Applications Total Minus 5 Exemptions	78 (73)	94
33% Single family applications likely eligible for NEW General Permit Minus 5 Exemptions	26 (21)	27
67% Single Family applications likely requiring Freshwater Wetland Application with Variance Application (same as current PD)	52	67
PD Commercial Applications Total Under New Law: ○ Minus (7) Exemptions = 145 ○ Minus 36 Other projects that do not increase = 109 ○ Increase by 30% = 142 ○ Add in the 36 Other projects that do not increase = 178	152	178
Subdivisions Total • 70% likely eligible for NEW Freshwater Wetlands Application • 30% likely require Freshwater Wetland Application with Variance (same as current PD	36 25 11	47 33 14
Redevelopment Total Minus 5 Exemptions = • 50% likely eligible for NEW General Permit Minus 5 Exemptions =	20 (15) 10 (5) 6	20 7 8

• 30% likely eligible for NEW Freshwater Wetlands Application • 20% likely requiring Freshwater Wetland Application with Variance Application (same as current PD)	4	5
New Development Total • 5% likely eligible for NEW General Permit • 60% likely eligible for NEW Freshwater Wetlands Application • 35% likely requiring Freshwater Wetland Application with Variance Application (same as current PD)	58 3 35 20	75 4 45 26
Others Total Minus 2 Exemptions 2 • 100% likely requiring Freshwater Wetland Application with Variance Application (same as current PD) • Likely **not** to increase in new jurisdictional area, e.g., docks, bridge replace, damn repair, wells	38 (36)	36 (No increase)

Permit Application Preparation Costs -To derives estimates of application costs, DEM surveyed three members of the Wetlands Legislative Task Force that have experience in preparing applications for submittal to the Agencies to provide input on the costs applicants incur in applying to the Agencies under the current Rules. This information was used to generated assumptions for the estimated costs to apply to the Agencies using the permit application types in the proposed Rules. These cost estimates (rounded to nearest $100) are below. It is recognized that costs will vary given specific site conditions and the complexity of a project. Wetlands Program Supervisors estimated that the cost to prepare an application for a General Permit will be 10% less than the cost to submit a Freshwater Wetlands Application (no variance).

Table 6-2. Application Preparation Cost Assumptions

Application Types	Application Preparation Costs
Preliminary Determination for Non-residential -- Current Rules	$24,300

Preliminary Determination for Single Family -- Current Rules	$4,800
Freshwater Wetland Application Non-residential, No Variance	$15,100
Freshwater Wetland Application Non-residential, with Variance	$24,300
Freshwater Wetland Application Single Family, No Variance	$3,700
Freshwater Wetland Application Single Family, with Variance	$4,800
General Permit Residential	$3,300
General Permit Non-Residential	$13,600

Table 6-3. Agency Decision Times

Application Types	Decision Time (days)
Preliminary Determination - Current Rules	35
Freshwater Wetlands Application, No variance	30
Freshwater Wetlands Application with Variance	35
Freshwater Wetlands Application for Single Family with Variance	30
General Permit Residential	10
General Permit Non-Residential	15

Estimated Time Savings Cost To Private Sector - Based on inquiries with contractors regarding the value of a one-week-faster permitting process, for this analysis, RIDEM developed the assumption that placed the value at $650 per week or $93 per day. This falls in the middle of the range of $300-$1,000 which reflected the feedback obtained by RIDEM.

6.3 Analysis Summary – Current and Proposed Process

The cost savings associated due to rule changes, including streamlined applications when no variance is needed, were estimated by comparing the current permit process to the process envisioned to be administered under the proposed rules using the assumptions described above. The Agencies note that applicants will also obtain some cost-savings by the elimination of duplicative process associated with local ordinances. Data was not readily available to quantity the savings of this beneficial streamlining for this analysis. The Agencies note there is considerable variation in the local ordinances.

Table 6-4. Cost to Prepare Applications -Current Process

Application Type	Number	Cost per Application (Table II.C)	Total Costs
Preliminary Determinations - Single Family	101	$4,800	$484,800

Preliminary Determinations – Commercial (Non-Residential)	187	$24,300	$4,544,100
Totals	288		$5,028,900

Table 6-5 - Cost to Prepare Applications Under Proposed Rules

Application Type	Number of Applications (Table II.B)	Cost per Application (Table II.C)	Total Costs
Freshwater Wetland Application Non-Residential, No Variance	86	$15,100	$1,298,600
Freshwater Wetlands Application Non-Residential, with Variance	81	$24,300	$1,968,300
Freshwater Wetlands Application Single Family, with Variance	67	$4,800	$321,600
General Permit Residential	27	$3,300	$89,100
General Permit Non-Residential	11	$13,600	$149,600
Exemptions	16	0	0
Totals	288		$3,827,200

Table 6-6. Costs for Agency Decision Times

Application Type	Number of Applications (Table II.B)	Decision Time per Application (days)	Total Days	Total Cost $93/day
Freshwater Wetland Application Non-Residential, No Variance	86	30	2580	$239,940
Freshwater Wetlands Application Non-Residential, with Variance	81	35	2835	$263,655
Freshwater Wetlands Application Single Family, with Variance	67	30	2010	$186,930
General Permit Residential	27	10	270	$25,110

General Permit Non-Residential	11	15	165	$15,345
Exemptions	16	0	0	0
Totals	288			$730,980

Table 6-7. Comparison of Costs Between Existing Process and Proposed Process

	Current Process	**Proposed Process**
Cost for Application Preparation (Private Sector)	$5,028,900	$3,827,200
Cost for Agency Decision Time (Private Sector)	$937,440	$730,980
Total	$5,966,340	$4,558,180
Permit Streamlining Savings Per Year		$1,408,160

The analysis results in an estimated savings per year associated with process changes (streamlining) of $1,408,160. Given the need to issue general permits and the phase in of the effective date, the Agencies assume it will the full savings will initially be 25% in year 1, 50% in year 2 and fully realized in year 3 and each year thereafter. Over the twenty- year analysis period this equates to about $26,403,000. The present value of the twenty-year savings is $**13,295,700** assuming a 7% discount rate.

