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Information About Estuaries and Near Coastal Waters Autumn 1996, Volume 6, Number 4

Table of Contents

[How a Watershed Works](#)

[Dredged Material Management Plans](#)

[Connecting Coastal Initiative to the Oceanic Continuum](#)

[Watershed Management Techniques](#)

[Testing the effectiveness of BMP's in Connecticut](#)

[Implementation of CCMP's](#)

[Two NEP's retool for the next step](#)

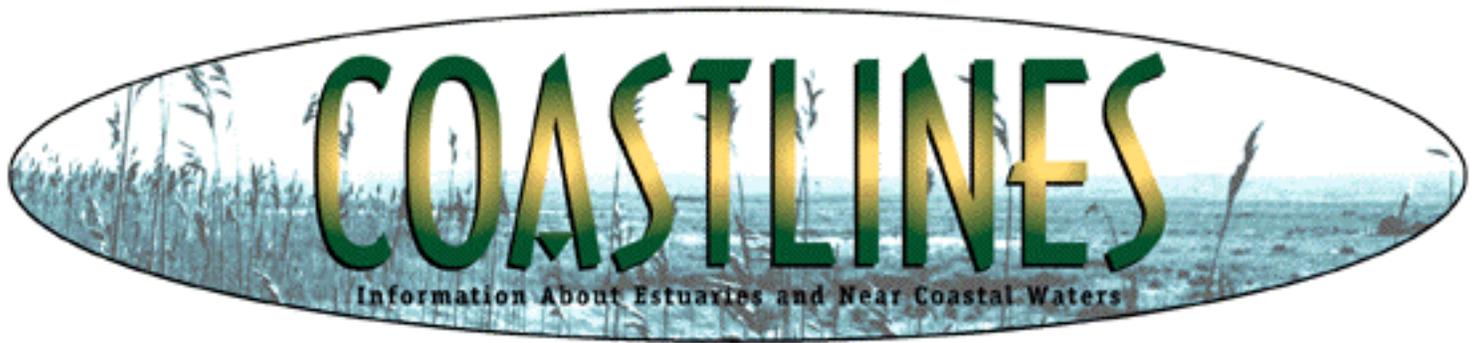
[Announcements](#)

[What's happening in coastal management](#)

[Neat Web Stuff](#)

[New Septic System Education Kits Available](#)

[About Coastlines](#)



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Watershed

The watershed pours it all together, from the ridgetops to the rivers and the bay. It's the source and the process, defining and shaping the water, the land, and the lives --within and below.

JoAnne Booth
Tillamook County, Oregon

How a Watershed Works

Over the past years, a greater appreciation has been growing for the importance of managing resources, coastal or otherwise, based on natural rather than political boundaries. For many types of resources, the watershed provides the most effective physical unit. In the following article we discuss some of the ways in which watersheds "work".

Watersheds, sometimes referred to as drainage basins, transport water from upland areas to receiving waters in a variety of pathways. Perennial streams are perhaps the most obvious. Precipitation which infiltrates the watershed surface and recharges the underlying ground water provides chronic base flows as the ground water discharges to the downgradient receiving waters. Surface runoff which occurs during

(and following) precipitation events results in more sporadic but significant inputs called "stormflows". The rates at which ground water and stormwater move through a watershed are dependent upon a range of factors, including rainfall, geology, soils, topography, and vegetation.

As the landscape becomes developed, watershed functions change and the hydrologic pathways are often affected. Most significantly, as natural pervious surfaces become paved or covered with buildings, the amount of surface runoff increases dramatically. Less obvious, the amount of infiltration and ground water discharge diminishes. Depending on the stormwater management practices which are employed, significant changes in watershed hydrology are likely to occur.

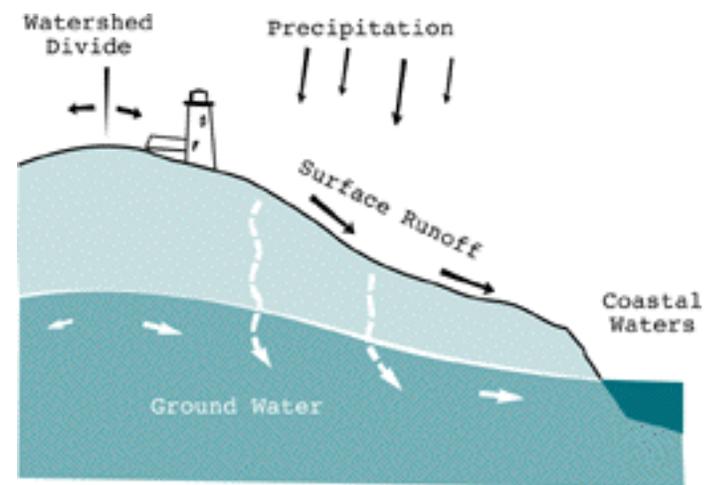


Fig.1 Paths of Water Flow

Perennial streams, wetlands, and coastal waters depend upon these regular discharges of fresh water to maintain habitats in streams and wetlands and appropriate salinity levels in coastal embayments and estuaries. The changes in watershed hydrology as the landscape in the watershed becomes more developed often disrupt the rates and timing of discharges. In an undeveloped system, precipitation will infiltrate and become part of ground water or may drain into wetlands. Movement through ground water is very slow as compared to surface water travel. (While surface water may travel in feet per second, common rates of ground water flow are in the foot/day to the foot/month or even foot/year range.) This lessens the highs and lows of surface water volumes, making the discharge more constant. Wetlands work in a similar manner, holding water following precipitation events and discharging it slowly over time. In developed areas, stormwater tends to run off quickly into surface streams, resulting in a limited "flash flood" situation after heavy rains, with dry periods in between.

Watersheds also play key roles in pollutant attenuation. Natural vegetative surfaces and soils decrease levels of pollutants through physical filtration and biochemical transformations. Development of land necessitates the removal of these resources, reducing the watershed's capacity to attenuate and assimilate pollutants. In order to make up for this loss, management techniques must develop compensatory measures such as stormwater treatment, best management practices, and sewage treatment. Faster flows of stormwater also lead to increased erosion, and typically carry contaminants to receiving waters faster and in higher concentrations than in an undeveloped system. The results downstream may be contaminated sediments clogging habitats and navigation channels.

Impacts to watersheds and receiving waters tend to occur incrementally and often go unnoticed for long periods of time. For example, hydrocarbons, metals, and other pollutants are transported from paved surfaces with every rain event. Traditionally, stormwater has been directed to wetlands or surface waters with little or no treatment. Over time these pollutants accumulate in the downstream aquatic ecosystem and begin to cause long-term deterioration of habitats.

