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Possibility of Consolidated Wetland Mitigation in a Multi-Layered Legislated State

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Possibility of Consolidated Wetland Mitigation in a Multi-Layered Legislated State

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ABSTRACT

Wetland impacts result from private and public construction. Increasing population has led to an increase in development and consequently to an increase in national wetland impacts. In the past decades legislation has been passed to protect and to compensate for the wetland acreage lost to such development. Compensation can be achieved on-site or off-site by the party impacting the wetland and alternatively the mitigation responsibility may be transferred to a consolidated wetland mitigation (CWM) program. CWM programs provide permittees with increased flexibility when fulfilling permit requirements while increasing efficiency, the rate of success and environmental quality. In-lieu fee (ILF) and wetland banking (WB) programs are two of the most widely utilized programs in the United States. However, Connecticut stands as one of the few states to not have implemented such programs and therefore, most, if not all, impacts are compensated for by the permittee. The implementation of CWM in Connecticut is hampered by the state's legal structure, because municipalities have regulatory authority over wetland compensation by private entities within their jurisdiction. Currently, only state agencies (e.g. CT Department of Transportation) are able to create a consolidated program, but with limited acreage impacted per year, it is unclear whether it could be sustainable. Incorporating private impacts from municipalities would increase the wetland impact market, making CWM more feasible for program establishment. In this study we have assessed the feasibility and financial implications of instituting CWM in Connecticut. We have conducted a survey of states with CWM programs and evaluated private wetland impact data in Connecticut. Our results suggest that even if 5% of the reported private impacts were mitigated for in a CWM program at a mitigation ratio of

2:1, the program would be viable for implementation. This is in part because private wetland impacts represent more than 95% of the state's total impacted acreage. Establishing a CWM program would represent a flexible solution to the state's wetland mitigation practices, and, supported by the data, an opportunity that cannot be ignored with the potential to generate $2M annually towards wetland mitigation. In addition, our study demonstrated that given the lack of knowledge and interest from the towns regarding a CWM program, an education program will be essential to implementing a CWM under the current legislative conditions.

INTRODUCTION

Wetlands are important aspects in ecosystems due to the richness of biotic life as well as their role in chemical cycling. Wetlands also provide benefits to humans via wildlife habitat, recreation, flood control and the mitigation of nutrient contamination. However, these services are compromised as wetlands and watercourses regularly are impacted by human development (Zedler and Kercher 2005, NRC 2001). Impacts result from private (e.g., driveways, parking lots) and public construction (e.g., state roads and public works), with state transportation agencies impacting significant areas of wetlands each year. Impacts to wetlands by development have traditionally increased throughout the United States as population increases and urban centers expand. Highways and transportation projects have increased in the past decade in response to budgetary increases associated with the passing of the Transportation Equity Act for the 21st Century (Marble and Riva 2002). To maintain human quality of life and environmental quality, wetlands impacts have been avoided, or minimized if avoidance is not possible. Therefore, while impacts to wetlands due to development will continue to be an issue in the future, increased legislation requirements have led to a decrease in the amount of wetland acreage lost to development. For example, in Connecticut (CT), the amount of impacts to wetlands has decreased dramatically, from 453 acres in 1991 to 124 acres in 2003 (CT DEP 2010).

When avoidance is not possible and all efforts have been made to minimize the impacts, remaining wetland losses and impacts must be compensated for either through enhancement of existing wetlands, restoration of degraded wetlands, creation of new wetlands or the preservation of existing wetlands, as mandated by state and federal

regulatory legislation. Compensation can be achieved on-site or off-site by the party impacting the wetland. Alternatively, responsibility for compensation can be transferred to a consolidated wetland mitigation program. Such management strategies regarding wetland mitigation practices are designed to balance the economic benefits of development with the ecosystem services and societal benefits that wetlands provide. Traditional mitigation approaches have involved on-site mitigation of impacts. However, off-site consolidated compensatory wetland mitigation (CWM), including wetland banking (WB) and in-lieu fee (ILF) programs, has been introduced as a viable alternative, offering cost (Ayres 2000) and environmental benefits relative to permittee-responsible mitigation (PRM). From a project impacting party perspective, economies of scale allow for a reduction in oversight and maintenance requirements, consistent and documented management decisions, and a decrease in construction delays (TRB 2002). Simultaneously, CWM also improves environmental functions and needs by providing larger wetland areas, increased and more consistent management, and enhanced scientific and technical input in the design and management (NRC 2001).

While wetland resources are valued and generally protected in CT with impacts regulated under the Inland Wetland and Watercourses Act (IWWA), CWMs have yet to be implemented in CT. At present, impacts to wetlands in CT are compensated for primarily through PRM, often at a high cost with the potential for construction delays involving state transportation projects (Mark Alexander, Environmental Planning, CT Department of Transportation, Personal Communication). Often, the small scale and potential isolation of onsite mitigation sites render them ecologically insignificant. Most states in the United States (US), including some New England states, have adopted these

mitigation approaches (ELI 2006), taking advantage of the economies of scale and improved environmental benefits. In CT, a few non-profit agencies have expressed interest in establishing a program, including the National Audubon Society and Ducks Unlimited among others, and state agencies (e.g., the CT DEP and ConnDOT) are also interested in exploring alternative options (Mark Alexander, Personal Communication). However, the "home rule" legal structure complicates the implementation of wetland mitigation alternatives by increasing the number of regulatory layers (BenDor and Brozovic 2007). The multi-layered jurisdictional system in CT with respect to water resource regulations does not permit local, private impacts to be mitigated via CWMs. This reduces the potential number of impacted acres that might buy into such programs by requiring separate credit systems for each of the 161 municipalities dramatically reducing (>95%) the total impacted acreage buying into alternative mitigation systems and increasing the cost per project over which operating costs would be distributed. In addition to the strong "home rule" sentiment and structure, the lack of large undeveloped parcels of land, and the prevailing support of the public for environmental considerations in the state make establishing alternatives to PRM more difficult.

We conducted a study to assess whether CWMs, such as ILF and WB programs, are viable options to be implemented in CT. Surveys were conducted of state agencies in other states and used to determine the potential benefit and implementation challenges for CT. Our overall objective was to determine whether a CWM program would be viable in Connecticut and the possibility given the current regulatory structure. Specific objectives were to assess the challenges to CWM implementation in CT, review recent CWM programs established in New England, apply those regional lessons to CT and to evaluate

the impact of modifying state legislation to allow for private impacts participation. In addressing these objectives, we have summarized the potential challenges to CWM implementation in CT. More importantly, we have evaluated alternative options concerning private impacts and present a path and benefits to implementation.

