WATERSHED INITIATIVES & DECISION SUPPORT TOOLS

Environmental Law Institute

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ALTERNATIVE FUTURES ANALYSIS – BLACKBERRY CREEK WATERSHED, ILLINOIS

LEAD AGENCIES/ORGANIZATIONS

Blackberry Creek Watershed Resources Planning Committee
Illinois Department of Natural Resources
Kane County, Illinois
U.S. Environmental Protection Agency, Region 5
U.S. Environmental Protection Agency, Office of Research and Development
The Conservation Foundation[1]

OTHER PARTICIPATING AGENCIES/ ORGANIZATIONS

Conservation Design Forum, Inc.[2]

FUNDING SOURCES

The Blackberry Creek Watershed Alternative Futures Analysis Project was funded by a grant from the U.S. Environmental Protection Agency through the Illinois Department of Natural Resources, with a match from the Kane County Department of Environmental Management.[3] The project budget was approximately $300,000.[4]

GEOGRAPHICAL AREA CONSIDERED

The Blackberry Creek watershed is located in south central Kane County and north central Kendall County within the Fox River Basin of Illinois and is approximately 73 square miles in area. Due to data limitations, analysis within the project area focused on Kane County.[5]

1 Blackberry Creek Watershed Alternative Futures Analysis. July 2003. Conservation Design Forum, Inc. 17 Feb. 2004 <http://www.cdfinc.com/CDF_Portfolio/Regional_Scale/Blackberry_Creek/Blackberry_Creek_Final_Report.htm>.

2 *Ibid.*

3 *Ibid.*

4 Sumner, Rich. Personal communication. 3 Mar. 2004.

5 Blackberry Creek Watershed Alternative Futures Analysis, Jul. 2003, p.9.

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ACTIVITIES

Background

In recent years, the U.S. Environmental Protection Agency (EPA) has placed more focus on community-based environmental planning, which emphasizes decision-making by local stakeholders to address community-wide environmental issues. The EPA has advocated "environmental visioning" as a tool to aid in this community-based approach. In short, an environmental vision is the description or picture of a preferred future state for a community, chosen from several potential landscape scenarios. Environmental visioning, the "process of generation and selection of alternative landscape futures," often relies on Geographic Information System (GIS) technology both to develop and to support different environmental visions.[6] By allowing stakeholders to more fully understand the future benefits and consequences of each choice, the process aids community members in moving towards common understanding, conflict resolution and collective

6 U.S. Environmental Protection Agency. "Environmental Planning for Communities: A Guide to the Environmental Visioning Process Utilizing a Geographic Information System (GIS)." September 2000. EPA/625/R-98/003. Office of Research and Development. Cincinnati, OH. 17 Feb. 2004 <http://www.epa.gov/ORD/WebPubs/gis/625r98003.pdf>.

7 U.S. Environmental Protection Agency. "Willamette Basin Alternative Futures Analysis." August 2002. EPA/600/R-02/045(b). Office of Research and Development. Washington, DC. 17 Feb. 2004 <http://www.epa.gov/wed/pages/projects/alternativefutures/twopager.pdf >.

action.[7] Visualization of alternative maps can have a powerful effect on landowners and other stakeholders.[8]

Alternative Futures Analysis is a GIS-based environmental visioning process for community-based planning for land and water resources.[9] The analysis is based on a framework for landscape-level environmental design pioneered by Carl Steinitz of Harvard University's Graduate School of Design.[10] Under this framework, landscape models are based on the state and operation of the landscape, the potential alterations to the landscape and predicted results of those alterations, and an evaluation of the alternative impacts. The method focuses specifically on understanding and accurately depicting the current conditions and processes of the landscape, evaluating the impacts and changes resulting from different alternatives, and well-informed decision-making among alternatives.[11] Alternative Futures Analysis has been utilized in several areas of the country, including Monroe County, PA, Camp Pendleton, CA, Willamette River Basin, OR, and, most recently, the Blackberry Creek watershed, IL.[12]

Goal of the effort

In the Blackberry Creek watershed of Kane County, IL, flooding problems initially prompted the formation of the Blackberry Creek Water Resource Planning Committee and, eventually, the Blackberry Creek Watershed Management Plan. The Plan focuses on preventing the degradation of water quality, biological integrity, and streambanks as the area develops.[13] Significant amounts of development are expected over the next decade in southern Kane County, IL, where the current land use is about 70 percent agricultural and 20 percent urban. The Alternative Futures Analysis was conducted to allow Blackberry Creek watershed municipalities and counties to make informed decisions relating to site design practices and land uses by modeling and evaluating both possible development scenarios and strategies to protect and restore stream and wetland resources under alternative scenarios.[14]

The Blackberry Creek Watershed Management Plan outlined four distinct goals:

- Reduce existing flooding problems.
- Improve water quality and related stream and wetland resources.
- Avoid negative impacts of development on flooding and watershed resources.
- Establish a watershed framework to implement the objectives set out in the Watershed Management Plan.[15]

In conjunction with the plan's four main goals, the primary purpose of the analysis is "to illustrate and evaluate potential alternative futures for stream and wetland protection and restoration in the Blackberry Creek watershed."[16] The intent was to compare what could occur if development codes and land use plans were followed, if development continued "business as usual," and if conservation-based site design and ecologically sensitive land use planning were adopted. The results of the Analysis will inform Kane County decision-makers as they develop land use plans and strategies.[17]

Inventory

Kane County, the Northeastern Illinois Planning Commission, and others have prepared a wetland inventory and are currently assessing stream and wetland quality under an Advanced Identification (ADID) study funded by the U.S. Environmental Protection Agency.[18]

Additional data layers were provided by the U.S. Geological Survey (watershed boundaries, land use/land cover), Kane County (roads, highways and rails, floodplains, stream location, township, and municipal boundaries), and the USDA Natural Resource Conservation Service (hydric soils).[19]

Assessment

The Blackberry Creek watershed alternative futures analysis project demonstrates how integrating environmental design at both the site and watershed scale can protect water resources.[20] The population of wetlands was first inventoried and identified according to their type and condition, their potential for restoration and mitigation, and the function they provided to the watershed.[21] Present-day decisions regarding land use were evaluated by projecting their likely outcomes. These outcomes are

8 Kentula, Mary. Personal communication. 17 Nov. 2003.

9 "Willamette Basin Alternative Futures Analysis," August 2002.

10 Framework for Landscape Planning. Harvard University Graduate School of Design. 4 Mar. 2004 <http://www.gsd.harvard.edu/studios/brc/framework/framework.html>.

11 Steinitz, Carl. A Framework for Theory Applicable to the Education of Landscape Architects (and Other Environmental Design Professionals. Harvard University Graduate School of Design. 4 Mar. 2004 <http://www.gsd.harvard.edu/studios/brc/framework/framework_treatise.html>.

12 Kentula, Mary. Personal communication. 17 Nov. 2003.

13 Blackberry Creek Watershed Alternative Futures Analysis, Jul. 03, p.7.

14 Blackberry Creek Alternative Futures Analysis. 2003. Conservation Design Forum, Inc. 17 Feb. 2004 <http://www.cdfinc.com/CDF_Portfolio/Regional_Scale/Blackberry_Creek/Blackberry%20Creek%20Alt%20Futures.pdf>.

15 Blackberry Creek Watershed Alternative Futures Analysis, Jul. 2003, p.7.

16 Blackberry Creek Watershed Alternative Futures Analysis, Jul. 2003, p.10.

17 Blackberry Creek Watershed Alternative Futures Analysis, Jul. 2003, p.9.

18 Blackberry Creek Watershed Alternative Futures Analysis. Sept. 2003. Conservation Design Forum, Inc.

19 Blackberry Creek Watershed Alternative Futures Analysis, Sept. 2003, p. 9-13.

20 "Willamette Basin Alternative Futures Analysis," August 2002.

21 Sumner, Rich. Personal communication. 3 Mar. 2004.

expressed as maps of projected future land use and land cover. Potential effects for each of the different "futures" were then evaluated for a wide range of ecological and socio-economic endpoints.[22]

The futures analysis in Blackberry Creek watershed had four distinct phases:

- Template design. Categories of templates (i.e. commercial industrial, rural residential, agriculture, stream corridors, etc.) were selected and prepared. For several categories, two templates were prepared: a conventional version and a conservation-designed version. A total of 14 templates were designed, all of which had to meet countywide stormwater, floodplain, wetland protection, and development standards for Kane County.
- Scenario design. Three scenarios were created for land use alternatives: existing conditions, current proposed land use, and conservation land use. Each scenario provided continuous simulation hydrologic modeling to evaluate the implications of the various land use futures.
- Evaluation. The 14 templates and three alternative scenarios were modeled for hydrologic impact.
- Community outreach. Ongoing community education involves residents and public leaders to review the products that have been developed.

Planning

The information produced by the analysis will be considered by Kane County as they develop land use plans and stormwater management strategies, including recommendations for §404 mitigation decision-making and restoration opportunities.[23] Project participants are currently implementing an outreach plan to local communities in the County. Several follow-up analyses and projects also continue, including a Blackberry Creek Watershed economic analysis, a cost analysis of conservation versus conventional development in the region, model ordinance language development and zoning code analysis, and monitoring of conservation design performance. Some suggestions for follow-up projects include additional scenario modeling, demonstration projects, and various levels of monitoring.[24] The Blackberry Creek Watershed Management Plan is currently being updated through to the year 2030.[25]

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Blackberry Creek Alternative Futures Analysis. 2003. Conservation Design Forum, Inc. 17 Feb. 2004 <http://www.cdfinc.com/CDF_Portfolio/Regional_Scale/Blackberry_Creek/Blackberry%20Creek%20Alt%20Futures.pdf>.

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22 "Willamette Basin Alternative Futures Analysis," August 2002.

23 Sumner, Rich. Personal communication. 3 Mar. 2004.

24 Blackberry Creek Watershed Alternative Futures Analysis, Sept. 2003, p. 51-54.

ARKANSAS WETLAND INVENTORY AND RESTORATION PRIORITIZATION

LEAD AGENCIES/ORGANIZATIONS

The Arkansas Multi-Agency Wetland Planning Team is a consortium of six state agencies: Arkansas Natural Heritage Commission, Arkansas Game and Fish Commission, Arkansas Department of Environmental Quality, Arkansas Soil and Water Conservation Commission, Arkansas Forestry Commission, and University of Arkansas Cooperative Extension Service.[26]

OTHER PARTICIPATING AGENCIES/ ORGANIZATIONS

Various other federal and state agencies contribute financial and technical assistance on a somewhat regular basis, though they are not member agencies.[27]

FUNDING SOURCES

Wetlands Program Development Grants from the U.S. Environmental Protection Agency, which are matched by the State of Arkansas, fund Multi-Agency Wetland Planning Team activities.[28]

GEOGRAPHICAL AREA CONSIDERED

The State of Arkansas, which is divided into five major planning regions: the Ozark Mountains, the Arkansas River Valley, the Ouachita mountains, the West Gulf Coastal Plain, and the Mississippi Alluvial Plain (Arkansas Delta).[29]

25 Sumner, Rich. Personal communication. 3 Mar. 2004.

26 Arkansas Multi-Agency Wetland Planning Team. 2001. Arkansas Multi-Agency Wetland Planning Team. 1 Mar. 2004 <http://www.mawpt.org/>.

27 Murray, Elizabeth O. (MAWPT). Personal communication. 27 Feb. 2004.

28 *Ibid.*

29 Murray, Elizabeth O. and Ken Brazil. "For Arkansas, Protection Begins with Multi-Agency Planning." National Wetlands Newsletter May-June 2003: 1+.

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ACTIVITIES

Background

Like many states, Arkansas does not administer a state-level regulatory program for wetlands, nor does any single state agency have a statutory mandate to protect wetlands. However, many state agencies are involved in wetland management activities, and the Multi-Agency Wetland Planning Team (MAWPT) was established in the mid-1990s to address non-regulatory wetland planning and conservation issues in the state.[30] Under the MAWPT, many initiatives have been launched, including a state wetland inventory, a wetland prioritization model based on geographic information systems (GIS), a wetland classification and characterization database, a wetland planning database, and functional assessment models based on the hydrogeomorphic (HGM) approach. These tools are allowing state agencies to make better planning and management decisions about wetlands.[31]

Goal of the effort

Following the *Arkansas Wetland Strategy*, the MAWPT promotes voluntary, incentive-based, locally led conserva-

30 Murray, Elizabeth O. (MAWPT). Personal communication. 27 Feb. 2004..

31 Murray and Brazil, p.1.

tion planning through implementation of the following objectives:

Policy Objective

- Achieve no net loss and long-term net gain of wetland functions and values in each of the five planning regions.

Watershed Objectives

- Characterize the composition, function, and landscape patterns of wetlands in Arkansas.
- Conduct analyses that identify priority wetland protection and restoration sites based on the characteristics, distribution, and function of the state's existing wetlands.

Statewide Objectives

- Develop better understanding of wetland hydrology, composition, structure, functions, and values, as well as techniques for management and restoration through research on Arkansas wetlands.
- Increase the quantity and enhance the quality of Arkansas wetlands on public lands through coordinated acquisition and improved stewardship.
- Increase the level of public and landowner knowledge and benefits from wetland conservation on private lands through education and incentives for wetland protection, restoration, stewardship, and enhancement.
- Support creation of urban riparian/wetland greenbelts for education and urban wildlife habitats.
- Increase wetland information delivery to local government, the public, and schools.
- Develop administrative and organizational structure for private and public mitigation activities.
- Develop state capacity for tracking wetland activities and long-term monitoring of wetland restoration and protection efforts.[32]

Inventory

The University of Arkansas at Fayetteville has been commissioned by the MAWPT to assemble a GIS inventory of the state's wetlands. Because the greatest portion of the state's wetlands lie in the Delta region, inventories for that area have already been completed. Inventories for the remaining four regions are underway.[33]

The MAWPT is also currently undertaking an HGM classification of the state's wetlands in order to produce information about landscape and geomorphic position, water sources, and hydrodynamics. As part of the classification, wetland types are also characterized by wetland class, subclass, and community type. In addition, the HGM classification facilitates functional assessment and has been proposed as one of the tools for alternatives analysis and impact assessment. Regional HGM guidebooks are being developed in conjunction with the U.S. Army Corps of Engineers and will likely be used for a variety of purposes, including monitoring restoration efforts, state mitigation banks, and other public holdings.

The Arkansas Wetland Information Management System is also being developed by the MAWPT in order to make impact and restoration data readily available online. The system is being designed to provide GIS capability to non-GIS users over the Internet. In addition, program information will be quickly accessible and can be queried for data regarding individual wetland planning areas, eco-regions, congressional districts, counties, permits, and conservation programs. The Information Management System will be capable of real time updates.[34]

Assessment

Through GIS analysis, priority areas for restoration and protection are identified on a watershed or regional basis. Ranking depends on characteristics such as fundamental structure and proximity of the land to other topographical features.[35] The general methodology for the prioritization consists of these following general steps:

- Collection of the appropriate watershed-scale geographic data on ecosystem components needed for decision-making.
- Review of maps of ecosystem components (with on-the-ground verification as needed).
- Preparation of component overlay maps to investigate relationships between individual wetland components (with on-the-ground verification as needed).
- Development of general wetland goals and objectives of the project, emphasizing measurable or mappable attributes.
- Implementation of GIS-based procedures to generate maps of protection and restoration priorities.
- Review of maps (with on-the-ground verification as needed).
- Synthesis of information into a wetland protection and restoration strategy, based on goals developed for the watershed.

32 Murray and Brazil, p.23.

33 Colbert, Kenneth. Personal communication. 1 Mar. 2004.

34 Murray and Brazil, p.25.

35 Arkansas Wetland Conservation Plan: Wetland Planning Area Reports. 2001. Arkansas Multi-Agency Wetland Planning Team. 1 Mar. 2004 <http://www.mawpt.org/plan/area_reports.asp>.

- Development of a monitoring and evaluation plan for the watershed strategy.[36]

The methodology generates raster-targeted areas for prioritization of 100 square feet in size.[37] The prioritized areas for restoration and protection are then identified and discussed in Wetland Planning Area Reports, which are used by natural resource planners in their conservation efforts. Indeed, the Wetland Reserve Program currently gives extra points to projects that are being planned in wetland priority areas that have been identified through GIS analysis.[38] Furthermore, the MAWPT envisions that these decision support tools will be used in siting Arkansas State mitigation banks.[39]

At present, the methodology has been applied in more than half of the state's watersheds. Because the Delta region contains the greatest portion of the state's wetlands, efforts began there and have gradually expanded. Fine-tuning and modifications have allowed costs to decrease since the Delta region was completed and an Arkansas ecoregion can now be analyzed using these methods for roughly $50,000. The state plans to analyze the remainder of the state's watersheds.[40]

36 The Standard GIS Methodology for Wetland Analysis. Arkansas Multi-Agency Wetland Planning Team. 1 Mar. 2004 <http://www.mawpt.org/pdfs/Standard_Methodology_of_Analysis.pdf>.

37 Colbert, Kenneth. Personal communication. 1 Mar. 2004.

38 Arkansas Wetland Conservation Plan: Wetland Planning Area Reports. 2001. Arkansas Multi-Agency Wetland Planning Team. 1 Mar. 2004 <http://www.mawpt.org/plan/area_reports.asp>.

39 Brazil, Ken and Kenneth Colbert. Personal communication. 25 Feb. 2004.

40 Colbert, Kenneth. Personal communication. 1 Mar. 2004.

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Murray, Elizabeth O. and Ken Brazil. "For Arkansas, Protection Begins with Multi-Agency Planning." National Wetlands Newsletter May-June 2003: 1+.

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BALDWIN COUNTY ADVANCED IDENTIFICATION AND WETLAND CONSERVATION PLAN

LEAD AGENCIES/ORGANIZATIONS

Baldwin County Commission

OTHER PARTICIPATING AGENCIES/ ORGANIZATIONS

U.S. Environmental Protection Agency, Region IV
U.S. Army Corps of Engineers, Mobile District
Alabama Department of Environmental Management
South Alabama Regional Planning Commission
Alabama Department of Conservation and Natural Resources, State Lands Division
University of South Alabama

FUNDING SOURCES

The Baldwin County Wetlands Conservation Plan was funded through a $269,000 State Wetlands Protection Development Grant from the U.S. Environmental Protection Agency. A match was provided by the Baldwin County Commission.

The Advanced Identification study was funded through a U.S. Environmental Protection Agency grant to the Alabama Department of Environment Management with a match provided by the Baldwin County Commission. The total cost was $225,000.

GEOGRAPHICAL AREA CONSIDERED

The Advanced Identification study focused on 89,000 acres in southern Baldwin County, Alabama. The Baldwin County Wetlands Conservation Plan involved all of Baldwin County, or approximately 1,655 square miles.

