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Information About Estuaries and Near Coastal Waters Fall 1994, Volume 4, Number 4

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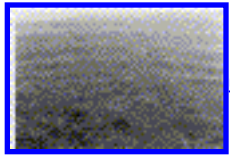
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Seagrasses as a Primary Indicator of Water Quality

Sep-Oct Coastlines 10/4/94

Seagrasses serve as a good indicator of water quality because they are so sensitive to change, and they are so visible. "Light penetration into estuarine waters is critical to seagrasses," said Bob Day, Program Scientist at the IRLNEP. "Algal growth due to high nutrient levels in the water, turbidity, and colored water from freshwater flows all lessen the amount of light that reaches the grasses and therefore impact their growth."

In the [Indian River Lagoon National Estuary Program](#) (IRLNEP), seagrasses are the only indicator used to measure water quality changes, and in the [Tampa Bay National Estuary Program](#) (TBNEP) they are the primary indicator. They are also a primary indicator in the Chesapeake Bay restoration effort.



[Seagrass Beds in the Indian River Lagoon](#)

Courtesy of the Indian River Lagoon NEP

Some of the activities responsible for the decreased water quality include dredge and fill projects, nonpoint source pollution from road runoff, septic systems, and agricultural practices, and turbidity from boat propellers. "The Indian River Lagoon has experienced significant urban growth throughout much of the region and also receives large amounts of fresh water input in the southern portion of the Lagoon that are related to agricultural activities," explained Day. "And along with those developments has come a decline in seagrasses." Losses during the past few decades have been as high as 100 percent in some areas, according to Day.

In addition to serving as a good indicator of water quality, seagrasses are also important for their functions in the marine environment. "Seagrasses provide critical habitat for many estuarine species, including fish, crabs, and shrimp," said Holly Greening, Program Scientist at the TBNEP. "Small fish use the grasses as a nursery and adults feed in them, while crabs, shrimp, mollusks, and other marine creatures attach themselves to the grasses to feed or hide," explained Greening.

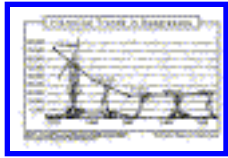
Tracking the historical trends in seagrasses based on aerial photo interpretation has been well documented in the TBNEP. As the accompanying figure shows, seagrass acreage declined from more than 76,000 to about 40,000 acres between 1870 and 1950. And from 1950 to 1980 the decline continued its downward trend to a low point of about 21,000 acres.



[Coastal wetland](#)

"Since 1988 we have seen an increase of about 2,000 acres, probably due at least in part to decreases in nitrogen levels in the water, which leads to decreases in algal growth, and ultimately to clearer water," explained Greening. "We know that algal levels have decreased dramatically since 1985, and when 20 to 25 percent of the 'incident light' hitting the surface of the water penetrates to the bottom, seagrasses can grow again."

Restoration of 15,000 acres during the next 20 years is a goal of the TBNEP. "One of the most significant aspects of this approach is that we are using a living resource as a major indicator of the Bay's health rather than simply measuring changes in water quality," said Greening. "If the seagrasses are returning and, importantly, functioning as habitat for many marine creatures, then we know that the overall health of the water must be good. The seagrasses themselves tell us about nitrogen levels, and the marine creatures tell us about other issues such as dissolved oxygen and pesticides."



[Graph of Historical Trends in Seagrasses](#)

At the IRLNEP, Day agrees that the use of a living resource has many benefits. "This is something that the average person can see and touch," said Day. "The City of Melbourne stopped wastewater treatment plant discharges of about eight million gallons per day into the Lagoon in the late 1980s. In recent years, scientists studying the Lagoon and residents in the area have noticed clearer water and expanding seagrass beds. These water quality and habitat improvements will benefit both sport and commercial fishing, which are important elements of the area's economy."

For further information, contact Bob Day at the IRLNEP, (407) 984-4950, or Holly Greening at the TBNEP, (813) 893-2765.

Chesapeake Bay Seagrasses Up 85%

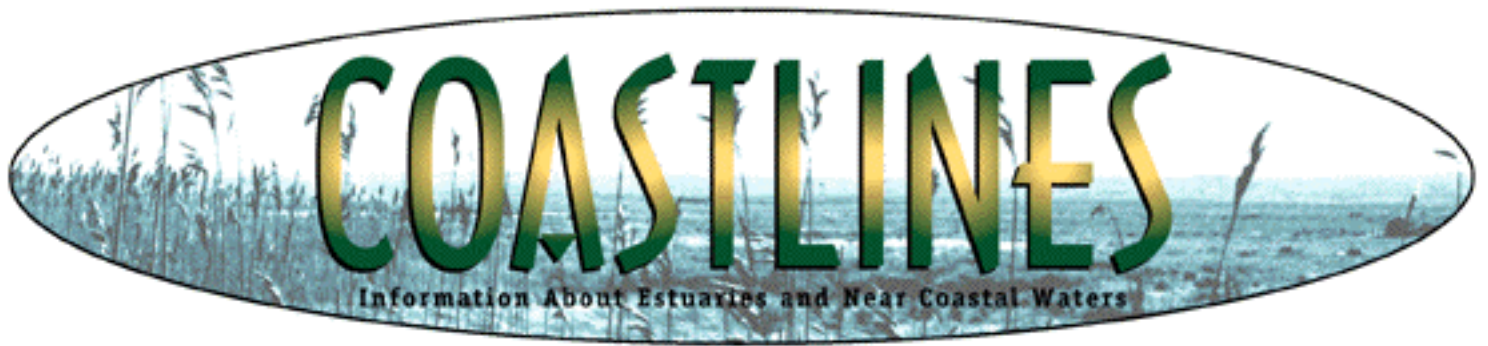
In 1984, Chesapeake Bay reached a historical low of 38,000 acres of seagrasses, but by 1992 there were more than 70,000 acres, an increase of 85 percent in eight years.

Initial data for 1993 indicate that Bay grasses continue to expand and grow more densely on many existing beds. Grasses also have spread to areas within the Bay and the Potomac River, where they have not been seen for several decades.

The Chesapeake Bay Program (CBP), the multigovernmental partnership committed to restoring the Bay, is working toward an interim recovery goal of 114,000 acres, a level that will be reached by the year 2005 at the current rate of growth. This goal, agreed to by the CBP partners in 1993, represents the areas in the Bay watershed that have been vegetated at one time or another since the early 1970's, when complete mapping of grasses in the Bay began.

Program scientists and managers estimate that underwater grasses might have covered 400,000 acres of the Bay watershed at one time. Based on this potential, the Program is developing new recovery goals for the future beyond 114,000 acres.

Information courtesy of the Chesapeake Bay Program.



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GIS and NEMO Join Forces

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Reduction of polluted runoff can only be achieved through informed land use decisions at the local level. Based on that conviction, a three-year project entitled "Nonpoint Education for Municipal Officials" (NEMO) began in Connecticut in the fall of 1991. Working with three towns along the Connecticut coast, NEMO is aimed at devising useful ways to help teach local officials about the links between land use and water quality.

The pilot project is using GIS (Geographic Information System) technology to teach officials (volunteer commissioners are the primary audience) about nonpoint source water pollution. According to Chester L. Arnold, Jr., NEMO Project Manager, influencing municipal land use decisions in water quality issues is very difficult. "The limited time that most people can devote to this one issue in the course of their routine duties, combined with the high turnover rate typically experienced by municipal commissioners, adds an additional challenge to the education process."

"However," continued Arnold, "the recent proliferation of new federal and state nonpoint laws and programs has underscored the growing need for local officials to be knowledgeable about the causes,

effects, and management of polluted runoff."

With GIS, the NEMO project has produced maps to help show local officials the connections between the water systems and current land uses in their communities. Images of topography and drainage systems are used to emphasize the water cycle, the watershed concept, and the need for watershed management. Then, ground and aerial photos plus land use data are used to portray current land use patterns and pollution problems. Finally, using the community's present zoning regulations, a "buildout" scenario is developed to show the possible land use patterns and resultant pollution problems that might arise if future development follows the growth blueprint created by zoning.

Based on these scenarios, and benefiting from GIS images that show the relationship of a town's land use to its water quality in a dramatic and understandable way, officials are able to develop new plans and strategies in their day-to-day land use decisions. "By using GIS, we are applying the principle of 'A picture is worth a thousand words' to the education process," said Arnold.



[Map of Waterford, Connecticut imperviousness buildout](#)

Courtesy Univ. of CT. Dept. of Nat. Res. Mgmt. & Engr.

The NEMO team believes that by retaining their focus on devising an effective educational package, rather than on using their GIS capabilities primarily for data analysis, a program of practical use to local decision makers will emerge, and will be effective in helping to manage nonpoint source pollution.

While the main focus of the NEMO project at this time is to pursue further work in the pilot towns, there is also a desire to broaden the scope to a national level. "Others are encouraged to use our program as a template or as a catalyst to begin similar programs," said Arnold. "Also, we may offer a training course and/or a 'cookbook' in the future. We have had a great many requests from across the country, and we are very interested in helping those people."

NEMO is funded by the Extension Service (ES) of the U.S Department of Agriculture, and is the first of a number of ES projects around the nation directed at helping to protect the water quality of estuaries of national importance. NEMO is a project of the University of Connecticut Cooperative Extension System, in cooperation with the Connecticut Sea Grant College Program and the University's Department of Natural Resources Management and Engineering. The project has a number of publications available, and a 12-minute videotape on nonpoint source pollution suitable for the general public. For further information, contact Chester Arnold at (203) 789-7865; fax (203) 789-6461.

NEMO's Goal

To develop a process for educating professional and volunteer municipal officials about the impacts of land use on water quality and about the options available for managing those impacts.



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Shorewatch - Coastal Issues In Your Living Room

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Local cable access television stations across Massachusetts are now broadcasting a series of programs on coastal issues thanks to a joint project of the Massachusetts Coastal Zone Management (MCZM) office and the Woods Hole Oceanographic Institution (WHOI) Sea Grant Program.

In only 18 months, Shorewatch: A Forum for Coastal Issues and Outreach, has grown to a potential audience of more than one million people in 70 communities across eastern Massachusetts, according to Tracey Crago of the WHOI Sea Grant Program. Also, the manager of a local access station in Santa Barbara, California, learned of the series and has begun showing it in that area.



[Coastal Scene](#)

Photo Courtesy Bruce Morgan

More than 60 videotapes have been obtained from local videographers and from groups across the country. The U.S. Fish and Wildlife Service production "Plight of the Plover" deals with the conflict of wildlife habitat and recreational use. Alaska Sea Grant teamed up with the U.S. Coast Guard to produce a three part educational series on fisheries safety and survival, while the U.S. EPA funded a local production called "Turning the Tide: Keeping Pollution at Bay" that describes pollution sources and impacts to water quality in Buzzards Bay, Massachusetts, and highlights the successes of local and regional initiatives that are working towards improvement.

Identifying sources of videotapes and then obtaining them either at no cost or at an affordable cost has been a time intensive effort, according to Crago and project partner Pam Rubinoff of MCZM. Sometimes it has been necessary to obtain the rights to show a videotape that has licensing arrangements handled by a large organization such as Turner Broadcasting System, Inc., which can be a very involved process. Many of the videotapes included in the Shorewatch series have been obtained from EPA, U.S. Fish and Wildlife Service, and the National Oceanic and Atmospheric Administration (NOAA), parent to both Sea Grant and MCZM.