BACKGROUND

Legislation

Federal

After the Clean Water Act (CWA) was passed in the 1970s a series of subsequent laws were passed concerning wetland impacts. The 40 Code of Federal Regulation (CFR) Section 230.10(a) prioritized avoidance of impacts to wetlands. When impacts cannot be avoided, the progression is to minimize impacts and as a last resource to compensate through mitigation any wetland impacts that could not be avoided. After all unavoidable impacts have been minimized, compensatory wetland mitigation for acreage lost due to development must be carried out. Traditionally, federal agencies had an administrative preference to carry out on-site PRM projects at or adjacent to the impact site. When such compensatory mitigation projects were not deemed to be practical or beneficial, then off-site, CWMs were advisable. This was changed when in 2008 the US Army Corps of Engineers (USACE) and the US Environmental Protection Agency (USEPA) released rules and regulations on "Compensatory Mitigation for Losses of Aquatic Resources" (USACE 2008). The new rule acknowledges the advantages of CWMs and gives them an administrative preference when mitigating for aquatic losses over PRM except for those cases involving water quality or flood control. Banking is preferred. However, if a WB is not available in the service area, then ILF programs would be preferred prior to PRM. The shift in federal administrative preference was sparked in the recent years by studies indicating not only the advantages of CWMs to impacting parties (USACE and USEPA 2008), but also for regulatory agencies and the environment (TRB 2002, Verhoeven 1999). The increase in use of CWMs over the past two decades is evidenced by their

presence in almost all states in the US (TRB 2002). Regardless of CWM or PRM, the listed compensatory mitigation order of preference is usually followed: restoration, enhancement, creation, and preservation. While preservation secures ecological function for existing ecosystems, this is the least preferred as this does not contribute to the goal of "no net loss" of wetlands (CRS 2005).

State of Connecticut

The state of CT represents a unique case with respect to wetland regulation. While impacts by state agencies are regulated by the CT DEP, the CT IWWA (Connecticut State Statutes 1972a) gives authority for private impact regulation to municipalities to consider wetland mitigation when needed. The legislation requires municipalities to take measures to help "prevent or minimize" the degradation of wetlands, and requires measures to establish compensatory mitigation. The IWWA provides autonomy to municipalities in CT, but federal law, including mitigation requirements, may also apply, particularly for large projects. Therefore, some mitigation projects regulated by the municipalities may sometimes require the design of mitigation projects that are in sync with federal regulations.

The IWWA does not specifically preclude private actions from inclusion in third-party mitigation. Section 22a-42 of the state code passes the responsibility to mitigate through the CT DEP to municipalities, particularly town Inland Wetland Commissions (IWC). However, two CT Supreme Court cases have shaped the legal landscape regarding third-party mitigation alternatives. In the first case (Red Hill Coalition, Inc. v. Conservation Commission, 1989 CT 212), the Court determined that accepting funds in

lieu of PRM did "satisfy the intent of the legislature" with regard to the IWWA by having a well-developed plan in place for the town to utilize those funds to perform in-kind mitigation elsewhere in the watershed. Two key factors in this decision were the presence of a well-developed plan and the town, who is in charge of overseeing the initial mitigation, performing the future off-site mitigation. Conversely, in the second case (Branhaven Plaza, LLC v. IWC of the Town of Branford, 1999 CT 251) the Court determined that accepting funds for future off-site, in-kind mitigation was not acceptable without a well-developed, planned future mitigation.

Informal discussions with state wetland legal experts advised caution in interpreting these decisions. Legislation in CT (Connecticut State Statutes 1972b) does specify that "municipalities may come together to form a district" to regulate wetlands on a regional basis. However, while an ILF/WB program outlines a sufficient plan to satisfy the Court according to the Branhaven case, the formation of the wetland district may not overcome the need for one of the towns involved to be the party directly performing the future in-kind mitigation as specified in the Red Hill case. Two prior pieces of legislation; the Multiple Use Rivers Act (Connecticut State Statutes, 1997) and the Protected Rivers Act (Connecticut State Statutes, 1995) specifically address the ability of multiple municipalities in a watershed to form a regional district regarding water resources. However, while these pieces of legislation provide promise that a district may be possible for wetland regulation even under the current statutes, particularly the Multiple Use Rivers Act, neither act has yet been implemented by any municipalities in the state. Based on these cases and opinion, under current law compensatory mitigation alternatives

may only be used if 1) there is a well developed plan and 2) it is performed by the municipality (i.e., town).

Wetland Mitigation Mechanisms

Compensatory mitigation can be performed either on-site or off-site through PRM or through CWM. PRM is carried out by the impacting party while CWM often requires the involvement of a third party. CWM can involve compensation for either all of the impacts or only those impacts deemed to remain after PRM has been performed. In short, after the permittee has impacted a wetland, the permittee may pay a third party a fee based on their impacts in exchange for assuming the responsibility of mitigation.

Permittee-Responsible Mitigation

Mitigation carried out by the permittee is the most common mechanism for compensatory mitigation nation-wide and represents the largest yearly acreage of all compensatory mitigation mechanisms. As the current practice in CT and the historical option prior to initiation of WB and ILF programs, PRM serves as the base case against which alternative wetland mitigation options are assessed. In this option, a permittee, who has impacted a wetland or an aquatic resource, is responsible for the compensatory mitigation. Therefore, the permittee must compensate and maintains the responsibility for ensuring that the compensatory mitigation is successful.

Although representing the dominant form of mitigation, in many cases PRM is the least preferred and an impractical option (USACE, 2008). Many impacted sites are in developed areas. Therefore, land suitable for remediating the impacts directly is either unavailable or costly. Additional challenges associated with PRM practices are the design

limitations as small-scale PRM mitigation projects often lack the mitigation expertise which CWM sponsors often possess and may fail to provide for the wetland functions lost. Sometimes, the scale is so small that mitigation is not conducted or mitigation is attempted and the project is unsuccessful due to limited attention and design resources (Gardner et al. 2009). In PRM, permittees are seldom required to conduct long-term monitoring of the mitigated site, jeopardizing the long-term success of such sites (although the USACE now holds all mitigators to the same standards).

Consolidated Mitigation Alternatives

In general, CWMs present many advantages that project-specific PRM lacks (GAO 2001, TRB 2002, Ruhl and Salzman 2000). Due to the large number of PRM sites, the USACE's monitoring duties are increased, having a CWM program decreases the time required for government oversight. CWM allow for economies of scale because many small impacts can be consolidated into one site, reducing the cost of maintenance and initial set-up costs (planning) as this only requires one team of experts to develop a single CWM site. Additionally, having a readily-available mitigation option can potentially minimize costly delays in construction. If it is agreed that it is impractical to remediate through PRM, a permittee has an option to pay a fee to a CWM program for off-site mitigation at a commensurate cost of PRM. EPA (1995) has identified some additional advantages of CWMs. CWM may enhance the integrity of the aquatic ecosystem by consolidating compensatory mitigation into a single large parcel of land. This integration may bring together financial resources, planning and scientific expertise that is not practicable in many PRM proposals. Therefore, this consolidation of resources can

increase the potential for the establishment and long-term management of successful mitigation that maximizes opportunities for contributing to biodiversity and/or watershed function.

While there are many benefits to establishing a CWM, challenges faced by these programs also need to be considered. The first challenge is in defining the service area; resource agencies involved in the process of creating a program will have to negotiate the physical region able to participate in the CWM program. This is a complicated matter as different states define service are in different terms. For instance in Maine (ME) (USACE-NE 2010), the service areas are defined in terms of biophysical regions whereas in Pennsylvania (ELI 2011) and New Hampshire (NH) (NHDES and USACE 2008) they are defined in terms of watershed and subwatershed basins. Another challenge associated with CWM is related to the negotiations needed to establish mitigation ratios (MR). To third party sponsors such as non-for-profit organizations or resource agencies, a high MR is beneficial because this translates into higher revenue to the program, but to permittees this translates into a higher fee they have to pay. Finding the right MR, therefore, may pose issues when making decisions to establish the program. Monitoring, the continued assessment of wetland ecological performance, has been identified as a shortfall of many mitigation projects for both PRM and CWM (Harvey and Josselyn 1986; TRB 2002; NRC 2001). Furthermore, the lack of a cooperative spirit among local, state and federal agencies was identified by the FHWA (2006) as one important challenge that needs to be resolved. The study outlined some of the challenges encountered in achieving a cooperative spirit, including conflicting priorities among agencies, inconsistent terminology, conflicting boundaries, lack of planning, etc. Finally, state regulatory

structures represent a major roadblock when establishing CWMs. The different legal structures in each state influence how likely a program is to be established. In CT and Massachusetts, for instance, the legal structure prevents most permittees from participating in CWM programs and therefore these have not been established.