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BACKGROUND

About 30 percent of Baldwin County's land area is wetlands. These wetland resources are threatened by the fast rate of population growth and economic development in the coastal county. In 1995, local leaders initiated the Advanced Identification (ADID) process with assistance from U.S. Environmental Protection Agency (EPA) Region IV. The primary goal of the ADID effort to inventory and assess the area's wetland resources was to inform permitting and mitigation decision-making and guide wetland acquisitions. The effort also sought to increase public awareness of wetland issues and guide development away from sensitive wetland areas.[41]

Following the ADID process, the Baldwin County Commission (BC Commission), working with the EPA, began to draft the Baldwin County Wetland Conservation Plan (BCWCP) in 1999. The BCWCP sought to continue the work begun in the ADID and to expand the ADID wetland assessment to the entire county.[42] A non-regulatory effort, the BCWCP includes four main tasks:

- Development of a Wetland Protection Overlay District (WPOD) and incorporation of the WPOD into the County Zoning Regulations.
- Development of a geographic information system (GIS) wetland data layer, including information on the locations, types, and functional capacities for wetlands throughout the county.
- Development of a wetland education and outreach program.
- Design and implementation of wetland restoration/creation projects throughout the county.[43]

ADID

Inventory

Initial inventories of the ADID area were done through analysis of GIS data layers, which included data

41 Brantley, William H., Jr. Baldwin County Wetland Advance Identification (ADID) Technical Summary Document. (Bay Minette, Alabama: Baldwin County Commission, 1999) 5.

42 Stallman, Cara and Kenneth McIlwain. The Baldwin County Wetland Conservation Plan: Final Summary Document. *Draft*. (Bay Minette, Alabama: Baldwin County Commission and U.S. Environmental Protection Agency, December, 2003) 28-29.

43 Stallman and McIlwain, p. vii.

from the National Wetlands Inventory (NWI) and data on hydric soils, fire, endangered species, pre-existing mitigation sites, land use, well-head protection areas, roads, flood plains, and both color infrared and black and white aerial photography.[44] Data on groundwater levels were collected by monitoring six locations throughout the ADID area from January 1997 to April 1998. Hydric soils were mapped using existing field-verified data from the USDA Natural Resources Conservation Service.

The area's wetlands were classified according to the Cowardin and hydrogeomorphic (HGM) classification systems. In order to determine suitability for fill, all of the aquatic resources in the ADID area were grouped into four HGM wetland classes: riverine, fringe, flat, or depressional. The Mobile District of the U.S. Army Corps of Engineers (Corps) also undertook a study to validate the remote sensing-based wetlands classification.[45]

Assessment

The ADID Technical Committee next developed a plan and methodology for performing functional assessments within the ADID area. The committee first screened lands for "red flags" that would automatically make them unsuitable for fill, and thus would not be included in the functional assessment. These included public conservation lands, naturally rare wetlands, critical habitat for endangered species, and mitigation wetlands and banks.[46] Aquatic resources that were not red-flagged then underwent assessment for four major functions: water/flood storage, sediment/toxicant/nutrient removal, wildlife/fisheries habitat, and groundwater maintenance. The Committee developed GIS-based functional assessment models to assess each of the four major functions in three wetland types (riverine, flat, and depressional—fringe wetlands are regulated by the Alabama Department of Environmental Management) using "variables" or indicators. Variables included soil type, wetland size, previous hydrologic disturbance, surrounding land use, site hydrology, NWI type, habitat connectivity, floodplain location, and vegetation type.[47]

The committee then generated a list of "yes or no" questions for each HGM classification group in order to assess the variables at each wetland site. Each "yes" response was given equal weight. Where a "no" answer did not count against a particular wetlands site, variables that were considered "issue[s] of opportunity rather than functional performance" were counted as "bonus" questions. For instance, a wetland that is adjacent to high intensity land uses would be given credit for removing sediment and toxicant loads because of its landscape position, but a wetland that does not have high intensity adjacent land uses would not be scored lower since it does not have the "opportunity" to fulfill that added function. Based on the percentage of "yes" answers, each wetland site was designated as "potentially suitable," "generally unsuitable," or requiring "site-by-site" evaluation. Agencies involved in permitting cooperated in designating thresholds for suitability for each wetland type.[48]

Baldwin County Wetlands Conservation Plan

Wetland Inventory and Classification

The BCWCP included a wetland classification that, like the ADID effort, included both Cowardin and HGM classification. The plan's area, approximately 300,000 acres of wetlands, was classified using NWI data with some field verification. After consulting with the Corps, which oversaw the validation study for the ADID, BCWCP staff conducted a validation study to ensure the accuracy of the inventory. The team also conducted HGM classification, functional capacity assessment, and soil surveys. For the purposes of functional assessment, all of the area's wetlands were also classified into five HGM types: flat, depressional, riverine, fringe, and slope.[49]

Assessment

Functional assessments were conducted for all of the aquatic resources in the county using the Remote Wetland Functional Assessment Model (RWFAM), an automated GIS-based tool also used during the ADID. NWI data were first divided into 8-digit hydrologic unit code (HUC) watershed areas. Additional data on endangered species, fire, flood, wellhead protection areas, land use, hydrology, and roads were added to the database.[50]

The RWFAM includes three separate models—one each for riverine, flat, and depressional wetland types (all fringe wetland areas were designated as suitable for conservation because of their sensitivity; functional assessment was not done for slope wetlands because of their relative rarity in the landscape). Models assessed the same four functions as in the ADID (water/floodwater storage, sediment/toxicant/nutrient removal, wildlife/fisheries habitat, and groundwater maintenance).[51] While the functional assessment of the ADID designated suitability for filling, the RWFAM assessment classifies each wetlands site as suitable for conservation, enhancement or restoration. The functional values of each wetland polygon in the county were assessed using the same groups of ques-

44 Brantley, p. 16.

45 Brantley, p. 16-29.

46 Brantley, p. 33.

47 Brantley, pp. 36-49.

48 Brantley, pp. 48-50

49 Stallman and McIlwain, p. 6, 16.

50 Stallman and McIlwain, p. 19.

51 Stallman and McIlwain, p. 88.

tions used in the ADID. For the automated RWFAM model, the interagency Technical Advisory Committee developed a point system whereby each response generated positive or negative point values that are then totaled for each wetland. For each wetland type, the committee designated different point ranges for restoration, enhancement or conservation.[52] The Digital Wetland Layer includes the entire inventory and assessment data generated by the RWFAM and can easily be updated as new data become available.[53]

Progress to date

The ADID Technical Summary Document was released in 1999. In the report, 98 percent of the project area wetlands (58 percent of the total project area) were designated as "generally unsuitable for fill." Less than one percent of area wetlands (0.5 percent of total area) were designated as "site-by-site evaluation required," and the remaining percentage were designated as "potentially suitable for fill with compensatory mitigation."[54] In the Technical Summary Document, the ADID Interagency Team issued the following recommendations:

- Corps exploration of the possibility of general permits for selected ADID areas.
- Encouragement of county-wide Wetlands Conservation Plan to extend the kind of assessment done in the ADID to the rest of the county (now being finalized).
- Exploration of the feasibility of including local agency participants in interagency on-site field meetings.
- Purchase of highly functional wetlands.
- Encouragement of participation in other wetlands conservation programs (e.g. the Wetland Reserve Program).[55]

As part of the ADID effort, the agencies held public meetings and workshops to receive input from local stakeholders and to provide outreach on both the ADID and wetlands generally.[56] Similarly, the development of the BCWCP included several public meetings and workshops to solicit stakeholder input and inform the public both about the plan and general wetland issues in the county.[57]

The BC Commission is in the process of finalizing a draft of the BCWCP. According to the RWFAM assessment included in the draft plan, the vast majority of aquatic resources in Baldwin County are highly functioning and suitable for conservation.[58] The county will soon conduct on-the-ground validation of the functional assessments. County officials expect that the model will become more complete and more useful as the depth and breadth of remote data increase.[59]

While the products of the ADID and BCWCP processes are non-regulatory, the assessments conducted are intended to guide development and wetland-related decision-making for both government agencies and private entities in the area. The BCWCP staff distributes maps generated from the Digital Wetland Layer to stakeholders, which include local, state, and federal agency staff, developers, landowners, and environmentalists. Anticipated mitigation projects include a mitigation bank for county road projects, targeted acquisition of key wetland areas, and experimental shoreline protection measures.[60] During the development of the BCWCP, the county, along with various partners, undertook several wetland restoration and enhancement projects. Baldwin County planning officials expect that future restoration projects will be largely guided by the model.[61]

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52 Stallman and McIlwain, p. 26.

53 Stallman, Cara (Baldwin County Planning and Zoning Dept.). Personal communication. 8 Mar. 2004.

54 Brantley, pp. x-xi.

55 Brantley, pp. 73-76.

56 Brantley, pp. 60-61.

57 Stallman and McIlwain, pp. 28-29.

58 Stallman and McIlwain, p. 27.

59 Stallman, Cara (Baldwin County Planning and Zoning Dept). Personal communication. 8 Mar. 2004.

60 Stallman and McIlwain, p. 39.

61 Stallman, Cara (Baldwin County Planning and Zoning Dept). Personal communication. 8 Mar. 2004.

ENVIRONMENTAL IMPACT STATEMENT FOR IMPROVING THE REGULATORY PROCESS IN SOUTHWEST FLORIDA

LEAD AGENCIES/ORGANIZATIONS

U.S. Army Corps of Engineers, Jacksonville District, Regulatory Branch

OTHER PARTICIPATING AGENCIES/ ORGANIZATIONS

Cooperating agencies included the U.S. Environmental Protection Agency and U.S. Fish and Wildlife Service. The process involved a wide range of state and local government agencies along with landowners, developers, nongovernmental organizations, and other stakeholders.

FUNDING SOURCES

U.S. Army Corps of Engineers, Regulatory Branch
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service

GEOGRAPHICAL AREA CONSIDERED

The geographic scope of the project is 1,500 square miles in Lee and Collier counties, the two fastest growing counties in Florida. This area represents portions of two 8-digit hydrologic unit codes. The study focused on one major basin, and surrounding areas were added for habitat and other reasons.[62]

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62 Barron, Robert (U.S. Army Corps of Engineers). Personal communication. 24 Feb. 2004.

ACTIVITIES

Background & goal of the effort

Concerns that the permit-by-permit §404 process might not adequately address cumulative impacts led the U.S. Army Corps of Engineers (Corps) to initiate the Southwest Florida Environmental Impact Statement (EIS). The EIS assesses the state of aquatic resources in an area covering over 1,500 square miles in the two fastest growing counties in Florida and addresses future wetland permitting and preservation activities.[63] The EIS provides improved information for the permitting process, greater linkage between Corps' permitting decisions and county comprehensive plans, and, possibly, a general permit. The consideration of cumulative impacts, as opposed to project-by-project review, has led to a reduction in habitat fragmentation, reduced cost for applicants in some areas, and greater predictability.[64]

Summary

The Corps assembled a group of community members and stakeholders known as the Alternatives Development Group (ADG) in order to identify key issues relating to land use. The group also developed and evaluated several predictions for alternative development scenarios.[65] The ADG identified the 62 most pressing issues relating to development in the area and mapped 28 alternative future land use scenarios.[66] The Corps converted the alternatives into a geographic information system (GIS), allowing the overlay of various scenario layers to highlight areas of agreement and conflict.[67]

63 U.S. Army Corps of Engineers. "Appendix B - Field Implementation: Case Study Methods and Analysis," Draft Nationwide Permits Programmatic Environmental Impact Statement. (Washington DC: U.S. Army Corps of Engineers, 2001) B-5. 19 April 2004 <http://www.iwr.usace.army.mil/iwr/pdf/DPEIS/Appendix_B.pdf>.

64 U.S. Army Corps of Engineers. Environmental Impact Statement (EIS) On Improving the Regulatory Process in Southwest Florida. (Jacksonville, Florida: U.S. Army Corps of Engineers, Jacksonville District, 2000) ii. 9 Apr. 2004 < http://www.saj.usace.army.mil/permit/hot_topics/SFLAEIS/feisdoc.htm>.

65 U.S. Army Corps of Engineers. Environmental Impact Statement (EIS) for Improving the Regulatory Process in Southwest Florida (Presentation). (Jacksonville, Florida: U.S. Army Corps of Engineers, Jacksonville District, 1999). 25 Nov. 2003 <http://www.saj.usace.army.mil/permit/hot_topics/SFLAEIS/PDF_Files/aug99.pdf>.

66 U.S. Army Corps of Engineers, EIS p. iii.

67 Barron, Robert (U.S. Army Corps of Engineers). Personal communication. 6 Feb. 2004.

Using the work of the ADG, the Corps assembled maps showing five alternative scenarios or "ensembles" for development and permitting in the region. In processing the issues and alternatives developed by the ADG, the Corps gathered existing data on natural resource conditions, historic vegetation, permitting activity, socio-economic conditions, endangered species, and water quality for the region. No new field research was conducted in preparing the EIS. Each of the scenarios was then evaluated according to the issues identified by the ADG.[68] The Corps used data analyses and a GIS developed for the South Florida Comprehensive Conservation Permitting and Mitigation Strategy effort to develop and evaluate the alternative ensembles.[69]

From the 62 issues identified by the ADG, the Corps selected 16 key Permit Review Criteria (PRCs). The PRCs were selected because they relate to issues whose "potential cumulative effects are particularly within the concern of the Corps."[70] Of the 16 PRCs, 11 were incorporated into the final Record of Decision, including the effects of development on six types of wildlife habitat (crested caracara, bald eagle, Florida panther, shorebirds, red-cockaded woodpecker, and Florida scrub jay), general habitat fragmentation, flow ways, marshes, Regionally Significant Natural Resources, and water quality.[71] The Corps then used a GIS to develop maps identifying key areas for each of the selected issues. Some of the issues, such as water quality, were mapped using weighted quantitative indexes for comparative analysis to determine which areas were most important for preserving the identified values.[72] Other issues were mapped using species inventory data and other existing GIS datasets and databases.

Progress to date

The EIS process produced a list of PRCs related to key wetland-related functions, as well as maps of the areas that are particularly important to maintaining those functions within the study watersheds. The Natural Resources Overlay Map shows sensitive and ecologically important preservation areas that have been identified as preferred sites for future mitigation activities. The map also identifies less sensitive areas in which an abbreviated permitting process might be used.

While the amount of fill acreage has not changed considerably since the finalization of the EIS, the quality of mitigation has been improved considerably. Permit review staff are now able to readily identify where fills will have the greatest effects on the specified values and require appropriate mitigation for those impacts.[73]

The EIS effort has been successful in providing permit reviewers with a means of assessing the potential cumulative impacts of development in the study area; however, it has not yet led to the development of the intended regulatory products. While a general permit was one of the goals of the process, habitat and wildlife concerns raised by stakeholders made issuing a general permit very difficult, and the Corps has not produced a general permit based on the EIS as of yet.[74] In addition, Lee and Collier counties have not yet adopted the Memorandum of Understanding that the Corps drafted at the outset of the EIS process. However, the counties may adopt study recommendations in their comprehensive plans.[75]

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68 U.S. Army Corps of Engineers, EIS p. ii.

69 Brumbaugh, Robert and Erica Hieber. Opportunities to Improve Regulation of Aquatic Resources on a Watershed-Basis: Regulatory and Planning Links in Three Districts. (Washington, DC: U.S. Army Corps of Engineers, Institute for Water Resources, 2001) 44. 24 Nov. 2003 <http://www.iwr.usace.army.mil/iwr/pdf/oppstudypolicy.pdf>.

70 U.S. Army Corps of Engineers, Record of Decision: Environmental Impact Statement On Improving The Regulatory Process In Southwest Florida, Lee and Collier County, Florida. (Jacksonville, Florida: U.S. Army Corps of Engineers, Jacksonville District, 2003) 19 April 2004 <http://www.saj.usace.army.mil/permit/hot_topics/SFLAEIS/PDF_Files/ROD_complete.pdf>.

71 *Ibid.*

72 Barron, Robert (U.S. Army Corps of Engineers). Personal communication. 6 Feb. 2004.

73 *Ibid.*

74 *Ibid.*

75 Brumbaugh, Robert and Erica Hieber p. 44

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INTEGRATED WETLAND RESOURCES EVALUATION DECISION SUPPORT SYSTEM

LEAD AGENCIES/ORGANIZATIONS

U.S. Army Corps of Engineers, Institute for Water Resources

FUNDING SOURCES

U.S. Army Corps of Engineers, Institute for Water Resources

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SUMMARY

Developed by the U.S. Army Corps of Engineers' Institute for Water Resources (IWR), the Integrated Wetland Resources Evaluation Decision Support System (IWREDSS) is a computer-based decision support system for watershed- or regionally-based wetlands planning and related environmental restoration activities, including wetland mitigation banking. IWREDSS was designed as part of the U.S. Army Corps of Engineers' National Wetlands Mitigation Banking Study for the purpose of assisting in the formulation and evaluation of alternative aquatic resource plans for mitigation banks and other mitigation sites. The tool is especially useful in urban and urbanizing watersheds in which alternatives must address multiple planning objectives and criteria. The modeling framework is not intended to generate final plans, but can help in the formulation of initial prototype plans.[76]

IWREDSS includes both a multi-objective programming (MOP) model and a multi-criteria decision-making (MCDM) model. For each application, the MOP model must be created to manipulate existing economic, ecologic, spatial, and land use data to generate alternative wetland plans. Using a type of mathematical optimization modeling called mixed-integer programming, the MOP uses the objectives and constraints specified for each study area to create scenarios with varied combinations of wetland creation, preservation, restoration, enhancement, and economic development for the set of candidate sites.[77] The plans are generally developed to meet three types of objectives:

- Economic development objectives, which include direct financial costs (e.g. restoration costs), other economic impacts, and economic benefits.
- Environmental quality objectives, which include wetland function objectives (e.g. fish habitat, other habitat, and water quality), hydrologic objectives (e.g. flood flow reductions and hydrologic connectivity), and geographic objectives (e.g. acreage protected, site connectivity, external perimeter, and surrounding land use).
- Other issues and objectives, which include existing land use ordinances and other legal or political requirements.

76 Williams, Justin C. National Wetland Mitigation Banking Study – A Multi-objective Decision Support System for Watershed-Based Aquatic Resources and Wetlands Planning: IWREDSS. 98-WMB-10 (Alexandria, Virginia: U.S. Army Corps of Engineers, Institute for Water Resources Report, 1998) vii.

77 Williams, Justin and Robert Brumbaugh. "A Multiobjective Decision Support System for Wetland Mitigation Banking in a Watershed Context" from Proceedings of Watershed '96, June 8-18, 1996: Session 34. (Alexandria, Virginia: U.S. Army Corps of Engineers, Institute for Water Resources, 1996). <http://www.epa.gov/OWOW/watershed/Proceed/williamj.html>.

Plans can be generated to maximize a single objective or the tradeoffs between multiple objectives.[78]

The plans generated by the MOP are then evaluated, screened, and ranked with the MCDM according to criteria specified by various stakeholders.[79] MCDMs can take many different forms, some of which are available in commercial software. The tool can be used to evaluate different siting options for mitigation banks within a watershed such that economic costs are minimized and ecological benefits are maximized.[80] MCDM's typically require three types of inputs:

- The alternative/criteria matrix, which is a table showing the level of fulfillment of criteria (e.g. costs or ecological functional lift measurements) for alternatives produced in the MOP.
- Utility functions, which represent "the value, worth, or preference of a particular level of fulfillment to the decision maker."
- Criteria weights, which represent the relative importance of each criterion, as assessed by a particular stakeholder or decision-maker.

The Institute for Water Resources has created several MCDM models specifically for environmental decision-making.[81] The tool is compatible with the §404 regulatory decision-making processes.