"Reaching people who are watching television in the comfort of their own homes is a great way to get the information out there," said Rubinoff. "A lot of the videos are management oriented, and a lot of the viewers are local officials and involved citizens, so we're reaching an important audience in this way." Another way of reaching local citizens with the videotapes has been to make them available to schools, local town boards, and other interested groups.

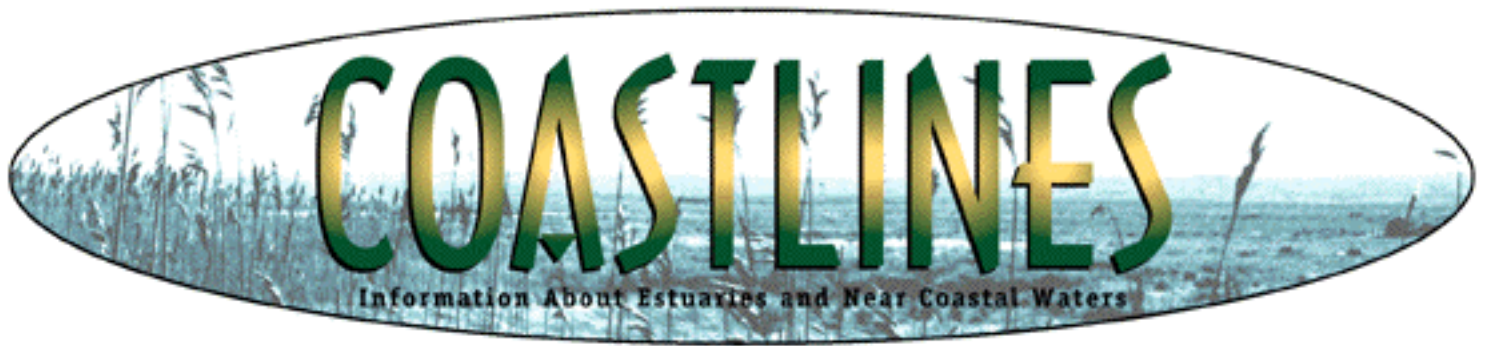
One goal of the program is to produce more local shows. A cable station on Cape Cod has provided considerable amounts of advice, time, and assistance, and a few productions have been completed in their studio using a talk show format. Interviews have been conducted with people involved in coastal issues, including U.S. Representative Gerry Studds, Chairman of the House Committee on Merchant Marine and Fisheries, and John Bullard, Director of NOAA's Office of Sustainable Development and Intergovernmental Affairs.

Doing more local productions in the studio will benefit the series by allowing current local issues to be addressed in conjunction with the videotapes, and satellite time (which is being pursued) will help by cutting down significantly on dubbing and mailing costs, but the most important long-term challenge of the series is to continue acquiring new videotapes at reasonable cost. To meet this need, both Crago and Rubinoff are constantly in search of new or previously untapped productions dealing with coastal and environmental issues.

"All of the program managers at the community cable stations have been extremely cooperative, supportive, and flexible," said Crago. "A key to the success of the series is that so many producers and environmental organizations throughout the country have graciously donated their productions at no charge and without restrictions - often multiple copies. The generosity and willingness of groups and

individuals to cooperate for the sake of educating and informing the public about various coastal and marine issues continues to amaze us."

For more information on Shorewatch, or if you know of any videotapes that may be suitable for the series, contact Tracey Crago at the WHOI Sea Grant Program, (508) 457-2000, ext. 2665.



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Pollution in Portland Harbor - 1800s Style

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What do the 1876 Bird's Eye Map of Portland, Maine, and a current analysis of pollutants in Portland Harbor have to do with each other? Potentially everything.

An unusual study conducted for the [Casco Bay Estuary Project](#) provides comprehensive data on historic sources of pollution that may help explain the types and quantities of pollutants found in a recent sediment study of Casco Bay.

"Many people point fingers at visible, point sources of pollution in Portland, such as oil terminals," said Lee Doggett, Technical Advisor to the Casco Bay Estuary Project. "This study of historic sources of pollution helps people see the bigger picture, which includes the consideration that pollution in the harbor may be due to uses along the shore as many as 50 or 100 years ago."



[A sardine cannery in Portland Harbor in the late 1800s. Lead has been identified as the primary contaminant.](#)

Photo Courtesy Casco Bay Estuary Project

Another reason for doing the study was to obtain more information on parcels of land along and near the harbor that are presently vacant. For instance, one large waterfront parcel is known to be highly contaminated with coal tar from an historic use. Development of that site and others like it could lead to the release of large amounts of toxic materials into the harbor, according to Doggett. With stormwater runoff identified as a major concern by those developing the Comprehensive Conservation and Management Plan (CCMP) for Casco Bay, it was decided that conducting the historic pollution study would be a prudent step in evaluating all potential sources of contaminants.

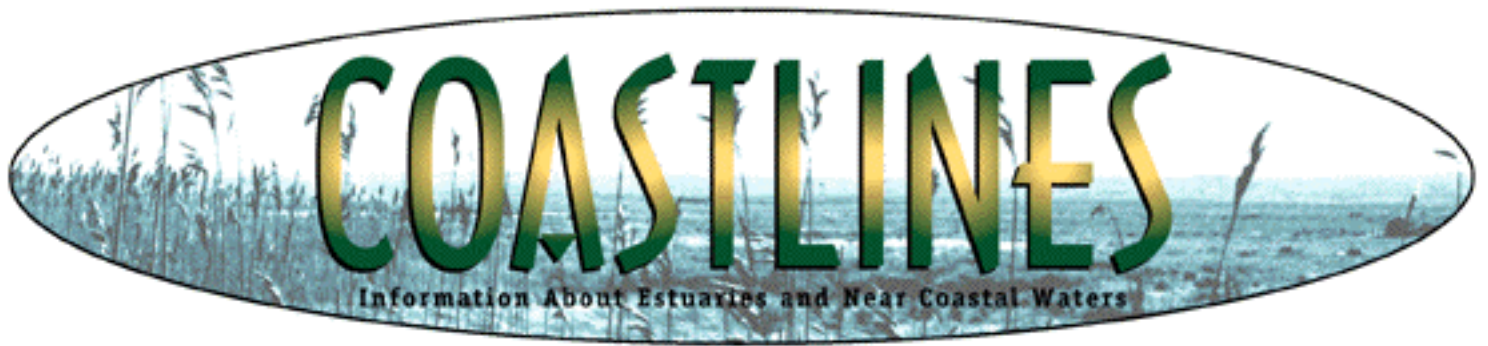
Historian Edward L. Hawes, Ph.D., painstakingly reviewed the 1876 Bird's Eye Map of Portland, as well as Sanborn insurance maps, old photographs, newspaper stories on microfilm, old business directories, and maps of sewer systems showing key lines with directions of flow and outfalls, to get a sense of the documentary evidence of the area.

Equipped with maps and other materials and knowledge, Hawes went into the field to search for additional evidence. Patterns of industry and commerce were identified, sometimes by using street names as clues, or the location of railroad yards. All of the data were recorded on topographic maps and then Geographic Information System maps.

This information can then be used to make a determination of what the likely pollutants are at the sites or in the nearby watercourses. The information has been given to the Maine Department of Environmental Protection, Oil and Hazardous Waste Bureau. According to Doggett, the Department has located underground fuel tanks that were never removed from the sites of abandoned gas stations.

The historic sources inventory may also help explain the origin of some contaminants in the harbor that have recently been discovered. "In some cases, there is no known existing source for a contaminant. In other cases, there may be an industry that is meeting its permit requirements but contaminants have been found in that area. The historic sources study provides us with another possible explanation for those contaminants," explained Doggett.

For further information on this project, including learning how to do a "dirty history", contact Anne Payson, Public Outreach Coordinator for the Casco Bay Estuary Project, (207) 828-1043; fax (207) 828-4001.



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EPA Renews Commitment to the Coastal America Partnership

On July 12, 1994, Robert Perciasepe, Assistant Administrator for EPA's Office of Water, announced a renewed and strengthened federal commitment to protect, preserve and restore the Nation's coastal ecosystems. EPA is one of ten federal agencies that signed an updated Memorandum of Understanding (MOU) that defines this unique collaborative partnership called Coastal America.

Over the past two years, the Coastal America partnership has provided an excellent opportunity for EPA to accomplish many of its major objectives during this time of limited resources. Today, there are more than 90 action-oriented projects underway in 23 States involving over 200 non-Federal organizations. Working together, the partnership has restored thousands of acres of wetlands; reestablished spawning streams for anadromous fish; reduced agricultural non-point source pollution; and protected several endangered species of fish, birds and marine mammals.

The purpose of Coastal America is to:

- Protect, preserve and restore the Nation's coastal ecosystems through existing federal capabilities

and authorities;

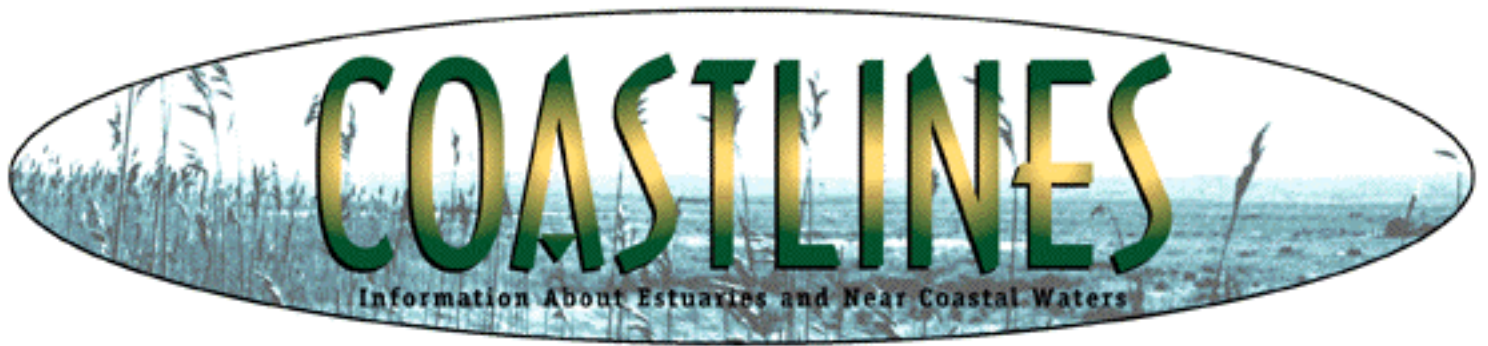
- Collaborate and cooperate in the stewardship of coastal living resources by working in partnership with other federal programs and integrating federal actions with state, local, and non-governmental efforts; and
- Provide a framework for action by focusing agency expertise and resources and producing environmental results.

The Coastal America partnership is an effective approach for helping this Administration achieve its goal of creating a government that works better and costs less.

EPA's objectives in the Coastal America partnership are to:

- Ensure that senior EPA managers who can commit resources participate in the Coastal America national and regional teams;
- Participate in all appropriate activities of the partnership, e.g., technical assistance and education/outreach efforts;
- Give high operational and funding priority to projects that meet EPA criteria and have been endorsed by Coastal America, particularly those that also contribute to the Administration's Sustainable Development and Ecosystem Management Initiatives; and
- Seek opportunities for collaborative partnership efforts and identify available funding for integration under Coastal America.