Wetland Banking

A WB is an entity administered by a private organization, a state agency or a public interest group (non-governmental organization) which restores, enhances, establishes and/or preserves a wetland area for a fee in exchange for assuming permittee mitigation responsibility (ELI 2006). After the program has been established and the wetland fees have been collected from the permittees, the permittees are not responsible for the compensatory mitigation nor the costs associated with maintenance or ecological success of the wetlands and/or other aquatic resources. The organization operating the WB assumes the responsibility and risk associated with achieving successful mitigation. Third-party commercial WBs are usually private ventures established by investors who sponsor the WB for profit. The sponsors provide the needed upfront capital (financial assurances) to start the mitigation project before permittees start paying the fees. Before a CWM is established, a WB contract between the regulatory agencies and the third party program sponsor is produced as the short- and long-term action plan of the program. Additionally, the WB Instrument, the term used to describe this contract,) must specify the financial assurances necessary to conduct and monitor mitigation projects. Such WBs are common in Illinois and Florida and many other non-New England states with large amounts of wetland impacts (Robertson 2004, TRB 2002, ELI 2006). Some state

transportation agencies with a high impacted acreage have also established WBs for their own use, and in some cases private entities.

The new mitigation rule (USACE, 2008) expresses the administrative preference for establishing WBs as a wetland mitigation practice. This decision was made based on many reasons. However, the primary basis for the decision is that WB programs are already established during or prior to the occurrence of the impacts, an advantage when compared with PRM and ILF programs which are usually performed after impacts have occurred creating a lag time between impact and mitigation. Also, in cases where a WB has been operating effectively for an extended period, the remediation has an increased chance of success. However, the establishment before the sale of credits also represents the primary challenge specific to establishing a WB in the need for up-front capital. The WB sponsor must have sufficient funds to buy the necessary land (unless they already own it), to cover the mitigation expenses, to monitor the site and to manage the program. Therefore, WB programs mostly are undertaken by commercial bankers who have the capital needed to establish the bank. State WBs are often financed with state or federal funds, but are less common than their commercial counterparts. Both commercial and state WB programs have significant financial hurdles to overcome. The establishment of a WB as an investment is challenging in states that have little impacts to wetlands like CT and other New England states, because investors are not able to cover setup and operational costs within a practical time frame. For state agencies, an additional challenge involves the issue of how to access the funds necessary to purchase, establish and manage the site in already tight state budgets.

In-Lieu Fee

ILF mitigation programs are established between a regulatory agency (i.e., the USACE and, in some cases, a state wetland program) and a third party sponsor (i.e., a public agency, such as a state wetland program, or a nonprofit conservation organization). In ILF programs, a permittee may pay fees to the sponsor in lieu of meeting their mitigation obligations through other means (ELI 2006). In contrast with WBs, fees generally are paid ahead of the actual establishment of the mitigation of the wetland site but as in WBs permittees are exempt of the compensatory responsibilities. ILF programs provide permittees with the ability to pay third-party sponsors when project-specific compensatory mitigation is not practical or there is no WB program. The program accrues fees paid by permittees and when enough funds have been collected CWM projects are conducted. Similar to WBs, ILF programs must also create an ILF instrument stating the long-term action plan of the program. However, as opposed to a WB instrument, this does not have to give details of the CWM site or extensive financial assurances (USACE 2008).

There are benefits of ILF programs relative to WB programs. Whereas WBs mostly are administered by state DOTs or for-profit third party organizations, ILF programs mostly are administered by non-profit organizations and land trusts (ELI 2009). Such organizations often have ecological conservation values and access to relevant environmental information that will be reflected when establishing mitigation projects (e.g. wetland mapping, historical wetland data, parties interested in contributing to the mitigation process). Many non-profit environmental organizations also have experience working cooperatively with interagency groups and in managing other such programs.

Additionally, ILF programs provide an alternative to compensatory mitigation where WBs are not accessible and/or will not be developed. In the case of CT, for instance, there has been limited interest in developing commercial WBs due to limited projected demand. However, an ILF program established by state agency or a non-profit organization could be the solution to provide alternatives to PRM without the requirement of upfront capital.

The most important challenge regarding ILF involves the lag time between the occurrence of the impacts and performance of the mitigation (USACE 2000), which could be 1 year or more. Moreover, given the delay in establishing actual sites, a successful ILF program must have a financial structure in place ahead of time to demonstrate how funds will be handled. An effective accounting structure is critical in ensuring the establishment of successful mitigation sites. Yet, given the speculation of future costs, the calculation of appropriate fees relative to the ecosystem services (e.g. recreation, flood control, groundwater re-supply) that will be provided is difficult. Finally, the payment of mitigation fees prior to actual construction of a mitigation project increases the uncertainty that in-kind mitigation will occur. The specific ecological functions and needs impacted may not be available to be restored, enhanced, created or preserved within the service area, particularly for specific habitats.

METHODS

Research triangulation involving a literature review, surveys, expert discussions and state wetland data were used to assess current issues associated with establishing a CWM in CT. We used the information gathered in a literature review of CWM programs to develop a series of three surveys aimed at obtaining more detailed information concerning CWM implementation, operation and interest from specific sets of organizations. The first survey was distributed electronically to state resource agencies to help in the understanding of challenges and methodology involved in establishing a CWM program. Follow-up surveys were distributed electronically to third-party organizations involved in wetland mitigation practices in CT. In addition, teleconferences were conducted with two New England (NE) states to discuss their specific approaches. We also engaged in discussion sessions with representatives of ConnDOT and CT DEP as well as state legal experts. Finally, two quantitative analyses were developed to determine the feasibility of establishing a CWM in Connecticut. The first analysis was performed to determine the feasibility of program establishment with ConnDOT wetland impacts only. The second analysis addressed the impact on economic program feasibility with the inclusion of private impacts.

Survey

The survey of state agencies was distributed to state transportation and, environmental protection agencies as well as federal transportation (FHWA) and environmental (EPA, USACE district offices). The survey included 28 questions involving a mixture of formats regarding policy (e.g., permitting, impacted acreage, etc.),

administration, and design of WB or ILF wetland projects (e.g., economics, limitations, etc.). Questions were constructed based on cited benefits and challenges associated with CWMs and discussions with respective resource agencies (Lori Sommers, New Hampshire Department of Environmental Services Wetlands Bureau, personal communication 2010). A total of 15 states in addition to Connecticut were contacted to participate in the survey based on proximity to Connecticut and CWM program implementation history: Connecticut, Florida, Illinois, Maine, Massachusetts, New Hampshire, New Jersey, New York, Ohio, Oregon, Pennsylvania, Rhode Island, Vermont, Virginia, Wisconsin and Washington. A total of 14 surveys were completed, representing 12 state agencies, the USACE-NE and FHWA (Table 1). The objectives of this comprehensive survey was to further understand the issues these agencies had encountered when establishing a CWM and to identify potential agencies that could be contacted for additional questioning on the specifics of program establishment.