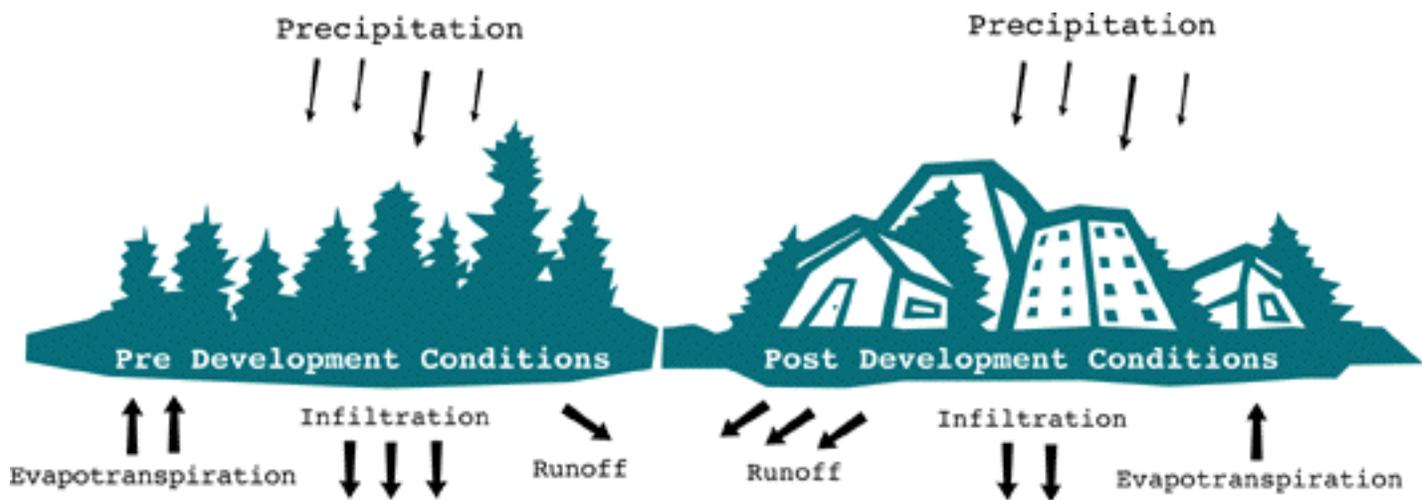


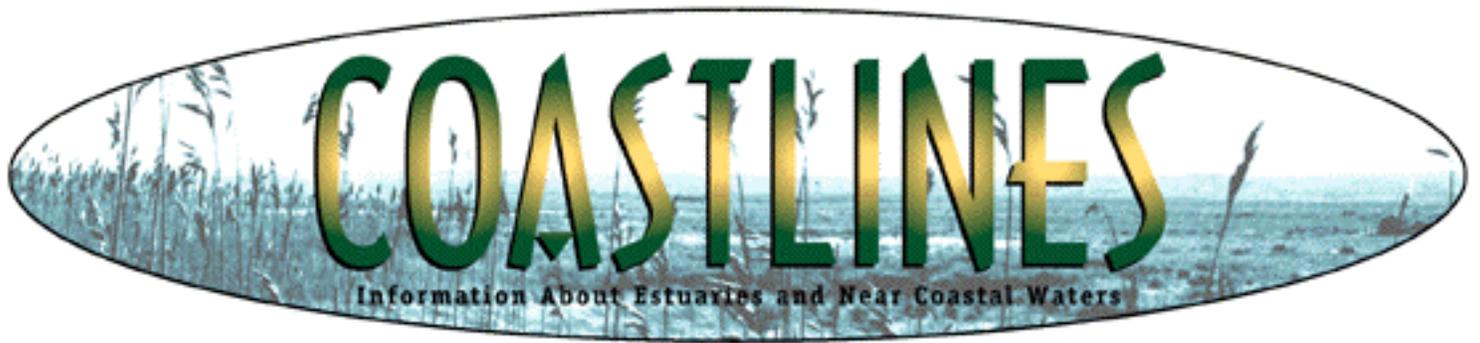
Fig. 2 Water Cycle Diagram (with wooded landscape and permeable soils)

Another example of the insidious nature of watershed pollution is the degradation of ground water underlying the watershed surface. Invisible from atop the land's surface, ground water quality is degraded from subsurface sewage discharges, from infiltration of fertilizers applied at the surface, and where stormwater runoff is infiltrated. Because of the slow rate of ground water movement, significant lag times are common between the time when a pollutant enters the ground water system and when it ultimately discharges to a downgradient receiving waterbody. The contaminant which enters the ground water at the upper end of the watershed today may not appear in the receiving waters until five to fifty years later.

Where receiving waters are sampled and analyzed to evaluate the impacts of watershed development, lag times must be accounted for. The water quality measured today in an estuary may be the result of development which occurred twenty years ago and the receiving water may not yet exhibit any effects of more recent developments in the watershed. This time-lag relationship between watershed development and receiving water quality has important implications in setting thresholds and performance standards for watershed management.

These concepts of how watershed hydrology "works" in three dimensions as well as over differing time spans become part of most successful watershed management programs. Many of the case studies presented in *Coastlines* have developed from an improved understanding and recognition and understanding of such processes.

For additional information about watershed hydrology, see "Water in Environmental Planning", Thomas Dunne and Luna Leopold, 1978, W.H. Freeman & Co., New York, 818 pages or "A Watershed Approach to Urban Runoff, Handbook for decisionmakers", produced by the Terrene Institute (Washington DC) in conjunction with US EPA Region 5, 1996, 115 pages.



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Dredged Material Management Plans

In October of 1993, the national Secretary of Transportation convened an Interagency Working Group on the Dredging Process in order to recommend actions to improve the federal system for reviewing and approving dredging projects (see *Coastlines*, Winter 1996, Issue 6.1). A significant outcome of this process was the creation of the National Dredging Team (NDT), an interagency group whose purpose is to facilitate the resolution of dredging issues among participating federal agencies, including EPA, the Corps of Engineers, NOAA's National Marine Fisheries Service and Office of Ocean and Coastal Resource Management, the Fish and Wildlife Service, and the Maritime Administration. One of the NDT's major activities over the past year has been to focus on ways to strengthen planning mechanisms for dredging and dredged material management in order to make the process less contentious and more predictable. A major milestone on the road to achieving this goal is the just-released draft guidance document entitled "*Dredged Material Management Plans and Local Planning Groups*".

This draft guidance is designed to facilitate the development of long-term, watershed-based dredged material management plans by Local Planning Groups (LPGs) for both federal and non-federal dredging projects. In order to ensure that these plans are truly comprehensive and inclusive, membership of LPGs is intended to include representatives of relevant federal, state, and local government agencies, navigation project sponsors, fishermen's organizations, environmental interest groups, business interests, and other pertinent parties. The draft guidance states that dredged material management plans and LPGs

should be established for all ports and harbors in which dredging is contemplated within the next 20 years. LPGs are to be chaired by the Corps of Engineers or co-chaired with port authorities.

According to the guidance, the following are key concepts to consider during the planning process for dredging projects:

The planning process must reflect the unique mix of environmental, political, and economic circumstances in the individual port and the region;

Planning strategies must be sufficiently flexible to consider advances in technology, new scientific data, and changes in economic circumstances or environmental conditions, different--and changing--local/regional priorities, and to efficiently integrate these new factors into the decision-making process;

Progressive dredged material planning also must be coordinated with broader transportation planning efforts, such as the National Transportation System, and other regional/local efforts such as Coastal Zone Management Plans, and Comprehensive Conservation and Management Plans developed by participants in the National Estuary Program;

Dredged material managers need to emphasize watershed protection approaches and include management of point and non-point source pollution controls to reduce harbor sedimentation and sediment contamination, thereby minimizing those problems at their source;

Regional and local interests must develop direct mechanisms for early coordination and advance planning for dredging activities, and selection and management of dredged material disposal alternatives and sites;