For more information on Coastal America, please contact Marian Mlay, Director of the Oceans and Coastal Protection Division, at (202) 260-1953, or Betsy Tam of her staff at (202) 260-6466.



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U.S. EPA Reference Handbook for Local Officials

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"We all know that environmental law - and therefore environmental regulation - is growing more and more complicated. It's even complicated to find out what the rules are. Local officials have pointed out that the right information has been very difficult to find, and then when they do find it, it's very confusing." Carol Browner, U.S. EPA Administrator, wrote those words in the Preface to *A Guide to Federal Environmental Requirements for Small Governments*, published in September 1993.

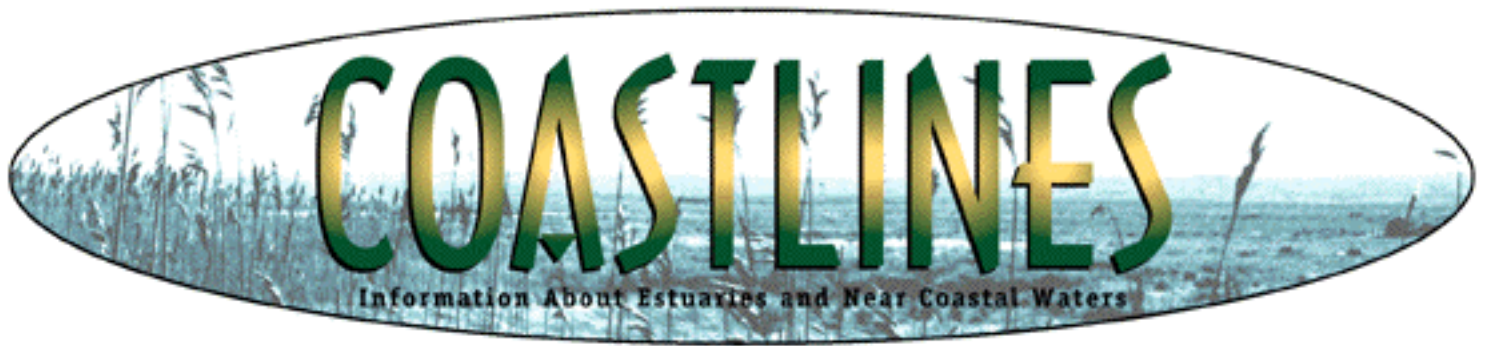
The reference handbook is intended to help local officials become familiar with requirements that may apply to their jurisdictions, and to explain the information in a simple, straightforward way. The guide is divided into sections on water, waste, toxics, air, voluntary programs, and phone contacts. The use of "if" statements and questions serve to aid the reader in quickly finding the relevant section(s) of the document.

For instance, "If your government operates or contracts for public landfill and/or hazardous waste

disposal, see pages 32 to 36." Within each individual topic, there are questions such as "Does the coliform monitoring rule apply to my community?" The answer to that particular question is yes for every community public water system, which is then followed by sections on timetables, maximum contaminant levels, monitoring requirements, and actions the community should be taking.

The term "small governments" is not specifically defined in the document. Instead, it is recognized that small governments come in many sizes and shapes, from small cities to villages to tiny unincorporated hamlets. And the levels of environmental services that they provide may differ significantly, from extensive infrastructure to a very limited range of services. But regardless of the type of community or level of services, the publication will help the reader understand who is responsible for what regarding environmental requirements for small governments.

The document, *A Guide to Federal Environmental Requirements for Small Governments*, can be purchased for \$7.50 from the U.S. Government Printing Office, (202) 783-3238. The document number is 055-000-00459-5.



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Vessel Pumpout and Estuary Health

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In Waquoit Bay, Massachusetts, boaters can now call Marine VHF Channel 9, and a vessel from Little River Boatyard will come out to the boater's location and pump out the holding tank for five dollars. Or, boaters can go to Edwards Boatyard on the Bay where an attendant will quickly empty tanks for the same five dollar charge.



[The National Pumpout Symbol](#)

In nearby Buzzards Bay, one of the goals of the Comprehensive Conservation and Management Plan (CCMP) of the [Buzzards Bay Project](#) is to achieve No Discharge Area status from EPA for all embayments. "The discharge of sewage from boats is a potential risk to human health and to shellfish," said Dr. Joseph Costa, Director of the Buzzards Bay Project. "This form of pollution degrades water quality by introducing microbial pathogens into the environment and by increasing biological oxygen

demand."

Studies conducted in Puget Sound, Long Island Sound, Narragansett Bay, and Chesapeake Bay have confirmed that boats can be a significant source of fecal coliform bacteria in coastal waters, particularly in areas with high boat densities and low hydrologic flushing. Swimming beaches and shellfish beds may be closed if coliform levels exceed designated thresholds. The major pathogens are bacteria and viruses, and the most commonly reported ailment is acute gastroenteritis.

While Buzzards Bay began working towards its goal several years ago, harbors and bays across the nation are now benefitting from the Clean Vessel Act Pumpout Grant Program, authorized by the Clean Vessel Act of 1992. Designed to provide federal money to coastal states for the construction and maintenance of pumpout station and waste reception facilities for recreational boat holding tanks and portable toilets, the program is now in the third year of a five-year run. Funded from the Sport Fish Restoration Account of the U.S. Fish and Wildlife Service, up to \$40.2 million will be made available to states over the five-year period. (During the Fiscal Year 1995 season, \$7.5 million was available. The deadline for FY 1996 applications is May 1, 1995.)



[Marina scene](#)

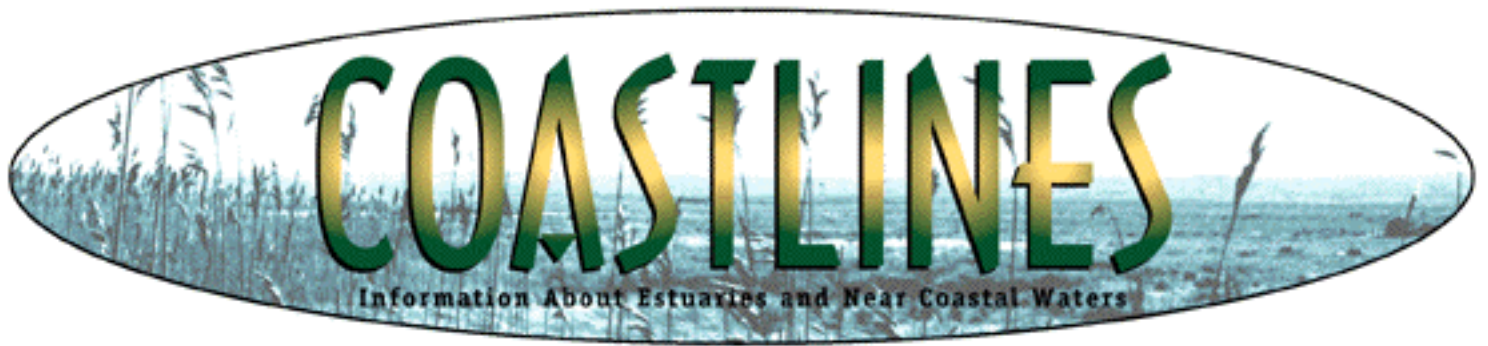
Photo Courtesy Bruce Morgan

Projects selected by the Fish and Wildlife Service for 1994 included surveys and plans in 28 states, construction of 538 pumpout stations and 127 dump stations in 29 states, and education programs in 31 states.

According to Joel Salter of EPA, public outreach funds are available to produce informational materials such as signage at marinas, brochures containing information on the availability of facilities, and the relevant laws pertaining to the handling of vessel waste in a particular area. "NEPs (National Estuary Programs) are a good vehicle for educating the public on the benefits of this program for all citizens, and the ease of use for boaters," said Salter. "Implementation of the program will benefit estuaries and the users of estuaries by improving water quality, which will lead to safer swimming waters and the reopening of shellfish beds in many areas."

For copies of the rule providing the requirements for participation in the Clean Vessel Act Pumpout Grant Program, mail a request to the Division of Federal Aid, Fish and Wildlife Service, U.S. Department of the Interior, Room 140, 4401 North Fairfax Drive, Arlington, Virginia 22203.

For further information on the Clean Vessel Act Pumpout Grant Program, contact Joel Salter of EPA, (202) 260-8484.



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Calling all Barrier Islands

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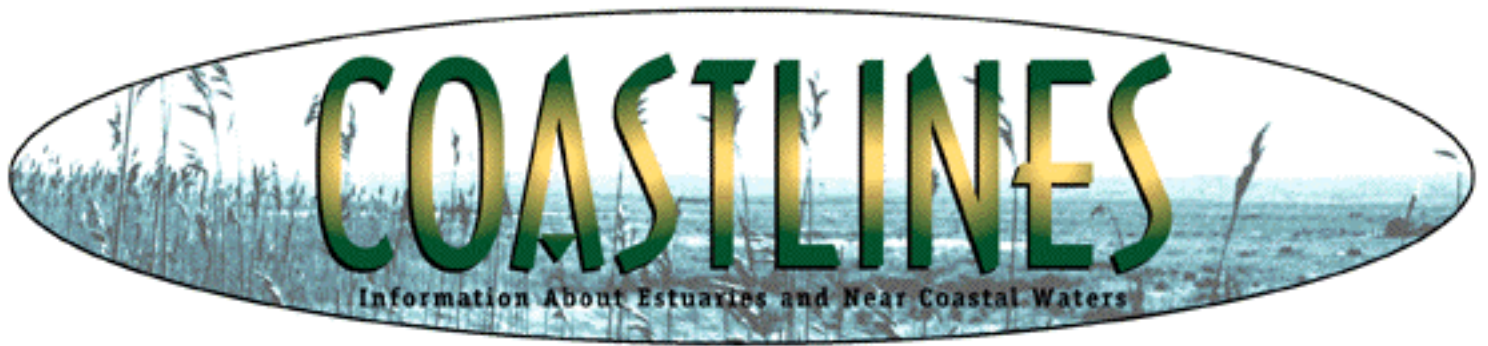
It's called BIONET, and its goal is to link as many barrier island communities together as possible by computer network. BIONET, which stands for Barrier Island Ocean Watch Network, is a project of the Alliance for a Living Ocean (ALO), a New Jersey ocean conservation organization. Because ALO is located on a barrier island, it has a particular interest in issues such as ocean conservation, protection of seashore animal habitats, dune protection, and living on barrier islands in an ecologically responsible way.

So far, the search to determine interest in joining the BIONET has resulted in 55 barrier island communities in ten states having been contacted, largely due to the assistance of Professor Stephen P. Leatherman, Director of the University of Maryland's Laboratory for Coastal Research and a barrier island specialist. The 55 that have been contacted are:

New York - Fire Island Pines; New Jersey - Barnegat Light, Harvey Cedars, Surf City, Ship Bottom, Beach Haven, Brigantine, Atlantic City, Ventnor, Margate, Longport, Ocean City, Strathmere, Sea Isle City, Avalon, Stone Harbor, Wildwood, and Cape May; Maryland/Virginia - Assateague Island; N.