IWREDSS presupposes the presence of existing economic, ecologic, and spatial datasets. While IWREDSS does not require geographic information systems (GIS), integration with GIS can provide both access to existing datasets and a means of visualizing alternatives generated through the tool. Both components of the tool can be integrated with GIS to allow visual analysis and presentation of the various plans; however, there is no software available to do this simply.[82]

Applications to date

IWREDSS was tested in association with the Mill Creek Special Area Management Plan (SAMP). The MOP used in the Mill Creek SAMP created 50 alternative plans, which were shaped by objectives and constraints including minimizing costs and secondary economic impacts, realizing no net loss or achieving net gains of wetland functions, and achieving biogeographic attributes. The MOP alternatives were evaluated and ranked using three different MCDMs, which represented different combinations and weightings of preferences. The MOP alternatives were compared with the actual preferred alternative from the SAMP process. GIS was used to identify the attributes to be used in the MOP and to map and display MOP alternatives.[83]

While the tool showed some promise in assisting in generating and assessing alternative plans in the Mill Creek SAMP, there are several technical and practical challenges to its widespread implementation. Some elements of IWREDSS may be transferable from one project to the next, but models must also sometimes be recreated for planning applications in which the objectives are largely new. Thus, the tool requires users to have technical expertise and may not be cost effective for some smaller or less complicated applications.[84] Setting up the MOP model for Mill Creek required about four days' worth of labor by technicians.[85] Labor costs can increase with the number of candidate sites and the number of criteria in each specific application.[86]

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78 *Ibid.*

79 Williams, p. iv.

80 Williams and Brumbaugh.

81 Williams, pp. 48-51.

82 Williams, p. 65.

83 Williams, p. viii.

84 Williams, p. 65.

85 Williams, p. 38.

86 Williams, Justin (Johns Hopkins University). Personal communication. 18 Feb. 2004.

LANDSCAPE LEVEL REFORESTATION PRIORITIES IN THE MISSISSIPPI ALLUVIAL VALLEY

LEAD AGENCIES/ORGANIZATIONS

U.S. Geological Survey

OTHER PARTICIPATING AGENCIES/ ORGANIZATIONS

The Lower Mississippi Valley Joint Venture is a voluntary, non-regulatory partnership of private organizations and federal and state agencies, established to coordinate waterfowl and wetland habitat conservation in the Mississippi Alluvial Valley.[87] The U.S. Geological Survey is one of multiple partnering state and federal agencies.[88]

FUNDING SOURCES

U.S. Geological Survey
U.S. Fish and Wildlife Service
Ducks Unlimited

GEOGRAPHICAL AREA CONSIDERED

Mississippi Alluvial Valley, West Gulf Coastal Plain

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ACTIVITIES

Background & goal of the effort

Thousands of hectares of cleared wetlands are being reforested annually in the Mississippi Alluvial Valley (MAV). Although the broad-based and long-term benefits of reforestation have been recognized, planning for restoration is generally not conducted on a landscape level. For example, selections for enrolling land parcels in the MAV in the Wetland Reserve Program are determined with criteria that vary between states and change from year-to- year.[89]

To address this deficiency, the Landscape Level Reforestation Prioritization Project used raster-based digital data to assess the value of forest restoration based of the benefits conveyed to different regions within the MAV. Specifically, the project assesses benefits affecting migratory forest birds, but also assesses benefits to the threatened Louisiana black bear, natural flood storage basins, and enhancement of water quality.

The project uses conservation goals to prioritize areas where reforestation will provide the greatest benefits. For example, by targeting reforestation to increase the area of interior forest habitat, migratory landbirds that depend on bottomland forests as breeding habitat will directly benefit. Similarly, targeting areas that are frequently flooded for reforestation will markedly reduce financial losses within the MAV floodplain.[90]

Inventory

Creation of a wetlands inventory is an ongoing activity. Numerous layers of digital data were used and others were developed to meet project objectives. Inventories built upon the U.S. Geological Survey database for forested landcover. In addition, Ducks Unlimited provided soil moisture indices.[91] To make these data available to the public, associated metadata files for these digital data were created.[92]

87 About LMVJV. Lower Mississippi Valley Joint Venture. 1 Mar. 2004 <http://www.lmvjv.org/About_LMVJV.htm>.

88 Twedt, Dan. Personal communication. 1 Mar. 2004.

89 Research Project: Digital Data and Metadata for Landscape Level Reforestation Priorities in the Mississippi Alluvial Valley. 10 Oct. 2000. U.S. Geological Survey – Patuxent Wildlife Research Center. 23 Feb. 2004 <http://www.pwrc.usgs.gov/research/sis2000/twedt07.htm>.

90 *Ibid.*

91 Twedt, Dan. Personal communication. 1 Mar. 2004.

92 Research Project: Digital Data and Metadata for Landscape Level Reforestation Priorities in the Mississippi Alluvial Valley. 10 Oct. 2000. U.S. Geological Survey – Patuxent Wildlife Research Center. 23 Feb. 2004 <http://www.pwrc.usgs.gov/research/sis2000/twedt07.htm>.

Assessment

Phases of the Prioritization Project are:

i. Assignment of a set of reforestation priorities to each hectare in the MAV based on its relative value for (a) the conservation of forest breeding landbirds, (b) the conservation of black bears, (c) natural flood storage basins, and (d) improving water quality.
ii. Use of these criteria to set reforestation priorities by assigning a relative value of reforestation to each hectare in the MAV.
iii. Creation of metadata files for the associated digital data files.[93]

Results generated by the methodology are quite specific, pinpointing areas for restoration as small as 900 square meters. Thus far, decision support models have been generated for migratory forest birds. Draft models have been developed for the Louisiana black bear, as well as natural flood storage.[94]

Future plans include continued refinement of the decision support models, and expansion of the project into the West and East Gulf Coastal Plain. The methodology has potential applications to guide mitigation decision-making. Indeed, private industry has used the migratory bird support model to assist in locating reforestation projects for carbon sequestration credits. In addition, the forest bird model is currently used as one of the selection criteria by the USDA Natural Resources Conservation Service for enrollment in the Wetlands Reserve Program.

[93] *Ibid.*

[94] Twedt, Dan. Personal communication. 1 Mar. 2004.

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NATIONAL ESTUARY PROGRAM – TAMPA BAY

LEAD AGENCIES/ORGANIZATIONS

The Tampa Bay Estuary Program is a partnership of Pinellas, Hillsborough, and Manatee counties; the cities of Tampa, St. Petersburg and Clearwater; the Florida Department of Environmental Protection; the Southwest Florida Water Management District; and the U.S. Environmental Protection Agency.

The program is governed by a Policy Board composed of elected officials and a Management Board of top-level bay managers and administrators, who work with both technical and citizen advisory groups.[95]

FUNDING SOURCES

Through §320 of the Clean Water Act, the U.S. Environmental Protection Agency's National Estuary Program funds the annual budget of the Tampa Bay Estuary Program. These funds are matched by the program's local- and state-level partners.[96]

GEOGRAPHICAL AREA CONSIDERED

The 2,300 square-mile watershed of the Tampa Bay Estuary on the central western coast of Florida.

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ACTIVITIES

Background

The Clean Water Act reauthorization of 1987 established the National Estuary Program (NEP) to improve the quality of estuaries deemed of national importance. Administered by the U.S. Environmental Protection Agency, the Act requires plans to be developed for attaining or maintaining water quality in an estuary. There are currently 28 estuaries in the NEP.[97]

Each NEP must create and implement a Comprehensive Conservation and Management Plan (CCMP) to meet the goals of §320 of the Clean Water Act. The plan must address all aspects of environmental protection for the estuary, including issues such as water quality, habitat, living resources, and land use. Based on a scientific characterization of the estuary, the CCMP is developed and approved by a broad-based coalition of stakeholders. The CCMP establishes priorities for action, research, and funding, and serves as a blueprint to guide future decisions and activities related to the estuary.[98]

Congress designated Tampa Bay an "estuary of national significance" in 1990. The Tampa Bay Estuary's CCMP, entitled Charting the Course, was approved in 1997. The program's partners, multiple agencies representing local, state, and federal government, pledged their commitment to the Tampa Bay CCMP and organized the Tampa Bay Estuary Program (TBEP) in 1998. The last 14 years have seen groundbreaking scientific research and action on the bay's most pressing problems.[99]

Goal of the effort

Charting the Course outlines six main focus areas and associated goals for the Tampa Bay Estuary:

- Water and sediment quality. Goals center on reducing the amount of nitrogen reaching the bay, reducing the amount of toxic pollutant in sediments, gaining a better understanding of air pollution's effects on water quality, and reducing bacterial contamination.
- Bay habitats. Goals center on restoring habitats to past ratios, preserving freshwater flows, reducing propeller damage to seagrass, protecting often-overlooked habitats, such as oyster reefs and mud flats, and implementing the TBEP master plan for prioritizing habitat restoration areas.

95 What is the Tampa Bay Estuary Program? Tampa Bay Estuary Program. 13 Feb. 2004 <http://www.tbep.org/tbep.html>.

96 Eckenrod, Richard. Personal communication. 23 Feb. 2004.

97 National Estuary Program. 21 Nov. 2003. U.S. Environmental Protection Agency. 13 Feb. 2003 <http://www.epa.gov/owow/estuaries/>.

98 National Estuary Program: Comprehensive Conservation and Management Plans. 16 Jan. 2004. U.S. Environmental Protection Agency. 13 Feb. 2003 <http://www.epa.gov/owow/estuaries/ccmp/>.

99 What is the Tampa Bay Estuary Program? Tampa Bay Estuary Program. 13 Feb. 2004 <http://www.tbep.org/tbep.html>.

- Fish and wildlife. Goals center on improving enforcement of fishing and environmental regulations, investigating opportunities for manatee protection zones, and restoring the bay scallop.
- Dredging and dredged material management. Goals center on developing a long-term dredged material management plan for the bay that focuses on beneficial uses.
- Spill prevention and response. Goals center on improving the coordination of ship movements in the narrow, 40-mile long shipping channel and the installation of anchors for oil-containment booms in environmentally sensitive areas.
- Public education and involvement. Goals center on publication, distribution, classroom involvement, cleanup efforts, bay mini-grants, and other volunteer activities.[100]

Inventory

Motivated by apparent losses and thinning in area seagrasses, the TBEP began working in 2001 with the Gulf of Mexico Program, the U.S. Geological Survey, the Southwest Florida Water Management District, and the Florida Marine Research Institute on what was to eventually become the Tampa Bay Estuary Imagery System, or Digital Library. Discussions at that time revealed that improved access to digital present-day and historic inventories of sea grasses and other habitats was a priority for resource managers and researchers. In addition, many other priorities for the region would benefit from this type of data being widely available. To address these issues, the U.S. Geological Survey and Gulf of Mexico Program led the effort to produce a website that would provide access to multiple years of aerial photography of the Tampa Bay region. Today, the Tampa Bay Estuary Imagery System provides partial coverage for the bay for 1926, and full coverage for 1947-52, 1999, and 2002. Images are available as JPEG files and georectified IMG/MrSID files, while metadata is available for each set of imagery and vector geographic information system files.[101]

Assessment

In order to set priorities for habitat restoration and protection, the TBEP worked with area stakeholders to produce the Tampa Bay Habitat Protection and Restoration Masterplan.[102] The Masterplan identified the losses that have occurred in the area and provided a scientific foundation for the restoration and protection goals set forth in Charting the Course (see Goal II above).[103]

Prioritizing of areas for restoration and protection is based entirely on habitat ratios.[104] The study analyzed trends in emergent marine and estuarine wetland loss and determined where losses had been greatest, based on percentage area. Comparisons of estimated historic acreage to present day acreages showed dramatic changes in the relative proportions of tidal marsh, mangrove/cordgrass marsh, salt barren, and low-salinity habitats. Proposals for protection and restoration are based in the premise that "a combination of habitats is essential to the continued ecological viability of Tampa Bay, and that these habitats must be restored with regard to historic proportions." In other words, the basic concept is to restore historic habitat ratios—this paradigm is termed "Restoring the Balance."[105] Goals generated by the project emphasize protection and restoration of low-salinity and salt barren habitats.[106]

The study relied primarily on aerial photography maps (available through the Tampa Bay Estuary Imagery System described above), as well as some amount of fieldwork and data collection. Targets generated are not geographically explicit; instead, they simply set bay wide goals for restoration while allowing TBEP partners greater flexibility in addressing the goals. Implementation of the Restoring the Balance plan is accomplished mainly through non-regulatory, resource management initiatives of the TBEP partners, though partnering regulatory agencies are also encouraged to direct mitigation efforts towards these types of habitats.[107]

Planning

Efforts are currently underway to revisit the Restoring the Balance plan and update habitat ratios as appropriate. Habitats in addition to the three emergent habitats analyzed in the original study will also be examined. The TBEP's Technical Advisory Committee recently recommended the initiation of research that would help establish goals for tidal creeks and rivers. New maps have been created since the original 1995 analysis, which will contribute to the planned expansion of efforts.[108]

100 Bay Restoration Plan Highlights. Tampa Bay Estuary Program. 17 Feb. 2004 <http://www.tbep.org/action.html>.

101 Project Description. Florida Marine Research Institute – Tampa Bay Estuary Imagery System. 19 Feb. 2004 <http://ocean.floridamarine.org/tbep/project_description.htm>.

102 Setting Priorities for Tampa Bay Habitat Protection and Restoration: Restoring the Balance [Executive Summary]. 1995. Technical Publication #09-95 of the Tampa Bay Estuary Program. Prepared by Lewis Environmental Services, Inc. Available at <http://www.tbeptech.org/TechPubs/t0995.pdf>.

103 Eckenrod, Richard. Personal communication. 23 Feb. 2004.

104 *Ibid.*

105 Setting Priorities for Tampa Bay Habitat Protection and Restoration: Restoring the Balance [Executive Summary], p. *vii*.

106 Eckenrod, Richard. Personal communication. 23 Feb. 2004.

107 *Ibid.*

108 *Ibid.*

Progress to date

A Baywide Environmental Monitoring Report (BEMR) is released periodically by the TBEP. The BEMR provides information to resource managers and scientists on a variety of topics important to restoration and protection efforts, including sediment and water quality, nutrient loading, habitats and animal populations, and areas of degradation or changing condition. The BEMRs indicate significant progress towards TBEP goals for nitrogen management, acres of seagrass, and increases in low-salinity habitats.[109]

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109 Baywide Environmental Monitoring Report: Summary and Conclusions. Tampa Bay Estuary Program. 17 Feb. 2004 <http://www.tbep.org/baystate/bemr.html>.

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NOAA COASTAL SERVICES CENTER– LANDSCAPE CHARACTERIZATION AND RESTORATION PROGRAM

LEAD AGENCIES/ORGANIZATIONS

National Oceanic and Atmospheric Administration, Coastal Services Center

OTHER PARTICIPATING AGENCIES/ ORGANIZATIONS

The Coastal Services Center has various partner agencies and organizations throughout the country.

FUNDING SOURCES

National Oceanic and Atmospheric Administration

GEOGRAPHICAL AREA CONSIDERED

Coastal states, including the Great Lakes, and U.S. Atlantic and Pacific Islands.

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ACTIVITIES

Background and goals

The National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center's Landscape Characterization and Restoration Program began in 1995 with the goal of providing interdisciplinary analysis to aid coastal resource management agencies. Each year, the Landscape Characterization and Restoration Program (LCR) performs geographic and issue-based characterizations for efforts around the country. Geographic characterizations typically integrate physical, ecological, and socio-economic data in order to assist managers in assessing resource issues in small- to medium-sized watersheds. Issue-based characterizations typically focus on a wide range of factors affecting an issue in a larger geographical area, sometimes encompassing several states.[110]

LCR generally selects one geographic characterization project per year to which it will contribute up to $300,000 of financial resources, as well as staff time and technical resources. In selecting projects, the LCR chooses one region of the country per year from which to draw proposals.[111] Most projects are selected via a competitive process administered through the Federal Register; others evolve from collaborations between scientists at the Coastal Services Center and partner institutions. LCR projects often include spatial analysis tools and decision support systems designed to address particular watershed and landscape level coastal resource management issues, including wetland conservation and restoration. Though LCR generates tools and resources for use in specific settings, the tools created can be modified or customized to fit other applications. Two examples of tools created by LCR are described below.

Spatial Wetlands Assessment for Management & Planning

LCR developed the Spatial Wetlands Assessment for Management & Planning (SWAMP) to help managers prioritize wetland habitats within a watershed. A conceptual model based on geographic information systems (GIS), SWAMP builds off the North Carolina Coastal Region Evaluation of Wetland Significance (NC-CREWS) tool, which was developed by the North Carolina Division of Coastal Management. SWAMP was developed for the Ashepoo-Combahee-Edisto River Basin of South Carolina.[112]

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110 Landscape Characterization and Restoration Program: Background. 12 Feb. 2004. NOAA Coastal Services Center. 9 Mar. 2004 <http://www.csc.noaa.gov/lcr/lcrbkgd.html>.

111 Olson-Callahan, Alyssa (NOAA, Coastal Services Center). Personal communication. 2 Mar. 2004.

112 Sutter, Lori. Spatial Wetland Assessment for Management and Planning (SWAMP): Technical Discussion. Publication No. 201-29-CD (Charleston, South Carolina: NOAA Coastal Services Center, 2001) 1. 19 April 2004 <http://www.csc.noaa.gov/lcr/text/images/TechDisc.pdf>.

SWAMP consists of two modules for two hydrogeomorphic classes—tidal and riverine—that examine a wetland's contribution to water quality, hydrology, and habitat within a watershed. The model considers site-specific characteristics obtained from soil and vegetative data, as well as landscape characteristics, such as watershed position and proximity to other water bodies, obtained from GIS analyses. SWAMP uses ArcView® 3.x with Spatial Analyst® and an interface that allows the user to explore alternatives for prioritizing wetland habitat.[113] The GIS data layers required for SWAMP are wetland boundaries and types, land cover, soil boundaries and types, hydrography, watershed boundaries, and roads.[114]

Based on the data inputs, each wetland within a watershed is designated as "exceptional," "substantial," or "beneficial" for each of several parameters in the three functional groups. The SWAMP parameters are a set of pre-established measurement criteria and include relative threshold values or measures that define whether a wetland provides functions at exceptional, substantial, or beneficial functional levels.[115]

The parameters in SWAMP and NC-CREWS are similar. The main difference between the two models is that SWAMP allows users to determine how the parameters are weighted during the overall assessment of water quality, hydrology, or habitat function.[116]

Though the tool has not been tested or implemented beyond the Ashepoo-Combahee-Edisto River Basin, its primary purpose was to provide an opportunity for LCR to evaluate the level of effort needed to develop tools of this type. This evaluation and the lessons learned from building SWAMP contributed to the conceptual basis for the California Riparian Ecosystem Assessment Method (SCREAM), as well as the three Rhode Island Site Selection tools: Saltmarsh, Anadromous Fish Run, and Seagrass.