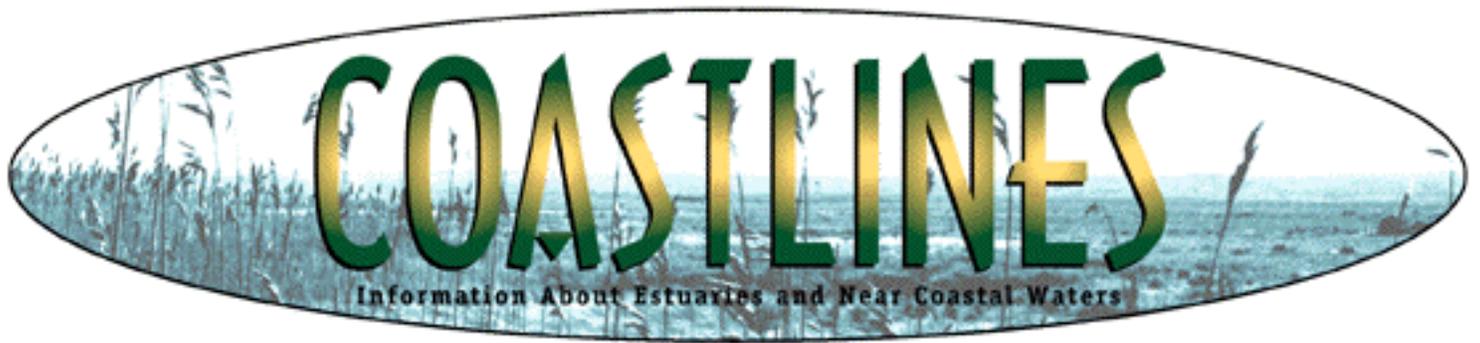
Participation must include representatives of all stakeholders so that there is widespread understanding of:

- the role of the local port in the regional economy
- the availability of dredged material management options
- the environmental considerations of dredging and disposal
- the roles and responsibilities of the agencies involved and other stakeholders

Beneficial use of dredged material should be emphasized for all dredging projects;

Local dredged material planning efforts must be consistent with regional or national dredging policies; and All agencies must be committed to developing, as well as implementing, the plans.

To receive a copy of the draft guidance, contact Wanda Resper at U.S. EPA (4504F); Oceans and Coastal Protection Division, 401 M Street, SW, Washington, DC. 20460, 202-260-9130 or resper.wanda@epamail.epa.gov



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Connecting Coastal Initiatives to the Oceanic Continuum

Many recent regional planning efforts have documented the link between watersheds and nearshore waters. The Chesapeake Bay Program and the National Estuary Program are now expanding the scope of environmental analysis by considering the effects of atmospheric deposition from sources far "upstream" from traditional coastal ecosystem boundaries. Our next challenge is to broaden our consideration seaward to those transboundary issues that transcend estuaries and coastal drainage areas.

This article offers glimpses of that seaward nexus and encourages managers and planners to scan all horizons when setting priorities and measuring success. Our recent emphasis on long-term sustainability and some very visible marine population declines (Atlantic and Pacific salmon, New England cod and haddock, Gulf of Mexico redfish, south Atlantic corals, north Pacific Stellar sea lions) have combined to heighten interest in the connection between shoreside actions and offshore ecosystem health and productivity.

Fortunately, our knowledge base is expanding swiftly. The National Estuary Program, NOAA's Coastal Ocean Program, state coastal management programs, and many other efforts have enlightened us about nutrient cycling, food-chain interactions, and climatological cycles. Along Pacific Northwest salmon

streams, we are now much more aware of direct relationships between timber harvest practices, hydropower development, agribusiness, wildlife health, and aquatic productivity. Salmon fishery management plans that were once dominated by at-sea harvests and spawning escapement goals for the Columbia, Klamath, and other fish streams are now managed by broader regimes involving water supplies in Idaho and Montana and natural climatological changes affecting forage food supply in the insular Pacific. Connections to land-based activities and the role of larger, natural perturbations must be addressed in the interest of resource sustainability and economic viability.

New knowledge has been accompanied by foreboding glimpses of the economic implications of corrective actions. How will we pay for the multi-billion dollar water-quality improvements identified as the key to estuary improvements in Long Island Sound? That is merely one example where the land-sea connection demands that society improve its waste management, land-use practices, and development policies, each with oceanic implications.

In the past, several well-established programs were predicated on the land-sea connection but focused strongly on the nearshore portion of ocean waters and did not provide adequate consideration of the off-shore side or of the oceanic species that depend on nearshore habitats for survival. Similar situations arise in some ocean management programs, which don't venture upland in search of solutions to problems with downstream implications.

Logic dictates that onshore activities will affect habitat and population health offshore. More specifically, estuarine-dependent species and life stages which depend on fragile nearshore habitats should be expected to be affected negatively by wetland fill, piped discharges, atmospheric deposition, and other anthropogenic activities. Impacts from parking lot run-off and home chemical usage may affect the sensitive nearshore waters that are important to offshore species like sharks which breed in the Florida Keys or pup in Delaware Bay, seabirds which dive into coastal waters for schooling fish, green sea turtles that graze on submerged grasses, and shrimp that rely on estuaries for reproduction and development.

These connections are often most visible for sensitive life stages of offshore species like crab larvae, juvenile fish, or turtle hatchlings. Each of these species occupies a temporary, but special, coastal niche determined by salinity, sediments, currents, water clarity, and other variables which can be influenced by human activities. Slight ecological shifts from freshwater diversions, shoreline change, and other human interventions can thus affect the habitat quality and quantity and the health of offshore stocks.

The National Estuary Program, habitat restoration initiatives, and coastal management efforts have shown that, with the proper perspectives, we can recognize these connections and improve overall marine resource health. Marine species with estuarine-dependent life stages should benefit from habitat improvements resulting from land-side activities such as sewerage system upgrades, no-till farming, and vegetated buffer zones. These ecological imperatives are included in our goals to attain "swimmable" or "fishable" waters and "no net loss" of wetlands, but the connections are stronger in the seaward direction than many of us probably realized at the time those goals were established.

The connections between coastal environmental health and offshore populations vary geographically. NOAA's National Marine Fisheries Service has determined that about 32% of the commercial fish landings off the northeastern states are estuarine dependent during some life stage. That figure reflects the reliance on offshore features such as Georges Bank but also reveals the importance of salt marshes as habitat for juvenile lobsters and coastal shallows for adult bluefish. The dependence figure jumps to a staggering 98% along the Gulf of Mexico, where marshes support menhaden and shrimp populations, and drops to only 1% in the Pacific islands where the volcanic island structure limits coastal habitats.

Some of these land-sea relationships are self-evident (when a marina physically displaces a shellfish bed or when fish migrations are disrupted by an irrigation gate) while others are assumed (when vessel sewage discharge is expected near a marina and shellfish beds are restricted automatically).

These connections may manifest themselves at the ecosystem or watershed level. The massive Mississippi River floods of 1993 pumped fertilizer-laden freshwater into the Gulf of Mexico, exacerbated the "dead zone" south of the delta, contributed to unusual oceanographic conditions and noxious algal blooms that swept around the Florida coast to North Carolina, and prompted fishing closures and marine mammal concerns through food chain interactions.