Carolina - Hatteras and Carolina Beach Island; S. Carolina - Isle of Palms, Edisto and Folly Beaches, Seabrook, Kiawah, Sullivan's and Hilton Head Islands; Georgia - Tybee, St. Simons, and Jekyll Islands; Alabama - Dauphin Island; Florida (west coast) - Moreno Point, Sand, Pardee, Anna Maria, Longboat, Siesta, Casey and Long Keys, St. George, Clearwater Beach, Treasure, Honeymoon, Captiva, Sanibel, Estero, Bonita Beach, and Marco Islands; Texas - Port Aransas, Galveston, Follets, Mustang, North and South Padre Islands.

If you know of any other barrier island communities that would be interested in being included, please contact the ALO by e-mail through the Colorado Center for Environmental Management Bulletin Board by dialing (800) 677-4184. Announcements have also been placed on the EcoNet system.



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From Christmas Trees to Marshland

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The June-July 1993 issue of *Coastlines* reported on a project in Jefferson Parish, Louisiana, where 130,000 donated Christmas trees were being used to construct marshland in abandoned water canals. According to Marnie Winter, Director of the Jefferson Parish Environmental and Development Control Department, all signs indicate that the goals of the project will be met and even exceeded. Her status report follows.

Our preeminent goal, creation of floating marsh in abandoned oil field canals, is becoming evident in two test canals as compared with an adjacent canal that is being used as a control. The two test canals received fertilizer in 1993, while in 1994 only one canal is being fertilized on a regular basis. Water quality is being monitored by regular sampling for salinity, dissolved oxygen, pH, phosphate, nitrate, and alkalinity.

In the spring of 1994, during our botanical survey, it was noted that emergent marsh had begun to form along the banklines of all cells in one of the canals (each canal is divided into four cells by brush fences), and in the middle of one cell in the same canal. It was expected that marsh would form at the banklines

first because that is the shallowest point, but the Christmas trees placed in the middle of the canal have already formed a base that allows for floating marsh attachment.

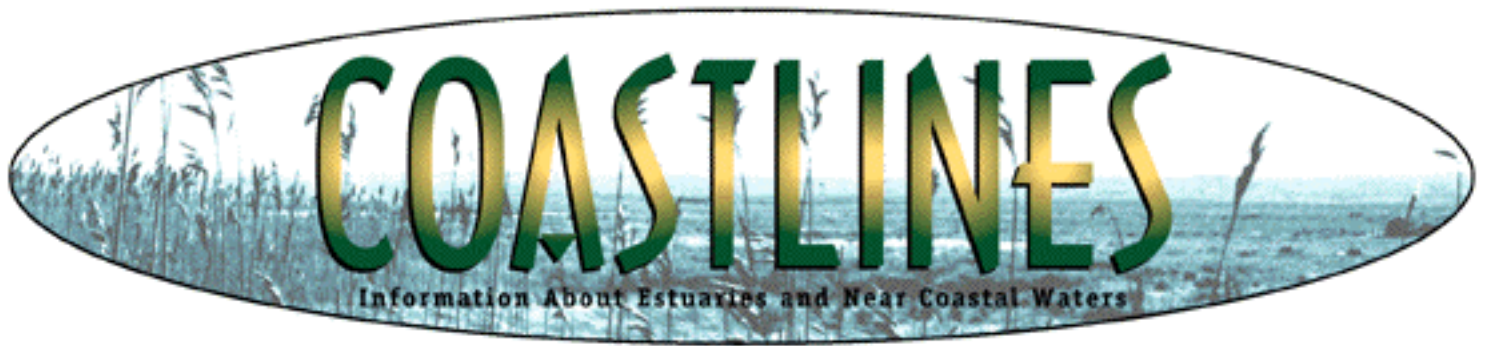
All cells of the other test canal have prolific growth of alligator weed and water hyacinths, yet also have the greatest amount of vegetative diversity. Duck potato, bull tongue, milfoils, and duckweed are common within each cell, and wild rice and cattails are common at the shoreline. Snakes, alligators, birds, frogs, ducks, and many insects are also inhabiting the newly formed marsh.

The key to success is the matrix of brush that forms the cells and provides nature its first link in the floating marsh process - a passive anchorage. This anchorage restrains the vegetation and prevents breakup of the mat. Large birds, including egrets and cranes, are readily supported on the newly formed mat. We feel confident that, barring a major hurricane, this project will exceed expectations by its conclusion in the spring of 1995.

For further information, contact Marnie Winter, Director, Jefferson Parish Environmental and Development Control Department, (504) 838-4230.

For more information on the Barataria-Terrebonne NEP, click [here](#)

Note: Photo of ducks nesting in Christmas trees to go with article.



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Remote Sensing in Estuarine Education

Sep-Oct Coastlines 1 10/4/94

Nonpoint source pollution and trends in agriculture are being studied in a lofty way in Ohio's Old Woman Creek watershed on Lake Erie. Aerial photographs are serving as a basic source of information for scientists, and as a platform for public outreach and education for those people involved in several types of work at the Old Woman Creek National Estuarine Research Reserve.

"When we show both old and recent photos to farmers, it provides us with a forum to discuss land use changes that have occurred on the farm," said Linda Feix, Education Coordinator at Old Woman Creek. "Once we have interested a landowner in the photos, it's easy to begin discussions about water quality and best management practices."

Photos also graphically convey the concept of a watershed, according to Feix. "It is often easier for people to grasp the concept of a watershed when they are looking at aerial photographs, as opposed to maps and standard explanations of what a watershed is."

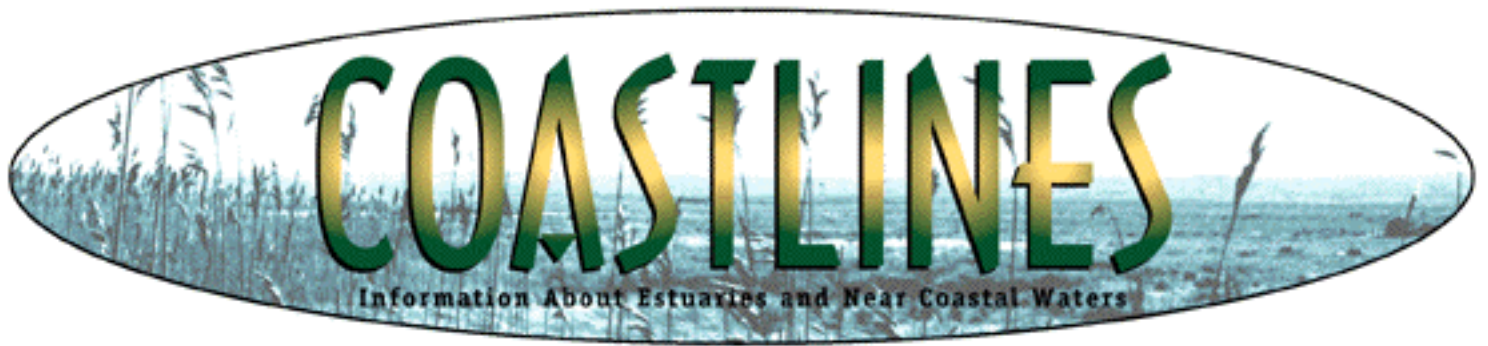
The photos are also being used by scientists and planners to identify potential sources of pollution, such

as landfills, open construction areas, pipelines, storage tanks, and dump sites. Careful scrutiny of stereoscopic sets of aerial photos, land use and land cover maps, classification coding systems for land use and land cover identification, and base maps of a study site allows for a very detailed and accurate inventory and analysis of an area.

Comparing photos from two time periods allows for additional analysis. "The photos are a tool for us to monitor changes and activities in the environment over time by determining the amount and types of change from one decade to another," said Feix. "That quantification of the information allows us to possibly anticipate hot spots of pollution in the watershed."

Finally, at a time when it seems that almost everyone is using a Geographic Information System(GIS), it is important to recognize that not everyone has GIS, according to Feix. "Not everybody has access to GIS, but aerial photos are available to just about everybody," said Feix. "And if you learn how to read all of the information that they contain, the photos provide a wealth of valuable data."

For further information, contact Linda Feix at the Old Woman Creek National Estuarine Research Reserve, (419) 433-4601.



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New Policy on Combined Sewer Overflows

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EPA estimates that combined sewer overflows (CSOs), which occur when older sewer systems discharge raw sewage and stormwater directly into watercourses during major storm events, annually discharge 1,200 billion gallons into streams, lakes, and estuaries across the country. CSOs have been linked to beach and shellfish bed closures, human health problems, fish kills, and high drinking water treatment costs.

On April 11, 1994, EPA announced a new national policy to control CSOs, giving communities the flexibility necessary to find affordable solutions to the problem. The policy, negotiated with municipalities, environmental groups, and states, is expected to prompt communities to commit to long-term strategies that will reduce raw discharges from CSOs by at least 85 percent.

Under the policy, states are encouraged to coordinate the CSO planning process with the review and revision of state water quality standards. Also, municipalities would use a targeted approach, giving

highest priority to environmentally sensitive receiving waters. The policy instructs municipalities to work with EPA, states, and water quality groups to develop long-term CSO control plans, evaluate control options, and select a workable approach. Finally, the policy notes that the financial capability of a municipality may be considered in the development of a CSO control implementation schedule.

About 1,100 communities, mostly in the northeast and Great Lakes area, will be affected by the new policy. According to EPA, the policy will be incorporated into National Pollutant Discharge Elimination System (NPDES) permits or "other appropriate enforcement mechanisms."

"This policy is one of the Administration's Clean Water Act reauthorization initiatives," said EPA Administrator Carol Browner. "A new Clean Water Act containing a policy like this will strengthen environmental protection, [and] improve state and local flexibility." To obtain a copy of "The Combined Sewer Overflow Control Policy," Federal Register Notice 59 FR 18688 (EPA 830-Z-94-001), contact NCEPI, 11029 Kenwood Rd., Bldg. 5, Cincinnati, OH 45242; fax (513) 891-6685.

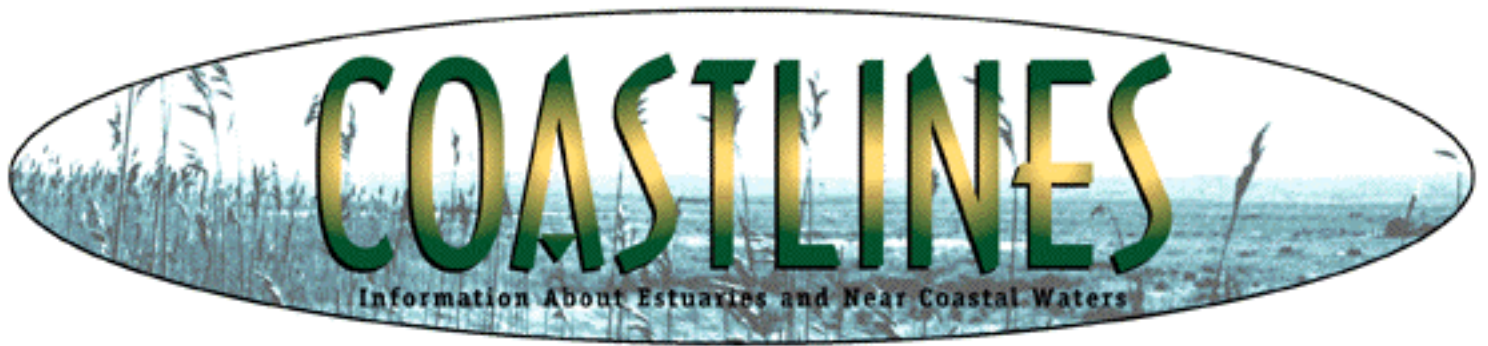
For more information on CSOs, contact Jeff Lape, EPA Office of Wastewater Enforcement and Compliance, (202) 260-7361.