Additional surveys were developed to reach out to third-party organizations that had demonstrated an interest in developing CWMs in CT, including The Nature Conservancy (TNC) and the Virginia-based Watershed Strategies, as well as the 15 Connecticut Regional Planning Associations (RPAs). The objective of these two third-party surveys was to identify the issues that have impeded the development of CWMs in the state. Additionally, the survey of the 15 RPAs was developed to determine the knowledge with regard to CWMs and the regional willingness to participate in WB or ILF programs across the state. This survey was implemented to better understand the dynamics of regional districts and their connection to local authorities. While not directly reflecting the town regulatory structure, the districts have town representation and reflect whether

municipalities would be amenable to participating in CWM programs. Questions addressed whether the RPAs were familiar with CWM programs and to how many of the towns within the RPAs would be willing to participate in a CWM program.

Table 1 List of states and their respective organizations which responded to the CWM survey. Marks represent a response. All state transportation and environmental protection agencies were contacted, with only select FHWA agencies contacted. The USACE New England Regional Office also responded.

STATE	TRANSPORTATION AGENCY	ENVIRONMENTAL AGENCY	FHWA
Florida	X	X	
Illinois	X		
Massachusetts	X		
New Hampshire		X	
New York	X	X	
Ohio	X		X
Vermont	X		
Washington	X		
Wisconsin		X	

Wetland Impact Data

Wetland impact data for private development (does not include state agency impacts) was obtained from the CT DEP Wetlands Management Division. The data is self-reported by the individual town Inland Wetland and Watercourses Commissions and provides an estimate of yearly wetland impacts by town in Connecticut for the period of 2002 to 2006 (CT DEP 2010). We organized the town wetland impact data by six HUC-8 watersheds (figure 1) to determine the amount of private impacts that could potentially be integrated into a CWM program. HUC-8 watersheds were selected based on the

experience of other states, such as NH and Tennessee (ELI 2009), where this watershed division is used for CWM purposes. Additionally, the separation of Connecticut into six watersheds provides a manageable approach that is consistent with CT DEP watershed delineation (CT DEP 2011). ArcGIS was used to divide Connecticut into six HUC-8 watersheds to apportion the data from the 169 towns in the state on a watershed basis. For towns located in multiple watersheds, wetland impacts and cost of land were apportioned based on the percentage of area located within each respective watershed. This enabled an estimation of CWM implementation at a watershed scale.

Self-reporting by the town IWCs could over- or under-estimate wetland impacts. Overestimates may occur in some towns due to rounding of the impacted area (e.g., 0.2 acre reported as 1 acre). Conversely, relying on self-reporting underestimates the total impacts as some IWCs are more responsive, demonstrated by missing values for five of the 169 towns. Yet, the self-reported data provides an estimate of the magnitude and distribution of impacts across the state, particularly for those greater than 1 acre, which provide the majority of projects able to contribute to a CWM program. This impact data will be useful in assessing the potential economic benefits of implementing a CWM program for private impacts in Connecticut. As a result, legislators may be more inclined to change the state law which prevents these private impacts from participating in a CWM.

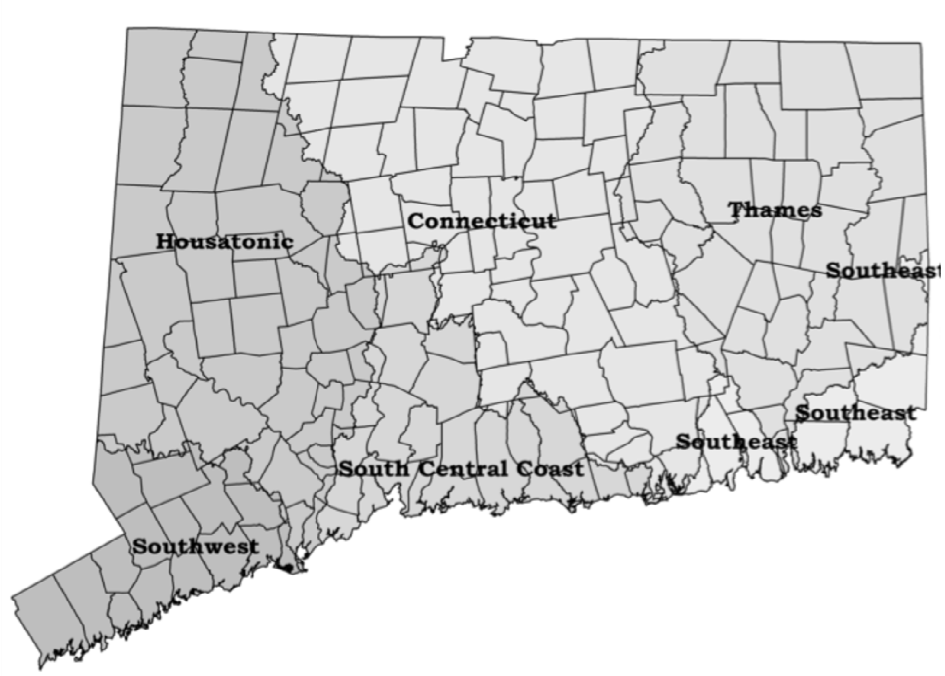

Figure 1 Map of the CWM program service areas based on the HUC-8 watersheds in Connecticut.

Economic Analysis

An economic analysis was performed for two case scenarios. In the first set of calculations the amount of wetland impacts included only those of the ConnDOT, about 3 acres per year. This amount accounts for all impacts produced by transportation projects with the assumption that all of these impacts were to be compensated with through a CWM program. This case represents the current legislative situation regarding wetland impacts, with only those by the state permitted to mitigate through third parties. A second set of calculations is included to assess the benefit of including private impacts from individual towns. Wetland impact data obtained from the CT DEP was used to estimate the average annual impacts for each town. Two subsets of analysis were evaluated by

total area impacted and by large impacts defined by being greater than 10000 ft^2, the size currently in use in New Hampshire's CWM program.

To evaluate the economic feasibility of implementing a CMA program, the cost of mitigation must be estimated. Land values (LV), wetland construction costs (WCC) and the mitigation ratio (MR) factor into the cost to the impacting party to use the CWM program (ME DEP 2010; Equation 1). The wetland mitigation program revenue per acre (WMR) is calculated as follows:

$$WMR = (LV + WCC) * MR \quad (1)$$

$$OHI = WMR * OHR \quad (2)$$

We assumed an average value for the WCC of $76,000/acre for Connecticut based on available ConnDOT estimates (Mark Alexander, personal communication 2010). The MR and the overhead rate (OHR), although variable, will be established in the CWM instrument. Overhead income (OHI) will be calculated with the OHR based on the WMR obtained (Equation 2). WMR will depend on the LV within each mitigation area. New Hampshire and Maine use assessed tax information to estimate the LV on either a town or county level (Maine DEP 2010, NHDES and USACE 2008). Assessed land values from the individual municipalities are reported to the state agencies, which have developed a formula to predict the average cost of an acre of undeveloped land for wetland mitigation. While Connecticut towns also collect property tax assessment values, a mechanism currently does not exist for these individual town values to be converted to the LV for undeveloped acreage and corrected for over- or under-estimation of property values in each town based on recent sales. Given that a method for calculating the equalized average cost of land per acre in each town is lacking in Connecticut, we

estimated LVs via two possible options, the equalized net grand value (ENGV) and values of recent purchases through the Connecticut Land Use Acquisition Program (CLAP).