Integrated Coastal Management Tool

The Lake St. Clair Coastal Habitat Restoration and Conservation Project is a cooperative landscape characterization effort led by the Great Lakes Commission and LCR. The goals of the project are to develop a GIS, an Integrated Coastal Management (ICM) tool for prioritizing coastal habitat restoration and conservation sites, and a draft coastal habitat restoration plan for the Lake St. Clair region.[117] The ICM tool will use data from the GIS to help local resource managers identify areas with especially important habitat restoration and prioritization potential and examine the impacts of various management decisions.[118] The project area is not defined by watershed boundaries because a full watershed assessment would include a much larger area of concern. Instead, the project area includes the lake itself and the land areas within a 10-mile area of the lake.[119]

The ICM tool has three major interlinked functions: habitat analysis, site prioritization, and alternatives analysis for land use planning. The tool calculates habitat statistics, including information about connectivity and habitat quality, which are used to examine how habitats function within a broader landscape context. Connectivity measures are based on the proximity and number of neighboring habitat patches and habitat quality measures are based on patch size, core area, distance to streams, distance to shoreline hardening, rare species, and exotic species. The tool will also include measures of the proportion of impervious surface and various measurements of the aquatic environment (e.g. water quality, temperature, light). These statistics will allow users to identify and rank components of the landscape. Users can also test various alternative land use scenarios using the tool to project possible effects on habitat statistics and the aquatic environment. While the required data inputs for the ICM tool vary according to types of analysis sought, all applications of the tool require land cover data in raster format. Users can analyze and display various data on current and projected conditions in GIS map, report or spreadsheet formats. [120]

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Sutter, Lori. Spatial Wetland Assessment for Management and Planning (SWAMP): Technical Discussion. Publication No. 201-29-CD (Charleston, South

113 Olson-Callahan, Alyssa. Personal communication. 8 Mar. 2004.

114 Sutter, p. 3-4.

115 Sutter, p. 44.

116 Sutter, p. 1.

117 Environmental Characterization: The Lake St. Clair Coastal Habitat Restoration and Conservation Project. NOAA Coastal Services Center. 9 Mar. 2004 <http://csc.noaa.gov/lcr/text/stclair.html>.

118 Great Lakes Commission. The Lake St. Clair Coastal Habitat Characterization and Restoration Project: Integrated Coastal Management Tool. 2003. 9 Apr. 2004 <http://www.glc.org/habitat/pdf/factsheet_12-03.pdf>.

119 Lake St. Clair Coastal Habitat Restoration and Conservation - Project Overview. Great Lakes Commission. 9 Mar. 2004 <http://www.glc.org/habitat/habitat.html>.

120 Great Lakes Commission, Apr. 2003.

Carolina: NOAA Coastal Services Center, 2001) 1. 19 April 2004 <http://www.csc.noaa.gov/lcr/text/images/TechDisc.pdf>.

Lake St. Clair ICM

Environmental Characterization: The Lake St. Clair Coastal Habitat Restoration and Conservation Project. NOAA Coastal Services Center. 9 Mar. 2004 <http://csc.noaa.gov/lcr/text/stclair.html>.

Great Lakes Commission. The Lake St. Clair Coastal Habitat Characterization and Restoration Project: Integrated Coastal Management Tool. 2003. 9 Apr. 2004 <http://www.glc.org/habitat/pdf/factsheet_12-03.pdf>.

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NORTH CAROLINA ECOSYSTEM ENHANCEMENT PROGRAM

LEAD AGENCIES/ORGANIZATIONS

North Carolina Department of Environment and Natural Resources
North Carolina Department of Transportation
U.S. Army Corps of Engineers, Wilmington District

OTHER PARTICIPATING AGENCIES/ ORGANIZATIONS

North Carolina Wildlife Resources Commission
U.S. Environmental Protection Agency, Region IV
U.S. Fish and Wildlife Service
National Atmospheric and Oceanic Administration's National Marine Fisheries Service
Federal Highway Administration

FUNDING SOURCES

Funding sources include the North Carolina Department of Transportation, In Lieu Fee Payments (§404/401 permit requirements, Nutrient Offset Payments, and Riparian Buffer Payments), state appropriations, the Federal Highway Administration, U.S. Environmental Protection Agency Wetland Program Development Grants, and the North Carolina Clean Water Management Trust Fund. The program's annual budget is approximately $60 million, but varies depending on projected impacts by the North Carolina Department of Transportation.

GEOGRAPHICAL AREA CONSIDERED

Statewide

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ACTIVITIES

Background

On July 22, 2003, the North Carolina Department of Environment and Natural Resources (NCDENR), the North Carolina Department of Transportation (NCDOT), and the U.S. Army Corps of Engineers - Wilmington District signed a Memorandum of Agreement (MOA) to establish the North Carolina Ecosystem Enhancement Program (EEP). The MOA was the result of several Process Improvement Workshops that were designed to evaluate and recommend improvements to the existing §404 permitting process. Sponsored by the NCDOT over a two-year period, the workshops were attended by all state and federal agencies involved in the permitting process.[121]

The EEP was created to consolidate the environmental mitigation programs of the North Carolina Wetlands Restoration Program (NCWRP) and the NCDOT.122 The NCDENR's NCWRP, the EEP's precursor, was created by the state legislature in 1996 as a non-regulatory program. The NCWRP's mandate was to improve the ecological effectiveness of compensatory mitigation through watershed planning and to act as an in-lieu-fee provider available throughout North Carolina. By provid-

[121] National Research Council. Compensating for Wetland Losses Under the Clean Water Act. (Washington DC: National Academy Press, 2001) 208-210.

ing a unified, watershed-based approach to the state's aquatic resource planning and mitigation activities, the EEP seeks to increase regulatory efficiency and ecological effectiveness.[123]

Goal of the effort

The primary goal of the EEP is to provide high quality, straightforward compensatory mitigation for unavoidable impacts to aquatic resources, while incorporating mitigation projects into comprehensive watershed restoration initiatives. The approach is intended to increase the ecological effectiveness of compensatory mitigation and provide a more cost-effective and predictable mechanism for mitigation.

In order to achieve this goal, the EEP calls for the development of comprehensive watershed restoration plans within each 8-digit U.S. Geological Survey Cataloging Unit (CU). Funds earmarked for compensatory mitigation, as well as other funding sources, are used to implement projects that will provide the greatest ecological benefits, are cost-effective, and will meet the goals established for each watershed.[124]

Watershed Assessment and Planning

Watershed Restoration Plans

In 1998, Watershed Restoration Plans (WRPs) for the 17 major river basins in the state were completed under the NCWRP. WRPs include restoration goals, narrative overviews of the basins, priority sub-basin maps with water quality information, watershed boundaries, land cover data, information on water quality problems, descriptions of priority sub-basins, and wetland impact information. Data for the WRPs were collected from numerous sources, including Basinwide Water Quality Management Plans and Assessment Reports, and the §303(d) list of impaired water bodies from the Division of Water Quality. Additional data on land use change, Natural Heritage Program priorities, habitat degradation, fishery management plans, and permitted impacts have also incorporated. The plans are updated every five-years and are coordinated with the Basinwide Water Quality Management Plans developed by the Division of Water Quality.[125]

Screening Methodology

The EEP's Watershed Needs Assessment Team (WNAT) is an interagency group composed of representatives from several state and federal agencies. The WNAT has developed assessment frameworks and methodologies for the EEP's watershed planning and restoration activities, as well as a screening methodology to identify Targeted Local Watersheds (TLWs) in which to concentrate planning and restoration activities. In order to identify TLWs, the screening methodology enables a comparison of the relative problems and assets of the local watersheds (14-digit hydrologic units, between 5,000 and 50,000 acres in size) within an 8-digit CU.126 The screening methodology relies on GIS data analysis of five broad categories of information: baseline watershed conditions, watershed resources or attributes, watershed problems, potential threats and stressors, and other factors of interest.[127]

Local watershed data from existing databases and functional assessments, as well as baseline watershed conditions data, are to be entered into a watershed attribute matrix, which includes data for each 14-digit local watershed in a CU. Analysis of the watershed attribute matrix narrows the field of eligible local watersheds by selecting only those areas with a combination of restoration needs and opportunities. Areas in which planning and restoration efforts will be concentrated are identified through an analysis of potential future stressors (primarily anticipated growth and development), as well as other factors, such as data richness and local interest.[128]

Detailed Needs Assessment and Local Watershed Planning

Once the screening methodology has been applied to identify TLWs, the EEP will work with local governments, nongovernmental organizations, and other stakeholders to complete local watershed plans in the selected TLWs. There is no set methodology for local watershed planning or identification and prioritization of mitigation projects. However, the WNAT has developed a general framework for detailed watershed needs assessment that can be adapted to the diverse landscapes and mitigation circumstances around the state.[129] The WNAT's watershed needs assessment framework includes a three phase process: Phase I is a baseline assessment, Phase II involves a detailed watershed analysis, and Phase III includes the

122 North Carolina Wetland Restoration Program. Wetlands Restoration Program: 2003 Annual Report. (Raleigh, North Carolina: North Carolina Wetland Restoration Program, 2003). 9 Apr. 2004 <http://h2o.enr.state.nc.us/wrp/publications/2003/03WRPAnnual.pdf>.

123 National Research Council, p. 208-210.

124 Watershed Needs Assessment Team. Report from the Watershed Needs Assessment Team to the Mitigation Coordination Group. (Raleigh, North Carolina: Ecosystem Enhancement Program, 2003) 7.

125 NCWRP Watershed Restoration Plans. North Carolina Wetlands Restoration Program. 25 Jan. 2004 <http://h2o.enr.state.nc.us/wrp/plans/wetrip.htm>.

126 North Carolina Wetland Restoration Program. Guide to the North Carolina Wetland Restoration Program's Watershed Restoration Strategy. (Raleigh, North Carolina: North Carolina Wetlands Restoration Program, 2001) 13 Feb. 2004 <http://h2o.enr.state.nc.us/wrp/pdf/restplans/Planning%20Guide.pdf>.

127 North Carolina Wetland Restoration Program. Guide, pp. 19-20.

128 *Ibid.*

129 North Carolina Wetland Restoration Program. Guide, p. 3.

development of an implementation plan.[130] Local stakeholder involvement is central to the local watershed planning process.

While neither the process nor the product of local watershed planning efforts is prescriptive, the plans do tend to have some common features. All the local watershed plans that were drafted for the NCWRP included "an inventory of the specific causes of watershed degradation identified through a detailed assessment, a plan that links watershed problems with specific restoration strategies that are supported by the local community, and a strategy for implementing restoration projects and other watershed initiatives identified in the plan,"[131] including possible sources of funding for measures proposed in the LWP.[132]

Program integration

The EEP seeks to establish synergies between the program's projects, private mitigation projects, and non-mitigation watershed projects in order to maximize ecological benefits.[133] State regulations dictate that mitigation banks must be located within TLWs or be proven to be consistent with WRPs. In addition, local watershed plans often include information about other nonpoint source pollution in the watershed and how it might be addressed through avenues other than compensatory mitigation.[134] Moreover, through the local watershed planning process, the EEP seeks to identify potential non-mitigation watershed projects that will compliment mitigation efforts.135

Progress to date and next steps

WRPs have been developed for all 17 of the state's major river basins. Targeted local watersheds have been identified in all 52 cataloging units within these basins. A total of 22 local watershed plans are in development or have been completed. The screening methodology has been tested in 10 cataloguing units throughout the state. Between July and December 2003, there were 10 permits/certifications issued to NCDOT with the EEP as the party responsible for the mitigation. To satisfy these mitigation needs, the EEP utilized existing mitigation assets developed by WRP and the NCDOT mitigation program. Recent EEP mitigation also has also included high quality preservation, generally with a commitment to provide additional 1:1 restoration. In addition, the EEP continues to implement mitigation projects to meet the mitigation requirements assumed through the WRPs' In Lieu Fee Program.[136]

The EEP is developing functional assessment tools to help guide its compensatory mitigation and planning efforts. The EEP is to be fully implemented by August 1, 2005. By 2014, the EEP aims to have all restoration projects in place five years before permitted impacts.[137] When it is fully implemented in 2005, the EEP will use a watershed approach to identify and implement approximately 90 percent of the state's compensatory wetland mitigation.[138]

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130 North Carolina Wetland Restoration Program. Guide, p 32.

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133 Ferrell, Ron and Suzanne Klimek. Personal communication. 30 Jan. 2004.

134 North Carolina Wetland Restoration Program. Guide, p. 10.

135 Ferrell, Ron and Suzanne Klimek. Personal communication. 30 Jan. 2004.

136 Ferrell, Ron and Suzanne Klimek. Personal communication. 29 Mar. 2004.

137 *Ibid.*

138 *Ibid.*

North Carolina Wetland Restoration Program. Wetlands Restoration Program: 2003 Annual Report. (Raleigh, North Carolina: North Carolina Wetland Restoration Program, 2003). 9 Apr. 2004 <http://h2o.enr.state.nc.us/wrp/publications/2003/03WRPAnnual.pdf>.

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SAN FRANCISCO BAY AREA WETLANDS RESTORATION PROGRAM

LEAD AGENCIES/ORGANIZATIONS

The San Francisco Bay Area Wetlands Restoration Program is governed by an Executive Council of federal, state, and regional agencies. The Coordinating Committee of the Executive Council oversees two Science Groups—the Design Review Group and the Monitoring Group—that include experts from a variety of organizations, including governmental agencies, non-governmental organizations, consulting firms, and academic institutions.[139] The San Francisco Estuary Institute, a non-profit organization working to "foster the development of the scientific understanding needed to protect and enhance the San Francisco Estuary,"[140] plays a lead role in the technical and scientific coordination and support for the Restoration Program.[141]

FUNDING SOURCES

Funding for the Restoration Program comes from federal, state, and local government grants, as well as private foundations.[142]

GEOGRAPHICAL AREA CONSIDERED

The geographic scope of the Restoration Program includes the four primary sub-regions of the San Francisco Bay downstream of the western boundary of the Sacramento-San Joaquin Delta at Broad Slough: Suisun Marsh and Bay, San Pablo Bay, Central Bay, and South Bay.[143]

139 Restoration Program Organizational Structure. San Francisco Bay Area Wetlands Restoration Program. 12 Feb. 2004 <http://www.sfwetlands.ca.gov/orgstructure.html>.

140 San Francisco Estuary Institute. San Francisco Estuary Institute. 12 Feb. 2004 <http://www.sfei.org/>.

141 Collins, Josh. Personal communication. 12 Feb 2004.

142 *Ibid.*

143 The San Francisco Bay Area Wetlands Ecosystem Goals Project: Bay Area Wetlands Ecosystem Goals Project. 28 Mar. 1999. San Francisco Estuary Institute. 12 Feb. 2004 <http://www.sfei.org/sfbaygoals/docs/goals1997/goalsproject/about.html>.

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ACTIVITIES

Background

The San Francisco Bay Area Wetland Restoration Program grew from of an initiative called the San Francisco Bay Area Goals Project (Goals Project). The Goals Project, a five-year effort coordinated by San Francisco Estuary Institute (SFEI), engaged more than 100 scientists and engineers to develop quantitative, map-based goals for wetland protection and management in the region.[144] Originating as regional teams of experts working separately to understand historical changes in selected habitats and wildlife populations, the scientific support for the Goals Project evolved into a shared vision of the optimal array of wetland habitat. The relative effects of people and natural processes on wetland form and function were resolved at the landscape scale. A regional Geographic Information System, the Bay Area EcoAtlas, was developed to help visualize past, present, and alternative future conditions.[145]

In 1999, the Goals Project released a report entitled *Baylands Ecosystem Habitat Goals*, which presented guidelines for the restoration and improvement of the wetlands and adjacent habitats of the San Francisco Estuary. From this, the Restoration Program was created to plan and

144 Collins, Josh. Personal communication. 12 Feb 2004.

145 Collins, Josh. Personal communication. 14 Feb. 2004.

implement the recommendations of the Goals Project by filling programmatic gaps and improving communication and coordination among the involved agencies.[146]

Goal of the effort

The Restoration Program's ultimate goal is the enhancement and protection of Bay Area wetlands and related habitats. Three main objectives have been established:

- Set up and maintain a forum of top-level local, state, and federal agency administrators to improve coordination and efficiency in the authorization and development of habitat projects.
- Provide voluntary project design review at the request of the public and private project sponsors in order to increase restoration and mitigation project success and efficiency.
- Advance the development of a regional wetlands monitoring program in order to further the understanding of habitat project successes and failures.[147]

Inventory

At the onset of the Wetlands Restoration Program, a complete wetlands inventory was conducted for the Bay Area. Both historical and modern-day habitats have been mapped and catalogued.[148] SFEI's Historical Ecology Program, which originated as a part of the Goals Project, has used a range of innovative methods to recover and synthesize the landscape's ecological history. The data have provided key information on Bay Area resources, and the group is currently working to transfer methodologies to other regions of California.[149] In addition to its role in wetlands inventory assessment, the Historical Ecology Program has recently launched an outreach campaign called Bayboards, which posted a network of roadside billboards, bus stop placards, library installations, and a website in order to educate the public about historical changes in local landscapes.[150]

146 Restoration Program History. San Francisco Bay Area Wetlands Restoration Program. 12 Feb. 2004 <http://www.sfwetlands.ca.gov/history.html>.

147 Restoration Program Mission Statement. San Francisco Bay Area Wetlands Restoration Program. 12 Feb. 2004 <http://www.sfwetlands.ca.gov/objectivesbenefits.html>.

148 Collins, Josh. Personal communication. 13 Feb. 2004.

149 Program Information. San Francisco Estuary Institute. 13 Feb. 2004 <http://www.sfei.org/HEP/programinfo.html>.

150 Bay Boards. Stillhere. 17 Feb. 2004 <http://www.stillhere.org/cat_bayboards.html>.

Assessment

Wetland Project Tracker

The Wetland Project Tracker, developed by SFEI to support the Wetlands Regional Monitoring Program, is one component of the Bay Area EcoAtlas. The Tracker provides a variety of information about the status of wetlands restoration, mitigation, creation, and enhancement projects in the San Francisco Bay Area. Data on location, size, sponsors, habitats, and contact persons are free and available to the public in both map form and summary sheets. Associated files are also available, and may include reports, data, photos, videos or commentary. Additionally, any user can submit files associated with a wetland project in the region.[151]

The San Francisco District of the U.S. Army Corps of Engineers (Corps) is planning to use the §404 permit process to encourage applicants to update the Tracker with project information, thus incorporating the Tracker into the state's regulatory structure. SFEI is currently working with the Corps, the Regional Water Quality Control Board, and other coastal zone managers to make sure that all mitigation projects can be geo-referenced in the Tracker to the sites being mitigated.

The Wetlands Project Tracker relies on historical maps from the EcoAtlas and U.S. Geological Survey topographic models as cartographic backdrops, though photographic base maps are in development. SFEI is currently working with the U.S. Fish and Wildlife Service's National Wetlands Inventory Program to expand the region's inventory of wetlands, lakes, and riparian habitats, which will extend the Tracker into local watersheds. Over time, the Tracker is expected to grow as new conservation projects are planned and constructed.[152]

At present, funding available to develop the Tracker's content is greater than the funding available to develop the Tracker's technology. To date, Tracker development has relied almost entirely on a $50,000 grant from the San Francisco Foundation. SFEI is currently developing proposals with other regions for continued development and replication of the Tracker in other areas of California in order to facilitate the creation of a statewide wetland-monitoring program. Sister programs to the Restoration Program, one located on the central coast and the other located in southern California, plan to partner with SFEI to develop Wetlands Project Trackers for their regions.[153]

151 Wetland Project Tracker. San Francisco Bay Area Wetlands Regional Monitoring Program. 13 Feb. 2004 <http://www.wrmp.org/projectsintro.html>.