Sidebar:

Key Components of the Policy

Under the policy, municipalities would immediately implement nine minimum controls:

- Proper operation and regular maintenance programs for the sewer system and CSOs.
- Maximum use of the collection system for storage.
- Review and modification of pretreatment requirements to assure CSO impacts are minimized.
- Maximization of flow to the municipal sewage treatment plant for treatment.
- Prohibition of CSOs during dry weather.
- Control of solid and floatable materials in CSOs.
- Pollution prevention.
- Public notice to ensure that the public receives adequate notification of CSO occurrences and impacts.
- Monitoring to effectively characterize CSO impacts and the efficacy of CSO controls.



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Improving Stewardship on Private Lands

Sep-Oct Coastlines 1 10/4/94

The future of wetlands is closely linked to land use decisions made by the stewards of the resource, and more than 75 percent of the remaining wetlands in the U.S. are on private lands. Working with state, county, and local governments, as well as private groups, EPA is developing a program to encourage wetlands stewardship on private lands.

More than 54 percent (about 117 million acres) of the nation's original wetlands no longer exist, and, according to U.S. Fish and Wildlife Service figures, about 290,000 acres are being lost each year due to human (e.g., agriculture and dredge and fill) and natural (e.g., Louisiana subsidence) causes. Due to the vital ecological and socioeconomic benefits and functions now known to be associated with wetlands, an effective national stewardship strategy is needed.

The August 1993 Clinton Administration Wetlands Plan strongly encourages cooperative efforts with private landowners to reduce reliance on regulatory programs as the primary means to protect wetlands resources, and to accomplish long-term wetlands gains. Collaborative efforts can help landowners to conserve wetlands resources while meeting their personal management and financial objectives.

As the result of a pilot project in 1992, the "Private Landowner's Wetlands Assistance Guide: Voluntary Options for Wetlands Stewardship in Maryland," was written as a cooperative venture by EPA, Maryland Cooperative Extension Service, and over a dozen other agencies and private organizations. The Guide is a comprehensive document of federal, state, and private nonprofit programs offering technical and/or financial assistance to private wetland owners within the state of Maryland.

State and county governments from around the country have expressed enthusiasm for, and interest in, the project. Several states have obtained the Guide on diskette as a template for developing their own guides. The California Coastal Conservancy has already developed a draft of their own *Wetlands Assistance Guide*, and has been conducting workshops for landowners through the central valley.

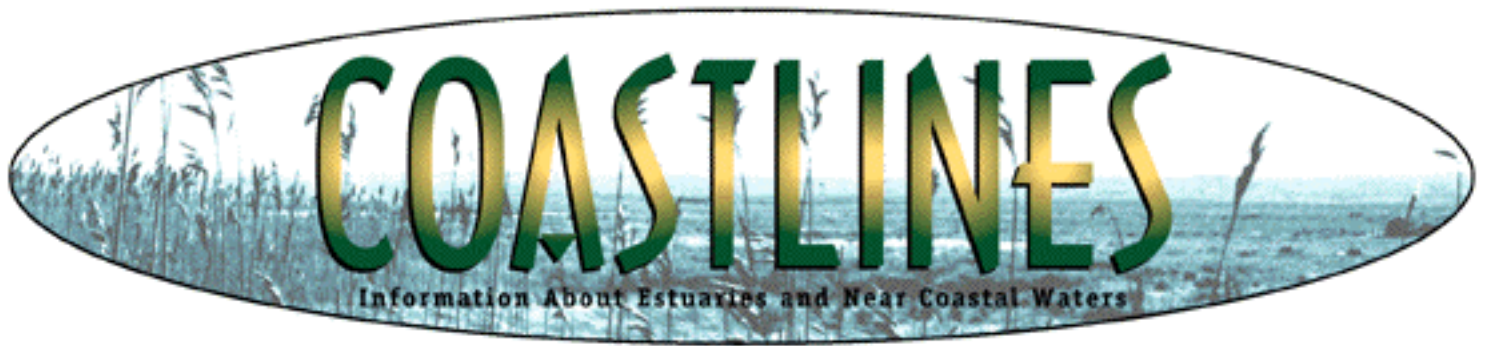
"The Guide developed in Maryland has served as a good template for California," said Jane Freeman, Environmental Protection Specialist for EPA in California. "We have revised it to reflect the way things work here, and added a few case studies to make it more tangible to the landowners that we are trying to reach."

The National Wetlands Conservation Alliance, consisting of government and private nonprofit groups, has formed to promote wetlands conservation and restoration and to assist EPA in developing a national strategy. "Our purpose is to promote a non-regulatory approach to wetlands protection, restoration, and conservation," said Gene Whitaker of the Alliance.

Efforts at the Alliance are geared to people who work directly with landowners. "In order to be truly effective, we need to reach the landowners of wetlands, and they trust those who work most closely with them," said Whitaker. The Alliance has established programs in Oregon, Arkansas, and Ohio, and has entered discussions with four other states.

The goal of the program is to ensure that government programs serve the interests of all those who view natural resource stewardship as an integral component of their management objectives.

For more information on wetlands private land projects, contact Marjorie Wesley of EPA in Portland, Oregon, at (503) 326-3250, or Gene Whitaker of the National Wetlands Conservation Alliance in Washington, D.C., at (202) 547-6223. For copies of the Guide, contact the Wetlands Protection Hotline, (800) 832-7828.



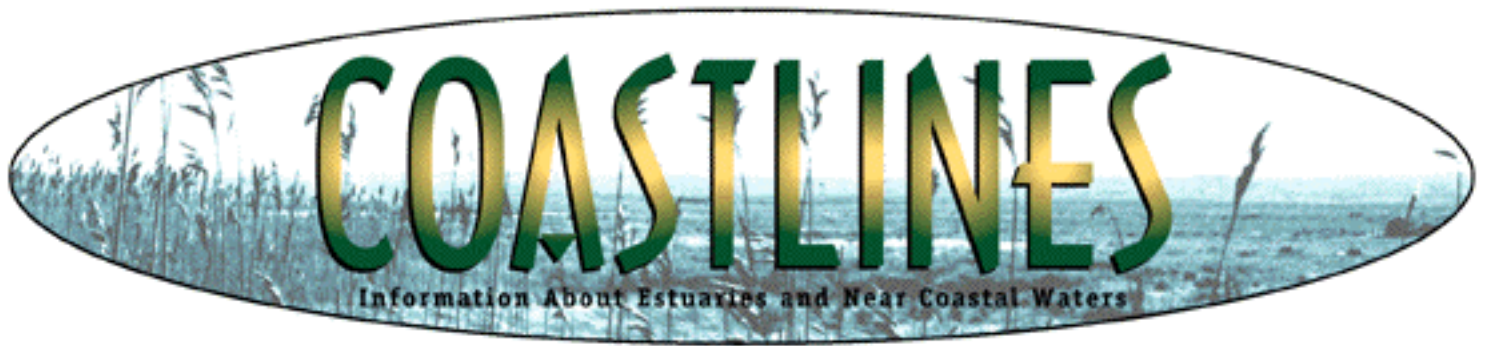
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Coastlines on Internet

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Beginning with this issue, *Coastlines* can be accessed on the Internet. For those people with the capability to receive information on the Internet, access to the EPA World Wide Web server is available through the following Universal Resource Locator: <http://www.epa.gov>. On the EPA home page, click on the NEP logo to get to Coastlines.



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Information Exchange

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Tillamook Bay Looking for GIS info

The [Tillamook Bay National Estuary Project](#) (TBNEP) is seeking information about the development of Geographic Information Systems (GIS) that integrate estuarine and watershed data. The Project is particularly interested in: 1) data management and QA/QC protocols relative to collection of data for use in the GIS and data transfers to the GIS; 2) experiences creating stream reach data layers linked to fisheries and aquatic habitat data; and 3) experience with public access to GIS through "hands-on" computer demos or satellite stations.

TBNEP is also seeking information on the development of bay circulation models. The Project needs examples of performance criteria for models and "accessible" models that communicate relatively complex processes to the public visually; also, information about technical problems likely to be encountered during modelling would be helpful. Finally, the Project is looking for technical experts who would be willing to review contract proposals.

If you have any information for the TBNEP, please contact Marilyn Sigman, Director, TBNEP, 4000 Blimp Blvd., Tillamook, OR 97141, (503) 842-9922; fax (503) 842-3680; email: MSIGMAN@til3.oes.orst.edu.

Delaware Inland Bays requests info on regulations and laws on phosphorus limits

The [Delaware Inland Bays Estuary Program](#) Citizens Advisory Committee is considering the introduction of a bill to limit the phosphorus content in detergents and other cleaning agents. Committee members would appreciate learning of existing laws and regulations in other states, or efforts currently underway to limit the phosphorus content of cleaning agents and thereby ultimately reduce phosphorus loadings to estuaries. Any background information regarding the basis for phosphorus limits, cost-effective alternatives to detergents that contain phosphorus, and results of cost/benefit analyses would be extremely helpful.

Please send information to John Schneider, Program Manager, Inland Bays Estuary Program, c/o DNREC, 89 Kings Highway, P.O. Box 1401, Dover, DE 19903, (302) 739-4590, fax (302) 739-6140.



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Publications

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Clean Water in Your Watershed: A Citizens Guide to Watershed Protection. (\$19.95, 90 pp., 1994). By Susan Alexander for the Terrene Institute, developed in cooperation with EPA Region 6. Written as a stimulus and tool for citizens involved in watershed protection, it focuses on easy and affordable citizens activities that can help local, state, and federal agencies design and complete a watershed protection or restoration project tailored to specific communities. The guide shows how to identify problems that threaten or degrade the watershed, gives people the vocabulary and direction needed to articulate possible solutions, and serves as a locator or map of agencies to contact for funds and technical assistance. Available from the Terrene Institute, 1717 K Street, NW, Suite 801, Washington, DC 20006-1504; (202) 833-8317; fax (202) 296-4071.

Distribution and Abundance of Fishes and Invertebrates in Mid-Atlantic Estuaries. (280 pp., March 1994). *Distribution and Abundance of Fishes and Invertebrates in North Atlantic Estuaries.* (May 1994). By the National Oceanic and Atmospheric Administration's Estuarine Living Marine Resources Program. The main purpose of these publications is to develop a framework that integrates information on marine and estuarine species and their associated habitats into a comprehensive and consistent structure. Three

salinity zones, as defined in NOAA's National Estuarine Inventory, provide the spatial framework for organizing information on species distribution and abundance within each estuary. A data sheet is developed for each species in each estuary, including information on spatial distribution by salinity zone, temporal distribution by life history stage, and relative abundance level. Available free of charge from David M. Nelson, Marine Resource Specialist at NOAA, (301) 713-1000 x 182; fax (301) 713-4384; or, Steven H. Jury, Marine Resource Specialist at NOAA, (301) 713-3000 x 185.

Global Marine Biological Diversity: A Strategy for Building Conservation into Decision Making. (\$50 hardcover, \$27.50 paperback, 350 pp., October 1993). This volume focuses on threats to life in the sea and ways to save, study, and use that life sustainably. The work of more than 100 expert contributors, from marine biologists and oceanographers to economists and government officials, this book presents the most up-to-date information and views on the challenge of conserving the living sea and how that challenge can be met. Developed by the Center for Marine Conservation and available from Island Press, Box 7, Covelo, CA 95428; 1 (800) 828-1302; fax (707) 983-6432.