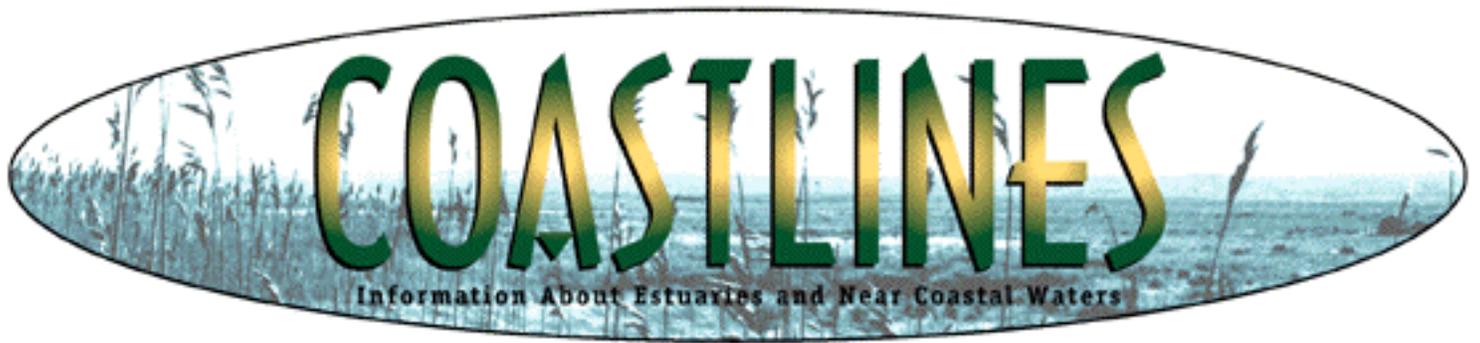
Further complications may be presented by meteorological conditions or long-term environmental change. Spring floods may contribute more sediments and chemicals to nearshore waters than would be seen from human activities. Hawaiian lobster populations may be affected by warming seas that decrease reproductive success, as well as by the fishery itself. Mississippi River channelization certainly affects natural wetland accretion but land subsidence and sea-level change may be major determinants of wetland loss in some Louisiana parishes.

Given the current state of knowledge and the urgency forced by the health of marine populations it is imperative that we connect land management practices and marine living resource management programs. The burden must be shared by land and sea programs, their host agencies at the state and federal levels and regional efforts that combine those forces with the private sector and academia. Moving inland from the coast, managers should consider more seriously how large-scale development projects affect hydrologic cycles and overall coastal ecosystem health. For example, water needs by agribusiness and metropolitan areas in the San Joaquin and Sacramento River watersheds threaten the delicate salinity regimes in the San Francisco Bay-Delta region. Moving seaward, several states are expanding their coastal management programs into the exclusive economic zone, thereby encouraging a stronger alliance with fishery management and protected species programs. The on-going debate on ocean governance and marine area management may offer opportunities to transcend traditional boundaries. Coastal management plans provide a common thread that could integrate across disciplines, facilitate partnerships, and connect habitat changes to economics. The National Estuary Program offers opportunities to expand well beyond water quality and more deeply into the impacts of environmental degradation on living marine resources.

That such connections exist is evident. The challenges to act on them are immense. It will be up to the

coastal managers at the local, state, and national level to ensure that progress in the next decade will exceed the successes of the recent past.

For further information, contact Thomas E. Bigford, NOAA/National Marine Fisheries Service, Office of Habitat Conservation, 1315 East-West Highway, Silver Spring, Maryland 20910, (301) 713-2325, ext. 135, fax: (301) 713-1043, e-mail: thomas_bigford@noaa.gov.



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Testing watershed management techniques in urban Connecticut

A section 319 monitoring program in the Jordan Cove Watershed

A 1994 National Water Quality Inventory report by the US EPA shows runoff from urban areas as the leading source of water quality impairment to surveyed estuaries, and the third largest contaminant input to lakes. Urbanization can increase the variety and amount of pollutants transported to receiving waters including sediment from development and new construction; oil, grease, and toxic chemicals from vehicles; nutrients and pesticides from turf management and gardening; pathogens from pet waste and leaking septic tanks; de-icing agents from winter road maintenance; and heavy metals from paved surfaces, roof flashing, and vehicle air emissions.

One way of managing urban stormwater is to carefully plan new development. Drainage system design should maintain equal volumes of runoff before and after building takes place. This can be achieved by using pollution prevention strategies and structural controls. Good engineering and architectural design practices for commercial, industrial, and residential development can also help in protecting sensitive ecological areas, minimizing land disturbances, and retaining natural drainage and vegetation.

The beginning stages of a stormwater quality monitoring project are now underway in Waterford, Connecticut. The before and after results of residential subdivision planning efforts intended to minimize runoff-related problems are being observed. Project funding is provided, in part by a Clean Water Act, Sec. 319, National Monitoring Program grant awarded by the (US EPA to the Connecticut Department of Environmental Protection (CTDEP). Initial site selection involved three criteria: 1) an appropriate hydrologic setting; 2) a willing land owner or developer who would allow up to 1-1/2 years of advance monitoring before build-out; and, 3) a town agreeable to adopt innovative site planning and development strategies. The chosen site is divided into two segments, one having building lots arranged in a conventional R-20 (i.e., half-acre) zoning pattern, and the other, cluster housing with no lot lines. Waivers from traditional town design standards, e.g., grassed swale in lieu of curbs and gutters, are being incorporated into the subdivision layout in the latter area.

Dr. John (Jack) C. Clausen, a researcher in water resources at the University of Connecticut, is conducting a ten year monitoring program to measure changes in water quantity and quality before, during, and after subdivision construction. Managerial and structural runoff best management practices (BMPs) will be used throughout construction and adopted as part of a routine maintenance program by a proposed homeowners' association. Phased grading, seeding of stockpiles, vegetation of open space, cross grading, and sediment detention swales are examples of BMPs to be used during construction. Permanent BMPs will include: pervious driveway surfaces such as gravel or crushed stone, landscape plantings, reduced roadway widths, roadside swales, areal drainage swale(s) and a cul-de-sac detention basin. Controlled nutrient and pesticides application, reduced application and use of alternative road deicers, street sweeping or vacuuming, and areal vegetation management are pollution prevention techniques the homeowners' association and town will be encouraged to adopt.

Monitoring is being conducted on a paired watershed design basis. This approach assumes that there is a quantifiable relationship between paired water quality data for the two watersheds, and that this relationship is valid until a major change is made in one of the watersheds. This basis does not require that the quality of runoff be statistically the same for the two watersheds, but that the relationship between paired observations of water quality remains the same over time--except for the influence of the BMP.

Background sampling at the chosen development site began in November 1995, establishing a baseline for future comparisons. Sanctuary Basin, a nearby subdivision built in 1987-88, is being used as a control. Both sites drain into Nevins Brook, a tributary to Jordan Brook which discharges into

Specific steps to reduce adverse impacts on hydrology and water quality in the Jordan Cove Watershed Project include:

1. Implementing BMPs on 100% of the lots in the BMP test portion of the subdivision;
2. maintaining post-development peak runoff rate and average volume at similar levels to pre-development levels;
3. maintaining post-development average annual loadings of suspended sediment to no greater than pre-development rates;
4. retaining sediment on-site during

Jordan Cove, a small estuary of Long Island Sound (see map). Water samples are being analyzed for total suspended solids, total phosphorous, total Kjeldahl, ammonia and nitrate+nitrite--nitrogen, fecal coliform bacteria, and, five-day biochemical oxygen demand. Monthly samples are being analyzed for copper, lead, and zinc.

It is a generally accepted axiom that good site planning can do a great deal to avoid increases in runoff and reduce the potential for erosion and sedimentation problems. In this project, identified goals are helping to direct the choice of practices and strategies for site development toward those which will reduce the root causes of adverse impact on hydrology and water quality. These goals include: 1) reproducing pre-development hydrological conditions; 2) confining development and construction activities to the least critical areas; 3) fitting the development to the terrain; 4) preserving and utilizing the natural drainage system; and, 5) creating a desirable living environment.