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153 Collins, Josh. Personal communication. 13 Feb. 2004.

California Rapid Assessment Method

The Restoration Program also supports development of the Bay Area Component of the California Rapid Assessment Method (CRAM), a field based assessment methodology for wetland conditions across a range of wetland types and geographic areas. Mainly intended as a cost-effective monitoring and assessment tool, it can be used to develop a landscape-level profile of the condition of different wetlands within a watershed, as well as to plan restoration activities. The tool provides a preliminary determination of the need for additional analysis or monitoring and supplementary regulatory information[154] and can be used in §404 decision-making by providing information for permit evaluation, site selection, and evaluation of mitigation success.[155]

Future directions

The principles that are at the foundation of the Wetland Restoration Program revolve around sharing of ideas, open dialogue, and collaboration. In more recent years, the political momentum relating to Restoration Program has decelerated to some extent, due to the economic downturn. Organizations and agencies have become more protective of their budgets and projects, though the program continues to make significant progress towards its organizational goals.[156]

Strategic planning within the Wetlands Restoration Program is aimed towards "Landscape Scenario Planning," an extension of the EcoAtlas to support real time modeling of ecological and economic outcomes for alternative regional and local land use decisions. This GIS-based decision support tool will allow groups of stakeholders, including resource managers and scientists, to explore together what effects present-day land use decisions might have on ecosystem health and the quality of life in the future.[157]

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SOUTHERN CALIFORNIA WETLAND RECOVERY PROJECT

LEAD AGENCIES/ORGANIZATIONS

The Southern California Wetland Recovery Project (WRP) is a consortium of 16 federal and state agencies committed by a 1997 memorandum of understanding called "The Working Agreement."[158]

Federal partners include the U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and Natural Resources Conservation Service.[159]

Participating California State agencies include the Resources Agency, California Environmental Protection Agency, Coastal Commission, Department of Fish and Game, Department of Parks and Recreation, State Coastal Conservancy, State Lands Commission, State Water Resources Control Board, and the Regional Water Quality Control Boards of San Diego, Santa Ana, Los Angeles, and the Central Coast.[160]

The WRP management structure consists of a governing board, a managers group, a public advisory committee, a science advisory panel, and five county task forces, as shown in the figure below.[161]

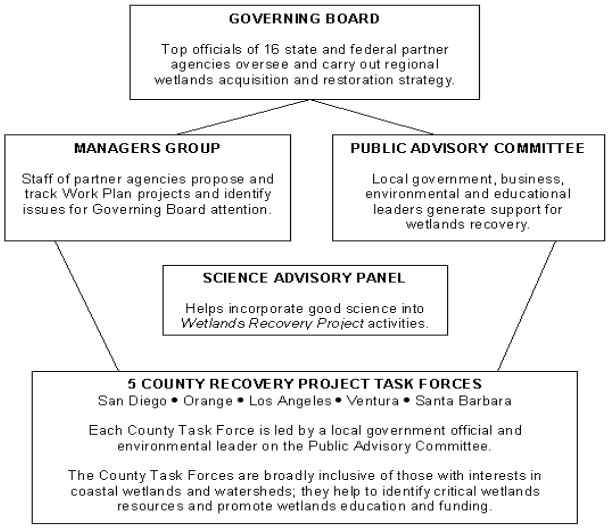

Figure One. Management structure of the Southern California Wetland Recovery Project.

OTHER PARTICIPATING AGENCIES/ ORGANIZATIONS

The Southern California Coastal Water Research Project (SCCWRP), a joint powers agency that focuses on marine environmental research, provides technical support by working in conjunction with the Science Advisory Panel to develop the overall design and methodologies to support WRP objectives.[162]

FUNDING SOURCES

Initial funding from the State of California came through an interagency grant from the Department of Fish and Game to the Coastal Conservancy. Several partner agencies also contributed funds and services for WRP development. Current funding for planning and implementation of restoration projects comes from several State Bond Initiatives.[163]

Funding sources for technical work done by the WRP's Science Advisory Panel include both state and federal grants from the California State Coastal Conservancy, the U.S. Environmental Protection Agency (§104 grant monies), U.S. Geological Survey, and the National Oceanic and Atmospheric Administration's Coastal Services Center (both funding and in-kind work).[164]

158 WRP Regional Strategy: Regional Goals (Draft). 1 Nov. 2001. California Coastal Conservancy. 3 Feb. 2004 <http://www.coastalconservancy.ca.gov/scwrp/documents/RegIStrat/RS-Ch3.pdf>.

159 Overview of the Wetlands Recovery Project. California Coastal Conservancy. 3 Feb. 2004 <http://www.coastalconservancy.ca.gov/scwrp/overview.html>.

160 *Ibid.*

161 What is the Wetland Recovery Project? NOAA Coastal Services Center. 3 Feb. 2004 <http://www3.csc.noaa.gov/socal/default.asp>.

162 Stein, Eric. Personal communication. 2 Feb. 2004.

163 Stein, Eric. Personal communication. 8 Feb. 2004.

164 Stein, Eric. Personal communication. 5 Feb. 2004.

GEOGRAPHICAL AREA CONSIDERED

The WRP's work spans wetlands and watersheds between Point Conception and the U.S. border with Mexico, including the five coastal counties of Santa Barbara, Ventura, Los Angeles, Orange, and San Diego.[165] In addition, many of the WRP activities are coordinated with analogous programs in the San Francisco Bay Area.[166]

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ACTIVITIES

GOALS

The goal of the Southern California Wetland Recovery Project is to provide a forum for interagency communication and coordination of wetland preservation, restoration, and management in southern California. The WRP's mission is to develop and implement a comprehensive plan for preserving and restoring the region's wetlands.[167]

The WRP's Regional Restoration Strategy was adopted on November 29, 2001 at a meeting of the Board of Governors. Long-term goals were developed through a multi-year planning process involving each state and federal partner, as well as the input from the WRP Science Advisory Panel and County Task Forces. The strategy provides guidance on how to manage program resources and measure progress.[168] Six general goals guide these efforts:

- Preserve and restore coastal wetland ecosystems.
- Preserve and restore stream corridors and wetland ecosystems in coastal watersheds.
- Recover native habitat and species diversity.
- Integrate wetlands recovery with other public objectives.
- Promote education and compatible access for coastal wetlands and watersheds.
- Advance the science of wetlands restoration and management in southern California.[169]

BACKGROUND

Along with a Governing Board, Managers Group, Public Advisory Committee, and County Task Forces, the Southern California WRP has a Science Advisory Panel that works to incorporate good science into WRP activities (refer to Figure One, above).[170] In keeping with goal six above, recent activities have focused on methods development, with the objective of forming an integrated monitoring and assessment program for wetlands and watersheds.[171] At the October 2002 WRP symposium, the Science Advisory Panel recommended the development of a regional wetlands monitoring program and the creation of decision support tools that prioritize regional wetland recovery. As part of this effort, the Science Advisory Panel, working in conjunction with the Southern California Coastal Water Research Project (SCCWRP), has developed mapping, inventory, assessment tools, and programmatic infrastructure to institute a long-term, region-wide monitoring program of southern California wetlands resources.[172]

Over the last three years, SCCWRP has been developing several methodologies for watershed assessments, including remote-sensing based approaches for mapping riparian areas, the landscape scale Southern California Riparian Ecosystem Assessment Method (SCREAM), the site-specific scale California Rapid Assessment Method (CRAM), various watershed/water quality models, and a regional monitoring/assessment program for regional wetlands. These tools support a regional ambient monitoring program and provide decision support for planners and

165 What is the Wetland Recovery Project? NOAA Coastal Services Center. 3 Feb. 2004 <http://www3.csc.noaa.gov/socal/default.asp>.

166 Stein, Eric. Personal communication. 8 Feb. 2004.

167 Sutula, Martha, *et.al*. Improving Regional Planning of Wetland Ecosystem Restoration and Management in Southern California: Southern California Wetlands Recovery Project Science Panel Recommendations. 15 May 2002. California Coastal Conservancy. 11 Feb. 2004 <http://www.coastalconservancy.ca.gov/scwrp/documents/SAP-PP1-ReglPlanning.pdf>.

168 WRP Regional Strategy. California Coastal Conservancy. 3 Feb. 2004 <http://www.coastalconservancy.ca.gov/scwrp/ReglStrat.htm>.

169 WRP Regional Strategy: Regional Goals (Draft). 1 Nov. 2001. California Coastal Conservancy. 3 Feb. 2004 <http://www.coastalconservancy.ca.gov/scwrp/documents/ReglStrat/RS-Ch3.pdf>.

170 WRP Management Structure. NOAA Coastal Services Center. 3 Feb. 2004 <http://www3.csc.noaa.gov/socal/images/screamfig2.htm>.

171 Stein, Eric. Personal communication. 2 Feb. 2004.

172 Science Advisory Panel. Memo to Wetland Recovery Project Board of Governors, 8 Sept. 2003. Available at <http://www.coastalconservancy.

regulators. At present, SCCWRP is at the end stages of method development and will soon be ready to begin field-testing the various tools.[173]

Planning

The WRP Science Advisory Panel's strategy for the development of a regional wetland-monitoring program is based on the U.S. Environmental Protection Agency's framework for comprehensive wetland monitoring and assessment, which includes three levels. Level One is the compilation of a region-wide inventory and mapping to characterize the extent of wetland resources. Level Two involves a regional assessment of resource condition relative to anthropogenic stressors. Level Three entails intensive monitoring and research to better understand fundamental wetland conditions and processes, particularly as they relate to stress and recovery efforts.[174]

At present, the Science Advisory Panel is preparing a position paper that outlines a strategy for the implementation of this conceptual framework and recommends specific methods and indicators for use in an integrated regional monitoring and assessment program. The panel will also continue to work with the WRP Managers Group on decision support tools that will be used to select projects for the general WRP Work Plan. In addition, they will continue to secure funds, develop, and test both SCREAM and CRAM.[175]

Inventory

The WRP Science Advisory Panel is targeting both present-day and historical resource data in the development of a publicly accessible, GIS-compatible, relational database of maps and data sets that describe the physical and biological extent of wetland and riparian resources in southern California's coastal watersheds. Priorities for development of the inventory include both updating existing wetland mapping and developing standardized approaches for mapping riparian and wetland resources. The panel has partnered with both the California State Resources Agency and the National Wetlands Inventory (NWI) program for this assessment.[176] Hydrogeomorphic (HGM) mapping codes are also being added to the NWI mapping in order to classify wetlands by HGM function and landscape position. This will allow for additional identification and prioritization of wetlands that have experienced the greatest impact regionally and facilitate implementation of the field-based CRAM.[177]

Assessment

Southern California Riparian Ecosystem Assessment Method

The Southern California Riparian Ecosystem Assessment Method (SCREAM) is a GIS-based tool to assess the ecological integrity of riparian resources on a landscape scale. The SCREAM framework is based on the NOAA Coastal Service Center's Spatial Wetlands Assessment for Management and Planning (SWAMP) model, which is used to examine the ecological significance of a wetland to its watershed by assessing its functional contributions.[178]

The Science Advisory Panel envisions that the SCREAM tool will strengthen long-term regional planning of recovery activities by identifying riparian areas with a high functional contribution to the watershed.[179] SCREAM could potentially support §404 decision-making by providing guidance on potential areas for restoration, but does not explicitly address site suitability. Instead, SCREAM provides a condition assessment. Once a database has been established, it is possible to examine different watersheds for restoration, helping to identify the most appropriate areas for mitigation.[180] The panel envisions a user-friendly, GIS-based tool that integrates a variety of data layers (e.g., land ownership, zoning maps, local conservation planning, etc.) to help prioritize recovery efforts. Data will be pulled from the inventory assembled by the Science Advisory Panel, as well as from other sources.[181]

Developed in large part by the NOAA Coastal Services Center, SCREAM is intended to be flexible and easily accessed by different regions of the country and users with varying degrees of technical experience. SCREAM could easily be adapted to other regions by compiling the appropriate geo-database and "adjusting the calibration" of the model for the appropriate landscape, physiographic or climatic conditions.[182]

The implementation plan for SCREAM includes a 1½-year pilot project during which time the methodology will be refined, data compiled, data gaps addressed, and the methodology tested in five southern California coastal watersheds. An evaluation of SCREAM's performance is currently scheduled for Fall 2004. At that time, WRP

ca.gov/scwrp/BOGMtgs/BOG092403/SAPUpdate2003.pdf>.

173 *Ibid.*

174 Wetland Monitoring and Assessment: A Technical Framework. U.S. Environmental Protection Agency. 11 Feb. 2004 <http://www.epa.gov/owow/wetlands/facts/techfram.pdf>.

175 Science Advisory Panel Memo, 1.

176 Science Advisory Panel Memo, 2.

177 *Ibid.*

178 Science Advisory Panel memo, 4.

179 *Ibid.*

180 Stein, Eric. Personal communication. 5 Feb. 2004.

181 Science Advisory Panel Memo, 5.

182 Stein, Eric. Personal communication. 5 Feb. 2004.

members will decide how best to incorporate the tool into regional recovery planning and will identify the resources needed to do so.[183]

California Rapid Assessment Method

The California Rapid Assessment Method (CRAM) is a field-based assessment methodology being developed to evaluate wetland conditions across a range of wetland types and geographic areas. Mainly intended as a cost-effective monitoring and assessment tool, it can be used as part of a probabilistic sampling program (like that used by EPA's EMAP) to develop a landscape-level profile of the condition of different wetlands within a watershed. This information can, in turn, be used to help plan, monitor, and assess restoration activities. The tool provides a preliminary determination of the need for additional analysis or monitoring and supplementary regulatory information,[184] and can be used in §404 decision-making by providing information for permit evaluation, site selection, and evaluation of mitigation success.[185]

CRAM will cost roughly $500,000 to develop over a four-year period, from initial conceptual development to calibration and validation of the tool. If another group were to replicate the method for use in another area, the costs would depend upon how much of the CRAM methodology they would retain. In theory, the tool could simply be recalibrated for application in a new area. However, the practicality of an application in a different region would depend on the needs and objectives of the specific region.[186]

Since CRAM was introduced to partner agencies in February 2003, the team has been working to continue the development of CRAM attributes and techniques. Future plans include verification that CRAM captures essential information and calibration of the tool. The provisional version of CRAM should be ready for field-use by early 2005.[187]

Coordination and communication

All WRP activities are coordinated through the Agency Managers Group, the Science Advisors Panel, the Public Advisory Committee, and watershed coordinators in each of the five coastal counties covered by the WRP. Additional technical working groups are formed to provide support, advise, and critique specific methods, such as CRAM.[188]

At a statewide level, the WRP and the Science Advisory Panel coordinate with two other regional groups: one focused on the San Francisco Bay area, managed by the San Francisco Estuary Institute; the other on California's central coast, managed by the California Coastal Commission. Together, these three groups have formed a "Statewide Monitoring Venture" and work collaboratively on the development of regional wetland monitoring programs, with the vision of eventually forming a consistent statewide monitoring program.[189]

All interim and final products produced by the WRP and the Science Advisory Panel are online and available to the public. In addition, the California Coastal Conservancy has established a Wetland Information Station that provides access to over 750 data sets, downloadable references, maps and photos, watershed and wetland profiles, and project summaries. The information station also includes an interactive web-based tool (using ArcGIS) that allows users to query, display, and download spatial data on the biological, physical, hydrological, and land-use properties of southern California coastal watersheds. Historical data and maps for 41 coastal wetlands are also available.[190]

Additional information is available at the following web sites:

- California Rapid Assessment Method (CRAM)—www.wrmp.org/cram.html.
- Southern California Coastal Water Research Project—http://www.sccwrp.org/.
- Southern California Wetlands Recovery Project—http://www.coastalconservancy.ca.gov/scwrp/index.html.
- Wetlands Information Station—http://www.regis.berkeley.edu/rhome/projects.html. California Riparian Ecosystem Assessment Method (SCREAM) -www3.csc.noaa.gov/socal/partners.asp.

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183 Science Advisory Panel Memo, 5.

184 Science Advisory Panel Memo, 3.

185 Stein, Eric. Personal communication. 5 Feb. 2004.

186 *Ibid.*

187 Science Advisory Panel Memo, 4.

188 Stein, Eric. Personal communication. 8 Feb. 2004.

189 *Ibid.*

190 *Ibid.*

Science Advisory Panel. Memo to Wetland Recovery Project Board of Governors, 8 Sept. 2003 <www.coastal-conservancy.ca.gov/scwrp/BOGMtgs/BOG092403/SAPUpdate2003.pdf>.

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SPECIAL AREA MANAGEMENT PLANS: LOS ANGELES DISTRICT

LEAD AGENCIES/ORGANIZATIONS

U.S. Army Corps of Engineers, Los Angeles District
California Department of Fish and Game

OTHER PARTICIPATING AGENCIES/ ORGANIZATIONS

All Los Angeles District Special Area Management Plans – U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, Regional Water Quality Control Boards
Western Riverside County Special Area Management Plan – County of Riverside
San Diego Creek Special Area Management Plan – County of Orange, City of Irvine
San Juan Creek / San Mateo Creek Special Area Management Plan – County of Orange
Otay River Watershed Special Area Management Plan – County of San Diego

FUNDING SOURCES

Funding was provided through the Water Resources Development Act by the U.S. Army Corps of Engineers' Los Angeles District and Waterways Experiment Station. In addition, the U.S. Environmental Protection Agency contributed funds through a State Wetland Conservation Grant with a match from the County of Riverside. Additional funding came from Rancho Mission Viejo, a private developer and landowner in the area, and Transportation Corridor Authorities.

GEOGRAPHICAL AREA

All Los Angeles District Special Area Management Plans—7 watersheds; 2,000 square miles, from the Mexican border to southern Orange County in the north and western Riverside County in the east.[191]
Western Riverside County Special Area Management Plan—San Jacinto and upper portion of Santa Margarita watersheds; County of Riverside, approximately 943,000 acres or 1,475 square miles.
San Diego Creek Special Area Management Plan – San Diego Creek Watershed; Orange County, approximately 110 square miles.
San Juan Creek / San Mateo Creek Special Area Management Plan – San Juan Creek and portions of the San Mateo Creek watersheds; Orange County, approximately 91,000 acres or 197 square miles.
Otay River Watershed Special Area Management Plan – San Diego County, approximately 145 square miles.

191 Smith, R. Daniel (U.S. Army Corps of Engineers). Personal communication. 4 Mar. 2004.

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ACTIVITIES

GOAL OF THE EFFORT

The goals of the Los Angeles District Special Area Management Plans (SAMPs) are to "minimize individual and cumulative impacts of future projects" while making the development process more predictable for communities and to establish "watershed-wide aquatic resource reserve program[s]." Developing regulatory products such as programmatic and general permits based on the SAMPs, is also one of the goals.[192]

192 San Diego Creek SAMP. U.S. Army Corps of Engineers, Los Angeles District. 13 Apr. 2004 <http://www.spl.usace.army.mil/samp/sandiegocreek-samp.htm>.

