



**DEVELOPMENT OF A NATIONAL-SCALE
INVENTORY OF SHORELINE CHANGE
DATA FOR IDENTIFICATION OF EROSION
AND ACCRETION**

Working Draft

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National Shoreline Management Study

The National Shoreline Management Study, authorized in the Water Resources Development Act of 1999 under Section 215c, presents an opportunity to examine the status of the Nation's shoreline for the first time in 30 years. Results from the study will provide a basis for Federal actions regarding shoreline management for the foreseeable future. The study will provide a technical basis and analytical information useful in developing recommendations regarding shoreline management, including a systems approach to sand management, and roles for Federal and non-Federal participation in shoreline management.

The study will:

*summarize information about the shoreline changes (erosion and accretion) available from existing data sources and examine the causes and economic and environmental effects;
identify and describe the Federal, state and local government programs and resources related to shore restoration and nourishment; and,
explore ideas concerning a systems approach to sand management.*

The assessment of the nation's shorelines will take into account the regional diversity of geology, geomorphology, oceanography, ecology, commerce, and development patterns.

The study will be undertaken through collaborative efforts with other agencies. Information and products will be scoped, developed, and reviewed by national technical and policy committees involving multiple agencies. The National Study team will also solicit input from other interested parties and in developing study recommendations.

The U.S. Army Corps of Engineers' Institute for Water Resources (IWR) is managing the study working closely with the Engineer Research and Development Center Coastal and Hydraulics Laboratory and Corps field experts. National technical and policy committees, which include other agency experts, will be assembled as integral components of the study.

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Or go to the study website at: <http://iwr.usace.army.mil/NSMS>. The website provides reports to date and study progress along with topical links to other related studies and relevant agency programs.

A limited number of reports are available and may be ordered by writing Arlene Nurthen, IWR Publications, at the above Institute for Water Resources address, by e-mail at: Arlene.nurthen@usace.army.mil, or by fax 703-488-8171.

EXECUTIVE SUMMARY

Data on representative shoreline positions, historic shoreline positions, erosion rates and areas of critical erosion are being collected, on a state-by-state basis from various existing Federal, State and local government programs and resources related to shoreline change. This dataset is being incorporated into a geographic information system database to provide a single source of what is now a diverse and widespread assortment of information on shoreline change and the state of local beach conditions. To understand coastal erosion and accretion patterns on a nationwide basis, and to provide guidance on management of sand resources, the compilation of shoreline data on a nationwide basis is needed. The data base is divided into a collection of digital base shorelines, available historic shore positions, any calculation of historic erosion rates and identification of coastal areas that have erosion problems from the 30 coastal states along the Atlantic, Pacific, Gulf of Mexico and the Great Lakes, as well as the Island territories of Puerto Rico, Virgin Islands, Guam, Samoa and the Northern Mariana Islands. Sources of shoreline positions and change information in digital format are available from several Federal agencies and many State coastal zone programs and are being downloaded into the inventory by state. Most data is of a high-resolution scale ranging from 1:10,000 to 1:40,000, not available in any other national database. Details of available data from each state are given along with the metadata listing such information as source and collection method, dates shoreline was mapped, coverage area and other information on shoreline type or use. Historic data are available from the mid 1800's to the present for most areas. This single source of unified information on shoreline change will provide a resource for further study of the state of the nation's coastline and how to manage sediment in a systematic and regional manner.

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DEVELOPMENT OF A NATIONAL-SCALE INVENTORY OF SHORELINE CHANGE DATA FOR IDENTIFICATION OF EROSION AND ACCRETION

INTRODUCTION

The National Shoreline Management Study (NSMS) will summarize information about changes to the Nation's shorelines. The U.S. Army Corps of Engineers (USACE) has been authorized in the Water Resources Development Act of 1999 under Section 215c to examine the status of the Nation's shoreline for the first time in 30 years, since the National Shoreline Study of 1971. The study will provide a technical basis and analytical information useful in developing shoreline management recommendations for a systems approach to sand management and roles for Federal and non-Federal participation in shoreline management along the Atlantic, Pacific, Gulf of Mexico and Great Lakes coasts. The nation's shorelines and beaches are a vital resource for recreational, natural resources, seaport and maritime commerce, residential and commercial uses. With the growth of population in the coastal zone, more competing pressures are put on the shores and beaches. To manage this resource, we must understand the scope and magnitude of erosion and accretion along U.S. shores.

The National Shoreline Study of 1971 (NSS), authorized by Congress in the Rivers and Harbors Act of 1968, was the first comprehensive study to appraise the National shoreline erosion problem. The purpose of the original 1971 study was to: 1) determine areas of the coast where significant erosion was occurring; 2) identify areas where erosion presented a serious problem, due to rates of shoreline retreat that required action to protect the upland infrastructure; 3) describe methods to protect against erosion; 4) provide cost estimates for protecting these areas; 5) recommend priorities to mitigate this erosion; 6) provide State and local authorities with information and recommendations for action to stop erosion; 7) develop land use guidelines; and 8) identify coastal areas where ownership was uncertain (U.S. Army, 1971a).

In the 1971 National Shoreline Study, nine regional reports were generated along the then existing USACE Division lines. Coastal engineers and planners recognized that they had to evaluate the scope and magnitude of the erosion problem, before Federal, State or local interests could do any long-range comprehensive planning. The nine reports covered:

- North Atlantic (Maine to Chesapeake Bay)
- South Atlantic - Gulf Region (Chesapeake Bay to Mississippi), Puerto Rico and the Virgin Islands
- California
- Pacific Northwest (Oregon and Washington)
- Great Lakes
- Lower Mississippi Valley (Louisiana)
- Texas
- Alaska
- Hawaii

Each report used criteria based on rate of erosion, economic factors, industrial use, recreational use, agricultural use, navigational needs, demographic distributions and ecological impacts. Various other Federal and non-Federal government agencies as well as civic and conservation groups also provided information. Areas of *critical erosion* (defined as shores where erosion control projects may be justified) were identified in the nine regions. *Non-critical erosion* areas (defined as shores that had an erosion problem but most likely where projects could not be justified based on the criteria) were also identified. Areas with stable or accreting shores were identified as *non-eroding*. In identifying the areas of critical and non-critical erosion, some of the regional reports considered the following: 1) use demand history, 2) projections of future use demands (based on judgment and available information), 3) general estimates of historic and future annual damages from property loss, 4) general estimates of historic and future annual damages from business and recreation forgone, and 5) the effect of continued erosion on ecological values

Each of the nine reports was further divided into smaller reaches to better cover the outer seacoast and estuaries or bay shorelines. These reaches were divided on geographic divisions (capes, inlets, etc...), coastal morphology (i.e. barrier islands, cusped forelands, rocky coasts, etc...), shoreline type (open coast or bay or estuary shoreline), and oceanographic and coastal processes. Areas of critical erosion were further divided into four priorities based on the time until erosion affects the life safety and property of coastal residents in these areas (U.S. Army, 1971a). The criteria used in the NSS were complicated and were subject to interpretation by each regional group. Therefore each regional report was slightly different in content and criteria. Critical erosion was identified by judgment and was subject to interpretation in each region without any nation-wide standard. These maps were produced without the benefit of the types of shoreline change maps and data that are readily available for most areas of the U.S. coast today. For further review on the 1971 study see Stauble and Brumbaugh (2003).

Other regional to national scale studies of shoreline change have been prepared in the 1980's and 1990's. The National Oceanographic and Atmospheric Administration's National Ocean Survey and the U.S. Army Engineer, Coastal Engineering Research Center (NOAA/NOS-CERC) Cooperative Shoreline Movement Study of the early 1980's examined change in shoreline positions along three coastal areas including:

- Part I, Cape Henry, Virginia to Cape Hatteras, North Carolina, 1849-1980 (Everts, et al., 1983);
- Part II, Cape Henlopen, Delaware to Cape Charles, Virginia, 1849-1980
- Part III, Tybee Island, Georgia to Cape Fear, North Carolina, 1852-1983 (Anders, et al., 1990)

Using the same techniques, a fourth section of coastline along southern California was mapped as a cooperative effort between the NOS, CERC and the Los Angeles District (LAD) as the NOAA/NOS-COE/LAD Cooperative Shoreline Movement Study as part of the Coast of California Storm and Tidal Wave Study covering the area:

- Imperial Beach to San Pedro, California, 1852-1982
(May and Barwin, 1985).

All of the coastal sections except Part II have analysis of erosion rates and identification of coastal morphologic variability from the mid 1800's to early 1980's.

The United States Geological Survey (USGS) National Atlas, in cooperation with CERC and the University of Virginia produced a two map set on coastal hazards (Anders, et al. 1985) and accretion and erosion for the entire U.S. Shoreline except the Great Lakes in 1985 (Dolan, et al., 1985). Later, as part of the Gulf of Mexico Program, a consortium of all of the States bordering the Gulf of Mexico and Federal agencies (Environmental Protection agency (EPA), U.S. Army Corps of Engineers (UASCE) and USGS) completed a more detailed study on historic shorelines of the Northern Gulf of Mexico in 1991 (Westphal, et al., 1991, revised 1996). In 1999, the USGS published another map set of Great Lakes shoreline type, including data on erosion and accretion from work initiated by the International Joint Commission (IJC) of the United States and Canada (Pope et al., 1999). All of these studies are dated and are in need of updating the shoreline positions and an assessment of the erosion problems. Numerous beach nourishment and other shore protection projects have been constructed in some of the most critically eroding areas since the 1970's. No national assessment has been done on the success of these projects in protecting the nations eroding coast

This paper will review the various existing Federal, State and local government programs and resources related to shoreline change. These data are being compiled as a reference source for the NSMS. . Assessment of the nation's shorelines takes into account the regional diversity of geology, geomorphology, oceanography, ecology, commerce, and anthropogenic development patterns. Documentation is provided on coastal areas that have been mapped, any historical assessment of shoreline change, if any shoreline change rates are available and if any assessment or identification of "critical erosion" has been done. Different methods used in the analysis process of each original data set are being reviewed. An identification and description of areas that are critically eroding based on the original various sources are being compiled based on several criteria. These criteria will be explained and examined for consistency between the various studies. The NSMS has assembled a database on shoreline change using as a starting point various programs available from coastal state's Coastal Zone Management programs as well as historic Federal shoreline change studies.

Numerous shoreline change studies have been completed in recent years or are being done presently by individual coastal State Programs. Their programs approach the problem of identifying eroding shores and identifying rates of change in a slightly different manner using different criteria. Maps of shorelines of differing dates are available from many states. These maps usually extend from the 1880's to the 1980's. However, the NSMS analysis will need more recent shorelines for most states. Analysis

of rates of change and identification of areas of concern are available for some and not for others. This document reviews the variability and similarities in each program.

DATA SOURCES AND METADATA STANDARDS BY COASTAL STATE

Several on-line data resources were investigated as part of this effort to gather all available data on shoreline change from Federal and state sources. The main Federal source of shoreline base data was NOAA. They are in the process of taking their paper copies of Topographic-sheets (T-Sheets) of shoreline position for several periods and converting them to digital and GIS ready formats. The data are available from NOAA's National Geodetic Survey (NGS) and Coastal Services Center (CSC). Most state shorelines are a compilation of mostly "mean high water" shorelines from various T-Sheets and aerial photographic interpretation that were surveyed at different times. These shorelines have been combined by NOAA and various state agencies to produce a single complete shoreline by state. For this initial data assessment stage, the NSMS is using this shoreline as a base map. These maps have of high resolution with scales ranging from 1:10,000 to 1:40,000, with most of the maps at 1:20,000 or 1:40,000. The shoreline was identified by digitizing the shoreline from the older (before 1950's) mylar charts or from newer photogrammetrically derived shorelines from aerial photography. This data set provides a detailed shoreline including differentiation of man made structures (seawalls, revetments), docks, piers and ramps, breakwaters, jetties and groins, marsh and the shoreline position of record (SPOR), which is recorded as the mean high water (MHW) shoreline by NOAA (**Figure 1**). This new digital vector shoreline data series has much more detail than the medium resolution shoreline available from NOAA, which has a resolution of 1:70,000. Most of the US shoreline has been compiled using the new high-resolution base shoreline by the Coastal and Hydraulics Laboratory and is reported on in this report, but work is still in progress in a few areas and should be completed in the near future.

Complete metadata accompanies each NOAA vector shoreline. It conforms to the Federal Geographic Data Committee Metadata standards of the date when the metadata was compiled. The standard horizontal co-ordinate system used by NOAA is decimal degrees latitude and longitude using the North American Datum of 1983 (NAD 83) in feet. Since the bulk of the data used in this study was already in these co-ordinates, this paper also uses these standards.

Several states also have programs to map their shores and some provide historical shorelines. A few states have calculated erosion rates based on this historical data and a few have identified "critical erosion" areas. Some of the states have provided digital data on their contemporary shoreline (late 1980's to 1990's) and historic shorelines. The digital data was incorporated into the GIS along with the metadata where available. Each state had a different originating coordinate system so the co-ordinates were converted using the ArcView coordinate conversion program. Some of the state programs have not created digital data but have hard copy information on shoreline change

GIS ANALYSIS AND DISPLAY

All of the digital shoreline data were entered into ArcView 3.2, a Geographic Information System produced by Environmental Systems Research Institute (ESRI). Some of the NOAA data was already in shape file format and was read directly into the GIS. Other data was in ArcInfo format and had to be converted into ArcView format using the ArcView import function. A state-by-state folder was formed for each of the 32 coastal states in the continental United States, Alaska, Hawaii and the territories of Puerto Rico and the US Virgin Islands. The territories of American Samoa, Guam, and Northern Mariana Islands have not been included at this time. Individual state folders contain the base shoreline, and any additional historic shorelines, change rates or erosion rates collected from NOAA or that particular states mapping program (usually based in either a Department of Natural Resources, Environmental Resources or Geological Survey). NOAA has not yet compiled the shorelines of several states, but most of those states have their own program to map a base shoreline. These have been downloaded to the NSMS database from their respective state GIS files. Each state had its own horizontal datum and the downloaded data is stored in its original form. Conversion was required to enter all the data into a common horizontal datum for use in the NSMS database. Coordinate transformation conversion was done using the ArcView Projection Utility.