The Connecticut Office of Policy and Management maintains a listing of the ENGV for property by town (CT OPM 2010) However, the equalized net grand value is not optimal as for estimating the value of undeveloped land as personal property, vehicles and the value of buildings are included. Assuming that land represents 35% of the property value and that approximately 12% of the ENGV reflects vehicles and personal property, we adjusted the town ENGVs to estimate the average cost of an acre of undeveloped land in Connecticut for each town. An alternative method for estimating the cost of land purchase for CWM purposes is to evaluate the average cost of purchases through the CLAP operated by CT DEP. A list of purchases from 2000-2010 was obtained and analyzed, excluding gifts and interdepartmental transfers, to obtain an average cost per acre purchased. Accounting for an average inflation rate over that period of 2.5%, the value in 2010 dollars for acreage was estimated. However, this value may be low relative to that experienced for mitigation purchases, as CLAP purchases reflect land contributed for water access, state parks, and/or state forests. In many instances, land may be purchased below market value. Complicating the use of CLAP values for our watershed-based calculations is that the purchase of land is not distributed throughout the state. While a good comparison to the ENGV estimate for a state-wide average, the CLAP does not provide the level of detail at the town, or even watershed, level for utility in a CWM program LV estimate. For this reason, the CLAP was only used for a state-

wide evaluation of CWM program feasibility for state impacts only. For private impact participation, the ENGV LV estimates were used.

We compared two methods to assess the economic viability of including the private impacts using the ENGV LVs for the individual towns. In the first method, the town LVs were averaged for each watershed with the WCC estimated at the watershed level. The weighted average land value (WALV) was calculated for each of the six watersheds (Equation 3).

$$WALV = \frac{\sum_{1}^{X} (Total\_Town\_Area * LV)}{Total\_Watershed\_Area} \quad (3)$$

Total Town Area represents the area of each municipality in the watershed. The WALV then is used in Equation 1 instead of the LV to calculate a total income for each watershed based on the specific impacts in the watershed. In the second method, we calculated the WCC for each town and then summed the town values to obtain the cost over the watershed. While the WALV provides a means of comparing the value of a CWM program in the sub-watersheds for large-scale management questions, the estimation of the WCC at a town level provides more specific information which matches the current regulatory framework in the state. Therefore, we used the second approach, the individual town WCC values, to estimate total watershed mitigation revenue and to assess the potential impacts of the MR and OHR on program sustainability.

RESULTS AND DISCUSSION

The survey of state agencies identified potential advantages and motivations as well as current concerns of CWM programs. In agreement with previous studies (NRC 2001, Ruhl and Salzman), states cited increased operational efficiency, enhanced ecological performance, and the transfer of permittee mitigation responsibilities as potential benefits. Challenges encountered by states when establishing a CWM program included the lack of cooperation among different resource agencies during program establishment. Interestingly, most responding agencies focused on issues encountered in site specific mitigation projects such as high land costs, site selection and project development, rather than program-wide issues such as defining the service area or establishing MRs. And only in follow-up communication were the issues in program overhead fees in New Hampshire revealed (Lori Sommers, personal communication 2010).

The survey also asked agencies to describe their state's mitigation programs, whether these were PRM or CWM. New Hampshire and Maine (answered by USACE-NE) reported that their states recently established ILF programs (CASE 2010). Wisconsin reported the use of transportation agency WBs. Illinois, Florida and Washington reported the use of commercial and/or transportation agency WBs as well as ILF programs. New York State and Vermont reported they do not have a CWM program, although Vermont reported efforts towards the development of an ILF program with a non-profit organization, Ducks Unlimited, as the sponsor. The ILF programs established in New Hampshire and Maine are of particular interest to Connecticut because these are the first states in New England to establish such a program. The survey and follow-up communications (Ruth Ladd, personal Communication 2010, Lori Sommers, personal

communication 2010) with people involved in the establishment of these programs is useful in identifying mechanisms and challenges towards developing an ILF instrument in a more developed area favoring local governance and with environmental awareness. Both programs are open to state and private impacting parties. Additionally, in order for the permittees to be able to utilize these ILF programs, impacts must be greater than 10,000 square feet (0.23 ac) and 15,000 square feet (0.34 ac) in New Hampshire and Maine, respectively.

The collection of sufficient overhead revenue is a critical concern given the responses from the TNC and Watershed Strategies, Inc. (CASE 2010), both of which suggested that the cost of running such a program in Connecticut was a major roadblock given the small amount of impacted acres that could potentially participate in the program These potentially interested parties and the RPAs also expressed concerns over the lack of availability of land with degraded wetland/stream systems to be mitigated. Both concerns mirrored those identified in the survey by resource agencies as roadblocks to establishing a CWM. Additionally, the low response from RPAs (2/15) suggests a lack of interest and/or knowledge of CWM programs in Connecticut. One objective of the RPA survey was to assess the likelihood of towns to participate in a CWM program, a critical component given the municipal wetland regulation. The low level of responses suggests that the municipalities are generally not aware of CWM program advantages and a disconnect exists between the scale of governance and that at which CWM programs would be viable across most of the Connecticut. However, the response from the Southwestern RPA, the area of highest development in the state, demonstrates the potential for regional implementation of a program.

Survey responses demonstrate that both WB and ILF programs provide a CWM option and are implemented widely throughout the US, providing a blueprint for implementation in Connecticut. However, WB programs, in most cases, must secure and establish a mitigation site in order to receive fees from permittees. Conversely, ILF programs may collect fees before a site has been secured. This means that to establish a WB program, large amounts of money are needed to cover the upfront costs associated with researching and procuring a suitable site and then establishing a mitigation project. This cost is in addition to costs associated with developing an instrument. Raising such capital can prove difficult, particularly given the current economic climate and the cost of land in Connecticut. Conversely, in an ILF program, a fraction of upfront capital is required relative to that for WB as mitigation sites and construction are not performed until sufficient funds have been collected from permittees. As significantly less money is required upfront for an ILF program, the current climate in Connecticut favors the establishment of an ILF program, with New Hampshire and Maine the most relevant examples. However, to be practical given current state regulations, state impacts must be able to support the operational costs of such a program. The amount of wetlands impacted by state agencies (<5% of total statewide impacts) generally is not sufficient to attract investors to establish a WB or ILF program as evidenced by the lack of interest from surveyed third-party organizations. Therefore, prior to moving forward with establishing a CWM program, a basic economic analysis needs to be performed to assess whether state impacts alone are sufficient to support a CWM, and more specifically, an ILF program.