Background

As part of the Southern California Aquatic Resources Study (a Civil Works General Investigation Study), the Los Angeles District of the U.S. Army Corps of Engineers (Corps) is currently involved in several watershed studies, including several SAMPs. The current SAMP efforts are based on similar watershed-based assessment and planning work conducted by the Corps at Camp Pendleton and Lemoore Naval Air Station, both in southern California.[193] The SAMP efforts are being led by the District's Regulatory Branch and staff from the Corps' Waterways Experiment Station with the support of the District Planning Division.[194]

The SAMP process used in the district includes the use and development of landscape level functional assessment, watershed scale indices of the ecological integrity of riparian resources, alternatives analyses, and watershed restoration plans. Each of the SAMPs is separated into three phases: aquatic resources are identified and assessed during Phase I; Phase II is the preparation of an environmental impact statement, including a 404(b)(1) alternatives analysis; and Phase III includes the finalization of environmental documents, completion of an watershed restoration plan, and issuance of programmatic §404 permits.[195]

Inventory

Each SAMP includes a watershed-scale aquatic resources delineation using field-verified geographic information systems (GIS) and remote sensing to determine where riparian ecosystems and other aquatic resources exist in the study areas.[196] Based on the delineation, the watersheds were then divided into assessment units called "riparian reaches" that are relatively homogenous with respect to "geology, geomorphology, channel morphology and substrate, vegetation communities, and cultural alteration."[197]

193 Smith, R. Daniel (U.S. Army Corps of Engineers). Personal communication. 10 Feb. 2004.

194 Brumbaugh, R. and E. Hieber. Opportunities to Improve Regulation of Aquatic Resources on a Watershed-Basis: Regulatory and Planning Links in Three Districts. Aug. 2001. U.S. Army Corps of Engineers - Institute for Water Resources. 24 Nov. 2003 <http://www.iwr.usace.army.mil/iwr/pdf/oppstudypolicy.pdf>.

195 Special Area Management Plans (SAMPS). U.S. Army Corps of Engineers, Los Angeles District. 13 Apr. 2004 <http://www.spl.usace.army.mil/samp/samp.htm>.

196 Smith, R. Daniel (U.S. Army Corps of Engineers). Personal communication. 20 Nov. 2003.

197 Smith, R. Daniel and Charles Klimas. Riparian Ecosystem Restoration Plan for San Juan and Western San Mateo Creek Watersheds: General Design Criteria and Site Selection. Draft Report to the U.S. Army Corps of Engineers, Los Angeles District, Regulatory Branch. (Vicksburg, Mississippi: U.S. Army Engineer Research and Development Center, Waterways Experiment Station, 2003).

Assessment

The SAMPs also include baseline assessments of riparian ecosystem integrity of the riparian reaches in the study area. The baseline assessment is meant to provide a basis for assessing watershed changes from restoration activities or development projects in the targeted watersheds. Each riparian reach is assessed at three different scales: 1) the riparian reach proper, 2) the local drainage, and 3) the larger drainage basin. The assessment process includes consideration of three indicators:

- Hydrologic indicators—altered hydraulic conveyance; surface water retention; perennialized stream flow; import, export, and diversion of surface water; and hydrologic interaction between stream channel and floodplain.
- Water quality indicators—sediment regime; land use/land cover in drainage basin, riparian ecosystem, and upland buffer areas; area of native riparian vegetation; altered hydrologic conveyance; surface water retention; perennialized stream flow; import, export, and diversion of surface water; and hydrologic interaction between stream channel and floodplain.
- Habitat integrity indicators—land use/land cover in drainage basin, riparian ecosystem, and upland buffer areas; and riparian corridor continuity; area of native riparian vegetation; and extent of exotic plant species.[198]

Because the data required for the assessment are generally not readily available, each reach is assessed through ground sampling, aerial photography, and GIS analysis to develop scores (0-100) for the various indicators and to gather other data for use in the later phases of the SAMP.[199] Groups of indicators are then combined to generate hydrology, water quality, and habitat integrity indices (0-1) for each of the three scales of each reach.[200] Based on the index scores, the reaches are ranked according to their ecological integrity. The reach rankings are among the many factors considered in analyzing alternatives and developing watershed restoration plans.[201]

Alternative analysis and restoration planning

The data gathered in the delineation and assessment are used in two subsequent SAMP activities: the alterna-

198 Smith, R. Daniel. Assessment of Riparian Ecosystem Integrity in the San Juan/San Mateo Watersheds, Orange County, California. Final Report to the U. S. Army Corps of Engineers, Los Angeles District. (Vicksburg, Mississippi: U.S. Army Engineer Research and Development Center, Waterways Experiment Station, 2000). 19 April 2004 <http://www.spl.usace.army.mil/regulatory/samp/sanjuanfa.pdf>.

199 Smith, R. Daniel (U.S. Army Corps of Engineers). Personal communication. 10 Feb. 2004.

200 Smith and Klimas, p. 2.

201 Smith, p. 2.

tives analyses and watershed restoration plans. By analyzing the baseline assessments, the Corps generates a Preferred Alternative for how the study area will be developed.[202] In the alternatives analyses, the team conducting the SAMP uses the same indicators and assessment methodology used in the baseline assessment to analyze how the ecological integrity of the riparian resources in the study area might be impacted under the Preferred Alternative and a range of other simulated future development scenarios. To determine which development scenarios would result in the least degradation of the riparian resources, baseline ecological index values are compared to the index values under various simulation conditions.[203]

In the watershed restoration plan, riparian restoration opportunities within the study area are identified and compared.[204] For each riparian area, the SAMP team estimates a "restoration potential," a measure of functional restoration that is practical given existing conditions with particular focus on geomorphic features and processes. Each reach is then assigned a general restoration design template according to its restoration potential. The team then estimates the level of effort (relative construction and planting costs) required to achieve the conditions outlined in the template. Using the baseline assessment methodology, the team analyzes the effectiveness of various restoration strategies at achieving the functional criteria desired.[205] The criteria used in each watershed restoration planning effort are determined by the SAMP team with stakeholder input.[206] The team can assess the effectiveness of various combinations of restoration activities, such as concentrating restoration in the most degraded reaches or prioritizing those projects that are expected to provide the greatest functional lift per unit of effort.[207]

All of the inventory, assessment, alternatives analysis, and planning activities are linked to GIS databases, allowing for the integration and visualization of a huge range of data.[208] In addition to the SAMPs, the district is undertaking other watershed planning activities in the study areas, including Advanced Identification studies, region-specific environmental impact statements, and Floodplain Maintenance Studies,[209] and expanded alternatives analyses for major highway projects.

202 Smith, R. Daniel (U.S. Army Corps of Engineers). Personal communication. 10 Feb. 2004.

203 Smith, p. 2.

204 Smith, and Klimas, p. ii.

205 Smith, and Klimas, pp. 3-4.

206 Smith, R. Daniel (U.S. Army Corps of Engineers). Personal communication. 10 Feb. 2004.

207 Smith, and Klimas, p. 4.

208 Smith, R. Daniel (U.S. Army Corps of Engineers). Personal communication. 10 Feb. 2004.

Cost

Replication of the process used in the Los Angeles District SAMPs for a watershed area of 100 square miles would cost approximately: $100,000–$200,000 for the watershed scale aquatic resource delineation, $75,000 for the alternatives analysis, and $100,000 for the watershed restoration plan. Costs for larger watershed areas would be higher, but economies of scale would lead to decreases in per acre costs.[210]

Status

- San Diego Creek Watershed SAMP—All three phases are completed.
- San Juan Creek Watershed/San Mateo Creek Watershed SAMP—Phases I and III are complete. Revised alternatives analysis is in process.
- Western Riverside County SAMP—Phase I is complete. Alternatives analysis is in process.
- Otay Creek Watershed SAMP—Phase I is complete.[211]

Future directions

The Waterways Experiment Station is currently in the process of adapting the methodology used in the Los Angeles District SAMPs for a 400 square mile watershed near Syracuse, New York.

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SPECIAL AREA MANAGEMENT PLAN: MILL CREEK

LEAD AGENCIES/ORGANIZATIONS

U.S. Army Corps of Engineers, Seattle District
King County, Department of Natural Resources
City of Auburn
City of Kent

OTHER PARTICIPATING AGENCIES/ ORGANIZATIONS

U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
Muckleshoot Indian Tribe Fisheries Department
Washington State Department of Ecology

FUNDING SOURCES

Funding was contributed by the Regulatory Program of the U.S. Army Corps of Engineers, Seattle District. The U.S. Environmental Protection Agency, Region X also provided a grant to help develop the aquatic resource restoration plan.

GEOGRAPHICAL AREA CONSIDERED

Mill Creek Basin, King County, Washington (22 square miles). This area is the last large wetland system and the last large site available for industrial development in southern King County.

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ACTIVITIES

Goals of the effort

Goals of the Mill Creek Special Area Management Plan (SAMP) include the following:

- Achieve balance between wetland protection and economic development.
- No net loss of aquatic resources functions and values.
- Improve consistency between federal, state, and local agencies permitting and planning efforts.
- Improve information cumulative impact assessment.
- Increase predictability in the permitting process.
- Streamline permitting of projects in certain areas meeting certain criteria.[212]

Background

The Mill Creek SAMP was initiated to address the conflict between resource protection and the demand for land development in the lower Green River Valley in King County, Washington. The U.S. Army Corps of Engineers (Corps) found that case-by-case permit review led to unpredictable outcomes and increasing fragmentation of the existing landscape. To address these problems, the Corps, U.S. Environmental Protection Agency, King County Department of Natural Resources, and the cities of Auburn and Kent, entered into an agreement in August 1990 to develop a SAMP to better manage and protect the wetland resources of the Mill Creek Basin, while allowing for some targeted development-related wetland impacts in the area.[213]

Inventory

In 1990-91, teams conducted field surveys to identify existing wetland and stream locations and areas. The inventory efforts were based on existing data from aerial photography, National Wetlands Inventory maps, soil maps, and past wetland inventories.[214] Stream habitat conditions were characterized by an interagency work group using past experience, existing water quality data,

212 Scuderi, Michael. "Lessons Learned from Preparation of the Mill Creek Special Area Management Plan." from Proceedings Watershed '96, June 8-18, 1996: Session 34. (Seattle, Washington: U.S. Army Corps of Engineers, 1996). 19 Apr. 2004 <http://www.epa.gov/owow/watershed/Proceed/scuderi.html>.

213 *Ibid.*

214 Mill Creek Special Area Management Plan, King County, Washington. 2000.

field visits, and fieldwork by others with special emphasis on assessing those streams likely to support salmon and other similar fish species.[215] The inventory found that most of the wetlands in the area were emergent wetlands (current and historical agricultural lands) with some forested and open water areas.[216]

Assessment

Baseline assessment

The SAMP committee conducted an assessment of wetland functions and values for the Mill Creek Basin in 1991 and 1992. The committee assessed all of the wetlands in the area using both the Wetland Evaluation Technique (WET)[217] and the Washington State Department of Ecology Wetland Rating System.[218] The team identified 155 wetland indicators from WET and the Washington State Wetland Rating System that could be used to assess 13 prime wetland functions (flood control, sediment/toxicant retention, sediment stabilization, groundwater recharge and discharge, aquatic diversity/abundance, wildlife diversity/abundance, wildlife breeding, wildlife wintering, nutrient removal/transformation, primary production and production export, recreation, and uniqueness) in the basin.[219]

To aid in the integration and comparison of functional assessment data generated through the different methodologies, the Washington State Department of Ecology developed the Indicator Value Assessment (IVA) methodology.[220] IVA assigns a relative weight (basic indicator, strong indicator, very strong indicator, or indicator of dysfunction) to each of the wetland functions assessed based on committee members' experience and knowledge.[221] The committee then used the functional assessment data to identify which of the 155 indicators were present at each of the wetlands sites. They then used the IVA weighting factors to generate a raw score for each function. All of the functions other than flood control, uniqueness, and recreation were then grouped into three equally weighted function groups: water quality improvement, fish habitat, and other habitat. Within each function group, individual functions were weighted equally. Each wetland was then scored on a 0-100 scale for each functional group to provide a relative measure of functional performance per acre for each wetland.[222]

Comprehensive functional assessment for the streams and riparian resources in the basin was not attempted in the SAMP.

Restoration potential assessment

During the functional assessment, restoration potential and possible restoration actions were assessed for each wetland in the study area. Each wetland was designated as having high, medium or low restoration/enhancement potential or as being suitable for preservation. The mitigation potential designations were based on five criteria: reliable hydrology regime; proximity to Mill Creek, Mullen Slough, and large tributaries; impacts of surrounding development; relative wetland functions; and wetland size. Of the approximately 2,400 acres of wetland in the study area, 900 acres were determined to be practically restorable and 600 of those acres were found to have medium or high restoration potential. The "functional lift" provided by restoring each of the wetlands with high and medium restoration potential was estimated by comparing the baseline IVA scores with simulated IVA scores for restored sites. The SAMP committee also identified 12 upland sites suitable for restoration using aerial photos, land use maps, and field visits.[223]

Site selection/prioritization

Using geographic information systems (GIS), the SAMP committee analyzed patterns in the spatial distribution of highly functional and less functional wetlands in the area. Through this analysis, informed by input from local stakeholders,[224] the SAMP committee developed nine alternative scenarios for the restoration, preservation, development, and management of aquatic resources in the basin from "All Fill" to "No Development." Each of the nine alternatives was then evaluated according to how they would affect key aquatic resource functions in the basin using the same IVA methodology used in the baseline functional assessment and restoration functional simulations. Other factors such as economic development, predictability, consistent

215 Mill Creek Basin, King County, Washington – Aquatic Resources Restoration Plan. 2000.

216 Scuderi

217 Wetland Evaluation Technique (WET). U.S. Army Corps of Engineers. 26 Jan. 2004 <http://www.wes.army.mil/el/emrrp/emris/emrishelp6/wetland_evaluation_technique_tools.htm>.

218 "Washington State Wetlands Rating System: Western Washington." Washington Department of Ecology. 1993. Second edition, Publication #73-94. Available at http://www.ecy.wa.gov/pubs/93074.pdf; *also* Scuderi, Michael (Army Corps of Engineers, Seattle District). Personal communication. 23 Feb. 2004.

219 Mill Creek Basin, King County, Washington – Aquatic Resources Restoration Plan. 2000.

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221 U.S. Army Corps of Engineers. Indicator Value Assessment. 26 Jan. 2004 <http://www.wes.army.mil/el/emrrp/emris/emrishelp6/indicator_value_assessment_tools.htm>.

222 Mill Creek Basin, King County, Washington – Aquatic Resources Restoration Plan. 2000. pp. 2.1-2.3.

223 Mill Creek Basin, King County, Washington – Aquatic Resources Restoration Plan. 2000. pp. 3.1-3.3.

224 Scuderi, Michael (Army Corps of Engineers, Seattle District). Personal communication. 23 Feb. 2004.

permitting processes, long-term maintenance, land acquisition and financing, and public access and recreational use were also evaluated for each alternative.[225]

The preferred alternative, known as Alternative 8, "Protect Mill Creek Corridor," or "Corridor Protection," was chosen from among the alternatives examined because, in the view of the SAMP committee, it provides the best balance between economic growth and functional improvements to aquatic resources. The committee felt that the reliance on compensatory mitigation as the driver of watershed restoration activities in this alternative provided a practical means of funding the proposed restoration activities.[226]

After the SAMP alternatives had been generated and the preferred alternative selected, the Corps' Institute for Water Resources (IWR) used the Mill Creek SAMP as a test case for the Integrated Wetland Resources Evaluation Decision Support System (IWREDSS). IWR used the IWREDSS to generate and evaluate a range of alternative plans for the protection, mitigation, and development of wetlands in the Mill Creek Basin. The SAMP preferred alternative generally compared favorably with the alternatives generated by IWREDSS.[227] [See IWREDSS summary for more information about the system.]

Compensatory mitigation requirements

The final Aquatic Resource Restoration Plan (ARRP), released in 2000 along with the SAMP, is based on the recommendations set forth in the Corridor Protection preferred alternative. It recommends that approximately 650 acres of wetlands be protected for preservation and/or restoration and 200 acres of lower value wetlands be made available for development.[228] The SAMP committee also identified both site-specific and general riparian restoration procedures for the basin.[229] The restoration goals set forth in the ARRP are primarily to be accomplished through compensatory mitigation for impacts to the wetlands in the SAMP areas that are designated as open to development. A limited amount of the basin's restoration activities will be used as mitigation for wetland impacts outside of the study area.[230] Outright land acquisition by government agencies and non-governmental agencies and flood plain and stormwater management tools are also important parts of the SAMP.[231] The compensatory mitigation ratios for impacts in the SAMP area are based on anticipated functional changes as measured by IVA points lost in the impacted wetlands and IVA points gained through the mitigation action. The IVA points-based mitigation ratios, identified through the wetland functions analysis, were converted to acreage ratios for ease of measurement.[232]

Progress to date

The SAMP was completed and released in 2000 along with the ARRP. Although Corps, state, and local regulators use the SAMP to inform permitting decision-making in the area, the SAMP has not been officially adopted by the local governments. The Corps has added a regional condition to nationwide permits that limits the use of many of the nationwide permits to only those areas designated for development under the SAMP.[233] Owners of developable wetland parcels are helping restore and enhance wetlands on some parcels designated in the SAMP as mitigation and restoration sites acquired by King County and the city of Auburn. The Corps anticipates contributing to the restoration of some sites as part of its Green/Duwamish River Basin (Ecosystem) Restoration Project.[234] King County and the cities of Auburn and Kent also developed a Flood Management Plan for the Mill Creek Basin in conjunction with the SAMP to ensure that flood damage reduction measures would be consistent with SAMP efforts to restore and enhance wetlands and streams.[235]

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225 Mill Creek Special Area Management Plan, King County, Washington. 2000. p. 4.1-13.

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AN APPLICATION OF THE SYNOPTIC APPROACH FOR WETLANDS CUMULATIVE EFFECTS ANALYSIS: SEDIMENT YIELD REDUCTION IN REGION IV

LEAD AGENCIES/ORGANIZATIONS

U.S. Environmental Protection Agency
National Health & Environmental Effects Research Laboratory, Western Ecology Division.
Region IV Wetlands Section.

FUNDING SOURCES

U.S. Environmental Protection Agency

GEOGRAPHICAL AREA CONSIDERED

U.S. Environmental Protection Agency, Region IV – Southeastern United States (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee)

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ACTIVITIES

Goals

In an effort towards improved water quality in the Southeastern United States, the U.S. Environmental Protection Agency (EPA), Region IV developed an application of the Synoptic Approach for Wetlands Cumulative Effects Analysis (synoptic approach) that sought to do the following:

- Optimize wetland restoration to ameliorate stream sediment.
- Prioritize restoration efforts of relevant EPA programs.
- Use a defensible, rigorous, and repeatable framework for decision-making.
- Continue development of the synoptic framework.[236]

Background

The synoptic approach grew out the EPA's Office of Research and Development, Western Ecology Division in Corvallis, Oregon.[237] A landscape-level technique for geographic prioritization, the approach has many potential applications for wetlands regulators, including assessing the cumulative effect of aggregate wetland impacts within a landscape, prioritizing areas for restoration or acquisition, and providing information for the development of regional watershed plans, such as Advance Identifications or Special Area Management Plans.[238] Furthermore, the synoptic approach provides a means by which to compare potential cumulative impacts between areas.[239]

The method is specifically designed to incorporate the best professional judgment of wetlands regulators who often have limited resources, time, and information.[240] In

236 Leibowitz, Scott, E. William Schweiger, and William B. Ainslie. "Regional Prioritizations of Biodiversity and Sediment Retention Functions: Findings and Management Relevance." Society of Wetland Scientists 24th Annual Meeting. Hyatt Regency Hotel, New Orleans, LA. June 2003.