SHORELINE DATA BASE

This shoreline database has many components collected from various Federal and state sources (**Table 1**). The data has all been converted to a common horizontal (Lat/Lon Decimal Degree NAD83) datum in ArcView by state. The respective shorelines are all listed by their source as representing the “mean high water” (MHW) shoreline. At the present time, several interpretations of what actually is the mean high water shoreline are in use by the various agencies. The mean high water shoreline may be different depending on what source was used to interpret the shoreline position. Older T-Sheets surveyed the MHW line using standard land survey equipment and interpretation of the field crew. Newer aerial photographic interpretation of the MHW line varies between agencies. Some use a tidal control on the time of photo flight, some use visual features on the photo. The newest techniques using topographic and bathymetric LIDAR have not yet been incorporated in this study, but will be added in the near future as data becomes available. The interpretation of a MHW line using this type of digital terrain data also uses various techniques. No attempt was made to change the location of the original shoreline from the various data sources.

Along with the base shoreline and historical coverage, a measure of the length of tidal shoreline as described in the NOAA publication *The Coastline of the United States* and the coastal population of coastal counties as measured in the 1990 Census is given for each state using the data from the NOAA Office of Ocean and Coastal Resource Management (NOAA/OCRM, 2003). A listing of available shorelines and other data collected to date for the NSMS follows. The listing is state-by-state basis organized by geographic region starting with the Atlantic coast.

Atlantic

Maine

Shoreline Base Maps

The Maine baseline shoreline is provided from the NOAA-Coastal Services Center (CSC) Digital Shoreline of the United States (<http://www.csc.noaa.gov/products/shorelines/digdata.htm>) and is a composite of the entire state from coastal survey maps dating from 1941 to 1986. The state has 8368 km (5,200 miles) of shoreline composed of numerous coves and rocky areas, and the coastal population is 885,703 people (NOAA/OCRM, 2003). The various T-Sheets used to produce the map had a scale of 1:5,000, 1:10,000 and 1:20,000. This state shoreline map was published in 2000 (**Figure 2**).

Historic Shoreline Change Programs

Data is available from the Maine Coastal Program on the status of southern Maine's sandy beaches. Information includes development, replenishment and erosional status. Data is also available on the length of the States coastline by county. Northern Maine's coast is mainly rocky shoreline. The Maine Geological Survey has divided the coast into four areas from north to south: Clifed Coast, Island-Bay Coast, Indented Shoreline and Arcuate Embayments. The Survey is in the process of mapping shoreline change in selected areas of the coast.

New Hampshire

Shoreline Base Maps

The New Hampshire coastal base map has been compiled from NOAA sources. New Hampshire has 211 km (131 miles) of coast with a coastal population of 350,078 people (NOAA/OCRM, 2003). The majority of the coast has been supplied by NOAA-NOS Shoreline Extractor (http://www.ngs.noaa.gov/newsys_ims/shoreline/index.cfm) and is a composite of the state shoreline from Biddeford Pool, Maine To Cape Ann, MA. Coastal survey maps from 1952 were used to produce the shoreline from aerial photography and the map was created in 2002 (**Figure 3**). An area of the New Hampshire northern shoreline was missing from this data set so an additional shoreline string of the Portsmouth, NH area was sent from NOAA-CSC on CD in ArcInfo format (converted to ArcView using the ArcView Import71 program). This shoreline string was digitized from T-Sheets dating from 1912 with a scale of 1:10,000 and was digitized in 2002.

Historic Shoreline Change Programs

None found at this time.

Massachusetts

Shoreline Base Maps

The shoreline base map for the State of Massachusetts is supplied by the State of Massachusetts, Office of Coastal Zone Management (MCZM). NOAA/OCRM (2003) lists the length of shoreline as 2,445 km (1,519 miles) with a coastal population of 4,494,398 people. The shoreline data is available from the Massachusetts Geographic Information system (MassGIS). The base map is part of the MassGIS and provides a 1:25,000 scale map of the entire State coastline, including the Islands of Martha's Vineyard and Nantucket. The base shoreline was digitized from linework from the USGS mylar map sheets for land boundaries in ARC/INFO. Export files are available in both ARC/INFO .e00 and ArcView .shp file formats. The shape files were downloaded for the NSMS base shoreline (<http://www.state.ma.us/mgis/ftp.cs.htm>). The metadata of all MassGIS data is in Massachusetts State Plane Mainland Zone Coordinate System (FIPZONE 2001), with a vertical datum of NAD83, meters. This statewide shoreline data set was converted to the NSMS base coordinates of Latitude/Longitude degree decimal and NAD83, feet (**Figure 4**). At the present time, only parts of the Massachusetts coast are available from NOAA in high resolution, so the complete state shoreline from MassGIS was used. The most recent data available from this source is 1982. A supplemental shoreline was added in the Chatham, MA area, since the formation of a new inlet in 1987 changed the shape of Nausit Spit on Cape Cod. The 2002 aerial photography set of the Chatham area was digitized as described in Stauble (2001) as part of a monitoring program of inlet evolution by CHL for the New England District. The latest inlet shoreline ArcView shape file was added to the base map from the study GIS. This shoreline was transformed from a horizontal datum of MA Mainland State Plane, feet to latitude/longitude, decimal degrees. The vertical datum on both shorelines was NAD83.

Historic Shoreline Change Programs

The MCZM has a historic shoreline database originally generated by Leatherman (1984) and described in Benoit (1989) and O'Connell (1997). Coastal Zone Management established an agreement with the US Geologic Survey (USGS), the Woods Hole Oceanographic Institution (WHOI) Sea Grant Program and the Cape Cod Cooperative Extension (CCCE) to produce an updated 1994 shoreline from the NOAA NOS color aerial photography. In 1997, the study was updated with the addition of the 1994 data set, to provide four to five historic shoreline positions mapped from the 1840's to 1994, that varied over the state depending on available historic shoreline data availability (Van Dusen, 2002). The maximum time span covers 1842 to 1994 (O'Connell et al., 2002). The nearly 140-year time span of shorelines came from a number of sources including NOAA NOS T-sheets, FEMA topographic map sheets, hydrographic map sheets, USGS quadrangles, aerial photography and orthophotographs. The shoreline change was calculated in GIS using the Digital Shoreline Analysis System (DSAS) originally developed by the USGS (Danforth and Thielier, 1994) and modified by Van Dusen (2002). The shoreline change maps are in 1:10,000 scale, with change rates calculated on

transects at a 40-meter (131 ft) interval. For more information on dates and methods of mapping of the historical shoreline see Van Dusen (2002). **Figure 5** shows an example of the historic shoreline available from the Massachusetts Historical Shoreline Change Product.

Rhode Island

Shoreline Base Maps

The Rhode Island baseline shoreline is provided from the NOAA-NOS Shoreline Explorer and is a composite of two state shorelines. The first shoreline is from NOS coastal aerial photographs from 1954 to 1956 covering Block Island Sound. The second shoreline covers Narragansett Bay from shorelines mapped in 1956 from NOS aerial photography. Both portions of the state shoreline map were published in 2002 (**Figure 6**). A few segments are not available in the high-resolution format, including upper Narragansett Bay and along the Connecticut-Rhode Island shoreline of Block Island Sound. The state has 676 km (420 miles) of coast including Narragansett Bay and the coastal barrier beaches, with a coastal population of 685,478 people (NOAA/OCRM, 2003).

Historic Shoreline Change Programs

None found at this time.

Connecticut

Shoreline Base Maps

The Connecticut coastal base map has been compiled from two separate NOAA sources. Connecticut has 995 km (618 miles) of shoreline, with a coastal population of 2,030,017 people (NOAA/OCRM, 2003). The eastern coast of Long Island Sound has been supplied by NOAA-NOS Shoreline Explorer and is a composite of the state shoreline from the New York state line to just west of Old Saybrook, CT. NOS aerial photography from 1984 (CM-8312) and 1986 (CM-8315) were used to produce the shoreline and the maps were created by NOS in 2002 (**Figure 7**). An area of Connecticut shoreline was missing from this data set so an additional shoreline string of the Niantic Estuary area and a section of coast from Groton, CT to the Rhode Island state line were sent from NOAA-CSC in ArcInfo format (converted to ArcView using the import functions). This shoreline string (PH-31) was digitized from T-Sheets dating from 1948 with a scale of 1:10,000 and was digitized in 2001. The coastline from Old Lyme to New London, CT (approximately 19.3 km (12 miles)) is still missing from this high-resolution data set.

Historic Shoreline Change Programs

The Connecticut Coastal Management Program is completing a shoreline change analysis study using NOAA T-Sheets and maps from aerial photography. The Connecticut Department of Environmental Protection, Office of Long Island Sound Programs has blue line copies only of shoreline change from the 1800's to the 1970's.

New York (Atlantic coast)

Shoreline Base Maps

The Atlantic coast of New York State, consists of the mainland and the north shore of Long Island fronting Long Island Sound and the south shore of Long Island fronting the Atlantic Ocean as well as the New York Harbor and Hudson River areas. A single shoreline was not available, but nine separate strings were available from NOAA that, when pieced together, covered the entire State's Atlantic shore. Some of the data was available from the NOAA Shoreline Explorer and some of the data came from NOAA/CSC on CD. The data is listed in Table 1 and the base shoreline was derived from T-Sheets for the early dates and aerial photography for dates after 1940. The dates of the shorelines ranged from 1927 to 1984. Some of the shorelines overlapped between segments, but were of different dates so multiple shorelines are in the database for those areas. The shorelines are mostly 1:10,000 scale and contain detailed positions of inlet jetties, groins, docks and piers, marsh islands, and the shoreline (**Figure 8**). Since the shoreline of the eastern end of the south shore of Long Island was from 1927-1933, Shinnecock Inlet had not formed yet. A more recent 1995 shoreline mapped from aerial photography was added from the CHL Coastal Inlets Research Program (CIRP) GIS study of the inlet (Morang, 1999). This shoreline was converted from New York State Plane, Long Island Zone, feet NAD 83 and NGVD 1929. The length of shoreline given by NOAA/OCRM (2003) for New York State included, both the Atlantic shoreline, Long Island Sound and Hudson estuary as well as the Great Lakes – St. Lawrence River, Lake Ontario, Niagara River and Lake Erie shoreline as 4,224 km (2,625 miles) with a coastal population of 15,026,340 people.

Historic Shoreline Change Programs

None found at this time.

New Jersey

Shoreline Base Maps

NOAA/CSC Digital Shoreline of the United States supplied the New Jersey shoreline, including New York Harbor and Delaware Bay. This base shoreline covers the entire state and is a composite of shorelines from 1932 to 1981, produced in 2002 (**Figure 9**). The shoreline covers 2,884 km (1,792 miles) and the state has a coastal population of 6, 978,509 people (NOAA/OCRM, 2003). The New Jersey Department of Environmental Protection (NJDEP) also has digitized a shoreline of the entire state from scanned aerial photography in 1986 (<http://www.state.nj.us/dep/gis/>). In addition the

NJDEP GIS has several layers of use in the shoreline study including rivers, marsh boundary, shoreline type and shore protection structures (jetties, groins, seawalls, revetments and breakwaters). Datum units are New Jersey State Plane, NAD83 feet, and the files were published in 1996 in ArcView shape file format. The data was downloaded and transformed onto the study coordinates. A new south jetty was constructed at Barnegat Inlet in 1990, so a supplemental shoreline and new jetty position was added from the CHL/CIRP GIS files at Barnegat Inlet in 1996 taken from aerial photography (Seabergh, et al., 1996)

Historic Shoreline Change Programs

A set of historic shorelines covering the Atlantic coast of New Jersey have been digitized by the State of New Jersey Department of Environmental Protection and include 11 dates starting from 1836/42 to 1977 (**Table 2**). Not all shorelines for each date extend for the entire length of the NJ coast. The historic shorelines are from NOAA T- and H-sheets covering 1836-42, 1855, 1866-68, 1871-75, 1879-85, 1899, 1943, 1951-53, 1971 and 1977. An example of a section of the southern New Jersey coast historic shoreline is shown for Great Egg Harbor Inlet in **Figure 10**. Historic and active inlets have also been identified on the NSMS GIS for NJ. The NJDEP is working on updating a newer shoreline than the 1986 state base shoreline using data from aerial photography in 1996. The Philadelphia District (NAP) also has an 2000 digital orthorectified air photo set for the entire NJ shoreline that could be used to add a newer shoreline if time permits. No shoreline change rates have been calculated with this data set.