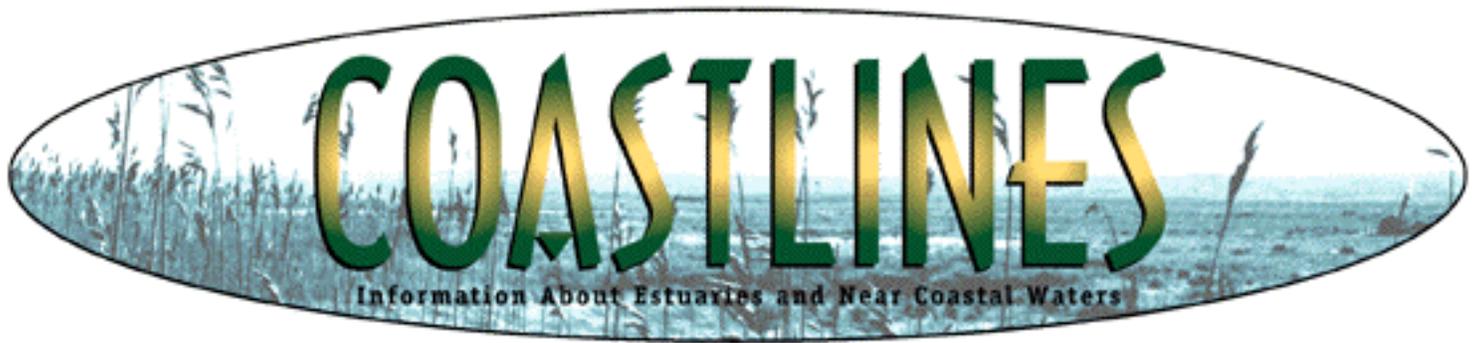
By 2010 it is predicted that almost one-half of the U.S. population will live near coastal waters. The need to reduce pollution from stormwater runoff therefore seems self-evident. It follows that verifying the extent to which existing and planned BMPs achieve this goal is of paramount importance. This is a task being undertaken on Long Island Sound, where recent studies show nonpoint source pollution, especially nitrogen, contributes significantly to the problem of eutrophication and the resulting oxygen depletion.

Periodic updates concerning project planning and data analyses will be presented in future issues of Coastlines. Project participants include the US EPA, CTDEP, Town of Waterford, researchers from the University of Connecticut, a property owner/developer, and a variety of public and private agencies and groups.

For more information about the Jordan Cove Urban Watershed, Section 319, National Monitoring Program Project, contact Bruce Morton at Aqua Solutions, 60 Burnside Avenue, East Hartford, CT 06108, (860)289-7664, fax: (860)289-7664.

construction;

5. reducing nitrogen export by 65% compared to current site planning practices and standards;
6. reducing bacterial export by 85% compared to current site planning standards and practices; and,
7. reducing phosphorus export by 40% compared to current site planning standards and practices.



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National Estuary Programs The Implementation Phase

In the life of a National Estuary Program, the development and acceptance of the Comprehensive Conservation and Management Plan (the CCMP) is a major step. Following that phase, however, as implementation of the CCMP looms, the Program often faces significant changes in administration and budget. Here are stories of how two Programs are facing those issues.

Delaware's Inland Bays: A New Model for Estuary Programming

Delaware's three small inland bays of Rehoboth, Indian River, and Little Assawomen cover a mere 32 square miles of surface water and are surrounded by a 300 square mile watershed. Remarkably, 40% of all residents of the US live within one day's drive of this area. The combination of existing residential development, extensive agricultural activity, and heavy seasonal tourism has significantly stressed the bays. The Comprehensive Conservation and Management Plan for these bays provided a means of coping with the impacts from this level of development. When it came time to implement the CCMP, the administrative structure evolved into the Center for the Inland Bays.

What makes this program unique is the Center's separate status as a non-profit, "neutral" forum. This organizational structure allows it to work toward a long-term, multi-user approach to conserving and preserving the resources of the bays. Thus, the Center is not a direct part of any state or federal agency, something which, in this setting, improves the ability to be flexible and fosters more public support.

Why a neutral, non-profit forum?

As in many states and counties, a significant number of citizens living near the Delaware Inland Bays are looking more toward voluntary measures for progress and less toward regulation. The local public would rather see educational measures as a first step prior to a government agency stepping in to force compliance. In the past, management of Delaware's Inland Bays was under the jurisdiction of the state's Department of Natural Resources and Environmental Control. Despite progress under this system, it became apparent that the public, agency leadership, and many others wanted to see a new approach to restoring the bays. To bring the agricultural sector, environmental groups, local civic leaders, tourists, scientists, and others together, the "Center for the Inland Bays" was conceived.

How was the Center formed and who controls it?

The Center was formed during the process of developing the Comprehensive Conservation and Management Plan (CCMP) and was sponsored by a local state representative. Establishment of the Center is credited to a core group of scientists, environmentalists, educators, farmers, and state leaders working along with US EPA officials. The Center's by-laws ensure diversity in representation. The Board of Directors includes Delaware's Secretaries of Agriculture and Natural Resources and Environmental Control, the Chairs of the Center's Scientific and Technical Advisory Committee, and the Citizen's Advocacy Committee, as well as representatives of county government, the local Conservation District, and citizens appointed by Delaware's House and Senate. This group provides a strong political component to the structure of the Center. As some might say, who better to have on your board than the key individuals in the state that influence, if not determine, environmental policy for the state?

What does the Center do?

The Center focuses on providing programs, educational outreach efforts, and demonstration projects to apply best management practices to solve problems in the Delaware Inland Bays. One project being attempted is to re-establish eel grass in shallow water areas. This submerged aquatic vegetation hasn't been seen in this environment since the 1970s. Eel grass provides habitat for fish and benthic invertebrates and filters excess nutrients out of the water. Another project focuses on teaching farmers new ways of measuring the amount of fertilizer needed on a field by using a chlorophyll meter. This device instantly provides a reading of the plant's chlorophyll levels and thus encourages farmers not to over-fertilize with nitrogen. Other demonstration projects focus on the preservation of watershed open space and farmland.

What about the future?

The Center is designed to take a long-term view. It will take years of hard work and community dedication to see that the goals and tactics of the CCMP are followed in regard to land use and water use planning. The Center needs to keep providing and expanding demonstration projects to show better ways of conserving the resources of the bay. The Center's organizational structure will provide the political will and bring the state's management resources together to ensure a cleaner, healthier ecosystem and watershed. Delaware's Inland Bays are providing a new model to emerging estuary programs of the future.

For further information, contact Dr. Bruce A. Richards, Executive Director, Center for the Inland Bays, P.O. Box 297, Nassau DE 19969, (302) 645-7325, fax: (302) 645-5765, E-mail: brichard@udel.edu.

Puget Sound's New Water Quality Protection Act

On July 1, 1996, the State of Washington changed the structure and strategy for protecting Puget Sound. The new approach is the result of the state's Puget Sound Water Quality Protection Act. Puget Sound was one of the first estuaries in the nation to be designated an "estuary of national significance" under the National Estuary Program (NEP). The Puget Sound Water Quality Authority's CCMP for comprehensively tackling water quality problems in the nation's second largest estuary was the first to receive EPA approval in 1991. In accordance with state law, the Authority went through a formal "sunset" review in 1994 and 1995 to examine the agency's mission and structure, and whether it should be abolished or continued. In 1995, Governor Mike Lowry introduced legislation to continue the Authority and its work. Proponents for terminating the Authority said that the agency had completed its mission of developing a comprehensive plan to protect Puget Sound. Others argued that, without the Authority, there would be no coordinated method for carrying out water quality protections called for under the Puget Sound Water Quality Management Plan.

After much deliberation during the course of two legislative sessions, the 1996 legislature did not reauthorize the Authority. Instead, the legislature passed a bill to create a 13-member Puget Sound Water Quality Action Team, comprised of the directors of state agencies involved in activities that affect Puget Sound, a city and a county representative, and a chair.