237 Ainslie, William B. Personal communication. 25 Nov. 2003.

238 Leibowitz, S., B. Abbruzzese, P.R. Adamus, L.E. Hughes, and J.T. Irish. "A Synoptic Approach to Cumulative Impact Assessment: A Proposed Methodology." 1992. EPA/600/R-92/167. U.S. EPA, Environmental Research Laboratory, Corvallis, OR.

239 Leibowitz, Abbruzzese, Adamus, Hughes and Irish, 3.

240 *Ibid.*

particular, the approach was created with the idea that a limited amount of data, or types of data, may be available. Imposing the task of collecting several types of landscape-level data was recognized as an arduous task early in the conceptual development of the synoptic model. Indeed, the method can simply be adapted to work with different sets of data and should be straightforwardly replicable.[241]

The synoptic approach can be developed for a variety of ecological endpoints. In other words, the method can be adapted to prioritize areas for restoration or for protection in order to increase species biodiversity, flood attenuation, water quality or a number of other ecological endpoints. In EPA Region IV, a synoptic assessment was conducted for the specific purpose of prioritizing wetland restoration to reduce sedimentation and optimize water quality. [242]

Planning

The synoptic assessment in Region IV was envisioned to eventually coordinate wetland activities with Total Daily Maximum Load (TMDL) decision-making by prioritizing sediment sinks within watersheds for improved water quality. How the results of the synoptic assessment will actually be implemented within the existing regulatory infrastructure is currently still being deliberated.[243]

In terms of guiding §404 decisions, results from the synoptic assessment could be utilized depending on the level of decision-making. Results are too general to guide site-specific success criteria but could be used to guide the siting and acceptance of mitigation banks. In order to put synoptic assessment in this context, the procedure may need to be honed further[244]

Inventory

In keeping with the premise of utilizing previously available data and information, a wetland inventory was not created specifically for the project, but was instead obtained from the National Land Cover Data (NLCD), a mapping of the land cover of the conterminous United States.[245] This data set is the result of an interagency cooperative effort involving the U.S. Geological Survey, EPA, USDA Forest Service, and National Oceanic and Atmospheric Administration. The database offers a suite of data layers, including classified land cover data derived from Landsat imagery, which is useful for a variety of applications.[246] The NLCD shows two types of wetland land covers: forested and non-forested.[247]

Assessment

The synoptic approach is a cost-benefit framework that results in a prioritization of restoration options. In general, there are two criteria for setting priorities in synoptic assessments: the projected marginal change in an ecological endpoint per unit of restoration effort, and the projected marginal change in an end point avoided per unit of protection effort.[248] In EPA Region IV, a specific conceptual model was developed to maximize the marginal reduction of sediment yields for each unit of management (restoration) effort (dollars, FTEs, etc.).[249] The statistically based evaluation of the conceptual model relies on a suite of GIS data layers, basically organized into three components for Region IV: (1) wetland restorability, (2) hydrological response, and (3) sediment yield. Because these three components cannot be measured directly, several indicators were assessed to create the 17 meta-data layers that would be evaluated by the synoptic model.[250]

The indices include watershed yield, runoff delivery, runoff interception, upland runoff, unpaved road runoff, development site runoff, channel sources, watershed protection activities, conservation programs, property value, and restorability.[251] The model is designed to utilize readily obtained information from existing data, or information that can be converted into GIS data to represent the scientific concepts that provide the "logic" to the model.[252]

In the EPA Region IV application, the indicators were analyzed in 8-digit hydrologic unit codes (HUCs) watersheds. The model yielded five levels of prioritization for each HUC analyzed and assigned rankings that ranged from high to low priority. Thus, the results of a synoptic assessment are not specific or targeted, but instead provide for general comparison of regions or watersheds for restoration within a geographic area.[253]

The Region IV model for reduced sediment yield reduction took about two years to develop. However, model designers meant for the approach to be easily repli-

241 Ainslie, William B. Personal communication. 9 Feb. 2004.

242 Vellidis, G., M. C. Smith, S. G. Leibowitz, W. B. Ainslie, and B. A. Pruitt. "Prioritizing Wetland Restoration for Sediment Yield Reduction: a Conceptual Model." Environmental Management 31(2003): 301-312.

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249 Vellidis, Smith, Leibowitz, Ainslie, and Pruitt, 303.

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251 Vellidis, Smith, Leibowitz, Ainslie, and Pruitt, 304-307.

252 Ainslie, William B. Personal communication. 9 Feb. 2004.

253 *Ibid.*

cated, and another assessment could likely be completed in nine to twelve months.[254]

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SYSTEM-WIDE MODELING, ASSESSMENT, AND RESTORATION TECHNOLOGIES (SMART) PROGRAM

LEAD AGENCIES/ORGANIZATIONS

U.S. Army Corps of Engineers
U.S. Army Engineer Research and Development Center, Environmental Laboratory

COLLABORATING AGENCIES/ ORGANIZATIONS

The Nature Conservancy
USDA Natural Resources Conservation Service
U.S. Environmental Protection Agency
U.S. Geological Survey

FUNDING SOURCES

U.S. Army Corps of Engineers

GEOGRAPHICAL AREA CONSIDERED

SMART has a "system-wide" focus, examining water resources at the project, watershed, and basin scales. For example, potential applications for ecosystem-wide restoration include:

Big Bear Lake and Allatoona Lake.
Upper Mississippi River Restoration (e.g. Habitat and Nitrogen Reduction).
Gulf of Mexico – Hypoxic Zone.
South Florida/Everglades Restoration Project.
Louisiana Coastal Area Restoration Study.
Middle Potomac Tributaries.[255]

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255 Ashby, Steven L. "System-wide Modeling, Assessment and Restoration Technologies (SMART) Program." PowerPoint Presentation.

ACTIVITIES

GOAL OF THE EFFORT

Recognizing the need to move towards a watershed approach to sustainable water resource management, the U.S. Army Corps of Engineers (Corps) is currently developing tools for system-wide assessments of water resources.[256] Ongoing research addresses tool needs for planning, assessing, and forecasting. Furthermore, tools are being developed in such a way that allows a wide range of stakeholders to effectively participate in decision-making.[257]

The System-Wide Modeling, Assessment, and Restoration Technologies (SMART) Program goal is to provide the Corps with needed technical capabilities to address environmental missions and responsibilities in water resources development at project, watershed, and basin scales. Furthermore, the SMART Program will seek to promote a better balance between economic and environmental considerations, and communicate these capabilities to stakeholders and decision-makers.[258] Ultimately, the program is being developed for implementation into Corps planning, construction, operation, and maintenance activities.[259]

BACKGROUND

The SMART Program assembles existing tools and develops additional tools for decision-making regarding aquatic resources in a system-wide context.[260] The SMART Program has three major focus areas:

i. Environmental processes and resource responses.
ii. Environmental assessment and prediction technologies.
iii. Decision support and application technologies.[261]

256 *Ibid.*

257 Ashby, Steve. Personal communication. 17 Nov. 2003.

258 U.S. Army Corps of Engineers (Corps). System-wide Modeling, Assessment, and Restoration Technologies (SMART) Program [DRAFT]. Vicksburg, MS: U.S. Army Engineer Research and Development Center, May 2002.

259 System-wide Modeling, Assessment, and Restoration Technologies (SMART) Program (Fact Sheet). Aug. 2003. U.S. Army Engineer Research and Development Center, Environmental Laboratory.

260 Ashby, Steve. Personal communication. 19 Feb. 2004.

261 Corps, 9.

For the first focus area, the objective is to increase understanding of the processes by which watershed events, both naturally occurring and related to human activity, influence water resources and their ecosystems. In order to increase this understanding, the SMART Program focuses on improving data collection and interpretation, understanding material transport processes in watersheds, and identifying biological and ecological processes and patterns that emerge across landscapes.[262]

The second focus area, environmental assessment and prediction technologies, has a broad scope. The objective is to develop and implement technologies that address system-wide issues related to environmental resources management, restoration, sustainability, and stewardship. The program's approach includes the development of predictive tools for environmental stewardship, sustainability, management, and restoration. Furthermore, these tools are being developed in such a way that they can provide decision support. Assessment and predictive techniques for physical variables, landscape succession, habitat quality, ecological structure, and dynamics are currently being developed for incorporation into a Common Delivery Framework (CDF). The CDF will include database and decision support tools with seamless linkages to geographic information systems (GIS) that can assist managers, stakeholders, and technical specialists.[263]

The third focus area, decision support and application technologies, identifies significant aspects of the decision-making structure (range of decisions, tools and processes available, as well as tools and processes needed). This feeds into the objective to apply system-wide, multi-objective tools, integrate approaches for resource management using SMART products, and transfer technology such that tools can be used in the field in an efficient and timely manner.[264]

Planning

The general product of the SMART Program will be a user-friendly framework for connecting environmental process information, assessment tools, and socio-economic tools for decision-making for ecological restoration and sustainable resource management. These products will aid future operations in the environmental arena by developing decision-support capabilities, and improving the efficiency of the planning process, cost-benefit analysis and assessment techniques, and techniques for meeting legislative requirements.[265] Now in its second year of existence, the SMART Program is expected to continue development over the next five to six years.[266]

Access to SMART Program tools will be available online for future users. While some SMART tools are easily utilized by users with any level of expertise, others require some amount of training before use. For these reasons, the Corps also plans to promote technology infusion to its partners, which include states and other federal agencies.[267]

The Corps has placed a strong emphasis on coordination with other federal agencies and organizations. At present, groups such the U.S. Environmental Protection Agency, the U.S. Geological Survey, and the USDA Natural Resources Conservation Service, as well as The Nature Conservancy, are providing some input on the development of the program. As the program progresses, input and coordination with additional agencies and organizations are expected not only avoid a redundancy of efforts, but also to build upon the strengths of other programs.[268]

Assessment

In essence, the SMART Program offers assessments of landscape features at the system level.[269] The SMART framework begins with discipline-specific data appropriate to the problem or opportunity being addressed and integration of the data into usable information. The information is then scaled to a landscape-perspective in order to address significant resources and multiple objectives for ecosystem restoration. Alternatives are then developed, analyzed, and evaluated prior to the decision-maker's actions.[270]

There are multiple parts to the SMART Program of varying complexity and uses, all designed for incorporation into a decision-making framework. The program advances a planning perspective, where goals and objectives are identified and performance measures are developed. It offers a suite of tools that can be modified and adapted according to the project or situation at hand. The lowest tier utilizes tools such as conceptual modeling and geospatial assessments for planning purposes. The second tier moves towards easily used numerical models, such as empirical or index-based models. The highest tier involves complex, multi-dimensional modeling.[271] Potential applications are numerous and widely varying, including restoration project planning and §404 mitigation decision-making.[272]

262 *Ibid.*
263 Corps, 19.
264 Corps, 30.
265 Corps, 7.
266 Ashby, Steve. Personal communication. 19 Feb. 2004.
267 *Ibid.*
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269 *Ibid.*
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WATERSHED-BASED MITIGATION, WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

LEAD AGENCIES/ORGANIZATIONS

Washington State Department of Transportation

OTHER PARTICIPATING AGENCIES/ ORGANIZATIONS

Washington Department of Fish and Wildlife
Washington Department of Ecology
Federal Highway Administration

FUNDING SOURCES

Funding has been provided by the Washington State Department of Transportation, with Federal Highway Administration research funds for testing.

GEOGRAPHICAL AREA CONSIDERED

Statewide

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ACTIVITIES

Goal of the effort

The Washington State Department of Transportation's (WSDOT) Watershed Mitigation Program seeks to streamline the environmental permitting process for transportation projects by utilizing a landscape context for mitigation and identifying mitigation opportunities to increase environmental benefits and reduce costs.[273]

Background

The Transportation Permit Efficiency and Accountability Committee (TPEAC) was created following the enactment of Washington's Environmental Permit Streamlining Act in 2001 to improve environmental performance and regulatory efficiency for transportation projects in the state. A Watershed Mitigation Subcommittee of the TPEAC was formed to develop a watershed approach to environmental mitigation for transportation project impacts.[274]

Summary

Through a process called "Watershed Characterization," WSDOT will assess current conditions in watersheds and identify possible mitigation sites and actions using a watershed perspective to maximize ecological benefit, achieve locally defined watershed recovery priorities, and reduce mitigation costs.[275] WSDOT's watershed approach is divided into three parts: Part I is a watershed characterization and cumulative impact assessment, Part II is a project site assessment, and Part III is identifying and assessing potential mitigation options.[276] The entire process is performed by an interdisciplinary team consisting of at least one hydrologist, hydrogeologist, ecologist, biologist, and water quality specialist. The teams make extensive use of GIS tools and spatial data in assessing existing conditions in the project area and in the targeted landscape area for mitigation. GIS is also essential in assessing potential project impacts and developing watershed-based mitigation strategies.[277]

Through the watershed characterization process, the WSDOT hopes to focus mitigation efforts on restoring "core ecosystem processes." Landscape attributes are used to characterize the condition of key ecosystem processes, such as the delivery and routing of water, sediment, nutrients and pollutants, heat, and large wood. In addition to

273 Washington Department of Transportation. Watershed-Based Mitigation. 25 Nov. 2003 <http://www.wsdot.wa.gov/environment/watershed/watershed_mitigation.htm>.

274 Gersib, Richard, Alan Wald, Tim Hilliard, Rob Schanz, Lauren Driscoll, Albert Perez, Jerry Franklin and Barb Aberle. Enhancing Transportation Project Delivery Through Watershed Characterization: Methods and SR522 Case Study. (Olympia, Washington: Washington State Department of Transportation, 2003). 19 Apr. 2004 <http://www.wsdot.wa.gov/environment/watershed/docs/methods.pdf>.

275 Washington Department of Transportation. Watershed Based Mitigation. 25 Nov. 2003 <http://www.wsdot.wa.gov/environment/watershed/watershed_mitigation.htm>.

276 Gersib, Wald, Hilliard, Schanz, Driscoll, Perez, Franklin, and Aberle, p.2.

277 *Ibid.*

these processes, biological integrity and habitat connectivity will likely be included in future characterizations.[278] WSDOT's new methodology focuses both impact assessments and mitigation design on mitigating impacts to these ecological processes at a landscape scale.

Assessment

During the Part I landscape characterization phase, the team establishes spatial and temporal scales of impact and mitigation analysis based on the surrounding land uses and the process impacts for which mitigation is needed.[279] They then characterize resources and ecological processes at play in the wider assessment area. This entails the development of datasets of potential wetland, riparian, and floodplain restoration sites that are used to both assess the extent of resource degradation and serve as a pool of potential natural resource mitigation options.[280]

Following landscape characterization, the team assesses the project site conditions and likely natural resource impacts in Part II. The team compiles existing data on aquatic resources and landscape attributes in the project right-of-way; estimates direct natural resource impacts, stormwater impacts, and other functional losses due to the project; explores potential in right-of-way mitigation requirements and possibilities; and determines out of right-of-way mitigation needs for the project.[281]

Mitigation site identification and prioritization

With a clearer understanding of landscape-wide ecological processes and mitigation needs, the team moves on to the identification and prioritization of mitigation sites and actions. Potential mitigation sites that are most likely to compensate for impacts to ecological processes at a landscape scale are identified through local watershed plans and photo interpretation of stereo-paired color aerial photos.[282] Using potential wetland, riparian, and floodplain restoration site databases developed in advance, each potential mitigation site is ranked based on attributes, such as environmental benefits, condition of key ecological processes, the type of natural resource being restored, and local priorities. For example, WSDOT gives preference to areas with key ecological processes categorized by the National Atmospheric and Oceanic Administration and the U.S. Fish and Wildlife Service as "at-risk," as opposed to areas considered "properly functioning" and "not properly functioning."[283] Potential mitigation sites are subjected to economic and environmental cost-benefit analysis to further inform the mitigation decision-making process.

Application

The WSDOT's watershed characterization method is not designed for use in all transportation projects in the state. Most project impacts will likely continue to be mitigated in the right-of-way where impacts occur since WSDOT already owns those lands.[284] When landscape position, projected development patterns, or land costs make mitigation in the right-of-way unfeasible, the watershed characterization process will be an option available to the project management team to guide mitigation decision-making.[285] It will be used primarily in projects likely to incur relatively high mitigation costs, such as projects in urban or urbanizing areas and projects expected to have serious or widespread impacts on natural resources.[286] A screening tool is in development that will help identify projects with the greatest need for off-site mitigation and watershed characterization.[287]

Progress to Date

The new watershed characterization and mitigation process was developed and tested in a pilot project for State Road 522 (SR522) completed in February 2003. The Federal Highway Administration provided research funds to develop methods in the SR522 pilot and to further develop, test, and refine watershed characterization methods in the widening of Interstate 405 in the Lake Washington watershed.[288] There will likely be at least one more round of peer review and project testing before the method is considered an operational tool. Concurrently, the Watershed Mitigation Subcommittee is working to integrate watershed methods into interagency policy and the transportation planning and design process.[289] While the watershed characterization process cost roughly $100,000 for the SR522 pilot project, per area unit costs will likely be lower in subsequent applications.[290]

A WSDOT technical team is also working cooperatively with the Washington State Department of Ecology

278 Gersib, Richard (Washington Department of Transportation). Personal communication. 9 Feb. 2004.

279 Gersib, Wald, Hilliard, Schanz, Driscoll, Perez, Franklin, and Aberle, p. 45.

280 Gersib, Richard (Washington Department of Transportation). Personal communication. 9 Feb. 2004.

281 Gersib, Wald, Hilliard, Schanz, Driscoll, Perez, Franklin, and Aberle, pp. 19-41.

282 Gersib, Richard (Washington Department of Transportation). Personal communication. 9 Feb. 2004.

283 *Ibid.*

284 *Ibid.*

285 Gersib, Wald, Hilliard, Schanz, Driscoll, Perez, Franklin, and Aberle.

286 Gersib, Richard (Washington Department of Transportation). Personal communication. 9 Feb. 2004.

287 Gersib, Wald, Hilliard, Schanz, Driscoll, Perez, Franklin, and Aberle, p. 1.

288 Identification of Mitigation Sites Through Watershed Characterization. Washington Department of Transportation. 25 Nov. 2003 <www.wsdot.wa.gov/environment/streamlineact/subcommittee_docs/watershed_characterization_overview.pdf>.

289 Gersib, Richard (Washington Department of Transportation). Personal communication. 9 Feb. 2004.

290 *Ibid.*

to explore using wetland restoration upslope of the project area as a means of compensating for stormwater flow control from increased impervious area. Initial modeling results have been promising and potential exists for using the restoration of wetlands as a "Best Management Practice" for stormwater flow control along side detention ponds and vaults.[291]

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291 *Ibid.*

Gersib, Richard, Brent Haddaway, Tim Hilliard, Ed Molash, Jim Park, Albert Perez, Virginia Stone. Enhancing Transportation Project Delivery Through Watershed Characterization: I-405 Case Study. (Olympia, Washington: Washington State Department of Transportation, 2004). 19 Apr. 2004 <http://www.wsdot.wa.gov/environment/watershed/docs/405NorthRentonCaseStudy.pdf>.