Delaware

Shoreline Base Maps

The base shoreline was in four segments including the Delaware Atlantic Coast, Delaware Bay, Delaware River, and the Chesapeake and Delaware Canal shorelines (**Figure 11**). NOAA/NOS Data Explorer supplied two segments and a CD supplied by NOAA/CSC provided the other two. A 5.5 km (3.4 mile) section of the coast at the southern end in the vicinity of Bethany Beach to the Maryland State line is missing from the high-resolution shorelines. **Table 2** lists the four segments and dates of the shorelines, which ranges from 1943 to 1978. There is overlap with the shorelines, but all were kept in the database since each shoreline had unique details of portions of the shore. The State of Delaware has 613 km (381 miles) of coast along the Atlantic and Delaware Bay/River. The coastal population is 666,168 (NOAA/OCRM, 2003)

Historic Shoreline Change Programs

The NOAA/CERC cooperative Shoreline Movement Mapping Program has produced paper copies of historic shorelines from Cape Henlopen to the Maryland State Line. These shorelines cover 1849, 1850, 1908, 1929, 1933, 1942, 1961/62, 1976 NOAA/NOS field surveys and 1980 NOS aerial photography (**Figure 12**). These shorelines will have to be digitized from original mylar sheets at CHL. The State of Delaware also has

mapping efforts on going in shoreline change, but it is not available in digital format at this time.

Maryland (Atlantic and Chesapeake Bay)

Shoreline Base Maps

The base map of the Maryland Atlantic coast and Chesapeake Bay was obtained from the State of Maryland Geologic Survey. The shoreline was mapped in segments that corresponded to the USGS 7.5 minute Topographic maps with a scale of 1:25000. The shoreline was digitized from 1988-1989 orthophotoquads for the base map. The digital files were supplied on CD from the Maryland Geologic Survey in ArcInfo format, in Maryland state plane NAD 83 meters coordinates. The data was then converted to ArcView format in Latitude/Longitude decimal degrees NAD83. Nine maps were merged to form the Atlantic coast section of the shoreline (**Figure 13**). The Chesapeake Bay base shoreline will be converted from the 116 orthoquads as time permits (**Table 3**). The Atlantic Coast and Chesapeake Bay shoreline of Maryland covers 5,134 km (3,190 miles) and has a population of 3,339,056 people (NOAA/OCRM, 2003).

Historic Shoreline Change Programs

The Coastal and Estuarine Geology program at the Maryland Geologic Survey is in the process of mapping the shoreline change along the Chesapeake Bay and Atlantic Ocean shorelines of the State of Maryland. The historic shorelines span from 1841 to 1977. Additional shorelines are being digitized from orthophographs from 1988 to 1995. This historical data is on CD for all of the coastal counties from various dates from 1840's to the 1995 time frame, depending on available coverage. The format is ArcInfo .e00 and will have to be converted at a later date. The Atlantic coast quads have three historic shorelines from 1849/50, 1942, and 1962 to match the base shoreline of 1989. The Chesapeake Bay historic shorelines are from various dates, but most have a 1880's, 1940's, and a 1990's shoreline. In addition, some of the Bay shoreline files have a 1950's, 1970's and 1980's date. The NOAA/CERC Part II cooperative Shoreline Movement Mapping Program has produced paper copies of historic shorelines from the Maryland State line to the Virginia State line. These shorelines cover 1849, 1850, 1908, 1929, 1933, 1942, 1961/62, 1976 NOAA/NOS field surveys and 1980 NOS aerial photography. A close-up of the Ocean City Inlet MD historic shoreline map is shown in **Figure 14**. The historic shorelines will have to be digitized from original mylar sheets at CHL for the entire Maryland coast.

Virginia (Atlantic and Chesapeake Bay)

Shoreline Base Maps

The Virginia base shoreline covers the Atlantic coast and Chesapeake Bay and was supplied by the Virginia Institute of Marine Science (VIMS), Center for Coastal

Resource Mapping. The shoreline was digitized from the most recent USGS 1:24000 topographic maps using the mean high water blue line representing the shoreline. Each 7.5 min. quadrangle sheet used different dates for the shoreline that ranged from 1964 to 1987. This digital shoreline coverage has an error of approximately +/- 10 meters as reported by the USGS. The shoreline data was in the Universal Transverse Mercator (UTM) zone 18, NAD83 coordinate system in meters. The data was downloaded from <http://ccrm.vims.edu/gis/gisdata.html> in ArcInfo format. It was converted into ArcView format and transformed into the project coordinates and is shown in **Figure 15**.

Attributes included in the shoreline layer included if the shoreline was open ocean, bay or coastal marsh. A Digital Marsh Inventory layer was also downloaded from the VIMS website that provided polygon identification of predominant marsh plant species types along the Atlantic Cost estuaries and Chesapeake Bay shorelines. These polygons identify the non-open ocean shorelines as to the type of vegetation that the particular estuary shoreline acted as a boundary. There were 12 categories of dominant marsh plant species in the tidal wetland layer with mapping dates from 1974 to 1988. The Atlantic coast and Chesapeake Bay shoreline is 5,335 km (3,315 miles) long with a coastal population of 4,010,900 people (NOAA/OCRM, 2003).

Historic Shoreline Change Programs

The NOAA/CERC Part II cooperative Shoreline Movement Mapping Program has produced paper copies of historic shorelines of the Atlantic coast from the Maryland State Line to Cape Charles. These shorelines cover 1849, 1850, 1908, 1929, 1933, 1942, 1961/62, 1976 NOAA/NOS field surveys and 1980 NOS aerial photography. These shorelines will have to be digitized from original mylar sheets at CHL. The NOAA/CERC Part I cooperative Shoreline Movement Program has produced paper copies of historic Atlantic coast shorelines from Cape Henry on the south side of Chesapeake Bay to the North Carolina State line. The dates on this map set cover 1852, 1859, 1916, 1925, 1944, 1962 NOAA/NOS field surveys and 1980 NOS aerial photography. These shorelines will also have to be digitized from original mylar sheets at CHL. Examples of portions of these maps were scanned in **Figure 16**.

North Carolina

Shoreline Base Maps

The North Carolina baseline shoreline is provided from the NOAA-CSC Digital Shoreline of the United States and is a composite of the entire state shoreline from coastal survey maps from 1930 to 1994. The state has 5,431 km (3,375 miles) of shoreline composed of the Atlantic coast as well as a group of large sounds in the northern part of the state and several smaller backbarrier marsh and river mouth estuaries in the south. The coastal population is 710,903 people (NOAA/OCRM, 2003). The various T-Sheets used to produce the map had scales of 1:5,000, 1:10,000, 1:20,000 and 1:50,000. This state shoreline map was published in 2002 (**Figure 17**).

Historic Shoreline Change Programs

The North Carolina Atlantic coast from the Virginia state line to Cape Hatteras are available in paper copy form only from the NOAA/CERC Part I cooperative Shoreline Movement Program. The dates on this map set cover 1852, 1859, 1916, 1925, 1944, 1962 NOAA/NOS field surveys and 1980 NOS aerial photography. These shorelines will also have to be digitized from original mylar sheets at CHL. The historic shorelines from Cape Fear to the South Carolina state line are available in paper copy only from the NOAA/CERC Part III cooperative Shoreline Movement Program. The dates on this map set cover 1878, 1914, 1923, 1933-34, 1972/73/75 NOAA/NOS field surveys and 1983 NOS aerial photography. These shorelines will also have to be digitized from original mylar sheets at CHL. The state of North Carolina, Department of Environmental and Natural Resources, Division of Coastal Management (DCM) also has a program to map historic shoreline change and identify the erosion prone areas of the coast. The DCM is attempting to identify and manage the cumulative and secondary impacts of coastal development on the coast. The DCM is building a coastal GIS to help in land-use management and regulatory decisions. Historic shoreline erosion maps are not yet available in digital form but are in the process of being compiled. Seventeen erosion rate maps are available in pdf format electronically for the entire open Atlantic coast. These maps extend between inlets and other distinct coastal geomorphic features. An example erosion rate map is shown in **Figure 18** covering erosion rates up through 1992. Areas where beach nourishment or dredge disposal projects have placed sand on the beach are also listed on the maps, but the exact influence of the projects on erosion rates are not calculated.

South Carolina

Shoreline Base Maps

The South Carolina baseline shoreline is provided from the NOAA-CSC Digital Shoreline of the United States and is a composite of coastal survey maps from 1984 to 1987. The state has 4,628 km (2,876 miles) of shoreline composed of the Atlantic coast as well as several estuaries, bays and river mouths. The coastal population is 904,460 people (NOAA/OCRM, 2003). The various T-Sheets used to produce the map had scales of 1:10,000 and 1:20,000. This state shoreline map was published in 2000 (**Figure 19**). A two CD set (U.S. Department of Commerce, 1999) is also available, which contains South Carolina beach management history, land cover and change data from 1990 to 1995, and beach elevation data from topographic LIDAR from 1996 and 1997 in ArcView GIS format. The LIDAR coverage is limited to Isle of Palms, a barrier island north of the Charleston Harbor Entrance.

Historic Shoreline Change Programs

The historic shorelines for the entire South Carolina Atlantic coast are available in paper copy only from the NOAA/CERC Part III cooperative Shoreline Movement

Program. The dates on this map set cover 1852, 1859-63, 1870-74, 1878, 1900, 1914, 1920-23, 1933-34, 1964, 1970-75 NOAA/NOS field surveys depending on shoreline segment and 1983 NOS aerial photography. These shorelines have been digitized from original mylar sheets provided by CHL by the Coastal Carolina University. Dr. Scott Harris is also adding some newer shorelines from aerial photography to update the shoreline change history as part of the USGS/NOAA Sea Grant South Carolina Coastal Erosion Study. This new digital file data set will be available in 2004. Two topographic LIDAR surveys from 1996 and 1997 are also available from a CD supplied by NOAA/CSC for portions of the South Carolina Coast, but coverage is incomplete. The extensive historic erosion of Morris Island just to the south of Charleston Harbor entrance is shown in **Figure 20**.

Georgia

Shoreline Base Maps

The Georgia baseline shoreline is provided from the NOAA-CSC Digital Shoreline of the United States and is a composite of coastal survey maps from 1933 to 1994. The Atlantic coast of Georgia is composed of “Sea Islands”, short barrier islands bisected by numerous inlets backed by extensive estuaries. The length of this irregular coast is 3,772 km (2,344 miles). The coastal population is 386,415 people (NOAA/OCRM, 2003). The various T-Sheets used to produce the map had scales of 1:10,000, 1:20,000 and 1:50,000. This state shoreline map was published in 2000 (**Figure 21**).

Historic Shoreline Change Programs

A quantitative shoreline change analysis is underway for the Georgia coast as part of a USGS/NOAA Sea Grant study of the South Carolina and Georgia Coastal Erosion Study. A consortium of Georgia Universities is in the process of collecting historic shoreline information for the Georgia coast. Shoreline change rates vary from +8 m/yr to -2 m/yr with a typical historic change pattern of erosion on the northern end of the shore sea islands and accretion on the southern end (Bush *et al.*, 2002). This work is in an ArcView GIS format and will be incorporated into the NSMS as the data becomes available.

Florida (Atlantic and Gulf of Mexico shorelines)

Shoreline Base Maps

The base shoreline for Florida was in 22 segments, including the Atlantic and Gulf Coast as well as Tampa bay and the backbarrier bay and lagoon shorelines (**Figure 22**). NOAA/NOS Shoreline Data Explorer supplied 14 segments and two CD's supplied by NOAA/CSC provided the other 8 shoreline segments. The dates range from 1927 to 1980, and were measured from T-Sheets and NOS aerial photography. **Table 2** gives the details of the 22 shorelines that were combined to produce the high resolution Florida

shoreline basemap. There was some overlap in the shorelines, but each of the overlapping segments was of a different date so both shorelines were included for completeness and historic record. The NOAA/OCRM (2003) identifies 13,576 km (8,436 miles) of shoreline in the State of Florida, with a coastal population of 12,356,550. The coastal zone includes many types of morphology as described by Tanner (1960). These include barrier islands; cusped forelands; beach rock shorelines; mainland beaches; mangrove shorelines; coral reefs; bays, lagoons and estuary shorelines; marshland coasts; and river deltas.

Historic Shoreline Change Programs

The Florida Department of Environmental Protection's, Bureau of Beaches and Wetland Resources has a data set of historical shorelines in digital form for most of the state's shorelines except the so called "zero energy coast" of the Big Bend area of the Gulf of Mexico coast. This area is composed of mostly open coast marsh and river mouths. The data was digitized from NOAA T-sheets and covers a range of dates depending on the coastal location as listed by county in **Table 4**. The data is in three different Florida state plane zones (Florida east, Florida west and Florida north in NAD27 feet). The data needs to be converted into Lat/Lon Dec. Deg. to view the entire state in the NSMS common datum. A portion of the Broward County historic shoreline map is shown in **Figure 23a**. A report on Critical Erosion has been prepared by the Bureau on a county-by-county basis and has been updated through 2000 and is available online at <http://www.dep.state.fl.us/beaches/>. Digital data on areas of the coast that have experienced critical erosion is available and was downloaded into the NSMS shoreline database. The Dade county map is shown in **Figure 23b**. A coastal GIS has been prepared for the Coast of Florida study and has an extensive database of the Region III section of the Southeast Atlantic coast of Dade, Broward and Palm Beach Counties. A state wide coastal monitoring program includes beach profiles, aerial photography, inlet management plans and assessment of dune and beach erosion and the management of a coastal GIS.

Gulf of Mexico and Caribbean

Puerto Rico and US Virgin Islands

Shoreline Base Maps

NOAA/CSC Digital Shoreline of the United States had a base shoreline for the islands in this group in the northern Caribbean Sea. The shoreline base was a compilation of shorelines from 1901 to 1995 from NOS coastal survey maps (for the older dates) and aerial photography (for the newer dates). These source maps and photos were at scales of 1: 5,000, 1:10,000, 1:20,000 and 1:40,000. **Figure 24** shows the base map for the islands that compose Puerto Rico and St. Croix, St. Thomas and St. John. Puerto Rico has 1,127 km (700 miles) and the Virgin Islands have 282 km (175 miles) of coast, with respective coastal populations of 3,008,274 and 101,809 (NOAA/OCRM, 2003). These islands feature rocky coasts with pocket beaches and embayments.