7.0. Additional Provisions to Reduce Costs and Improve Clarity, Readability, and Predictability

Many changes are proposed to the Rules to improve clarity, readability and predictability. Quantifying the benefits of these types of changes is extremely difficult and often not practical. As with any new Rule, initially it may take increased time to work with the Rules. However, over time as applicants become familiar with the requirements, both applicants and the Agencies are expected to experience increased efficiencies. These changes include the following:

1. Re-organized the order of the sections.

2. Created a new section that clarifies what is NOT considered a freshwater wetland. (Section 2.5.1(B))

3. Section 2.6 of the Rules "Exempt Activities" identifies certain activities that may proceed without a written permit from the Agencies, subject to conditions in the Rules. The proposed Rule expands this list of exempt activities and provides clarification on practices that were always considered exempt and not subject to permitting.

4. Standards (Section 2.7)

- Grouped all standards and review criteria into one section;
- Where possible, each standard has a specific measurable target;
- When standards cannot be met, the process to apply for a variance from the standard has been developed; and
- Variance review criteria are clearly specified. These criteria are consistent with the CRMC requirements used in implementing the Coastal Resources Management Program.

5. Section 2.7.1(B)(5) establishes a reduced buffer standard for new construction on an individual residential lot of record meeting specific conditions of an infill lot. Infill lots are small lots, on an existing road, are undeveloped and have structures on both sides. Applicants that meet the Infill lot standard will be eligible to submit an application for a Freshwater Wetlands permit with no variance request.

6. Reduced the number and simplified the fee categories (Section 2.8.9). Also, the new General Permits will have a reduced application fees compared to the existing preliminary determinations.

7. Require applicants for major land development and major subdivision projects to submit documentation of local master plan approval prior to submitting a wetlands application to DEM (Section 2.8.11(A)). This requirement is consistent with the procedures in state law (RI Gen. Laws Chapter 45-23) and will strengthen coordination between the municipal and state processes. By ensuring applicants receive local approval before submitting to DEM, applicants will avoid delays and costs in having to potentially resubmit applications to DEM after local review. It should be noted that CRMC already requires local approval certifying compliance with local zoning ordinances for all land development applications.

8.0 Summary and Net Present Value

The table below summarizes the Net Present Value (NPV) of societal benefits and costs estimated through this analysis for Options 2-4 including the Targeted Protection Option proposed by the Agencies. The costs are treated as negative values and added to the PV of benefits. The Agencies note the costs associated with Option 3 constitute a very small percentage (0.09 to 0.24%) of the total assessed property value in RI tabulated at over $118 billion in 2018. Over a twenty-year period, the estimated NPV reflects that the PV of societal benefits accrued annually as various ecosystem services are significantly larger than the estimated range of PV of societal costs. Option 3 recommended by the Agencies produces a range of NPV of **$545,549,400** to $**1,502,648,400** in societal benefits associated with implementation of the proposed Freshwater Wetland Rules. The Agencies, DEM and CRMC, have determined that that the benefits of the proposed rule justify the costs of the proposed rule and that the proposed rule achieves the objectives of the authorizing statute in a cost-effective manner over other alternatives.

Table 8-1: Summary Table of Estimate of Twenty-Year Societal Costs and Benefits – Proposed Freshwater Wetland Regulations

Option	Option Assumption	PV of Societal Benefits	PV of Societal Costs (-)	Net Present Value
2	High End of Range	$2,032,826,100	-$346,629,400	$1,686,196,700
	Low End of Range	$974,993,400	-$129,493,800	$845,499,600
	Best Case (High Benefits/Low Costs)	$2,032,826,100	-$129,493,800	$1,903,312,300
	Worst Case (Low Benefits/High Costs)	$974,993,400	-$346,629,400	$628,304,000
3	**High End of Range**	**$1,602,978,600**	**-$284,966,300**	**$1,318,012,300**
	Low End of Range	**$830,545,700**	**-$100,330,200**	**$730,215,500**
	Best Case (High benefits/Low Costs)	**$1,602,978,600**	**-$100,330,200**	**$1,502,648,400**
	Worst Case (Low Benefits/High Costs)	**$830,545,700**	**-$284,966,300**	**$545,549,400**
4	High End of Range	$1,089,576,700	-$171,570,700	$918,006,000
	Low End of Range	$544,684,800	-$60,404,900	$484,459,900
	Best Case (High Benefits/Low Costs)	$1,076,281,000	-$60,404,900	$1,015,876,100
	Worst Case (Low Benefits/High Costs)	$544,684,800	-$171,570,700	$373,114,100

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