Making Development Sustainable. (\$45 hardcover, \$22 paperback, 380 pp., 1992). Edited by Johan Holmberg. This book presents an integrated series of essays on the policies for sustainable development from the International Institute for Environment and Development. Available from Island Press, Box 7, Covelo, CA 95428; 1 (800) 828-1302; fax (707) 983-6432.

Beyond the Estuary: The Importance of Upstream Wetlands in Estuary Processes. (8 pp., June 1990). An EPA publication that identifies the types of wetlands that are located above estuaries, and briefly outlines the functions those areas perform. Also describes the relationships between these upstream wetland functions and estuarine processes, and the activities threatening the upstream wetlands and mechanisms for their protection. Available free of charge from the EPA Wetlands Protection Hotline, 1 (800) 832-7828.

Natural Wetlands and Urban Stormwater: Potential Impacts and Management. (76 pp., Feb. 1993). An EPA publication that describes issues related to the impacts of uncontrolled stormwater and urban runoff on natural wetlands. The document also explores various recommended options for managing these systems. Available free of charge from the EPA Wetlands Protection Hotline, 1 (800) 832-7828.

Aquatic Toxicology. (\$60, 512 pp., February 1994). Edited by Donald C. Malins and Gary K. Ostrander. Examines findings from recent research on the chronic effects of pollutants on aquatic species. Features research from renowned experts in the field. Targeted to aquatic toxicologists, aquatic biologists, fisheries scientists, industrial chemists, and researchers at federal, state, and university levels. Available from CRC Press, 1 (800) 272-7737; fax 1 (800) 374-3401.

Implementing a Stormwater Management Program. (\$59.95, 192 pp., January 1994). By David S. Pyzoha. Presents a four-step, common sense approach that describes how to create and implement a successful stormwater management program. Includes problem identification, program conception and creation, and final implementation using the fundamental elements of policy creation, institutional planning, technical planning, financial planning, and public involvement and awareness. Available from

CRC Press, 1 (800) 272-7737; fax 1 (800) 374-3401.

Pathobiology of Marine and Estuarine Organisms. (\$84.95, 576 pp., 1993). Edited by John A. Couch and John W. Fournie. This comprehensive review of aquatic animal pathobiology covers infectious and non-infectious diseases of vertebrates such as marine mammals and fishes, in addition to diseases of invertebrates such as crustacea, mollusks, and lower phyla. The book emphasizes pollution-associated diseases and includes a review on the effects of pollution on marine mammals. Available from CRC Press, 1 (800) 272-7737; fax 1 (800) 374-3401.

Restoration of Aquatic Ecosystems. (\$39.95, 567 pp., 1992). By the National Research Council. Outlines a national strategy for aquatic restoration, with practical recommendations covering both the desired scope and scale of projects and needed government action. Case studies of aquatic restoration activities throughout the country are featured. Available from Island Press, Box 7, Covelo, CA 95428; 1 (800) 828-1302; fax (707) 983-6432.

The Clean Water Act Twenty Years Later. (\$55 hardcover, \$29.95 paperback, 350 pp., October 1993). By Robert W. Adler, Jessica C. Landman, and Diane M. Cameron of the Natural Resources Defense Council. Explores the issues associated with the complex subject of water quality protection in this assessment of the successes and failures of the Clean Water Act over the past twenty years. In addition to examining traditional indicators of water quality, the authors also consider how health concerns of the public have been addressed, and present a detailed examination of the ecological health of our waters. Available from Island Press, Box 7, Covelo, CA 95428; 1 (800) 828-1302; fax (707) 983-6432.

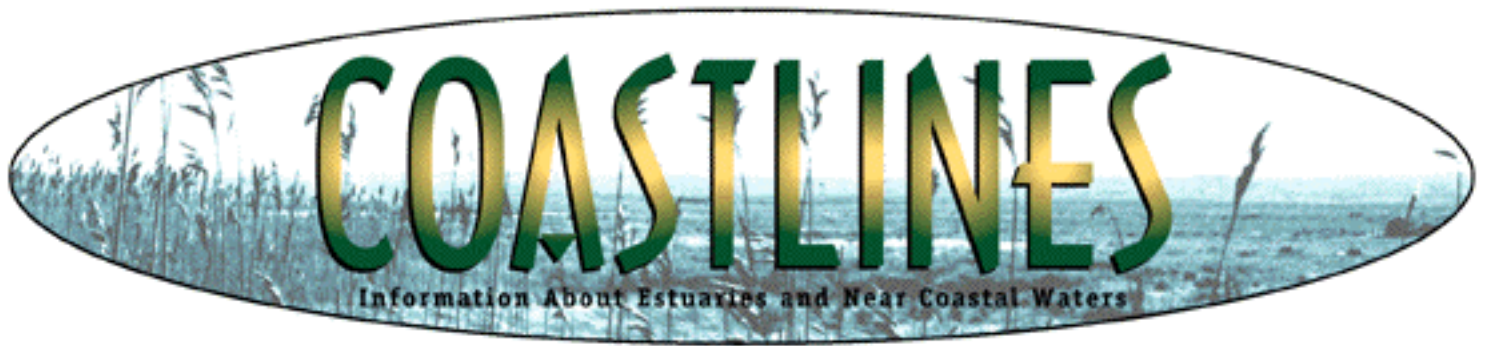
Wetlands and Coastal Zone Regulation and Compliance. (\$125, 208 pp., 1993). By Stephen M. Silverberg and Mark S. Dennison. This book reviews federal and state coastal zone regulations and fresh and tidal wetlands laws within the context of other environmental and administrative mandates and procedures. It outlines successful strategies for obtaining permits, taking into account the complicated interplay of federal and state regulations. Available from Island Press, Box 7, Covelo, CA 95428; 1 (800) 828-1302; fax (707) 983-6432.

Fundraising, Hands-On Tactics for Nonprofit Groups. (\$32.95 hardcover, \$16.95 paperback, 336 pp., 1993). By L. Peter Edles. This hands-on operation manual shows nonprofit professionals and volunteers how to design and run successful fund raising campaigns for their organizations. It shares insider tips for training solicitors, cultivating donors, and organizing gift drives that capture the emotions and imaginations of potential supporters. Available from Island Press, Box 7, Covelo, CA 95428; 1 (800) 828-1302; fax (707) 983-6432.

Protecting Coastal and Wetlands Resources: A Guide for Local Governments. (187 pp., April 1992). A hands-on guide designed to help elected officials and concerned citizens from coastal communities learn about a variety of approaches for managing their coastal and wetlands resources. The guide contains a comprehensive review of resource management and planning tools as well as 19 case studies. Available free of charge from NCEPI, 11029 Kenwood Road, Building 5, Cincinnati, OH 45242. Ask for document EPA842-R-92-002.

Agriculture and the Environment. (4 fact sheets, August 1993). A folder containing fact sheets that address watershed management and nonpoint source pollution in agricultural areas. Available free of charge from NCEPI, 11029 Kenwood Road, Building 5, Cincinnati, OH 45242. Ask for document EPA842-R-92-002.

Xeriscape Landscaping: Preventing Pollution and Using Resources Wisely. (April 1993). Describes landscaping and gardening methods that promote pollution prevention, water conservation, and sustainable resources, including public/private partnerships to promote resource efficient landscaping. Available free of charge from NCEPI, 11029 Kenwood Road, Building 5, Cincinnati, OH 45242. Ask for document EPA842-R-92-002.



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Calendar

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October 16-20

Water Environment Federation's 67th Annual Conference and Exposition. Chicago, Illinois. Topic of the conference is surface water quality and ecology. Sessions include "Coastal Water Quality Issues," "Environmental Monitoring and Assessment," "Sediment Quality Criteria Issues," and "Watershed Management in the Great Lakes." Contact Maureen Novotne, Water Environment Federation, 601 Wythe Street, Alexandria, VA 22314-1994; (703) 684-2400.

October 25-26

Management and Protection of Estuaries, Wetlands, and Coastal Waters: Tools for Local Governments. Narragansett, Rhode Island. Sponsored by EPA's Office of Wetlands, Oceans, and Watersheds, Oceans and Coastal Protection Division. The workshop is directed to officials of local government and high-level staff of planning, public works, and environmental affairs departments who will explore numerous comprehensive planning tools that can be used to achieve a balance of economic prosperity and coastal and wetland resource protection. Contact Macara Lousberg, U.S. EPA OWOW, (202) 260-9109; fax (202) 260-9960.

October 29-November 2

The 7th National Conference of Land Trusts. Chattanooga, Tennessee. The Land Trust Alliance's National Rally '94 is the largest land conservation conference in the country and the only national conference for and about land trusts. The audience includes land trust practitioners, lawyers, appraisers, planners, consultants, landowners, and government agency personnel at the local, state, and federal levels. Topics include creative financing, fund raising, outreach, nonprofit management, stewardship, legal issues, and land use. For more information, contact the Land Trust Alliance, (202) 638-4725; fax (202) 638-4730.

October 31-November 3

1994 International Hazardous Material Spills Conference. The Hyatt Regency Hotel and Convention Center, Buffalo, New York. The conference theme is "partnerships for hazardous materials safety" and will provide an opportunity for communities, state and local governments, industry, and international guests to learn more about how to prevent, prepare for, and respond to hazardous materials accidents. To receive registration materials, contact Ms. Angela Moody at (703) 442-9824. For questions regarding the conference, contact Ms. Sarah Bauer, (202) 260-8247.

November 6-10

American Water Resources Association 30th Annual Conference and Symposia - "National Symposium on Water Quality," "Symposium on National Water Quality Assessment (NAWQA)," and "Symposium on the Future Quality of the Great Lakes". The Fairmont Hotel at Illinois Center, Chicago, Illinois. The conference will provide a multi-disciplinary technical look at many new techniques for hydrologic investigation and water resources management. A forum will be provided for exchange of information and ideas from international as well as national scientists and engineers. There will be 17 technical sessions, with approximately 150 papers expected. Registration: AWRA, (301) 493-8600; fax (301) 493-5844.

November 17-18

Management and Protection of Estuaries, Wetlands, and Coastal Waters: Tools for Local Governments. Monterey, California. Sponsored by EPA's Office of Wetlands, Oceans, and Watersheds, Oceans and Coastal Protection Division. The workshop is directed to officials of local government and high-level staff of planning, public works, and environmental affairs departments who will explore numerous comprehensive planning tools that can be used to achieve a balance of economic prosperity and coastal and wetland resource protection. Contact Macara Lousberg, U.S. EPA OWOW, (202) 260-9109; fax (202) 260-9960.