Historic Shoreline Change Programs

None found at this time.

Alabama

Shoreline Base Maps

The Alabama baseline shoreline is provided from the NOAA/CSC Digital Shoreline of the United States and is a composite of the barrier islands, spits and mainland beaches on the Gulf of Mexico, backbarrier bays and the Mobile Bay with shorelines of the Mobile River tributaries extending some 16 km (10 miles) north of the head of the bay at the City of Mobile. The shorelines are a composite from coastal survey maps derived from NOS aerial photography from 1983 to 1988. The various NOS air photos used to produce the map had a scale of 1:20,000. This state shoreline map was published in 2000 (**Figure 25**). The state has 977 km (607 miles) of shoreline composed of the Gulf shoreline as well as the bay. The coastal population from the 1990 census is 476,923 people (NOAA/OCRM, 2003).

Historic Shoreline Change Programs

Historic shorelines are available from NOAA/NOS T-Sheets from 1849, 1867, 1890, 1892, 1908, 1917, and 1918 for various stretches of the Gulf coastal area of Alabama in digital format. NOAA/CSC has produced a CD (U.S. Department of Commerce, 1997a) containing GIS data on hurricane and flooding hazards of the state and the Gulf beaches in ArcView format. These older historic shoreline files are on the CD. The University of South Alabama, Department of Civil Engineering and NOAA/CSC conducted an erosion risk analysis, using these historical shorelines. The data is available from the NOAA/CSC CD but the historical shoreline data and erosion rate points had to be transformed from UTM Zone 16N NAD 83 meters to Lat/Lon NAD 83 Dec. Deg. for consistency in the NSMS GIS common coordinates. Additional historical data of one more recent time period was also used from NOS aerial photography for the University of South Alabama Shoreline Change Study which included 1978/79, 1981/82, and 1986 dates for various parts of the shoreline on the Gulf and around the bay, with most of the open Gulf coast in 1978/79 and 1982. This shoreline was similar to the base shoreline string used by NOAA/NOS in their Shoreline Data Explorer state shoreline file. Open Gulf shoreline erosion risk analysis was done for the two coastal counties of Dauphin Island in Mobile County on the west side of Mobile Bay Entrance and in Baldwin County on the east side of the Bay. The Baldwin County shoreline is a mix of a barrier spits, mainland beach, and barrier islands that covers Fort Morgan and the Cities of Gulf Shores and Orange Beach. The digital erosion rate was based on the University of South Alabama Shoreline Change Study, which indicated that most of the beach is eroding on the west end of Dauphin Island with some accretion on the east end. In Baldwin County, there is fluctuation in beach width with most of the County measuring recession of less than 5 ft/yr. The west tip of Fort Morgan Peninsula

had the most recession and there is some accretion of the shoreline west of Perdido Pass. An example of the historic shorelines and erosion rate stored in the NSMS database are shown in **Figure 26**.

Mississippi

Shoreline Base Maps

The Mississippi baseline shoreline is provided from the NOAA/CSC Digital Shoreline of the United States and is a composite of the entire state shoreline of the barrier islands, spits on the Gulf of Mexico and mainland beaches and river mouths on Mississippi Sound. The shorelines are a composite from coastal survey maps derived from NOS aerial photography from 1986 to 1987. The various NOS air photos used to produce the map had a scale of 1:20,000. This state shoreline map was published in 2000 (**Figure 27**). An additional shoreline from 1969 was available from the NOAA/NOS Shoreline Data Explorer from 1969 (PH6902232) for the area between Waveland and Pass Christian, including St. Louis Bay. This file contains more detail of some marshland and is included for completeness. The state has 578 km (359 miles) of shoreline composed of the Gulf shoreline as well as the Sound and other small bays and river mouths. The coastal population is 312,368 people (NOAA/OCRM, 2003).

Historic Shoreline Change Programs

None found at this time.

Louisiana

Shoreline Base Maps

The Louisiana baseline shoreline is provided from the NOAA/CSC Digital Shoreline of the United States and is a composite of the entire state shoreline of the Chenier plain in the western Gulf of Mexico, the Acadia Bays and the Mississippi River Delta Plain shoreline. The shorelines are a composite from coastal survey maps derived from NOS aerial photography from 1932 to 1986. The various NOS T-Sheets and air photos used to produce the map had a scale of 1:10,000 and 1:20,000. This state shoreline map was published in 2001 and contains a very detailed shoreline of the Mississippi River Delta (**Figure 28**). Because of all the changes through time of the Mississippi and Atchafalaya River deltas, forming a very irregular coastline, the state has 12,425 km (7,721 miles) of shoreline composed of the Gulf shoreline as well as the marsh associated with the delta. The coastal population is 2,044,880 people (NOAA/OCRM, 2003). The State of Louisiana also has a two volume CD, entitled *Louisiana GIS CD: A digital Map of the State*, which has the NOAA shoreline data as well as bathymetry and a long list of other geo-spatial data.

Historic Shoreline Change Programs

A joint study of the historical change in shorelines associated with the Acadia Bays and the Delta Plain has been done by the USGS, Louisiana Geologic Survey and University of New Orleans. The western Chenier Plain has not been studied. The Louisiana Barrier Island Erosion Study covered six shoreline segments of the present Delta Plain. An atlas is available in paper copy only of shoreline changes from 1853 to 1989 (Williams, et al., 1992). The six areas are the Chandeleur Islands - North and South located on the eastern side of the modern Mississippi River Delta, and moving in a westward direction, the Plaquemines Barrier system on the west side of the modern delta, the Camarada-Moreau headland and Grand Isle Barrier system, the Timbalier Islands (both of which make up the Bayou Lafouche Barrier system) and the Isles Dernieres Barrier system. There were 5 to 6 dates of available historic shorelines for each of the segments (**Table 5**). Shoreline change maps and erosion rates were provided in the atlas report for the entire study period from the 1850's or 1880's to the 1988/89 shorelines. **Figure 29** shows the erosion of Isles Dernieres from 1853 when a single island existed to 1988 when the system consisted of four smaller islands (Racoon, Whiskey, Trinity and East Islands) separated by passes. The historic shoreline data from the report will have to be scanned into the GIS database. Additional shoreline change data from 1985 and 1997 are available from a joint program of UNO and the New Orleans District for Southwest Pass and Pass A Loutre at the mouth of the modern Mississippi River delta and for Barateria Bay Waterway area and Grand Terre Island to the east of the delta mouth. More recent digital shorelines are available online from the USGS for the 1990's, along with the 1880's shorelines at <http://pubs.usgs.gov/dds/dds79/HTMLDOCS/catalog.htm>.

Table 5. Louisiana Barrier Island Study Shorelines							
Coastal Segment	1850-1880's	1890's	1920-1930's	1950's	1970's	1980's	1990's
Chandeleur Islands -North	1855		1922	1951	1978	1989	1999
Chandeleur Islands -South	1855-1869		1922	1951	1978	1989	1999
Plaquemines Barrier System	1884		1932	1956	1973	1988	1996
Camarada-Moreau Headland/Grand Isle Barrier System	1887		1934	1956	1978	1988	1996
Timbalier Islands	1887		1934	1956	1978	1988	1996
Isles Dernieres Barrier System	1853-1887	1890	1934	1956	1978	1988	1996

Texas

Shoreline Base Maps

The Texas baseline shoreline is provided from the NOAA/CSC Digital Shoreline of the United States and is a composite of the barrier islands and spits, river deltas and mainland beaches on the Gulf of Mexico and the lagoons behind the barrier systems. The shorelines are a composite from coastal survey maps derived from NOS T-Sheets and aerial photography from 1923 to 1989. The various NOS shoreline sources used to produce the map had scales of 1:5,000, 1:7,500, 1:10,000 and 1:20,000. This state shoreline map was published in 2001 (**Figure 30**). The state has 5,406 km (3,359 miles) of shoreline composed of the Gulf shoreline as well as the lagoons and bays. The coastal population is 4,447,727 people (NOAA/NOS/OCRM).

The State of Texas General Land Office (GLO) has developed a Texas Coast GIS that contains several layers useful in the NSMS (see <http://www.glo.state.tx.us/gisdata/gisdata.html> for a listing of available layers). Layers include navigation channels, streets, washover areas, and place names to name a few of the 63 layers of available data. This data is in Lat/Lon dec. deg. NAD83 format, which can be downloaded directly into the NSMS database. Most of the data was in ArcView .shp file format, but some are in ArcInfo .e00 format, which can be converted into a shape file format in ArcView.

Historic Shoreline Change Programs

The State of Texas, Bureau of Economic Geology maintains an ArcIMS on the Texas Shoreline Change project at <http://www.beg.utexas.edu/coastal/coastal01.htm>. The project has divided the Texas coast into three areas and contains digital data on historical shorelines and shoreline change rate calculations. Eighteen categories of shoreline type have been identified in two digital files of the entire Texas coast (divided into two sections, from the Sabine River to Matagorda Peninsula and Matagorda Peninsula to the Rio Grand River). Additional data is available on beach profiles, aerial photography and projected future shoreline positions. Historical shoreline data for the upper Texas coast covers the Sabine River to Sargent Beach and is provided in UTM zone 15 coordinates. The middle Texas coast covering the area from the Brazos/San Bernard Rivers Delta complex to Pass Cavallo and portions of the south Texas coast covering the coastline from Corpus Christi at Aransas Pass to Baffin Bay area of Padre Island (Griffins Point) are in UTM zone 14. The South Padre Island to the Mexican Border historical shorelines are not available at this time. The dates of coverage of available digital historic shorelines for the three areas are listed in **Table 6**. The historic shoreline data depends on the extent of coverage available for each date so there are gaps in coverage for each date. An example of the historic shorelines around the Entrance to Bolivar Roads between the Bolivar Peninsula and Galveston Island are shown in **Figure 31**. Shoreline change rates Calculated by the BEG are also available in digital form based on the historic shorelines. This shoreline data needs to be converted into Lat/Lon decimal degrees if this to be compatible with the coordinate system presented in this paper.

Table 6. Historic Shoreline Dates for Texas Coast		
North	Central	South
1838		
1851/52/53/56		1856
1882/83		
1923		
1930/34/37	1934/37	1937
1955/56/57	1952/56/58	1956
1965	1965	1965
1970/73/74	1974	1974
1982/87		
1990/91		1991
1995/96		
	2000	2000

Great Lakes

The base shoreline data for the Great Lakes coast contains many gaps in high-resolution shoreline. Data is available from the NOAA/NOS Shoreline Data Explorer for only limited sections of the Great Lakes at this time. Since the Great Lakes do not have oceanic tides, the shoreline mapped from NOS aerial photographs is the water line on that particular photo set. **Figure 32** shows the coverage for the entire region. Further work is needed to complete the coverage of high-resolution base shoreline data. The International Joint Commission (IJC) is in the process of creating a GIS of the Great Lakes and shoreline data from that effort will be investigated to see if it will be adequate for the NSMS. The IJC effort is composed of researchers and officials from both the United States and Canada. The Federal lead agencies for the study are the USACE and Environment Canada. The study is investigating the shoreline types, and historic shoreline change rates around the shores of the St. Lawrence River, Lake Ontario, Niagara River, Lake Erie, Detroit River, Lake St. Clair and St. Clair River, Lake Huron, Lake Michigan, St. Mary's River and Lake Superior (Pope, et al., 1999). At the present time this map and report is the main source for shoreline types and erosion rates along the Great Lake shorelines. Six basic lake shoreline types have been identified, cohesive bluffs, low banks, sand, wetlands, bedrock and artificial. Erosion rates are available based on shoreline position data from various Federal, State, and local shoreline data sources. Efforts are under way to coordinate with the database developed for the IJC Great Lakes-St. Lawrence River water level fluctuation study.

Listed below are the NOAA/NOS shoreline data by each state that are in the database at the present time. All of this data has been downloaded from the Shoreline Data Explorer.

New York (Great Lakes)

Shoreline Base Maps

Most of the shoreline of the western St. Lawrence River, Lake Ontario and Niagara River are in the database from five shoreline segments. The New York state high-resolution shoreline on Lake Erie has not been completed at this time. **Table 1** lists the shorelines used in the database. The NOAA/OCRM, 2003 did not differentiate the miles of shoreline along the Great Lakes part of New York State, but just gave the total shoreline for the Atlantic and Great Lakes as 4224 km (2,625 miles). The population was also not divided between the Atlantic coast and the Great Lakes. The total coastal and Lake population is 15,026,340 people, most of which includes the New York City and Long Island population numbers.

Historic Shoreline Change Programs

None found at this time.

Pennsylvania

Shoreline Base Maps

No high resolution Lake Erie shoreline data is available in the data base at this time. The Lake Erie shoreline length is 101 km (63 miles). The NOAA/OCRM, 2003 data also included the Delaware Estuary portion of Pennsylvania as part of the coastal area which included an additional 92 km (57 miles) along the tidal Delaware River between the Delaware state line and Trenton, NJ, which includes the Philadelphia metropolitan area. The coastal population reflects the inclusion of the large number of people living along the Pennsylvania shoreline of the Delaware River Estuary, which is given as 2,949,974 people. The Lake Erie population is not differentiated.