Current Situation: ConnDOT Impacts

The ConnDOT impacts approximately 3 acres per year, which is considered a low amount to establish a CWM program. Using the New Hampshire ILF program as an example, a basic economic comparison was performed to assess the financial feasibility of a CWM program. Based on the New Hampshire and Maine ILF programs, fees can be estimated using three components: the cost of wetland construction, the cost of land and a program overhead fee (Equation 1). Although variable by municipality, we assumed a constant construction cost of $76,000/acre throughout the state for ease of calculation as per the New Hampshire program (Mark Alexander, personal communication 2010). And while construction costs also vary by project, a priori costs are required given the pre-payment of the fee relative to project construction. The two average land values utilized provided upper and lower land cost boundaries in Connecticut ENGV of $56,000/acre and $24,000/acre for the ENGV and CLAP, respectively. Given a mitigation ratio of 2:1 and ConnDOT wetland impact of 3 acres per year, we estimate CWM program revenues of $600,000 and $800,000 per year using CLAP and ENGV land values, respectively. With an overhead fee of 20%, as currently proposed for New Hampshire, $120,000 and $160,000 per year would be obtained for program operation using CLAP and ENGV land values, respectively. The overhead percentage may be adjusted as needed to cover staff expenses. From discussions with other states, approximately 1½ staff will be required to operate the program, for a cost to cover salary and benefits of approximately $150,000 annually. This cost estimate suggests that an ILF program may be viable, even with the limited wetland impacts for Connecticut, assuming all impacts are compensated for through the CWM program. However, this simplified cost analysis only focuses on the

direct costs associated with establishing CWM projects. The analysis should also consider other offsetting benefits such as increased operational efficiency of permittees, decreased construction delays, project benefits to the public, and increased environmental functioning of larger, more contiguous CWM projects.

Private Impacts

Increasing the impacted acreage participating in the CWM would increase the program revenue, overcoming one of the challenges mentioned by the third parties in our second survey. Considering private (municipally regulated) impacts in addition to state impacts alters CWM landscape in CT by adding acreage and removing regulatory layers incentivizing potential sponsors. Generally, a multi-layered regulatory structure has been demonstrated to negatively affect CWM programs (BenDor and Brozovic 2007). CWM programs are prevalent in states that provide for little local authority over wetlands such as Florida (Reiss et al. 2009) and Illinois (BenDor and Brozovic 2007). Current legal opinion implies the need for town-directed mitigation, precluding a state-wide ILF program including private impacts. Under current law, compensatory mitigation alternatives may only be used if 1) there is a well-developed plan for the compensatory mitigation project and 2) compensatory mitigation is performed by the municipality (i.e., town). Currently, the only option for including private impacts in an ILF program is by organizing a regional wetland district involving oversight by all member towns. Yet, even this approach would be subject to legal interpretation. A state-wide program would require legislative action.

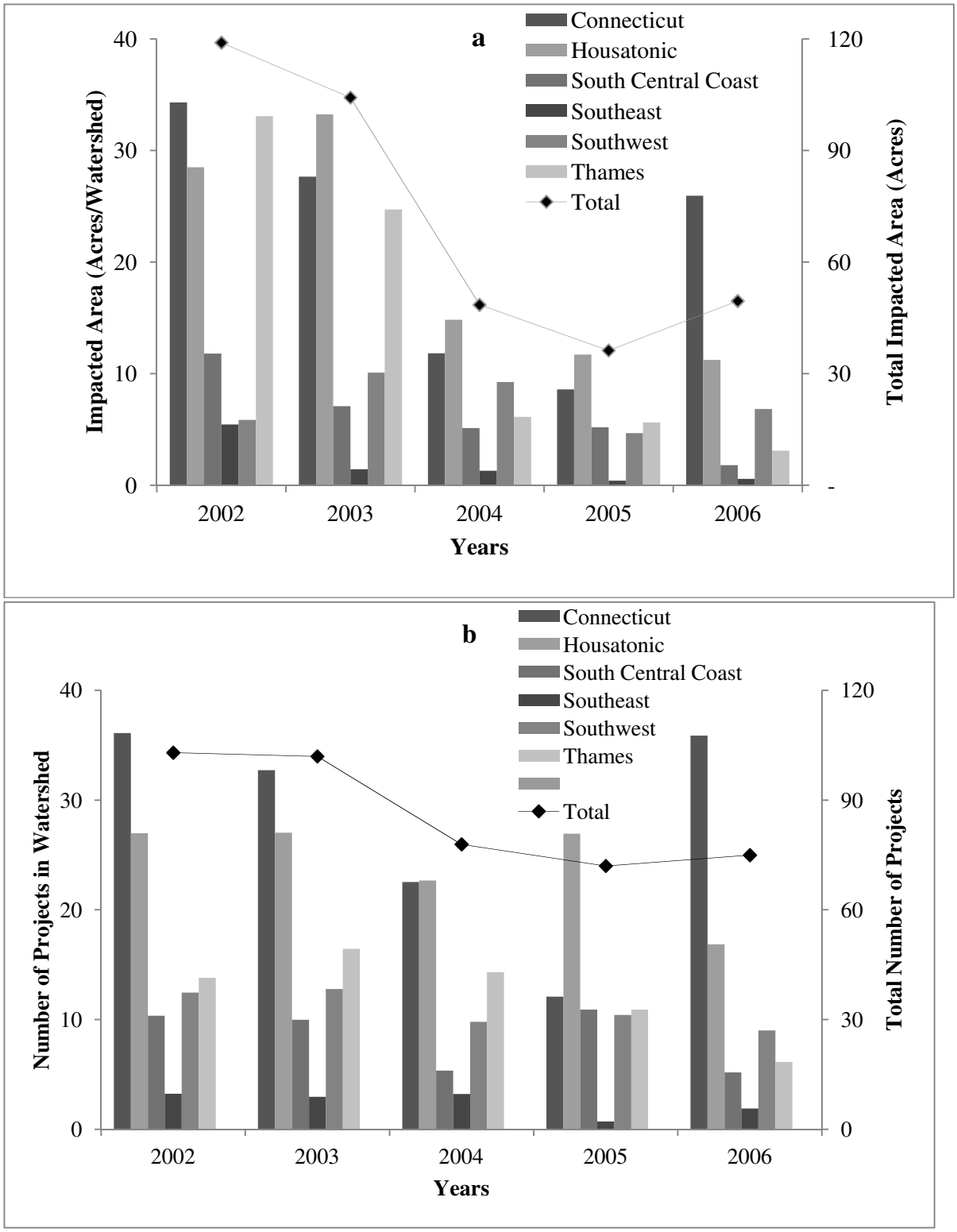

Figure 2 (a) Distribution of impact acreage (for impacts larger than 10,000 sq ft) in each of the six watersheds (left axis) and the total for Connecticut (right axis) for the years

2002 to 2006. (**b)** Distribution of the number of impacts (for impacts larger than 10,000 sq ft) in each of the six watersheds (left axis) and the total for Connecticut (right axis) for the years 2002 to 2006. Data collected via the Connecticut Department of Environmental Protection Inland Wetland Division (CT DEP, 2010).

Impacts regulated by municipalities in Connecticut represent more than 95% of total impacts in the state (CT DEP 2011). The disparity between the state and private impacts and the lack of total impacted acreage was cited by both interested third parties as a reason for not developing a CWM program in Connecticut. Over the period 2002-2006, a total of 506 acres were impacted throughout the state. However, many of these projects are minor and involve little acreage. To assess potential implications for CWM, we have separated the data for impacts larger than 10,000 ft^2 (~0.25 acre), a value roughly corresponding to the cutoff for USACE involvement and similar to that used in the New Hampshire and Maine programs (Figure 2a). Although declining, total annual impacted acreage for larger projects remains approximately 40 acres per year (Figure 2a). Most of the impacts are less than 2 acres with relatively few large projects (Figure 3). Having most of the impacts within the 2 ac boundary demonstrates that a few, large projects did not skew our data. The distribution of acreage reflects the occurrence of a few large projects (>10 ac). The distribution of project size demonstrates that the project size cutoff established in the Instrument would affect the sustainability of the program. As the cutoff size increases, the amount of impacted acreage permitted to participate in the program decreases.