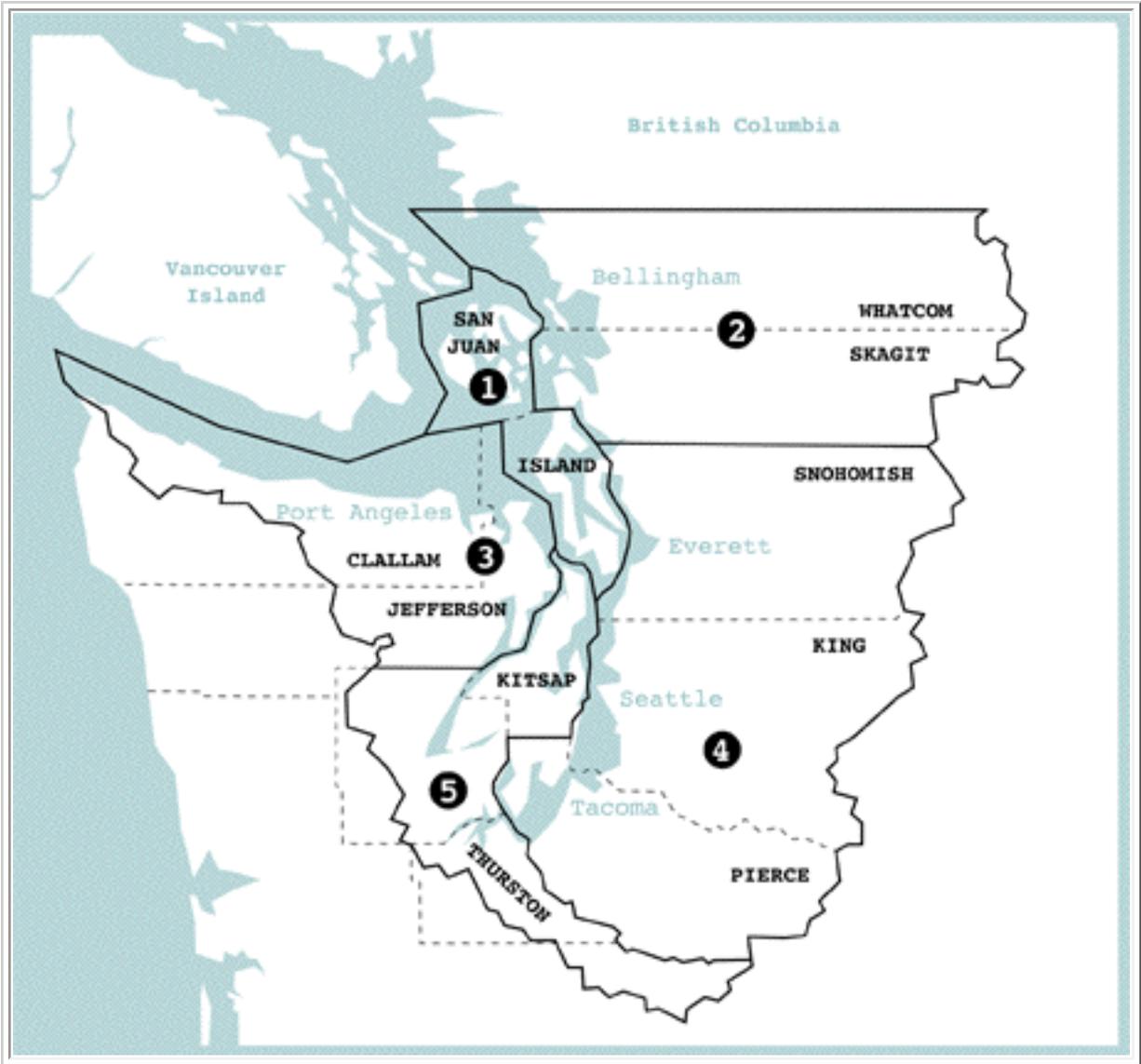
The bill also created a Puget Sound Council to advise the ActionTeam, made up of governor-appointed representatives from business, the environmental community, agriculture, the shellfish industry, counties, cities, and tribes. The Council also includes two legislators.

"We are turning a page in the history of protecting Puget Sound," said Nancy McKay, chair of the Action Team and former executive director of the Authority. "The legislature's intent was to strengthen water quality protection by helping state and local government implement the Puget Sound Plan." The legislature preserved many critical functions and programs of the Authority such as the Puget Sound Ambient Monitoring Program. The Authority staff now serves as support staff for the Action Team and

Council and is part of the Governor's Office.

Under the new approach, protection of Puget Sound's water quality and habitat will be driven by a two-year strategy. The Action Team's first priority is to develop a work plan, which will be based on the Puget Sound Plan, local priorities and other relevant activities which protect water quality and habitat. The work plan will be presented to the state legislature in January 1997.

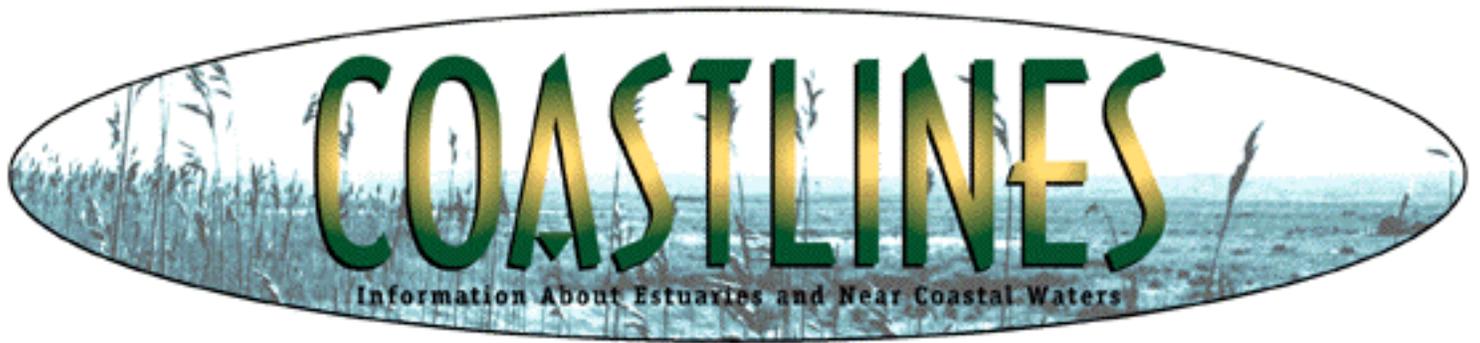
The new law identifies five geographic regions within Puget Sound and calls on the Action Team to identify and prioritize the local and state actions necessary to address water quality problems within each region. Water quality will be enhanced by providing regional technical assistance to help local governments implement the work plan. Every two years, the Action Team is required to prepare a new work plan which prioritizes local and state actions necessary to restore and protect the biological health and diversity of Puget Sound.



The distribution of the newly-identified, five geographic regions within the Puget Sound watershed

In addition to considering problems and priorities identified in local plans, such as watershed plans, the Action Team must coordinate work plan activities with other relevant activities, including state activities not funded through the Puget Sound Plan and watershed restoration activities. The Action Team is also required to develop a budget to sufficiently fund characterization of watersheds, technical assistance to local governments, state responsibilities in the work plan, implementation of the Puget Sound Ambient Monitoring Program, and support staff to the Action Team.

For more information about the Puget Sound Water Quality Action Team, contact Nancy McKay, Chair, at P.O. Box 40900, Olympia WA 98504-0900, (360) 407-7300, e-mail: jddpswqa@win.com, or Tom Cowan, External Relations Coordinator, at the same address, (360) 407-7330.