Historic Shoreline Change Programs

None found at this time.

Ohio

Shoreline Base Maps

Three shoreline segments are available from NOAA/NOS Shoreline Data Explorer for the Ohio shoreline of Lake Erie. **Table 1** lists the segments covering the area between Vermillion and Fairport, OH on eastern Lake Erie, Cleveland Harbor area and two portions of western Lake Erie. The rest of the Lake Erie Ohio shoreline has not been made available yet by NOAA/NOS. The State of Ohio's length of shoreline is 422 km (262 miles), with a coastal population of 2,750, 000 people (NOAA/OCRM, 2003).

Historic Shoreline Change Programs

None found at this time. Erosion hazard mapping is being undertaken by the Ohio Department of Natural Resources, to examine the high lake level impacts on portions of the Ohio Lake Erie shore (Guy, 1999). These data are not available at this time to the NSMS.

Michigan

Shoreline Base Maps

The Great Lakes shoreline of the State of Michigan covers portions of western Lake Erie, Detroit River, Lake St. Clair, St. Clair River, Lake Huron, Lake Michigan, St Mary's River, and Lake Superior. Twenty-two high-resolution shoreline segments are available for Lake Huron and Lake Michigan in the State of Michigan from the NOAA/NOS Shoreline Data Explorer, but several segments of this long coastline are not available yet in the high-resolution format. **Table 1** lists the available segments, mostly around harbors and waterways. Michigan has 5,291 km (3,288 miles) of coast on four Great Lakes, Lake St. Clair and their connecting rivers and bays. The coastal population is 4,460,981 (NOAA/OCRM, 2003).

Historic Shoreline Change Programs

None found at this time.

Indiana

Shoreline Base Maps

Of the three counties at the bottom of Lake Michigan, only Lake County has a high-resolution shoreline of the East Chicago/Gary, IN (Burns Harbor) lakeshore is available from NOAA/NOS Shoreline Data Explorer. The rest of the 72 km (45 miles) of Indiana's lake shoreline to the east including Indiana Dunes National Lakeshore and Michigan City is not available at this time. The coastal population of Indiana is 711,592 people (NOAA/OCRM, 2003).

Historic Shoreline Change Programs

None found at this time.

Illinois

Shoreline Base Maps

Of the two counties at the lower west side of Lake Michigan in Illinois, only Cook County's Chicago lakefront is available as a high-resolution shoreline from NOAA/NOS

Shoreline Data Explorer. The rest of the approximate 50 km (31 miles) of lake shoreline in north Cook County and Lake County, IL is not available at this time. The total length of shoreline was measured using the Illinois GIS to be approximately 93 km (58 miles). The length of shoreline and coastal population of Illinois is not available from NOAA/OCRM, 2003 as the Illinois Coastal Zone Management Program is inactive.

Historic Shoreline Change Programs

None found at this time.

Wisconsin

Shoreline Base Maps

The shoreline of Wisconsin covers Lake Michigan on the east and Lake Superior on the north. Eight Segments of NOAA/NOS Shoreline Data Explorer high-resolution shoreline are available (**Table 1**), mostly located in the commercial harbor areas. There are 1,320 km (820 miles) of shoreline along the two Lakes with a coastal population of 1,907,788 people (NOAA/OCRM, 2003).

Historic Shoreline Change Programs

None found at this time.

Minnesota

Shoreline Base Maps

Three lakeshore segments are available from the high-resolution NOAA/NOS Shoreline Data Explorer for the Lake Superior shoreline of Minnesota (**Table 1**). The harbor areas at Duluth, MN-Superior, WI Harbor area, Knife River and Two Harbors, and the docks around Silver Bay, Taconite Bay and Grand Marais are the only shorelines included in the Minnesota NSMS GIS at this time. The shoreline is characterized for the most part as a bedrock shoreline (Pope et al., 1999). There are 304 km (189 miles) of State shoreline comprising the western side of Lake Superior, with a coastal population of 212,496 people (NOAA/OCRM, 2003).

Historic Shoreline Change Programs

None found at this time. Due to the rocky nature of the shoreline, low recession rates are reported for this entire segment of lakeshore from Duluth to the Canadian Border (Pope, et al., 1999).

Pacific

California

Shoreline Base Maps

The California baseline shoreline is provided from coverage of most of the open Pacific Coast shoreline by the State of California, Spatial Information Library (CaSIL) found at <http://www.gis.ca.gov/index.epl>. The shoreline map was published in 1997 and covers the entire Pacific Ocean shoreline from the Oregon border to the Mexican border. San Francisco Bay and other estuaries are not included. The shoreline was digitized from 1:24000 USGS quadrangle sheets in NAD27 Albers projection, with measurements in meters. An additional coverage of the California Coast created in 2000 was supplied on a CD from California Coastal Commission, Department of Boating and Waterways (CalBoating) that updated the 1997 SIL shoreline to include San Francisco Bay and provide more detail information of data collected in the Los Angeles area for a 1977 study of the Assessment and Atlas of Shoreline Erosion along the California Coast. Additional attributes of shoreline type are also added to this coverage. These two state coverages were in state plane NAD27 meters and were transformed to Lat/Lon Dec Deg, NAD83. A third statewide coverage was downloaded from the NOAA/CSC San Francisco CD (U.S. Department of Commerce, 1998), which was produced as part of the Coastal Change Analysis Program (C-CAP). This coverage had to be transformed from UTM Zone 10, meters. According to the metadata, this shoreline was also from the USGS shoreline, but contains more detail than the two state shoreline coverages from SIL and CalBoating. San Francisco Bay, as well as most of the other estuaries and river mouths and harbors are included in this coverage, with docks and other structures. This layer did not have any attribute information on shoreline type. A combination of all three statewide shorelines and the high-resolution shoreline segments, are needed to provide detailed base map coverage since each one has different details of coastal morphology.

In addition, five selected stretches of the California coast were found in the NOAA-NOS Shoreline Data Explorer and are of higher resolution based on aerial photography. These segments are from selected shore reaches at Humbolt Bay, Monterey Bay, the Big Sur coast, and parts of the Los Angeles to San Diego and San Diego Bay shoreline. The shorelines are a composite from coastal survey maps derived from NOS aerial photography from 1948 to 1978 (Table 1). NOAA/CSC has plans to produce a high-resolution shoreline for the entire State of California in 2004.

The California base shoreline map for the NSMS is a composite of parts of the four maps, which include the CaSIL and CalBoating (for shoreline type) and the NOAA/CSC and NOAA/NOS Shoreline Explorer shorelines (for completeness and detailed shoreline type of the five selected areas) published in 1997, 2000, 1998 and 2000 respectively (**Figure 33**). The state has 5,515 km (3,427 miles) of shoreline composed of the Pacific shoreline as well as San Francisco Bay. The coastal population from the 1990 census is 21,859,530 people (NOAA/NOS/OCRM).

Historic Shoreline Change Programs

Historic California shorelines from Imperial Beach at the Boarder with Mexico to San Pedro just north of the Los Angeles/Long Beach (LA/LB) Harbor are available in paper copy form only from the NOAA/NOS – COE/LAD Cooperative Shoreline Movement Program. This coverage includes San Diego Bay and the LA/LB Harbor shoreline. The dates on this map set cover 1852, 1887, 1916/17, 1933, 1960, and 1972 NOAA/NOS field surveys and 1982 NOS aerial photography (**Figure 34a**). These shorelines will also have to be digitized from original mylar sheets at CHL. No other shoreline change data has been found at this time. Circulation cells have been identified along the coast and are available in GIS format form the CaSIL (**Figure 34b**)

Oregon

Shoreline Base Maps

NOAA/NOS and CSC are presently working on creating a high-resolution digital vector shoreline base map of the Oregon Coast in conjunction with the Oregon Department of Land Conservation and Development, Ocean-Coastal Management Program. This high-resolution shoreline was just made available in 2003 from the NOAA/NOS Shoreline Data Explorer, after conversion from the raster shorelines from NOAA aerial photography and paper t-sheets into 8 shoreline segments (**Table 1** and **Figure 35**). The Pacific Ocean shoreline and the banks of the Columbia River west to the Washington State boundary are included in the data set from t-sheets and aerial photographs dating from the 1920's to 1970's. The scale of the t-sheets used in this effort range from 1:5,000 to 1:20,000. The state has 2,269 km (1,410 miles) of shoreline composed of the Pacific shoreline as well as the mouth of the Columbia River. The coastal population from the 1990 census is 1,085,935 people (NOAA/OCRM, 2003).

Historic Shoreline Change Programs

Historic and shoreline type data may be available from State of Oregon, Department of Geology and Mineral Industries. Data has been collected on beach profiles, aerial photography (1974-81), grain size data, foredune heights, and beach width measurements (1974-81, 1989-91) and other data of areas along the northern California, Oregon and Washington coast (Peterson et al., 1994). An excel spread sheet exists for this data but has not been downloaded at this time. Littoral cells have also been identified for the three state areas.

Washington

Shoreline Base Maps

The shoreline base map for the State of Washington was downloaded from the Washington State Department of Ecology, GIS at <http://www.ecy.wa.gov/services/gis/data/data.htm> . The base shoreline coverage

included Puget Sound, Hood Canal, Strait of Juan de Fuca and the Pacific coastline (**Figure 36**). This shoreline was digitized from USGS 7.5 minute digital quads at a scale of 1:24,000. The original data was available in 2000 in ArcView digital format, in Washington State Plane NAD27 feet coordinates. NOAA has not yet produced a high-resolution shoreline for the Washington coast. The state has 4,870 km (3,026 miles) of shoreline composed of the Pacific shoreline and the Strait of Juan de Fuca/Puget Sound area. The coastal population from the 1990 census is 3,389,033 people (NOAA/OCRM, 2003). Drift directions and other coastal data are available from the Washington State Department of Ecology at their Coastal Atlas site at http://apps.ecy.wa.gov/website/coastal_atlas/viewer.htm.

Historic Shoreline Change Programs

Two CD sets are available from NOAA/CSC on coastal change along portions of the Oregon and Washington coast U.S. Department of Commerce (1997b, 2000) that look at changes at the mouth of the Columbia River estuary and Topographic LIDAR shoreline mapping program along portions of the Washington coast. LIDAR shorelines are available in the early 1990's to present and are available from the State, as well as beach profiles.

Historic shorelines from NOAA/NOS have been digitized by the Department of Ecology from select areas of the Washington coast using 1869, 1871, 1872, 1873, 1886, 1926, 1950 1951, 1955, 1957 t-sheets, and aerial photography from 1957 and 1995 (Kaminsky et al., 1999), with work continuing in shoreline change assessment along the entire Washington State coastline.

Alaska

Shoreline Base Maps

Seventy-five shoreline segments are available from NOAA/NOS Shoreline Data Explorer for the State of Alaska coast (**Figure 37**). **Table 7** lists the segments that have been mapped. These shoreline segments, for the most part, are in the populated areas of the Alaskan Panhandle, southern Alaska's Pacific coast, sections of the Aleutian Islands and portions of the north shore along the Arctic Ocean. Only a few shoreline segments along the Bering Sea are available in high-resolution at this time. The State of Alaska's length of coast is 54,562 km (33,904 miles), with a coastal population of 466,410 people (NOAA/OCRM, 2003). A section of the coast at Yakutat Bay on the Pacific coast was also available from a Coastal Change Analysis Program (C-CAP) CD provided by U.S. Department of Commerce, National Oceanic and Atmospheric Administration Coastal Services Center (US Department of commerce, 1997c). Much of the coast of Alaska is of glacial origin and contains many estuaries in the form of fjords and rocky shores.

Historic Shoreline Change Programs

No wide scale coverage of historic shorelines of Alaska has been found at this time.

Hawaii

Shoreline Base Maps

NOAA/CSC Digital Shoreline of the United States had a base shoreline for the main islands in the Hawaiian Island group. The shoreline base was a compilation of shorelines from 1911 to 1986 from NOS coastal survey maps (for the older dates) and aerial photography (for the newer dates). These source maps and photos were at scales of 1:5,000, 1:10,000, 1:20,000 and 1:40,000. **Figure 38** shows the base map for the islands of Hawaii, Oahu, Maui, Molokai, Necker, Kauai, Lanai, Laysan, Lisianski, Niihau, Nihoa, French Frigate Shoals and Gardner Pinnacles. Kahoolawe Island was not included with this data set. The Hawaiian Island chain covers approximately 2,092 km (1,300 miles) of the central Pacific, extending from Lisianski in the west to the big island of Hawaii in the east. The Islands have 1,052,700 miles of coast, with a total coastal population of 1,159,600 (NOAA/OCRM, 2003). These islands are volcanic in origin and are composed mostly of rocky coasts with pocket beaches and embayments.

Historic Shoreline Change Programs

Historic shoreline change studies are underway on Oahu to map coastal hazards along a highly populated coast. Shorelines from aerial photography were used from 1949, 1950 and 1996 to measure a 60-year change in the shoreline (Coyne, et al., 1999). These data is not yet included in the NSMS database. Subsequent studies have extended the historical study to a 70-year period with the inclusion of a 1926 shoreline data set for one beach area at Kailua Beach, Oahu (Norcross, et al., 2002). No historical shoreline data sets have been found for the rest of the islands.