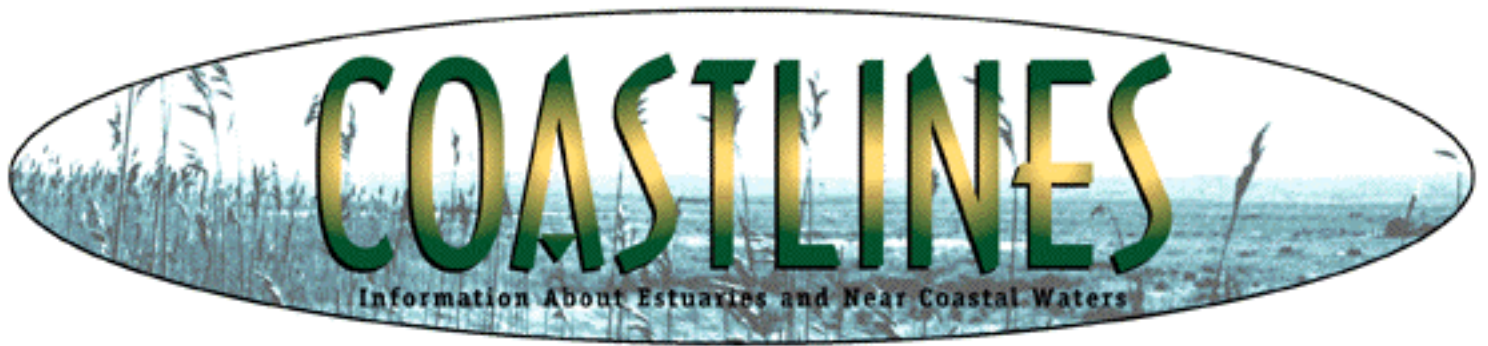
December 11-13

Seventh International Symposium on Individual and Small Community Sewage Systems. Atlanta, Georgia. The purpose of the symposium is to provide an opportunity for anyone with significant or important information on individual or small community sewage treatment to share their research and discuss critical issues with colleagues. Sponsored by the American Society of

Agricultural Engineers in cooperation with several organizations, including the National Small Flows Clearinghouse. Topics include: constructed wetlands, fate of contaminants, design and evaluation of innovative and alternative systems, and multi-state approaches to standards for on-site sewage treatment. Contact Michael Hoover, Ph.D., Department of Soil Science, Box 7619, North Carolina State University, Raleigh, NC 27620; (919) 515-3285; fax (919) 515-2167.

April 3-7, 1995

Technology Advances for Wetlands Science. Clarion Hotel, New Orleans, Louisiana. This national interagency workshop on wetlands is sponsored by the U.S. Army Corps of Engineers as part of the Wetlands Research Program. The theme emphasizes how research impacts wetlands technology and management strategies and how wetlands will be perceived by the public and wetlands professionals in the future. Additional information is available from the U.S. Army Engineer Waterways Experiment Station, (601) 634-2569; fax (601) 634-3664.



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Center for the Inland Bays

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Coast to Coast

The State of Delaware recently adopted the Inland Bays Watershed Enhancement Act, a long-term approach to planning designed to preserve and protect some of Delaware's most valuable natural resources. The Act establishes a non-profit "Center for the Inland Bays" to oversee the implementation of the Comprehensive Conservation and Management Plan developed by the Delaware Inland Bays National Estuary Program.

The [Inland Bays Estuary Program](#) Scientific and Technical Advisory Committee (STAC) and the Citizens Advisory Committee (CAC) will serve as formal advisory bodies to the seven-member Board of Directors. EPA and other federal agencies may serve as non-voting, Ex-Officio members. An Executive Director will prepare work plans and budgets, develop and carry out agreements of the Center, and oversee administration, among other responsibilities.

The Center will serve as a focal point through which all state agencies, Sussex County, and local governments will coordinate efforts to protect and improve the Bays. The Center will be able to receive and distribute grants and other funding to support wise use and enhancement efforts including:

- Educating users of the Bays to encourage stewardship;
- Encouraging and supporting voluntary actions such as the use of Best Management Practices by farmers and developers; and
- Encouraging restoration and land acquisition efforts.

For further information on the Center, contact Mike Mahaffie, (302) 739-4506.



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Tillamook Bay NEP is Underway

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Coast to Coast



[Tillamook Bay NEP logo](#)

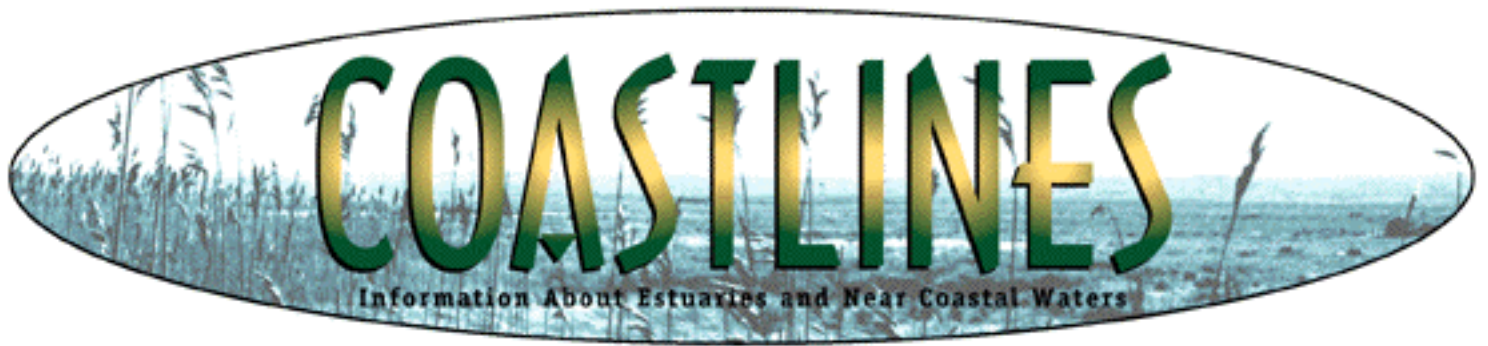
On May 28, 1994, a stalwart group of [Tillamook Bay National Estuary Project](#) (TBNEP) supporters braved a rainy Memorial Day weekend to cut the official "kick-off" cake along the shores of the Bay in northwest Oregon. Project staff disseminated information at a booth in the midst of traditional Bay activities, including the annual blessing of the fishing fleet and a salmon derby that raises funds for salmon restoration projects.

On July 1, the final EPA Region 10 signature was obtained for a Conference Agreement signed by both the Governor of Oregon and the Board of Commissioners of Tillamook County.

During Year 1 of the Project (approval of the workplan and grant occurred in mid-August), the focus will be on the three priority problems identified to date in a series of issue forums. Expert presentations on issues of salmonid population declines and habitat degradation, pathogen contamination/biochemical water quality, and sedimentation and erosion will be made at public meetings to be held in October and December, 1994, and February, 1995.

For further information on the TBNEP, contact Marilyn Sigman, Director, (503) 842-9922; fax (503) 842-3680.

Logo to accompany article



Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

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Welcome the Snook

Sep-Oct Coastlines 1 10/4/94

Coast to Coast

The State of Florida has added another specialty license plate to its repertoire, and the [Indian River Lagoon](#) will be the beneficiary. The snook, a highly prized inshore game fish, will adorn license plates beginning this fall based on passage of the proposal by the Florida legislature on May 12. "I am very excited about what the passage of this bill will mean to the Indian River Lagoon," said state senator Patricia A. Grogan. "We have taken a giant step toward preserving one of east central Florida's greatest resources."

Eighty percent of the proceeds from license plate sales will go toward restoration projects on the lagoon, while twenty percent will go toward education efforts to increase public awareness. According to Marty Smithson, program manager for the Lagoon's Surface Water Improvement and Management program, the first priority for the proceeds will be to construct retention ponds and sediment traps along U.S. Highway 1 to prevent stormwater runoff into the lagoon.



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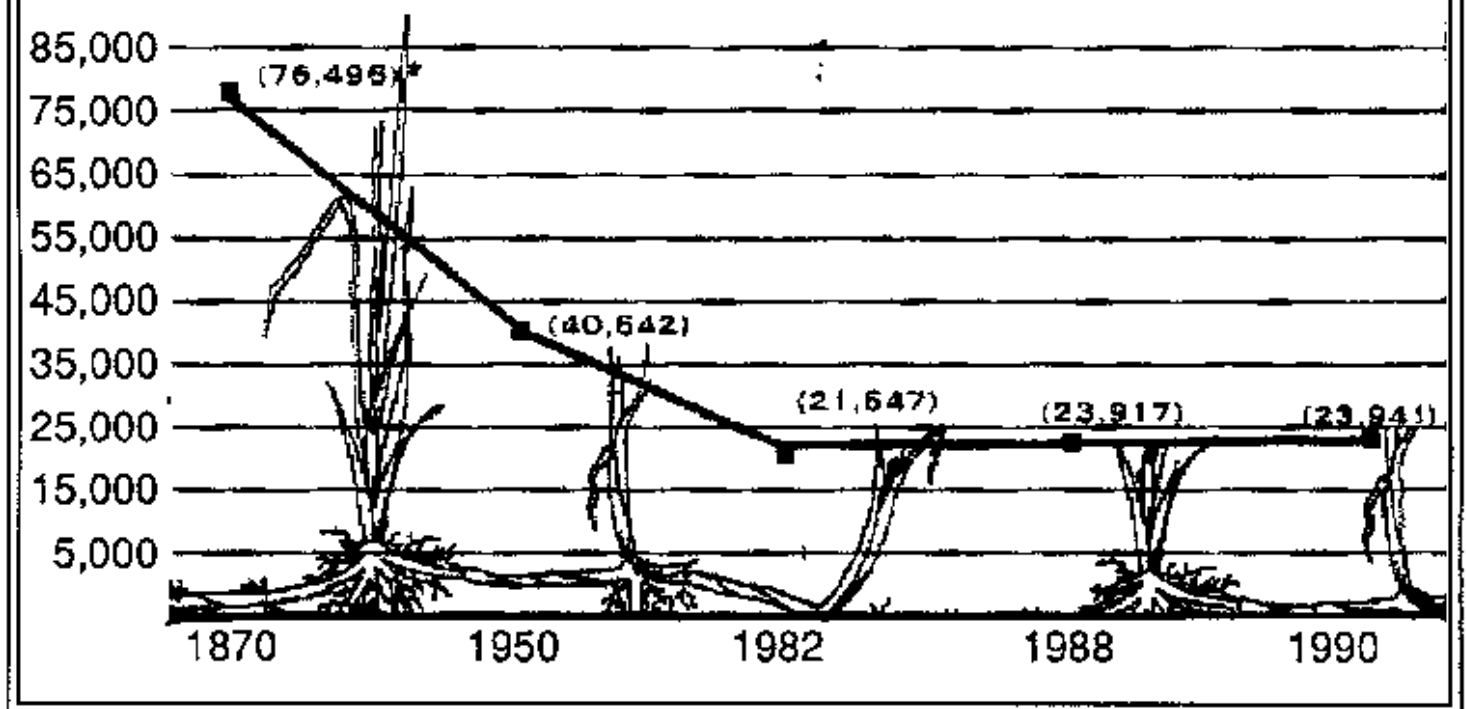
About Coastlines

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The Executive Director of the Alliance is Frances H. Flanigan. To make address changes, additions or comments, please write to the Alliance at 6600 York Road, Baltimore, MD 21212.