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Announcements

New Ecosystem Learning Center in Boston

The first in a series of Coastal America Ecosystem Learning Centers was officially designated at the New England Aquarium, Boston, MA in September. This program, to be expanded nation-wide, will establish a series of partnerships designed to allow federal agencies working in the coastal arena to "piggy-back" their public education and outreach efforts on those of established centers such as the Aquarium. Displays, sources of federal publications, and workshops are all planned for the Centers.

For more information about the Center at the New England Aquarium, contact William Hubbard of the New England Division of the Army Corps of Engineers at (617) 647-8381 (phone) or e-mail at william.a.hubbard@ned01.usace.army.mil.

For information about the program in general, contact Coastal America at 1305 East West Highway, Silver Spring, MD 20910.

Updated Boaters Guide Available

For those interested in safely navigating the Indian River Lagoon, the second edition of A Boater's Guide to the Indian River Lagoon is now available to the general public, including the 79,000 registered boaters in the lagoon region.

In addition to features offered in the first edition, such as marina locations and seagrass coverage, the second edition features several improvements. Included are full-color manatee protection zone maps and updated information about the changes in state and federal laws enforced by the Florida Marine Patrol in the lagoon region.

The Indian River Lagoon National Estuary Program spearheaded development and production of the guide. The publication is available by mail for \$3.25 with proceeds used for future reprintings. The boater's guide is also available at tax collection offices in Volusia, Brevard, St. Lucie, and Martin . In Indian River County, the publication is available at the Environmental Learning Center on Wabasso Island, 255 Live Oak Drive, Vero Beach.

For more information, please contact Johnnie Ainsley at the Indian River Lagoon National Estuary Program, 1900 South Harbor City Boulevard, Suite 109, Melbourne FL 32901, (407) 984-4950, fax: (407) 964-4937.

Indian River Lagoon gets CCMP Approval

County commissions from all five Indian River Lagoon region counties - Volusia, Brevard, Indian River, St. Lucie, and Martin - have approved proclamations of support for the Indian River Lagoon Comprehensive Conservation and Management Plan.

The plan, produced by the Indian River Lagoon National Estuary Program (IRLNEP), makes 69 major recommendations on ways citizens, local governments, and state and federal agencies can help clean up the lagoon. The plan details how municipalities can promote water and sediment quality improvements, living resources preservation, and restoration efforts. It also recommends enhancement of public and governmental involvement in protecting the lagoon.

"This level of support by local governments is very encouraging as we move to make the recommendations in the plan reality," said Derek S. Busby, Director of IRLNEP.

The plan represents a critical phase of the National Estuary Program, as it will facilitate important water quality improvement projects. Included are stormwater retrofits to redirect fresh water away from the lagoon and slow stormwater drainage, and construction of vital regional stormwater treatment ponds. The plan also seeks to reconnect mosquito impoundments and install baffle boxes in stormwater drains to trap sediments entering the lagoon.

The plan will be presented to the Governor late this summer for approval.

Direct queries to IRLNEP at 1900 South Harbor City Blvd., Suite 109, Melbourne, FL 32901, phone: (407) 984-4950 or 1-800-226-3747, fax: (407) 984-4937.

Woods Hole Oceanographic Institution Sea Grant Program Announces Availability of Publications Catalog

The Sea Grant Program of the Woods Hole Oceanographic Institution (WHOI) has just completed its first comprehensive publications catalog. The 80-page catalog lists nearly 600 marine scientific publications, including technical reports, fact sheets, journal articles, program guides, videos, books, and maps that have resulted from WHOI Sea Grant support since the inception of the program in 1971.

Single copies are available for a \$2 charge for postage and handling by contacting Tracy Crago, WHOI Sea Grant Communicator, WHOI, Woods Hole MA 02543, e-mail: tcrago@whoi.edu, or by calling (508) 289-2398.

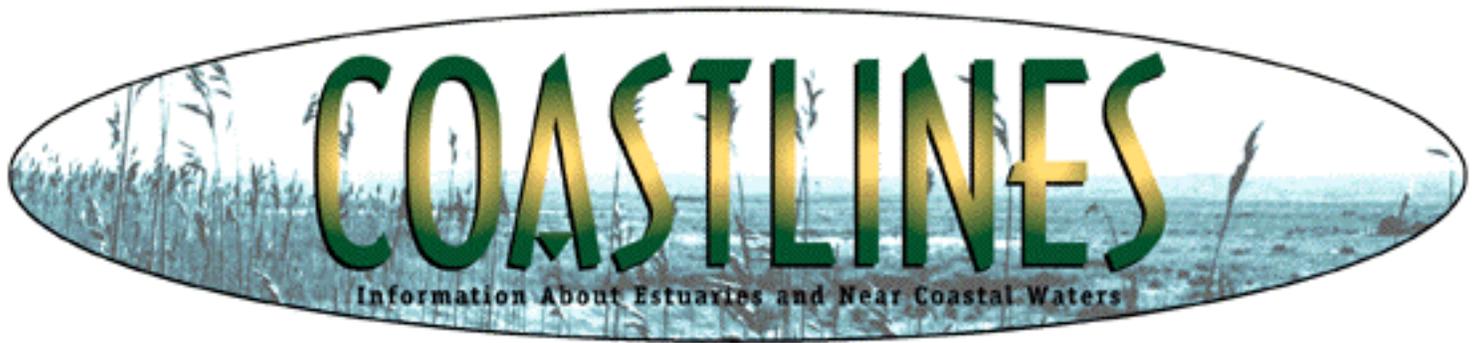
Video Available from Oregon State University

The Oregon State University Extension Service offers a video "*We All Live Downstream*", which should interest anyone who is concerned about healthy watersheds and clean water supplies. It explores how Oregon residents and government officials are trying to reduce nonpoint source pollution, but has implications for most every watershed in the country.

"We All Live Downstream"(VTP 021) is available for \$30.00 (includes shipping) by mail from Publications Orders, Extension and Experiment Station Communications, Oregon State University, 422 Kerr Administrative Services Building, Corvallis, OR, 97331-2119.

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Lolly, Lolly, Lolly, Get Your Web Sites Here!

A couple of issues back, we asked readers for interesting sites on the World Wide Web or other Internet activities they had come across. The following is a smattering of the responses. If you have a neat site that you have discovered, let us know at ed_coast@horsleywitten.com.

Watershed '96 Highlights now available on-line

A World Wide Web site has been established at which you can read or download almost all of the plenary presentations of this major conference, browse a photo album, or find links to related Web sites from Watershed '96. Point your browser to: <http://www.epa.gov/owow/watershed/w96index.html> [Link no longer available, January 2004]

Sea Grant Contacts

The National Sea Grant College Program World Wide Web site can be reached through the Sea Grant Media Relations site at: <http://www.mdsg.umd.edu/seagrantmediacenter/>. This provides connections to more than 30 plus Sea Grant Web sites around the United States.

Watershed Tools from EPA

A directory of watershed management tools is available from the US EPA at: <http://www.epa.gov/owow/watershed/tools>

Army Corps wetlands information

The US Army Corps of Engineers maintains a site related to wetlands, Corps regulations, and other information at <http://wetland.usace.mil/>

NOAA's Office of Ocean and Coastal Resource Management

NOAA's Office of Ocean and Coastal Resource Management is in the process of building a Web site which will allow browsers to access information related to a wide range of coastal management issues. When completed, the system will allow browsers to see what projects state coastal programs, National Estuarine Research Reserves and National Marine Sanctuaries are working on and read final reports of their work. The prototype can be reached at http://www-orca.nos.noaa.gov/coastal_zone

COASTNET

COASTNET is a network of people around the world interested in coastal management issues. Their e-mail messages are collected each day and sent in digest form to subscribers. If you want to find out about aquaculture of giant clams in Palau, the economics of sea level rise, or a special workshop on coastal management in South America, this is the place to go. To subscribe (for free) send an e-mail to listserv@uriacc.uri.edu and, in the text of the message (not the subject line), write: SUBSCRIBE COASTNET.