SUMMARY

Several shoreline change studies have been done in recent years or are being done presently by individual coastal states and Federal agencies with coastal mapping missions. Each of the coastal mapping programs approach the problem of identifying eroding shorelines and measuring rates of shoreline change using different techniques, coordinate systems and criteria to identify problems in erosion and accretion. States with existing historic shoreline positions maps usually extend from the 1880's to the 1980's. Available recent shorelines such as topographic LIDAR or bathymetric SHOALS data collected by the USGS (Stockdon, *et al.*, 2002; Sallenger, *et al.*, 2003) and USACE (Wozencraft and Lillycrop, 2003 need to be incorporated to update to present conditions and can be easily added to this NSMS database. Analysis of rates of change and identification of areas of concern for erosion or accretion are well documented for some

states but are lacking for others, making any assessment of a national-scale health of the coast difficult. The variability in each program requires standardization in mapping and analysis to be useful in understanding the magnitude of national coastal shoreline change problems and for development of a national strategy in coastal management.

A summary of shoreline data identified to date is presented to (1) show the diversity of data sets available for consideration for use in the NSMS, (2) to show large-scale regional trends in shoreline evolution, and (3) to identify the missing data that still needs to be collected. Collating all of the diverse existing data on spatial shoreline positions and temporal change may allow for standardization and compilation of a nationwide database on shore changes. These data are needed to identify on a national level, areas of significant coastal erosion, stable shore positions and accretion.

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Table 1. Shoreline Metadata - Base Shoreline for National Shoreline Management Study							
State	Source	Scale	Shoreline Dates	Publish Date	Original Spatial Data	Coverage	Missing Areas
Maine	NOAA/NOS/NGS/CSC	5,10,20000	19411017-19860901	20000818	Lat/Lon NAD83 Dec. Deg	Entire state shoreline	none
New Hampshire	NOAA/NOS/NGS	air/photos	19520101	20021125	Lat/Lon NAD83 Dec. Deg	Battleford Pool, ME-Cape Ann, MA PH114	Portions of Great Bay
	NOAA/NOS/NGS/CSC	10,000 T-sheets	19120615-19121201	20020606	Lat/Lon NAD83 Dec. Deg	Portsmouth NH-2c01	
Massachusetts	State-Coastal Zone Management	25000 USGS Quads	latest USGS Quad	2002	Mass Mainland ZoneNAD83 (m)	Entire state coverage	none
Rhode Island	NOAA/NOS/NGS	air/photos	19540401-19560501	20021125	Lat/Lon NAD83 Dec. Deg	Block Is Sound PH142	near RI/CT border
	NOAA/NOS/NGS	air/photos	19560501	20021125	Lat/Lon NAD83 Dec. Deg	Narragansett Bay PH163	
Connecticut	NOAA/NOS/NGS	air/photos	19840601	20021125	Lat/Lon NAD83 Dec. Deg	East-LI Sound CM-8315	New London to Mystic (13 mi)
	NOAA/NOS/NGS/CSC	10,000 T-sheet	19480502	20010517	Lat/Lon NAD83 Dec. Deg	PH-31	
	NOAA/NOS/NGS	air/photos	19840601	20021125	Lat/Lon NAD83 Dec. Deg	Fairfield Co (w LI Sound) CM-8312	
New York (Atlantic Coast)	NOAA/NOS/NGS	air/photos	19741001-19751001	20021125	Lat/Lon NAD83 Dec. Deg	NY Harbor CM-7301	none
		air/photos	19750501	20021125	Lat/Lon NAD83 Dec. Deg	East/Hudson R. CM-7403	
		air/photos	19840601	20021125	Lat/Lon NAD83 Dec. Deg	W. LI Sound CM-83-12	
		air/photos	19651001	20021125	Lat/Lon NAD83 Dec. Deg	E end Long Is PH6602	
		air/photos	19651001-19700901	20021125	Lat/Lon NAD83 Dec. Deg	N. Shore LI PH6603	
	NOAA/NOS/NGS/CSC	10,000 T-sheets	19271101-19331001	20020425	Lat/Lon NAD83 Dec. Deg	Rockaway to Fire Island NY-1933a	
		10,000 T-sheets	19330222-19331104	20020325	Lat/Lon NAD83 Dec. Deg	Westhampton to Montock Pt. NY-1933b	
		10,000 T-sheets	19470501-19471020	20020214	Lat/Lon NAD83 Dec. Deg	Rockaway to Far Rockaway PH-16a	
		10,000 T-sheets	19460801-19470923	20020213	Lat/Lon NAD83 Dec. Deg	Great South Bay PH-54	
New Jersey	NOAA/NOS/NGS/CSC	5,10,15,20000	19320401-19810901	20020911	Lat/Lon NAD83 Dec. Deg	Entire state shoreline	none
	State of New Jersey -DEP	air/photos	1986	1996	NJ State Plane NAD27	Entire state shoreline	none
Delaware	NOAA/NOS/NGS	air/photos	19691001-19891001	20021122	Lat/Lon NAD83 Dec. Deg	Bay/N. Atlantic PH6905	S. Bethany Bch to State Line
	NOAA/NOS/NGS	air/photos	19750401-19780601	20021125	Lat/Lon NAD83 Dec. Deg	Del River CM-7707	
	NOAA/CSC	20,000 T-sheets	19430101	20011101	Lat/Lon NAD83 Dec. Deg	Bay/N. Atlantic CS302b	
	NOAA/CSC	10,20,000 T-sheets	19460301-19480301	20011114	Lat/Lon NAD83 Dec. Deg	Del River PH7	
Maryland	State-Maryland Geologic Survey	25000 USGS Quads	1988-1995	2003	MD state plane NAD83	Chesapeake Bay and Atlantic Coast	none
Virginia	State of Virginia (VIMS)	24000 USGS Quads	1964-1987	1991	UTM zone 18 NAD83 (m)	Chesapeake Bay and Atlantic Coast	none
North Carolina	NOAA/NOS/NGS/CSC	5,10,20,50000	19330129-19941206	20020417	Lat/Lon NAD83 Dec. Deg	Entire State Shoreline	none
South Carolina	NOAA/NOS/NGS/CSC	10, 20000	19840201-19870201	20000808	Lat/Lon NAD83 Dec. Deg	Entire State Shoreline	none
Georgia	NOAA/NOS/NGS/CSC	10,20,50000	193303-19941206	20000919	Lat/Lon NAD83 Dec. Deg	Entire state shoreline	none
Florida	NOAA/NOS/NGS (SE)	air/photos	19790201-19800301	20021121	Lat/Lon NAD83 Dec. Deg	NE FL CM-7816	none
	NOAA/NOS/NGS/CSC (CD)	T-sheets	19280429-19300429	20021009	Lat/Lon NAD83 Dec. Deg	New Smyrna Bch to Daytona Bch FL129c01	
	NOAA/NOS/CSC (CD)	air/photos	19671001-19731001	20010815	Lat/Lon NAD83 Dec. Deg	St Augustine-Cape Canaveral PH-6716	

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Table 1. Shoreline Metadata - Base Shoreline for National Shoreline Management Study

	NOAA/NOS/NGS (SE)	air/photos	19690801-19700801	20021121	Lat/Lon NAD83 Dec. Deg	Central FL ATL PH6910	
	NOAA/NOS/NGS (SE)	air/photos	19700201-19700801	20021121	Lat/Lon NAD83 Dec. Deg	Region III-N PH7010	
	NOAA/NOS/NGS (SE)	air/photos	19710201-19751101	20021121	Lat/Lon NAD83 Dec. Deg	Region III-S PH7113	
	NOAA/NOS/CSC (CD)	air/photos	19630801-19661001	20010621	Lat/Lon NAD83 Dec. Deg	Key West to Dry Tortugas PH6003	
	NOAA/NOS/CSC (CD)	air/photos	19740301	20021121	Lat/Lon NAD83 Dec. Deg	Big Pine Key to Key West CM7201	
	NOAA/NOS/NGS (SE)	air/photos	19720701-19750501	20021121	Lat/Lon NAD83 Dec. Deg	middle Keys PH7120	
	NOAA/NOS/NGS (SE)	air/photos	19720201	20021121	Lat/Lon NAD83 Dec. Deg	upper Keys PH7119	
	NOAA/NOS/CSC (CD)	T-sheets	19350117-19350126	20020605	Lat/Lon NAD83 Dec. Deg	Florida Bay II FL3501	
	NOAA/NOS/CSC (CD)	air/photos	19720201	20011004	Lat/Lon NAD83 Dec. Deg	Florida Bay I PH6408	
	NOAA/NOS/CSC (CD-2)	T-sheets	19270222-19280412	20020604	Lat/Lon NAD83 Dec. Deg	Ten Thousand Islands FL2701	
	NOAA/NOS/NGS (SE)	air/photos	19781101	20021121	Lat/Lon NAD83 Dec. Deg	Venice to Everglades City CM-7708	
	NOAA/NOS/NGS/CSC (CD)	air/photos	19770101-19780101	20000915	Lat/Lon NAD83 Dec. Deg	Anna Maria Key-Ft. Meyers Beach fishr	
	NOAA/NOS/NGS (SE)	air/photos	197711	20021121	Lat/Lon NAD83 Dec. Deg	Tampa Bay CM-7715	
	NOAA/NOS/NGS (SE)	air/photos	19760901-19761001	20021121	Lat/Lon NAD83 Dec. Deg	St. Pete CM-7612	
	NOAA/NOS/NGS (SE)	air photos	19790201-19790301	20021121	Lat/Lon NAD83 Dec. Deg	Panhandle1 CM-7819	
	NOAA/NOS/NGS (SE)	air photos	19790201	20021121	Lat/Lon NAD83 Dec. Deg	Panhandle2 CM-7820	
	NOAA/NOS/NGS (SE)	air photos	19790201-19790301	20021121	Lat/Lon NAD83 Dec. Deg	Appalachicola CM-7821	
	NOAA/NOS/NGS (SE)	air photos	19770101	20021121	Lat/Lon NAD83 Dec. Deg	Panama City CM-7701	
	NOAA/NOS/NGS (SE)	air photos	19780101-19780201	20021121	Lat/Lon NAD83 Dec. Deg	Pensacola CM-7719	
Alabama	NOAA/NOS/NGS/CSC	20,000	19830401-19881001	20000808	Lat/Lon NAD83 Dec. Deg	Entire State Shoreline	none
Mississippi	NOAA/NOS/NGS/CSC	20,000	19860301-19870301	20000808	Lat/Lon NAD83 Dec. Deg	Entire state shoreline	none
Louisiana	NOAA/NOS/NGS/CSC	10, 20000	19321129-19861101	20010124	Lat/Lon NAD83 Dec. Deg	Entire State Shoreline	none
Texas	NOAA/NOS/NGS/CSC	5,7.5,10,20000	19230301-19890301	20010125	Lat/Lon NAD83 Dec. Deg	Entire state shoreline	none
	State GLO/BEG				Lat/Lon NAD83 Dec. Deg	Entire state shoreline	none
Great Lakes –	NOAA/NOS/NGS (SE)	air photos	19821001	20030113	Lat/Lon NAD83 Dec. Deg	St. Lawrence R CM-8205	Lake Erie
New York	NOAA/NOS/NGS (SE)	air photos	19840501	20030113	Lat/Lon NAD83 Dec. Deg	Lake Ontario- east CM-8302	
	NOAA/NOS/NGS (SE)	air photos	19800928-19800929	20030113	Lat/Lon NAD83 Dec. Deg	Lake Ontario-Rochester to Oswego CM-8004	
	NOAA/NOS/NGS (SE)	air photos	19800603-19800929	20030113	Lat/Lon NAD83 Dec. Deg	Lake Ontario-Rochester to Niagara CM-8000	
	NOAA/NOS/NGS (SE)	air photos	19800901	20030113	Lat/Lon NAD83 Dec. Deg	Niagara River CM-8104	
Pennsylvania							all
Ohio	NOAA/NOS/NGS (SE)	air photos	19750401-19750426	20030114	Lat/Lon NAD83 Dec. Deg	Vermillion - Fairport, OH CM-7510	many areas
	NOAA/NOS/NGS (SE)	air photos	200008	20030114	Lat/Lon NAD83 Dec. Deg	Cleveland Harbor, OH OH0001A	
	NOAA/NOS/NGS (SE)	air photos	19750914-19751001	20030114	Lat/Lon NAD83 Dec. Deg	W. Enid OH to Mich, CM-7603	
Michigan	NOAA/NOS/NGS (SE)	air photos	19770501-19780401	20030114	Lat/Lon NAD83 Dec. Deg	Detroit River PH-7118	many areas
	NOAA/NOS/NGS (SE)	air photos	19800601	20030114	Lat/Lon NAD83 Dec. Deg	Saginaw River CM-8001	
	NOAA/NOS/NGS (SE)	air photos	19790612	20030114	Lat/Lon NAD83 Dec. Deg	Manistee, Lake Mich. CM-7908	
	NOAA/NOS/NGS (SE)	air photos	19790701	20030114	Lat/Lon NAD83 Dec. Deg	Ludington Harbor, Lake Mich. CM-7901	
	NOAA/NOS/NGS (SE)	air photos	19790529	20030114	Lat/Lon NAD83 Dec. Deg	Grand Haven, Lake Mich. CM-7907	
	NOAA/NOS/NGS (SE)	air photos	19790601	20030114	Lat/Lon NAD83 Dec. Deg	St. Joseph, Lake Mich. CM-7909	