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WEST EUGENE WETLANDS PLAN AND PARTNERSHIP

LEAD AGENCIES/ORGANIZATIONS

City of Eugene
Lane Council of Governments

OTHER PARTICIPATING AGENCIES/ ORGANIZATIONS

U.S. Bureau of Land Management
U.S. Army Corps of Engineers
U.S. Fish and Wildlife Service
Oregon Division of State Lands
Oregon Department of Environmental Quality
Oregon Youth Conservation Corps
The Nature Conservancy
McKenzie River Trust
Willamette Resources and Education Network

FUNDING SOURCES

Planning Funds:

- The U.S. Environmental Protection Agency contributed $250,000 in planning funds and $50,000 for the Advanced Identification study.

Acquisition Funds ($20 million since 1992):

- Local sources include City of Eugene park bonds and stormwater funds.
- State sources include the Oregon Watershed Enhancement Board.
- Federal sources include Land and Water Conservation Funds, the Bonneville Power Administration, the North American Wetland Conservation Act Grants, Intermodal Surface Transportation Efficiency Act (for a bike trail), and the Water Resources Development Act.
- Private sources include The Nature Conservancy and private donations.

GEOGRAPHICAL AREA CONSIDERED

The West Eugene Wetlands initiative encompasses 3,000 acres of wetland and adjacent upland in the Amazon Creek drainage basin in West Eugene, Oregon.

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ACTIVITIES

Goal of the effort

The goals of the West Eugene Wetlands Partnership are to restore and maintain a healthy, hydrologically and ecologically connected system of native wetland ecosystems in the area; achieve a net gain in wetland acreage and functions; increase the predictability of the development permitting process in the area; and conduct environmental education based on natural and restored/enhanced wetlands.[292] The initiative focuses not only on wetland conservation and restoration, but also stormwater and floodplain management, recreation, education, and economic development.[293]

Activities

The West Eugene Wetlands Special Area Study (WEWSAS) was initiated in 1989 after wetlands were identified in a large area in west Eugene that was slated for

[292] Wold, Eric "City of Eugene's Wetland Mitigation Program." presented at the Third Stakeholder Forum on Federal Wetland Mitigation, July 29-31, 2003. (Portland, OR: Environmental Law Institute, 2004). 19 Apr. 2004 <http://www.eli.org/pdf/mitigation%20forum%202003/wold_presentation.pdf>.

[293] White, David and Leonard Shabman. National Wetland Mitigation Banking Study – Watershed-based Wetlands Planning: A Case Study Report. (Alexandria, Virginia: U.S. Army Corps of Engineers, Institute for Water Resources, 1995) 23. 19 April 2004 <http://www.iwr.usace.army.mil/iwr/pdf/95wmb8.pdf>.

industrial development.[294] The WEWSAS marked the beginning of the process whereby the West Eugene Wetlands Plan was developed to guide wetland restoration and preservation and economic development in the area. The plan was developed by a local interdepartmental team led by the Lane Council of Governments (L-COG). The development of the plan was substantially shaped by input from community members and a Technical Advisory Committee composed of representatives from key state and federal agencies.[295] Geographic information systems (GIS) were essential in layering and comparing the diverse data layers used in the development and implementation of the plan.

Site inventory and assessments / Plan development

The recommendations put forth in the West Eugene Wetlands Plan were based on extensive assessments of current and historical aquatic resource conditions, as well as detailed analysis of potential site-specific mitigation actions. Among the many studies that contributed to the development of the plan were an advanced identification (ADID) study funded with a grant from the U.S. Environmental Protection Agency (EPA) in 1989. The ADID included delineation and assessment of wetland functions and values using the Wetland Evaluation Technique, Level II.[296] Although one of the goals of the ADID was to develop a §404 general permit for the plan area, concerns from government agencies and nongovernmental organizations made development of a general permit unfeasible.[297]

The restoration design priorities in the plan focused on replicating historical vernal pool and wet prairie aquatic resources identified in the area on 19th century land survey maps. Other data sources included a habitat rating inventory, Federal Emergency Management Agency flood data, soil types, Natural Heritage data, waterway and drainage maps, winter wildlife surveys, and existing land use and zoning maps. The criteria used to determine whether an area was to be designated for restoration, enhancement, protection or development included presence of rare plants, existing plan designation, 100 year flood plain locations, proximity to perennial waterways, connection to other aquatic resources, biodiversity, prior permitting status, and existing infrastructure locations.[298]

The initial plan, targeting mitigation for sites where it was most likely to succeed, was "most beneficial to the ecological landscape," and required relatively little maintenance.[299] Several studies were conducted to assess soil, hydrology, and vegetation conditions in both reference wetlands and potential mitigation sites in the plan area. They identified alternative mitigation measures, selected preferred mitigation actions, and suggested allocations of mitigation credits for specific mitigation actions at each of several proposed mitigation sites in the plan area.[300]

Plan adoption and implementation

Upon adoption of the west Eugene Wetland Plan in 1992, the City of Eugene became the first city in Oregon to take advantage of a new state law authorizing cities to develop wetland conservation plans. The plan, which was a refinement of the city's comprehensive land use plan, called for the protection or restoration of 1,000 of the 1,300 acres of wetlands with additional upland areas to be protected to provide connectivity and buffers.[301] It identified isolated and highly degraded wetland sites in which development and fill activities would be allowed.[302] The plan included a map representing the vision for the area's future, a list of long-term goals, and proposed policies, implementation steps, and financing strategies to bring about those goals.[303]

Permit applications that are deemed to be consistent with the plan by the City of Eugene are forwarded to the Division of State Lands and U.S. Army Corps of Engineers (Corps) and are approved with little additional regulatory review. Since the plan was approved by state and federal agencies in 1994, the Corps and the Oregon Division of State Lands have approved all fill-removal permit applications consistent with designations in the West Eugene Wetlands Plan.[304]

Following the adoption of the plan, a coalition of local, state, and federal agencies and non-governmental organizations known as the West Eugene Wetland Partnership was formed to oversee its implementation. In 1994, the Wetlands Executive Team, composed of repre-

294 Gordon, Steve. "West Eugene Wetlands Program: A Case Study in Multiple Objective Water Resources Management Planning." in Wetlands and Watershed Management: Science Applications and Public Policy. Eds. J.A. Kusler, D.E. Willard, and H.C. Hull, Jr. Institute for Wetland Science and Public Policy/Association of State Wetland Managers, 1995.

295 Gordon, Steve (Lane Council of Governments). Personal communication. 6 Feb. 2004.

296 U.S. Army Corps of Engineers. Wetland Evaluation Technique (WET). 26 Jan. 2004 <http://www.wes.army.mil/el/emrrp/emris/emrishelp6/wetland_evaluation_technique_tools.htm>.

297 Gordon, Steve (Lane Council of Governments). Personal communication. 19 Feb. 2004.

298 Gordon, pp. 9-12.

299 Mitigation Options for Eight Sites in West Eugene. Lane Council of Governments. 1993. p. 11.

300 Alverson, Edward. Assessment of Proposed Wetland Mitigation Areas in West Eugene. (Portland, OR: The Nature Conservancy, 1993).

301 Gordon, p. 11.

302 Gordon, Steve (Lane Council of Governments). Personal communication. 6 Feb. 2004.

303 Protecting Wetlands, Managing Watersheds: Local Government Case Studies. International City/County Management Association and National Association of Counties. 1999. p. 8.

304 Wold, Eric (City of Eugene). Personal communication. 27 Feb. 2004.

sentatives from each member of the partnership, was established to oversee the cooperative management of the wetland resources in west Eugene. The partnership has used a number of avenues to implement the plan including natural resources zoning districts, conservation easements, outright purchase of identified preservation or restoration lands (primarily undertaken by the Bureau of Land Management, the City of Eugene, and The Nature Conservancy), and wetland mitigation banking. The partnerships' lands are managed in both a wetland mitigation bank and in non-bank preservation properties, such as the Willow Creek Natural Area, which is owned and maintained by The Nature Conservancy.

The mitigation bank was started in 1993 to provide a funding source for the restoration projects called for in the plan. The plan identified potential wetland mitigation sites. Once lands are acquired, detailed studies are conducted within each site to determine the most beneficial and cost effective mitigation sites and actions. A Mitigation Improvement Plan is developed that presents data on the historical and current conditions on the sites as well as proposals for mitigation activities.[305] Administered as a capital project of the City of Eugene, the mitigation banks operate on a revolving fund basis, in which the sale of credits from one restoration project funds the next restoration project.[306] The bank is primarily intended to provide advance mitigation credit for impacts in the designated development areas of the plan area. Bank credits can also be purchased to mitigate for impacts in other areas within the Urban Growth Boundaries of the City of Eugene and, occasionally, for impacts in the wider region.[307]

While the original plan included designations for which areas should be preserved, restored, or left open for development and studies conducted in preparation for the plan suggested possible mitigation schemes for some sites in the plan area, no single method or tool has dominated the design or implementation of mitigation in the area. The mitigation activities in West Eugene have largely been designed through adaptive management, whereby past successes and failures inform future activities. Through a new $200,000 grant from EPA, the partnership, along with scientists from the University of Oregon will test a range of restoration and enhancement activities beginning in the summer of 2004. The data from these experiments will inform future mitigation efforts in West Eugene and throughout the region.[308]

305 Willow Corner Mitigation Improvement Plan. Lane Council of Governments. 2002.

306 Gordon, Steve (Lane Council of Governments). Personal communication. 6 Feb. 2004.

307 *Ibid.*

308 Wold, Eric (City of Eugene). Personal communication. 27 Feb. 2004.

Progress to date

Between 1992, when the Wetland Plan was adopted, and 2004, the total amount of land owned by the partnership has increased from under 300 acres to over 2,800 acres.309 The partnership's mitigation banking activities have restored, enhanced or created 200 acres. Non-bank activities have restored another 500 acres. [310] The partnership's mitigation activities include implementation and monitoring of mitigation projects and an active native seed collection program. Active volunteer and environmental education programs are a vital part of establishing ties between the partnership's activities and the community at large.

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WETLANDS CHARACTERIZATION FOR NANTICOKE & COASTAL BAYS WATERSHEDS, MARYLAND

LEAD AGENCIES/ORGANIZATIONS

U.S. Fish and Wildlife Service, National Wetlands Inventory Program[311]

OTHER PARTICIPATING AGENCIES/ ORGANIZATIONS

Maryland Coastal Zone Management Program
Maryland Department of Natural Resources
National Oceanic and Atmospheric Administration[312]

FUNDING SOURCES

Maryland Coastal Zone Management Program - Department of Natural Resources
Maryland Department of Environment
Smithsonian Institution: Smithsonian Environmental Research Center
The Nature Conservancy
U.S. Environmental Protection Agency

GEOGRAPHICAL AREA CONSIDERED

Nanticoke and Coastal Bays Watersheds of Maryland

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311 Tiner, R., M. Starr, H. Bergquist, and J. Swords. Watershed-based Wetland Characterization for Maryland's Nanticoke River and Coastal Bays Watersheds: A Preliminary Assessment Report. Hadley, MA: U.S. Fish and Wildlife Service Northeastern Region, National Wetlands Inventory program, 2000. 11 Feb. 2004 <http://wetlands.fws.gov/Pubs_Reports/Md_Watershed/Md%27s%20pdfs/Preliminary2.pdf>.

312 *Ibid.*

ACTIVITIES

GOAL OF THE EFFORT

The U.S. Fish and Wildlife Service's National Wetlands Inventory Program (NWI) has developed a variety of products intended to aid in natural resource management. The NWI has improved and enhanced existing inventories of mapped wetlands by adding additional characteristics for the assessment of potential wetland functions. On several occasions, the NWI has provided assistance in conducting watershed-wide inventories and analyses of potential restoration sites.[313]

The State of Maryland sought to utilize this kind of information for natural resource planning in the Coastal Bays watershed and Nanticoke River watershed in order to assist state wetland managers in planning and evaluation at the watershed level. In a larger sense, the project aimed to produce a watershed-based wetland characterization that could contribute to the development of a state wetland strategy that prioritized acquisition, restoration, and areas for strengthened wetland protection. In addition, the project served as a foundation for additional watershed and site-specific studies.[314]

BACKGROUND

The U.S. Fish and Wildlife Service's National Wetlands Inventory Program is dedicated to producing information about the characteristics, quantity, and status of the nation's wetlands and deepwater habitats. To date, the NWI center has produced maps of U.S. wetlands for about 90 percent of the lower 48 states and 18 percent of Alaska.[315] These maps are used for a variety of purposes, including watershed planning.[316]

The NWI Program has recently developed procedures to produce watershed-based wetland and natural habitat integrity assessments using remote sensing data. Preliminary wetland assessments are currently being prepared for individual watersheds where the U.S. Fish and Wildlife Service receives support from other agencies,

313 Tiner, Starr, Bergquist, and Swords, 1.

314 *Ibid.*

315 National Wetlands Inventory: About Us. U.S. Fish and Wildlife Service. 17 Dec. 2003 <http://www.nwi.fws.gov/aboutus.htm>.

316 National Wetlands Inventory: Overview. U.S. Fish and Wildlife Service. 17 Dec. 2003 <http://www.nwi.fws.gov/overview.htm>.

such as the Maryland Coastal Zone Management Program and Maryland Department of Natural Resources (MDNR).

Assessment

NWI's wetland assessment model involves enhancing NWI digital data to include descriptors for wetland landscape position, landform, water flow path, and waterbody type. The model uses the expanded NWI database to produce a preliminary assessment of 10 functions: surface water detention, streamflow maintenance, nutrient transformation, sediment and other particulate retention, shoreline stabilization, fish and shellfish habitat, waterfowl and waterbird habitat, other wildlife habitat, and conservation of biodiversity.[317]

The basic mapping data are available online at the NWI website (http://wetlands.fws.gov). Additional classification datasets are available through the MDNR. Once datasets from the numerous states and watersheds have been standardized, they will also likely be made available on the NWI website.[318] In the meantime, data are available from partnering agencies.

The assessment in Maryland was based on an approach called "Watershed-based Preliminary Assessment of Wetland Functions," (W-PAWF) which uses a general literature review, as well as documented best professional judgment by wetland specialists from federal, state, and local agencies, and the academic community, to develop correlations between wetland characteristics in the NWI database and the 10 wetland functions. Besides documenting potentially significant wetlands for these functions, the assessment can be used for predicting the cumulative effect of wetland losses on the functions in individual watersheds.[319] The NWI Program has recently completed a report on cumulative impacts of wetland losses on wetland functions for the Nanticoke River watershed.[320]

The NWI Program has also developed a set of 10 remotely sensed indices for evaluating and monitoring wetlands and other natural habitats in watersheds, including natural cover (the amount of "natural" habitat remaining), wetland extent, vegetated stream corridor, wetland and other waterbody buffers, standing waterbody extent, channelized stream length, dammed river/stream length, wetland disturbance, and habitat fragmentation by roads. A tenth index is a composite of these indices with a weighting scheme assigned to individual indices. These indices, applied in the Nanticoke and Coastal Bays watersheds, provided statistics valuable in helping to assess the extent and general condition of natural habitats important to natural resource planners and managers. They can be used to assess current condition as well as to monitor future changes and evaluate conditions relative to the past.

The indices can be a useful tool for natural resource managers.[321] No expertise is needed to utilize the maps resulting from data, although some technical knowledge is required to enhance data with additional information. The Maryland watershed assessment cost approximately $58,000 to develop (including an inventory of ditches in the study watersheds). Since this project was the first of its kind, it is likely that costs will decrease with future applications. In terms §404 decision-making, the NWI maps can provide a frame of reference, illustrating a precise inventory of wetlands and wetland functions in a given region or watershed. However, not all of the mapped wetlands may be jurisdictional.[322]

The MDNR, working in conjunction the Delaware Department of Natural Resources and Environmental Control (which also shares the Nanticoke River Watershed), are currently utilizing the information produced by the assessment to examine hydrogeomorphic classes of wetlands in the watershed. The objective is to determine how conditions of restored sites compare to those of natural wetlands.[323] The Maryland Department of Environment (MDE), the state's agency responsible for regulatory decisions regarding wetlands, will use the study's information to target areas for restoration and mitigation activities. At present, MDE staff is planning how to proceed with the information.[324] In addition, this information will eventually be used in the development of a state conservation strategy, which will likely include mitigation and restoration recommendations.[325]

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ACRONYMS & ABBREVIATIONS

ADID – Advanced Identification
ADG – Alternative Development Group
ARRP – Aquatic Resource Restoration Plan

BC Commission – Baldwin County Commission
BCWCP – Baldwin County Wetlands Conservation Plan
BEMR – Baywide Environmental Monitoring Report

CCMP – Comprehensive Conservation and Management Plan
CRAM – California Rapid Assessment Method
CDF – Common Delivery Framework
Corps – U.S. Army Corps of Engineers
CU – Cataloguing Unit

EEP – Ecosystem Enhancement Program
EIS – Environmental Impact Statement
EPA – Environmental Protection Agency

FTE – Full-time Equivalent

GIS – Geographic Information System
Goals Project – San Francisco Bay Area Goals Project

HGM – Hydrogeomorphic
HUC – Hydrologic Unit Code

ICM – Integrated Coastal Management
IVA – Indicator Value Assessment
IWR – Institute for Water Resources
IWREDSS – Integrated Wetland Resources Evaluation Decision Support System

L-COG – Lane Council of Government
LCR – Landscape Characterization and Restoration Program

MAV – Mississippi Alluvial Valley
MAWPT – Multi-Agency Wetland Planning Team
MDE – Maryland Department of Environment
MDNR – Maryland Department of Natural Resources
MCDM – Multi-Criteria Decision Making
MOA – Memorandum of Agreement
MOP – Multi-Objective Programming

NCDENR – North Carolina Department of Environment and Natural Resources
NCDOT – North Carolina Department of Transportation
NC-CREWS – North Carolina Coastal Region Evaluation of Wetland Significance
NCWRP – North Carolina Wetlands Restoration Program
NEP – National Estuary Program
NLCD – National Land Cover Data
NOAA – National Oceanic and Atmospheric Administration
NWI – National Wetlands Inventory

PRC – Permit Review Criteria

RWFAM – Remote Wetland Functional Assessment Model (RWFAM)

SAMP – Special Area Management Plan
SCCWRP – Southern California Coastal Watershed Research Project
SCREAM – Southern California Riparian Ecosystem Assessment Method
SFEI – San Francisco Estuary Institute
SMART – System-wide Modeling, Assessment, and Restoration Technologies
SWAMP – Spatial Wetlands Assessment for Management and Planning
SR522 – State Road 522
Synoptic Approach – Synoptic Approach for Wetlands Cumulative Effects Analysis

TBEP – Tampa Bay Estuary Program
TPEAC – Transportation Permit Efficiency and Accountability Committee
TLW – Targeted Local Watershed
TMDL – Total Maximum Daily Load

USDA – U.S. Department of Agriculture

WET – Wetland Evaluation Technique
WEWSAS – West Eugene Wetlands Special Area Study
WNAT – Watershed Needs Assessment Team
W-PAWF – Watershed-based Preliminary Assessment of Wetland Functions
WPOD – Wetland Protection Overlay District
WRPs – Watershed Restoration Plans
WRP – Wetland Recovery Project
WSDOT – Washington State Department of Transportation