Historical Trends in Seagrasses



Sources: • R.R. Lewis III • R.R. Lewis III, K.D. Haddock, J.D.R. Johansson,
Basic 2 • Southwest Florida Water Management District, Surface Water
Improvement and Management IBWIMI Department

*Estimate, Based on Bathymetry

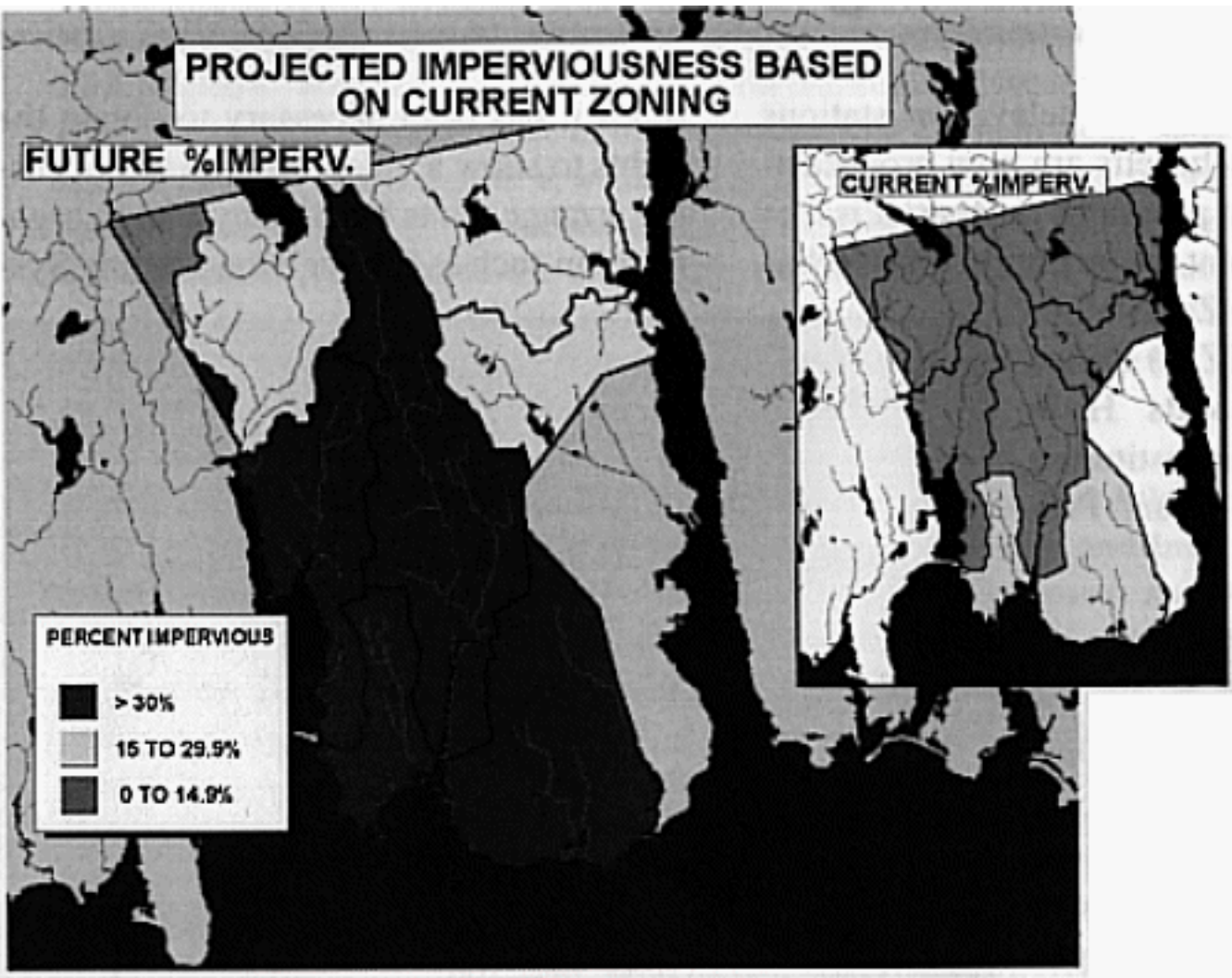
PROJECTED IMPERVIOUSNESS BASED ON CURRENT ZONING

FUTURE %IMPERV.

CURRENT %IMPERV.

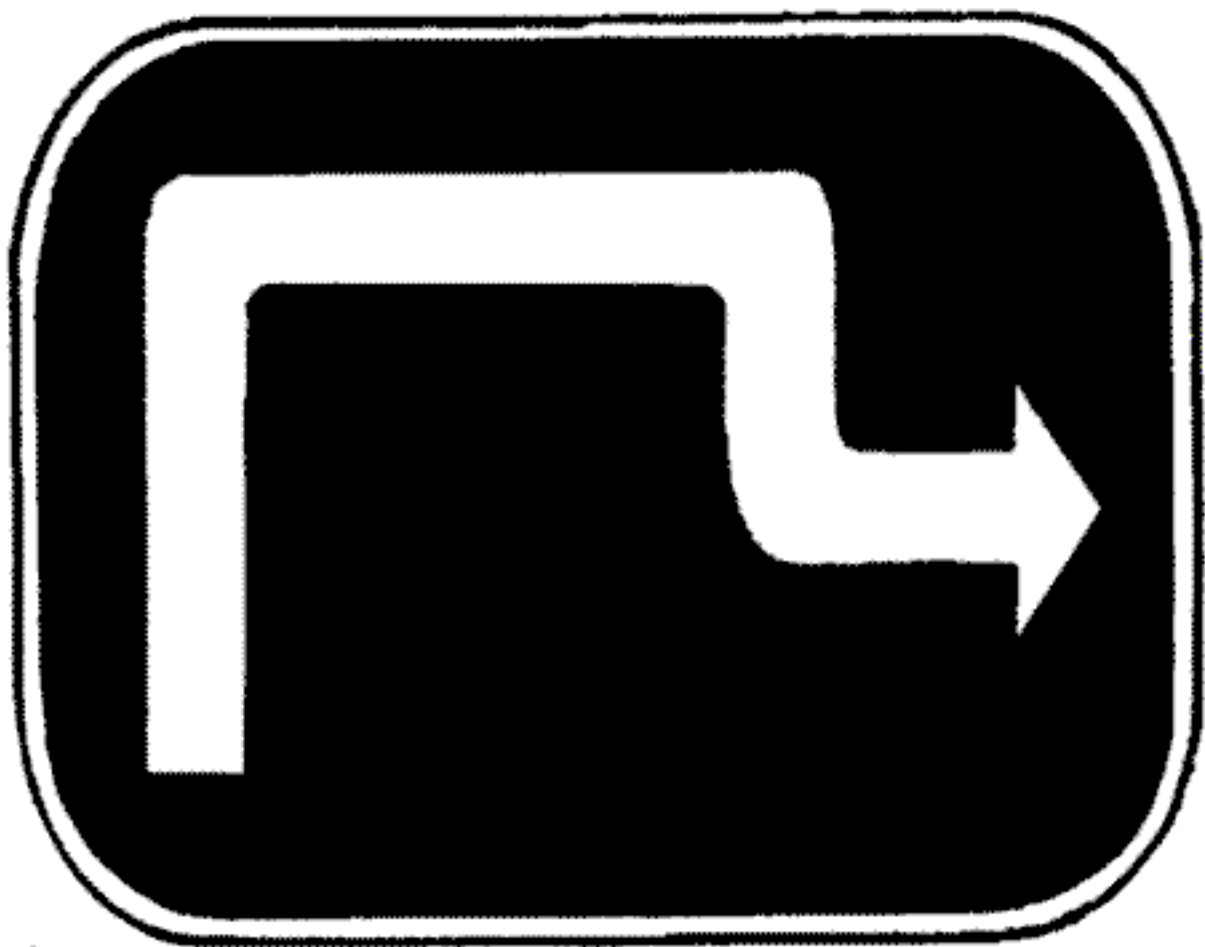
PERCENT IMPERVIOUS

- > 30%
- 15 TO 29.9%
- 0 TO 14.9%



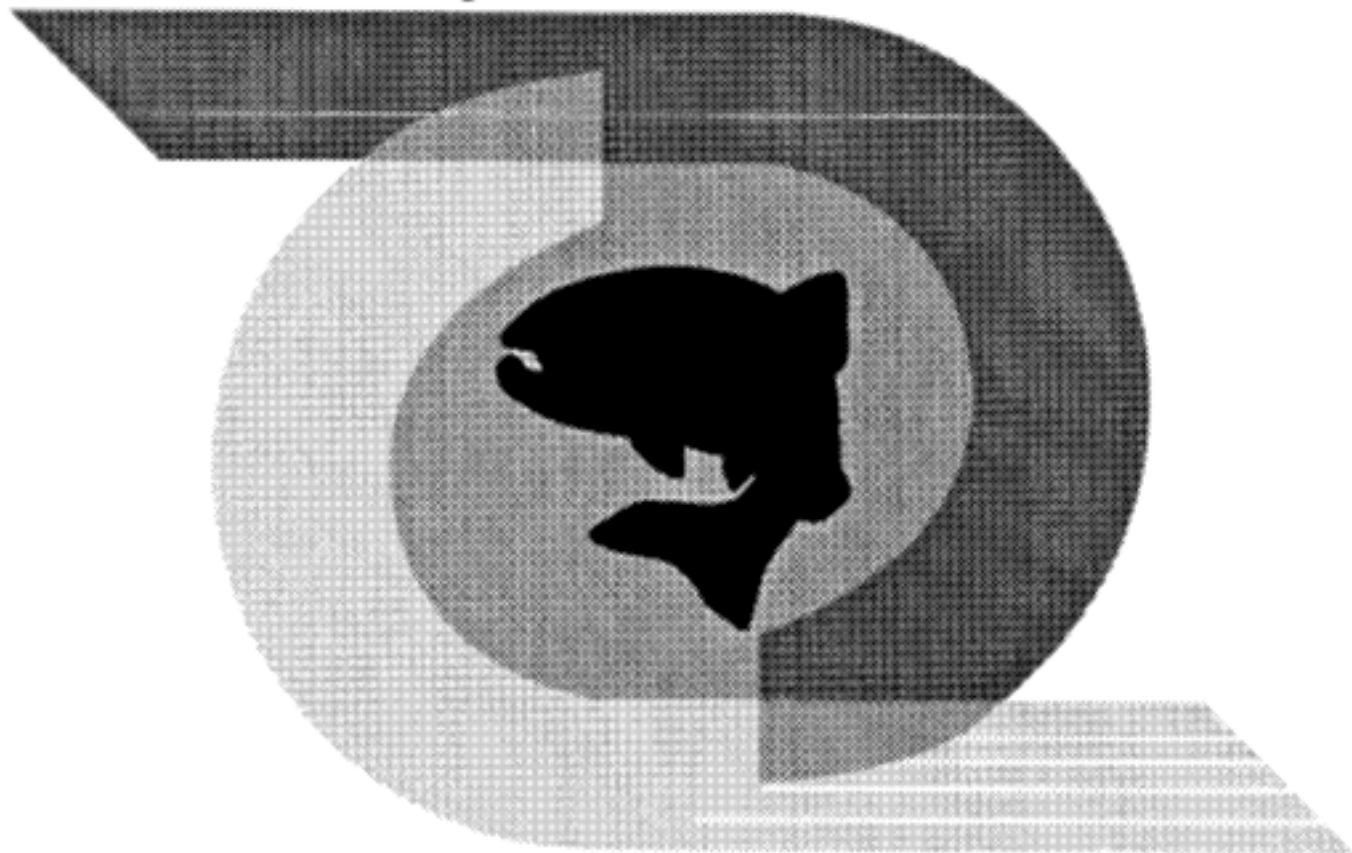








Tillamook Bay



National Estuary Project