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Table 1. Shoreline Metadata - Base Shoreline for National Shoreline Management Study							
	NOAA/NOS/NGS (SE)	air photos	19930710	20030114	Lat/Lon NAD83 Dec. Deg	Beaver Is, Lake Mich. CM-9303F	
	NOAA/NOS/NGS (SE)	air photos	19930707	20030114	Lat/Lon NAD83 Dec. Deg	High & Trout Is, Lake Mich. CM-9303G	
	NOAA/NOS/NGS (SE)	air photos	19930710	20030114	Lat/Lon NAD83 Dec. Deg	Manatou Is, Lake Mich. CM-9303D	
	NOAA/NOS/NGS (SE)	air photos	19870601	20030114	Lat/Lon NAD83 Dec. Deg	Scoolcraft Co., Lake Mich. CM-8606	
	NOAA/NOS/NGS (SE)	air photos	19870601	20030114	Lat/Lon NAD83 Dec. Deg	Pt Patterson to Gros Cap, L. Mich CM-8604	
	NOAA/NOS/NGS (SE)	air photos	19870525-19870604	20030114	Lat/Lon NAD83 Dec. Deg	Mackinac Area, Lake Huron CM-8603	
	NOAA/NOS/NGS (SE)	air photos	19840501	20030114	Lat/Lon NAD83 Dec. Deg	St. Mary's River south CM-8412	
	NOAA/NOS/NGS (SE)	air photos	19820601	20030114	Lat/Lon NAD83 Dec. Deg	St. Mary's River north CM-7806	
	NOAA/NOS/NGS (SE)	air photos	19860601	20030114	Lat/Lon NAD83 Dec. Deg	Whitefish Bay, Lake Superior CM-8511	
	NOAA/NOS/NGS (SE)	air photos	19860601	20030114	Lat/Lon NAD83 Dec. Deg	Luce Co., Lake Superior CM-8509	
	NOAA/NOS/NGS (SE)	air photos	19860601	20030114	Lat/Lon NAD83 Dec. Deg	Au Sable Pt to Marquette, L Sup. CM-8501	
	NOAA/NOS/NGS (SE)	air photos	19850601	20030114	Lat/Lon NAD83 Dec. Deg	Thorney Pt to Pt Abbaye, L. Sup. CM-8500	
	NOAA/NOS/NGS (SE)	air photos	19770501-19780618	20030114	Lat/Lon NAD83 Dec. Deg	Keweenaw Waterway, L. Sup. CM-7705	
	NOAA/NOS/NGS (SE)	air photos	19850601	20030114	Lat/Lon NAD83 Dec. Deg	Traverse Pt to Eagle Har., L Sup CM-8415	
	NOAA/NOS/NGS (SE)	air photos	19850601	20030114	Lat/Lon NAD83 Dec. Deg	Eagle Har. To 14 mile Pt., L Sup CM-8411	
Indiana	NOAA/NOS/NGS (SE)	air photos	19780601	20030114	Lat/Lon NAD83 Dec. Deg	Gary, IN, Lake Mich CM-7811	east 2/3 of Lake Mich shore
Illinois	NOAA/NOS/NGS (SE)	air photos	19780601	20030114	Lat/Lon NAD83 Dec. Deg	Chicago Lakefront CM-7811	north of Chicago
Wisconsin	NOAA/NOS/NGS (SE)	air photos	19790702	20030114	Lat/Lon NAD83 Dec. Deg	Racine Harbor, Lake Mich. CM-7903	many areas
	NOAA/NOS/NGS (SE)	air photos	19790702	20030114	Lat/Lon NAD83 Dec. Deg	Sheboygan Harbor, Lake Mich. CM-7905	
	NOAA/NOS/NGS (SE)	air photos	19790702	20030114	Lat/Lon NAD83 Dec. Deg	Manitowoc Harbor, Lake Mich. CM-79002	
	NOAA/NOS/NGS (SE)	air photos	19790702	20030114	Lat/Lon NAD83 Dec. Deg	Sturgeon Bay/Canal, Lake Mich CM-7904	
	NOAA/NOS/NGS (SE)	air photos	19730901	20030114	Lat/Lon NAD83 Dec. Deg	Baileys Har., Lake Mich. CM-7721	
	NOAA/NOS/NGS (SE)	air photos	19780401-19780501	20030114	Lat/Lon NAD83 Dec. Deg	Fox River, Green Bay CM-7812	
	NOAA/NOS/NGS (SE)	air photos	19800801-19800831	20030114	Lat/Lon NAD83 Dec. Deg	Duluth-Superior Harbor, L. Sup CM-8008	
	NOAA/NOS/NGS (SE)	air photos	19800830	20030114	Lat/Lon NAD83 Dec. Deg	Nemadji River, L Sup CM-8311	
Minnesota	NOAA/NOS/NGS (SE)	air photos	19800801-19800831	20030114	Lat/Lon NAD83 Dec. Deg	Duluth-Superior Harbor, L. Sup CM-8008	many areas
	NOAA/NOS/NGS (SE)	air photos	19820501	20030114	Lat/Lon NAD83 Dec. Deg	Two Har. & Knife River area L Sup CM-8316	
	NOAA/NOS/NGS (SE)	air photos	19840501	20030114	Lat/Lon NAD83 Dec. Deg	Silver B./Taconite H./G Marais H. CM-	

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Table 1. Shoreline Metadata - Base Shoreline for National Shoreline Management Study							
						8407	
Alaska	NOAA/NOS/NGS (SE)	10, 20000	various	see Table 7	Lat/Lon NAD83 Dec. Deg	numerous small segments	many areas
Washington	State Dept. of Ecology	24,000	USGS Quads	20000523	State Plane South Zone NAD27	Entire State Shoreline	none
Oregon	NOAA/NOS/NGS (SE)	T-sheets	19280629-19281001	20030730	Lat/Lon NAD83 Dec. Deg	Pistol River area OR42B01 (south)	none
	NOAA/NOS/NGS (SE)	T-sheets	19280601-19280901	20030730	Lat/Lon NAD83 Dec. Deg	Port Orford area OR42B02	
	NOAA/NOS/NGS (SE)	T-sheets	19251001	20030730	Lat/Lon NAD83 Dec. Deg	Prosper area OR42B04	
	NOAA/NOS/NGS (SE)	T-sheets	19240701-19240801	20030730	Lat/Lon NAD83 Dec. Deg	Langlois area OR42B05	
	NOAA/NOS/NGS (SE)	T-sheets	19280101-19281001	20030730	Lat/Lon NAD83 Dec. Deg	Cape Perpetue area OR43B01	
	NOAA/NOS/NGS (SE)	T-sheets	19200101	20030730	Lat/Lon NAD83 Dec. Deg	Reedsport estuary OR43B02	
	NOAA/NOS/NGS (SE)	T-sheets	19140101	20030730	Lat/Lon NAD83 Dec. Deg	Newport estuary OR43B03	
	NOAA/NOS/NGS (SE)	T-sheets	19260601-19270515	20030730	Lat/Lon NAD83 Dec. Deg	Manzanita area OR43C04 (north)	
California	CA State GIS CaSIL	24,000	USGS Quads	19970101	NAD27 m Albers proj.	All-COAST24A	San Fran Bay
	CA Coastal Commission (CD)	24,000	USGS Quads	20001001	NAD27 m Albers proj.	All-Coast_Status	
	NOAA/CSC (San Fran. CD)	24,000	USGS Quads	19980201	NAD27 m UTM Zone 10	All-Coastline	
	NOAA/NOS/NGS (SE)	air/photos	19481121	20021204	Lat/Lon NAD83 Dec. Deg	Humbolt Bay PH25	
		air/photos	19780401	20021204	Lat/Lon NAD83 Dec. Deg	Montrey Bay CM-7802	
		air/photos	19760301	20021204	Lat/Lon NAD83 Dec. Deg	Sur-South CM-7604	
		air/photos	19720301	20021204	Lat/Lon NAD83 Dec. Deg	LA-SD PH6702	
		air/photos	19600901	20021204	Lat/Lon NAD83 Dec. Deg	SD Bay PH6011	
Hawaii	NOAA/NOS/NGS/CSC	5,10,20,25000	19110101-19860501	20020410	Lat/Lon NAD83 Dec. Deg	Entire State Shoreline	
Puerto Rico/Virgin Is.	NOAA/NOS/NGS/CSC	5,10,20,40000	1901-19950314	20000808	Lat/Lon NAD83 Dec. Deg	Entire State Shoreline	none

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Table 2. Shoreline Metadata - Historic Shorelines for National Shoreline Management Study								
State	Source	Scale/Source	Shoreline Dates	Publish Date	Spatial Data	Coverage	Missing Areas	Erosion Rates
Maine								
New Hampshire								
Massachusetts	State-Coastal Zone Management	T-sheets NOAA/NOS	1844-1890	2002	MA Mainland NAD83 -m	entire state shoreline	none	Yes 40 m interval
		T-sheets NOAA/NOS	1892-1938					
		T-sheets NOAA/NOS	1948-1975					
		FEMA, Topo, ortho,AP	1978-1982					
		Air photo	1994					
Rhode Island								
Connecticut	Coastal Management Program	paper only	1800's - 1970's					
New York	State of New York -Dept of State							
New Jersey	State of New Jersey -DEP	T-sheets	1836-42	1988-1991	NJ State Plane NAD27	entire state shoreline	none	
		T-sheets	1855					
		T-sheets	1866-68					
		T-sheets	1871-75					
		T-sheets	1879-85					
		T-sheets	1899					
		T-sheets	1932-36					
			1943					
			1951-53					
			1971					
			1977					
		air/photos	1986					
Delaware	NOAA-CERC Part II Mapping Prog.	T-sheet	1849	1983	Lat/Lon NAD27	Atlantic shoreline	Del Bay	
	(Paper only)	T-sheet	1850					
		T-sheet	1908					
		T-sheet	1929					
		T-sheet	1933					
		T-sheet	1942					
		T-sheet	1961/62					
		T-sheet	1976					
		aerial photography	1980					
	State DNR	Profiles/ Leatherman			Atl Ocn/Del Bay			
Maryland	NOAA-CERC Part	T-sheet	1849	1983	Lat/Lon NAD27	Atlantic shoreline	Chesapeake	

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Table 2. Shoreline Metadata - Historic Shorelines for National Shoreline Management Study								
	II Mapping Prog.						Bay	
	(Paper only)	T-sheet	1850					
		T-sheet	1908					
		T-sheet	1929					
		T-sheet	1933					
		T-sheet	1942					
		T-sheet	1961/62					
		T-sheet	1976					
		aerial photography	1980					
	Maryland Geologic Survey	T-Sheet, Air Photo	see Table 3	2003	MD State Plane NAD83	Atlantic Coast/ Chesapeake Bay		
Virginia	NOAA-CERC Part II Mapping Prog.	T-sheet	1849	1983	Lat/Lon NAD27	Atlantic shoreline	Chesapeake Bay	
	(Paper only)	T-sheet	1850			MD state line to Cape Charles		
		T-sheet	1908					
		T-sheet	1929					
		T-sheet	1933					
		T-sheet	1942					
		T-sheet	1961/62					
		T-sheet	1976					
		aerial photography	1980					
	NOAA-CERC Part I Mapping Prog.	T-sheet	1852	1983	Lat/Lon NAD27	Atlantic shoreline		
	(Paper only)	T-sheet	1859			Cape Henry to NC state line		
		T-sheet	1916					
		T-sheet	1925					
		T-sheet	1944					
		T-sheet	1962					
		aerial photography	1980					
North Carolina	NOAA-CERC Part I Mapping Prog.	T-sheet	1852	1983	Lat/Lon NAD27	Atlantic shoreline	Cape Lookout-Fear	yes
	(Paper only)	T-sheet	1859			NC state line to		
		T-sheet	1916			Cape Hatteras		
		T-sheet	1925					
		T-sheet	1944					
		T-sheet	1962					
		aerial photography	1980					
	NOAA-CERC-DRSS Part III	T-Sheet	1978	1983	Lat/Lon NAD27	Atlantic shoreline		
		T-Sheet	1914			Cape Fear to SC line		

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Table 2. Shoreline Metadata - Historic Shorelines for National Shoreline Management Study								
		T-Sheet	1923					
		T-Sheet	1933-34					
		T-Sheet	1972/73/75					
		aerial photography	1983					
	Division of Coastal Management							yes
South Carolina	NOAA-CERC-DRSS	T-Sheet	1852	1983	Lat/Lon NAD27	Atlantic shoreline		
	Part III Mapping Prog.	T-Sheet	1859-63			NC state line to		
	Digital Coastal Carolina Univ	T-sheet	1870-74/78			Tybee Is GA		
		T-sheet	1900-1914					
		T-sheet	1920-23					
		T-sheet	1933/34					
		T-sheet	1970-7462					
		aerial photography	1982/830					
	Coastal Carolina U.	air photo						
Georgia								
Florida	State-B. of Beaches & Wetland Sys	FSU	varies by county	FL State Plane 3 zones	most of state	zero energy coast		yes
	See Table 4				NAD27			
Alabama	NOAA CD	T-Sheet	1849	1997	Lat/Lon NAD83 Dec. Deg.	Entire Gulf shoreline	none	yes
		T-Sheet	1867					
		T-sheet	1890					
		T-Sheet	1892					
		T-sheet	1908					
		T-Sheet	1917					
		T-Sheet	1918					
Mississippi								
Louisiana	USGS/LGS/UNO	paper only	1855-1989 (5 dates)	1992	Lat/Lon NAD83	Chandeleur Islands North	Chenier Plain	yes
			1869-1989 (5 dates)			Chandeleur Islands South		
			1884-1988 (5 dates)			Plaquemines Barrier System		
			1887-1998 (5 dates)			Camarada-Moreau/Grand Is.		
			1887-1988 (5 dates)			Timbalier Islands		
			1853-1988 (6 dates)			Isles Dernieres		

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Table 2. Shoreline Metadata - Historic Shorelines for National Shoreline Management Study								
						Barrier Sys		
Texas	TX Bureau of Econ. Geol.		1838-1996 (22 dates)		UTM Zone 15	Sabine Pass-Brazos R.		yes
			1934-2000 (8 dates)		UTM Zone 14	Brazos R.-Pass Cavallo		
			1856-2000 (7 dates)		UTM Zone 14	Aransas Pass-Padre Is		
			1941-1995		UTM Zone 14	Baffin Bay		
Great Lakes-								
New York								
Pennsylvania								
Ohio								
Michigan								
Indiana								
Illinois								
Wisconsin								
Minnesota								
Alaska								
Washington								
Oregon								
California	NOAA/NOS-COE/SPL	T-Sheet	1852	1985	Lat/Lon NAD27	Imperial Beach-San Pedro	central and north	
	Coast of CA Study	T-Sheet	1887					
	(Paper only)	T-Sheet	1916/17					
		T-Sheet	1933					
		T-Sheet	1960					
		T-Sheet	1972					
		aerial photography	1982					
Hawaii								
Puerto Rico/Virgin Is.								