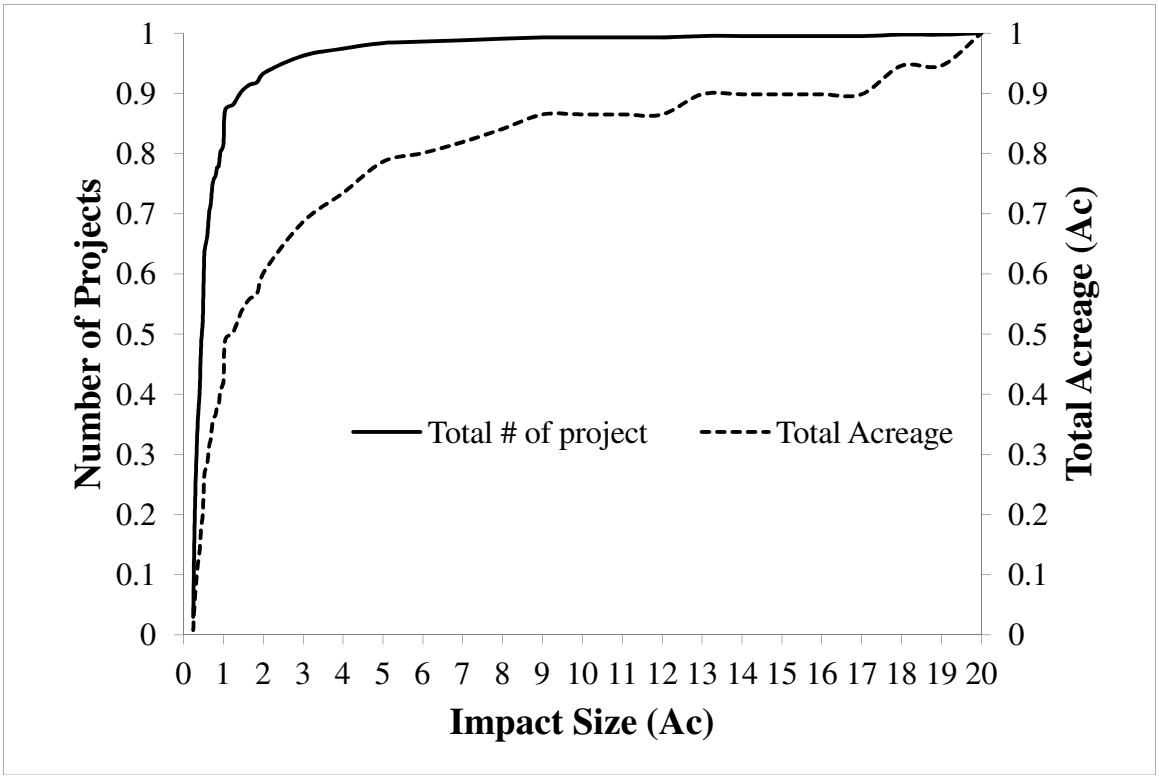

Figure 3 Cumulative distribution function of total private wetland impacts in Connecticut for the years 2002 to 2006 as a function of impact size. Left axis represents the distribution of the total number of projects and the right axis represents the total impacted acreage

Most large impacts occur in areas developing in the state. The areas with highest impacts per year, both by acreage (Figure 2a) and by project number (Figure 2b), are near the developing areas surrounding Danbury, Waterbury (both in the Housatonic watershed) and Hartford (Connecticut watershed). In total, 36 towns had an average of more than one large project per year, a number including but a few coastal towns (Supplemental Information). The distribution of impacts and lack of acreage in coastal areas likely is due to the high cost of land and the developed state of this region (CLEAR 2010). To further assess the distribution of impacts in the state, the average annual

impacts per town were aggregated by watershed. The Connecticut watershed had the highest annual average impacts (22 ac), followed by the Housatonic (19 ac) and Thames (15 ac) watersheds (Table 2). The Southeast watershed had the lowest large impact acreage (2 ac). However, after normalizing by watershed area, the southwest ranks at the top with $0.31x\ 10^{-4}$ acreage of impacted wetlands per total acreage of watershed, demonstrating the importance of impacts even within this highly developed portion of the state. The next highest normalize impacts were for the Housatonic and Connecticut watersheds at 0.25×10^{-4} and 0.24×10^{-4}, respectively (Table 2). The Southeast watershed had the lowest normalized impacts with 0.14×10^{-4} confirming that this region contributes the lowest to the total impacts, regardless of watershed size.

Table 2 Economic potential of a consolidated wetland mitigation program (CWM) to be implemented in Connecticut. Area-normalized impacts and potential CWM revenue are shown for all six watersheds as well as percent change of the two assessed methods and the revenue percentage of each watershed. The area-normalized impacts calculation corresponds to impact acreage divided by watershed acreage. Revenue Method 1 uses weighted average land values and impact acreage per watershed whereas Method 2 uses individual town land values and impact acreage to calculate revenue. A mitigation ratio of 2:1 and percentage of impacts able to participate of 10% was assumed for the calculation.

Watershed	Total Impacts (acres)	Area-Normalized Impact (10^4)	CWM Revenue ($)		% Difference Between Methods 1 and 2	% of Total Revenue (Method 1)
			Method 1	Method 2		
Connecticut	22	0.24	560,000	660,000	8%	34%
Housatonic	19	0.25	470,000	440,000	3%	23%
South Central Coast	6	0.21	200,000	200,000	0%	10%
Southeast	2	0.14	50,000	50,000	0%	3%
Southwest	7	0.31	320,000	300,000	3%	16%
Thames	15	0.2	270,000	280,000	2%	15%
Total =	71	1.36	1,870,000	1,930,000	2%	

With the exception of the Connecticut and Southwest watersheds, the watersheds exhibited a decrease in total annual impacts between 2002 and 2006 (Figure 2a). The Southeast watershed reached very low values in 2005 and 2006, whereas the Thames watershed had very high impact acreage in 2002 and 2003 followed by a drastic decline in the following years. However, the number of projects (Figure 2b) remained consistent for the Thames watershed throughout the studied period, indicating a stable project activity, albeit for smaller-impact projects. The Southwest, Housatonic and South Central Coast watersheds shows a consistent number of projects over the respective years, whereas the Connecticut watershed decreases before rebounding drastically in 2006. Overall, despite the significant decline in impact acreage (Figure 2a), the number of projects (Figure 2b) remains relatively constant throughout the time period, suggesting that the acreage size of impacts decreased rather than decreased occurrence of impacts.

Cost of Land

LVs estimated using an adjusted ENGV demonstrate the importance of using localized fees as values varied by town (Supplemental Information). LVWA for the six watersheds also varied (Table 3), with the Southwest region presenting a high value as expected because of its proximity to New York City. This watershed is comprised of highly-developed, affluent suburbs with high land values. The South Central Coast has the second highest LVs due to proximity to the coast and the urbanized nature of the New Haven area. The Connecticut, Housatonic and Southeast watersheds all present medium land values at $50,000/ac with the Thames watershed having the lowest LVWA of $20,000/ac, reflecting the rural nature of Northeastern Connecticut. The main purpose of calculating land values via watershed is to stress the importance of having localized fees that reflect the level at which wetland mitigation decisions are made within each ILF region. Permittees that have impacted wetlands in a town were land values are low, will likely not participate in the CWM program if the LV used for the fee calculation surpasses that of their own town. While we have presented watershed-level LVWA for regional comparison, the individual town values are likely more appropriate should an ILF program be implemented.