Chesapeake Bay (Virginia) Reserve provides Internet Training

The Chesapeake Bay National Estuarine Research Reserve in Virginia has been using the Internet for communication and information exchange for several years and has developed training programs and materials to introduce new or potential users to the techniques used in locating and transferring information via this resource. Over the past year they have trained more than 100 coastal resource managers in the basics of Internet communication.

Workshops have also been designed for those who already possess basic skills in Internet communications. Participants are led electronically to a variety of environmental information databases applicable to work in coastal resource management. They are also given training in forming efficient information searches, down-loading, and data handling procedures. All demonstrations are on-line.

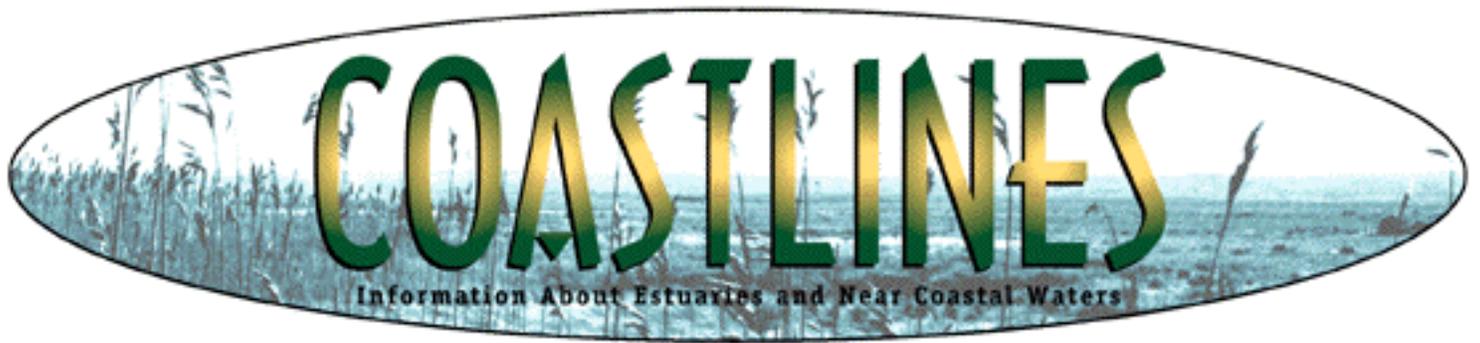
Reserve personnel have assembled a list of available sources for information useful to coastal managers and have created a special LINKS page on their homepage (<http://vims.edu/cbnerr/>) to address these concerns. This will allow resource managers to connect directly to needed information without having to do long searches and provide them with a "one-stop-shopping" method of gathering needed data.

For more information on these programs, please contact: David Niebuhr, Education Coordinator, Chesapeake Bay National Estuarine Research Reserve, P.O. Box 1346, Gloucester Pt, VA 23062, (804) 642-7144, fax: (804) 642-7120, e-mail: niebuhr@vims.edu.

Southwest Florida Water Management District and SWIM

The Surface Water Improvement and Management Program (SWIM) of the Southwest Florida Water Management District is now on the web and features several of their current projects related to coastal marsh restoration, stormwater retrofit, and watershed/waterbody modeling.

Their website is located at: <http://www.swfwmd.state.fl.us/>



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New Septic System Education Kits Available

The Padilla Bay National Estuarine Research Reserve has been developing an education project that addresses coastal nonpoint source pollution. It is intended for use nationally and will be aimed at watershed residents using septic systems.

Septic system failure is a significant issue for both human and environmental health and can result in contaminated drinking water supplies, closed shellfish beds, and eutrophication. Over one-third of the U.S. population uses septic systems resulting in more than 1 trillion gallons of water per year disposed of below the ground's surface.

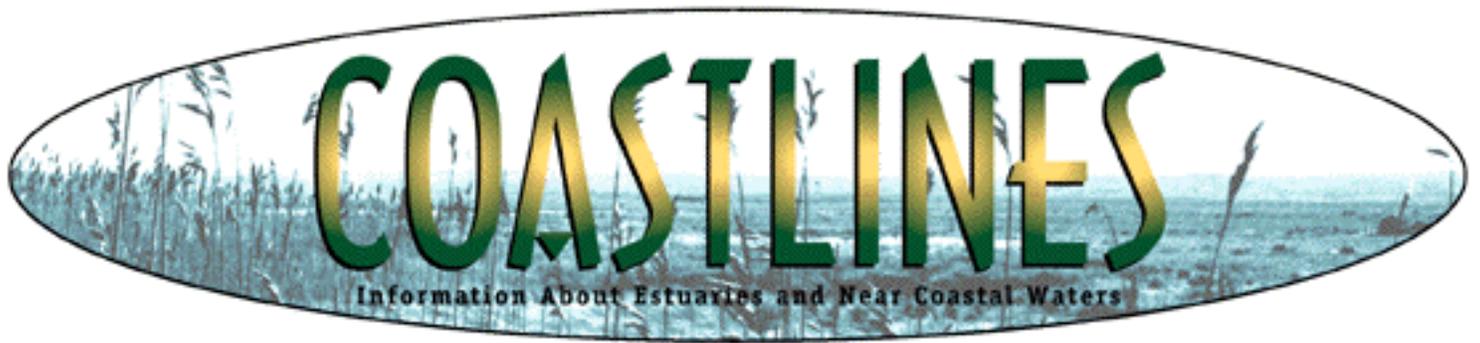
Failing septic systems may allow disease-bearing organisms to come in contact with water or food supplies for humans. A more subtle effect occurs when systems leak excessive nutrients to coastal waters. The nitrogen and phosphorus components function like fertilizers and can induce too much plant growth. Certain algae can become so abundant that they block sunlight in the water, shading and killing beneficial plants. As these plants disappear, so do the animals like salmon and crabs which depend on them. An excess of algae can also deplete the oxygen in the water, resulting in the death of fish and other animals. Algal blooms can either smother other, more beneficial, aquatic plants, or sufficiently shade them so that they don't develop to their full size and strength.

Since the project will be used nationally, Cathy Angell, designer of the project and Curriculum Specialist at the Reserve, has focused on universal "themes" helpful to septic system owners. These include care and maintenance of septic systems, reasons for failure, and health and environmental hazards of failing systems. One of the primary goals has been to make the information as accessible and user-friendly as possible.

The final product will be in the form of an education "kit" with various components that can be used selectively in different locations. The kit will include a slide show for group presentations, workshop outlines, color posters that remind people to pump their systems regularly, videos and written information on various types of systems, and a fact sheet series that addresses system care, maintenance, and health hazards. The kit will also include information about social marketing, setting up workshops, and working in partnership with the community and other agencies. A tabletop septic system model has been designed for use at workshops and displays which will be available.

The Septic System Education Kits should be available by December 1996.

For more information, please contact Cathy Angell at the Padilla Bay NERR, 1043 Bay View-Edison Road, Mount Vernon, WA 98273, (360) 428-1558, fax: (360) 428-1491, e-mail: cangell@padillabay.gov



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COASTLINES

Information About Estuaries and Near Coastal Waters

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Please let us know how we are doing, if you have something you would like to include in an issue, or what we can do to make *Coastlines* even better as we go along. You can contact us at:

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