Table 3 Weighted-average land values (WALV) for each of the six proposed HUC-8 watersheds in Connecticut. WALV were calculated from the summation of the town land value times the town acreage divided by the total acreage of the watershed.

Watershed	WALV ($/acre)
Connecticut	$50,000
Housatonic	$50,000
South Central Coast	$90,000

Southeast	$50,000
Southwest	$140,000
Thames	$20,000

Potential CWM Revenue

The total private impacts account for all impacts larger than 10,000 sq ft. In order to more accurately compute program revenue, we assumed a conservative estimate that only 10% of the private impacts would either be eligible for or elect to participate in the CWM program. An analysis of total potential revenue for the proposed ILF program using LVs and the estimated private impacts would be approximately $1.9M annually. The revenue estimate was performed via two methods: 1) using the LVWA per watershed (Table 3) and total impacts per watershed, and 2) estimating the revenue per town using the town land value and impact data per town prior to weighted averaging over the watershed (Table 2). Method 1 provides a rapid assessment of the potential revenue for each watershed using aggregated data. However, Method 2 represents the current level of governance and the data specificity likely to be used for a CWM program. Revenue estimates using the two methods were similar, with about 2% difference in the total revenue for each watershed with the Connecticut watershed having the highest discrepancy at 7% (Table 2). The potential revenue estimate of $1.9M also assumes a conservative mitigation ratio estimate of 2. The Connecticut watershed would particularly benefit from such a program, representing 34% of the revenue, due to the high number of impacts. Together, the Housatonic and Connecticut watersheds provide 57% of the total potential revenue, likely due to the larger areas and resulting higher impacted acreage. The Thames watershed represents 15% of the total potential revenue corresponding to the relatively high impacted acreage when compared with the coastal watersheds,

compensating for the lower cost of land in the watershed. The total impacts in the Southwest and South Central Coast watersheds are low. However, the higher land values compensate in the potential revenue projections, particularly for the Southwest which has the highest area-normalized impacts and LV, contributing 16 and 10% the total revenue, respectively. The Southeast watershed has a moderate cost of land and low impacted acreage (including the lowest area-normalized impacts); thus representing the least potential revenue with only 3%.

The distribution of potential revenue among the 6 HUC-8 watersheds demonstrates the potential for a program to be implemented regionally. The magnitude of revenue in any watershed is important in setting the time frame required to perform a realistic mitigation project using the revenue. Although operated at a state level, funds accrued within each watershed are required to be used towards mitigation in the same watershed within the timeframe specified in the instrument. Therefore, in anticipation of CWM program establishment it is essential to understand the nature of each watershed in order to establish a realistic ILF instrument timeframe. The low potential revenue for the Southeast watershed ($50K) could represent an issue during fund release, therefore, a different time frame for this watershed might be appropriate to include in the ILF instrument. Additionally, the collection of >$200K annually in the remaining watersheds suggests that an ILF program may be able to be implemented via a wetland district in one of the watersheds, particularly the Connecticut ($660K) should sufficient overhead fees be projected for operation.

Overhead Income

We assessed the potential impact of uncertainty in the overhead income (OHI) and the MR on the operational revenue, suggesting that an overhead rate greater than or equal to 10% should generate sufficient funds to cover operating expenses, regardless of the MR (Table 4). An overhead rate of 5% may be sufficient if the resulting MR is greater than 5. However, the MR is specific to each project depending on the type of impacted wetland and the proposed mitigation, with values generally varying between 1 and 20 acres mitigated per acre impacted. However, while necessary to include in calculations of revenue, a specific value is not possible due to the project-specific nature. Therefore, while specified in the CWM instrument, some uncertainty remains in the MRs. Only at a low MR of 2 and overhead fee of 5% is <$150K obtained to administer the program (Table 4), the amount to cover the 1½ persons estimated to be required for operation based on the New Hampshire case study. Similarly, a higher MR would accrue sufficient funds even at a low overhead rate. Therefore, establishing a program with at least an overhead rate of 10% would allow for the annual variability in funds accrued by the program.

Table 4 Estimation of overhead income (OHI) based on the total revenue from Table 2 (Method 2) as a function of overhead rate (OHR) and mitigation ratio (MR), with the assumption that only 10% of the private impacts compensate through the ILF program. Values listed for a MR = 2 reflect case evaluated for Table 2.

MR	5% OHR	10% OHR	20% OHR
2	$100,000	$190,000	$380,000
5	$240,000	$480,000	$960,000
10	$480,000	$960,000	$1,920,000

Education

The low response on the RPA survey (2/15) demonstrates the need for an effort to educate the public, town IWC agencies and the state legislature on the potential benefits of a state-wide CWM program. Considering private (municipally regulated) impacts in addition to state impacts in respect to a CWM program alters the wetland regulatory landscape in Connecticut. The introduction of private impacts would incentivize commercial bankers to establish such programs with the increased demand. However, the issue of town governance of wetland impacts in Connecticut must be incorporated. Connecticut has a history of "home rule" with local regulation of wetlands and a reluctance of towns to pass oversight of local resources to the state. Years of operation and training through the town IWC system has ingrained procedures into much of the public involved in wetland regulation. An educational program is necessary to address concerns over state involvement and to demonstrate the financial and environmental benefits of a CWM program. While no one has inquired about a CWM program at the state Municipal Inland Wetlands Training Program, the associated technical session would be an ideal location to disseminate such information. A CWM program could be established within the current regulatory structure, eliminating concerns over towns losing control over local resources and utilizing the existing human resources and knowledge base which has developed concerning wetlands in Connecticut.

CONCLUSIONS

A study was conducted to assess whether CWMs, such as ILF and WB programs, are viable options to be implemented in CT. CWM programs have yet to be implemented in Connecticut (CT) because of a multi-layered jurisdictional system that does not permit private impacts to be mitigated via CWMs, which account for about 95% of the total impacted acreage in the state. It was found that based on the current economic situation an ILF program is more viable than a WB program because establishing a WB program requires higher upfront costs. The financial analysis of a potential program was performed based on the assumption that only 10% of the private impacts would pay fees to the program yielding an estimated revenue of $1.9M annually in addition to a 10% OHI of $190K. The study shows remarkable results and confirms the plausibility of establishing an ILF program with the amount of revenue estimated sufficient to carry on mitigation projects and the overhead fee (10% and up) sufficient to cover administrative costs incurred in the program. Additionally, the study found that bringing CWM awareness to the municipalities is a very important aspect that needs to be addressed when establishing a program. Municipalities need to be informed of the advantages of having a consolidated system. With this in place municipalities would be able to establish a program within the current regulatory structure. Given the advantages and the high plausibility of establishing a CWM in CT, it is imperative that legislation is passed to change the current local regulatory system to one where large districts (e.g. HUC-8 watershed groups) are created and given authority to regulate water resources. Without legislation, cost will prevent municipalities from establishing CWM programs. For

sustainability, the CWM would benefit from being incorporated into the current system as towns are not likely to relinquish political power over local water resources.

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