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Table 4. Florida Historic Shoreline Data - DEP Bureau of Beaches and Wetland Resources												
Co\Dates	1850's	1860's	1870's	1880's	1890's	1900's	1910's	1920's	1930's	1940's	1950's	1960's
Nassau	1857		1871					1924	1933		1957-8	
Duval	1853, 1858		1871					1924	1933	1943-8	1951-4, 1957-8	1963-4
St Johns	1858-63	1867-72						1923-4	1937	1943-8	1949-52, 1952-56, 1956-7, 1958	1962-4
Flagler			1872-3					1923-4			1952-6, 1956-7	
Volusia			1873-5					1924, 1928		1947-52	1951-2, 1952-6, 1956-7	1969-70
Brevard			1876-81					1928-30		1947-9		1966-8, 1969-71
Indian River				1880-2				1928-30		1946-9		1966-8
St Lucie		1860-1		1882-3				1928-30		1945-9		1966-8
Martin				1883				1928-30		1940-2, 1942-8		1960-4, 1967
Palm Beach				1883-4				1927-9				1061-2, 1966-7
Broward				1883-4				1927, 1928	1934, 1935	1942-7		1961-2, 1969
Dade	1851	1867		1883			1913, 1919	1927-8	1935-6	1942-7		1961-2, 1969
Monroe	NO DATA											
Collier				1885				1927			1951-8, 1953-60	1965-7
Lee	1856-60			1885				1927	1939-43		1950-8, 1953-60	1960-1
Charlotte		1860		1883				1927	1939-44		1951-7	
Sarasota				1883						1942-4	1951-7	1962-4
Manatee			1874	1883				1925-6	1939-44		1952, 1953-7	1962-4
Pinellas			1873-4					1925-6	1939-44		1954-6	1962-4, 1969
Pasco	NO DATA											
Hernando	NO DATA											
Citrus	NO DATA											
Levy	NO DATA											
Dixie	NO DATA											
Taylor	NO DATA											
Jefferson	NO DATA											
Wakulla	NO DATA											
Franklyn	1856-9					1902			1934	1942-9		
Gulf	1857-8	1868-9				1902			1934			
Bay	1855	1869	1870, 1872						1934	1943	1954-6	
Walton			1872						1934-5	1943	1955-6	1969-70
Okaloosa			1871-2					1926-7	1930, 1934			1969-70
Escambia		1865-9	1867-71		1890, 1895	1902	1911	1920, 1926-7	1930, 1934			1965-70

Table 3. Maryland - Historic Shoreline Data - Maryland Geologic Survey					
Quad	1800's	1930's-1940's	1950's-1960's	1970's-1980's	1990's
Aberdeen					1994
Alexandria	1862			1974	1993
Annapolis	1847	1934	1965	1976	1994
Assawoman Bay	1850	1942	1962	1989	
Baltimore East				1975	1994
Baltimore West				1974	1994
Barren Island	1848	1942			1993, 1994
Benedict	1849	1942, 1944			1993
Berlin	1849	1942	1962	1989	
Betterton	1845	1943		1976	1995
Blackwater River					1995
Bloodsworth Island		1942		1988	
Boxiron	1850	1942	1962	1989	
Bristol		1942, 1944			1993, 1994
Broomes Island	1860	1942	1960		1993
Cambridge	1848	1940, 1943			1995
Cecilton					1995
Centreville					1992
Charlotte Hall	1868	1942	1959		1993
Chestertown	1846				1992
Chicamacomico River					1995
Church Creek		1942			1994
Church Hill					1992
Claiborne	1847	1937, 1942	1961		1992, 1994
Colonial Beach North	1863	1942	1958, 1961		1993
Cove Point	1848	1942			1993
Crisfield	1851	1942		1988	
Curtis Bay	1846	1934		1975	1994
Deal Island	1849	1942		1988	
Deale	1846	1934, 1944			1994
Denton					1995
Dividing Creek				1989	
Earleville	1845	1937		1976	1995
East New Market	1848	1940, 1944			1995
Easton	1900	1942			1995
Eden -				1988, 1989	
Edgewood	1846			1974, 1976	1994
Elkton	1845	1938		1976	1995
Ewell	1849	1942		1988	
Federalsburg					1995
Fowling Creek					1995
Galena	1846	1937, 1943		1976	1992, 1995
Gibson Island	1845, 1898	1942	1965	1975, 1976	1994
Girdletree	1843	1942	1963	1988, 1989	
Golden Hill	1848	1942			1994
Great Fox Island	1849	1942		1988	

Table 3. Maryland - Historic Shoreline Data - Maryland Geologic Survey					
Gunpowder Neck	1846	1933		1974	1994
Hallwood				1989	
Hanesville	1845			1976	1994
Havre de Grace	1845			1976	1995
Hebron				1989	
Hobbs					1995
Hollywood	1848	1942			1993
Honga	1848	1942			1994
Horseshoe Point	1846, 1847	1934, 1937, 1943, 1944			1994
Hudson	1847	1942			1994
Indian Head	1862			1973	1993
Kedges Straits		1942		1988, 1989	
Kent Island	1844	1942	1961	1976	1992
King George	1862, 1903		1961	1972	1993
Kingston				1988, 1989	
Langford Creek	1846	1942			1992
Leonardtown			1958		1993
Love Point	1846	1942		1976	1992
Lower Marlboro	1859	1942			1993
Mardela Springs				1988	
Marion	1852	1942		1988	
Mathias Point	1862, 1904		1961		1993
Mechanicsville	1860	1942, 1944			1993
Middle River	1847	1936		1974, 1975, 1976	1994
Millington		1937		1976	1992, 1995
Monie	1849	1942		1988	
Mount Vernon	1862	1939		1973, 1974	1993
Nanjemoy	1862, 1903		1961	1972	1993
Nanticoke	1849	1942		1988	1995
North Beach	1847	1934	1960		1993
North East				1976	1995
Ocean City	1850	1942	1962	1977, 1989	
Oxford	1847	1942			1994
Perryman	1845			1976	1994
Piney Point	1868	1943	1958, 1959		1993
Pocomoke City				1989	
Point Lookout	1849	1942	1955		1993
Point No Point	1848	1943	1955, 1958		1993
Popes Creek	1862	1943	1959, 1961		1993
Port Tobacco	1862			1973	1993
Preston	1848	1944			1995
Prince Frederick	1848	1942	1960		1993
Princess Anne				1988, 1989	
Public Landing	1849	1942	1961	1989	
Quantico	1862	1939		1972	1993
Queenstown	1846	1942			1992
Rhodesdale				1988	1995
Richland Point	1849	1942			1994

Table 3. Maryland - Historic Shoreline Data - Maryland Geologic Survey					
Ridgely					1992
Rock Hall	1845	1942		1976	1994
Rock Point	1868	1942	1958, 1959		1993
Round Bay	1845	1934	1965	1976	1994
Salisbury				1989	
Saxis	1851	1942		1988, 1989	
Selbyville	1850	1942	1961	1989	
Sharptown				1989	
Snow Hill				1988, 1989	
Solomons Island	1848	1942, 1943			1993
South River	1847	1934, 1944	1965		1994
Sparrows Point	1846	1934		1975, 1976	1994
Spesutie	1846	1938		1976	1995
St. Clements Island		1942	1958		1993
St. George Island	1858	1942, 1943	1958		1993
St. Marys City	1853		1958		1993
St. Michaels	1847	1937, 1942			1992, 1994
Stratford Hall	1868	1943	1958		1993
Sudlersville					1992
Swan Point	1846	1938		1976	1994
Taylors Island	1848	1942			1994
Terrapin Sand Point	1849	1942		1988, 1989	
Tilghman	1847	1937, 1942			1994
Tingles Island	1849	1942	1962	1989	
Trappe	1848	1942			1995
Wetipquin	1849	1942		1988	
White Marsh					1994
Whittington Point	1850	1942	1962	1989	
Widewater	1862, 1904			1972	1993
Wingate	1849	1942			1995
Wye Mills					1992
Note: <i>italic print = Atlantic Coast shoreline</i> regular print = Chesapeake Bay shoreline					

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Table 7. Alaska Base Shoreline NOAA High-Resolution Shoreline Metadata							
Location	Segment #	Segment File Name	Metadata Date	Source	Area Covered	Shoreline Date	Data From:
Panhandle	AK00a	Glacier Bay	20030730	NOAA/NOS/NGS (SE)	Glacier Bay fjord coast	19970817	Air Photo
Panhandle	AK01A	Kasaan Bay	20030730	NOAA/NOS/NGS (SE)	Kasaan Bay	1997	Air Photo
Gulf of Alaska	AK01b1	Resurrection Bay	20030730	NOAA/NOS/NGS (SE)	Resurrection Bay	1992	Air Photo
Gulf of Alaska	AK01C	Aialik Bay	20030730	NOAA/NOS/NGS (SE)	Aialik Bay	1998	Air Photo
Gulf of Alaska	AK0208	Port Valdez	20030730	NOAA/NOS/NGS (SE)	Port Valdez update	20010422	Air Photo
Panhandle	AK02A	Sitka Supplemental	20030730	NOAA/NOS/NGS (SE)	Sitka area addition	199903	Air Photo
Panhandle	AK02B	Skowl Arm	20030730	NOAA/NOS/NGS (SE)	Skowl Arm of Kasaan Bay	199705-199708	Air Photo
Panhandle	AK9702A	Ketchikan Harbor	20030730	NOAA/NOS/NGS (SE)	Ketchikan Harbor	19970809-19980515	Air Photo
Panhandle	AK9702B	N. Clarence Strait	20030730	NOAA/NOS/NGS (SE)	North Clarence Strait	19970810	Air Photo
Panhandle	AK9702C	Stikine Strait	20030730	NOAA/NOS/NGS (SE)	Stikine Strait	19970810-19980515	Air Photo
Panhandle	AK9702D	Zimovia Strait	20030730	NOAA/NOS/NGS (SE)	Zimovia Strait	19970810	Air Photo
Panhandle	AK9703A	Sitka North	20030730	NOAA/NOS/NGS (SE)	Sitka North	19970815-19980527	Air Photo
	AK9703B	Sitka South	20030730	NOAA/NOS/NGS (SE)	Duplicate of Sitka North	not used	
Gulf of Alaska	AK98B	Harris Bay	20030730	NOAA/NOS/NGS (SE)	Harris Bay	1998	Air Photo
Panhandle	CM7206	Zarembo Island	20030730	NOAA/NOS/NGS (SE)	Zarembo Island	19720601	Air Photo
Gulf of Alaska	CM7210	Hinchinbrook Island	20030730	NOAA/NOS/NGS (SE)	Hinchinbrook Island	19720701	Air Photo
Gulf of Alaska	CM7211	Valdez Arm	20030730	NOAA/NOS/NGS (SE)	West side of Valdez Arm	19720701	Air Photo
Panhandle	CM7309	Wrangell Narrows	20030730	NOAA/NOS/NGS (SE)	Wrangell Narrows area	19740701	Air Photo
Gulf of Alaska	CM7310	Kink Arm	20030730	NOAA/NOS/NGS (SE)	Kink Arm, Anchorage area	19730701	Air Photo
Gulf of Alaska	CM7312	Cook Inlet	20030730	NOAA/NOS/NGS (SE)	East side of Cook Inlet	19750701	Air Photo

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Table 7. Alaska Base Shoreline NOAA High-Resolution Shoreline Metadata							
Gulf of Alaska	CM7413	Icy Bay	20030730	NOAA/NOS/NGS (SE)	Icy Bay area	19750701-19750801	Air Photo
Panhandle	CM7414	Yakutat Bay	20030730	NOAA/NOS/NGS (SE)	Yakutat Bay	19750801	Air Photo
Panhandle		Yakutat Bayll83	19970615	NOAA/NOS/CSC (CD)	Yakutat Bay area	unknown	USGS DLG
Alaskan Penn.	CM7607	Shelikof Strait	20030730	NOAA/NOS/NGS (SE)	Shelikof Strait	19760601	Air Photo
Pacific Ocean	CM7709	Kodiak Island	20030730	NOAA/NOS/NGS (SE)	Kodiak Island	19770601	Air Photo
Gulf of Alaska	CM7710	Port Valdez	20030730	NOAA/NOS/NGS (SE)	Port Valdez oil terminal	19770501	Air Photo
Alaskan Pen.	CM8200	Cape Kilokak to Cape Kumlik	20030730	NOAA/NOS/NGS (SE)	Cape Kilokak to Cape Kumlik	19820701-19820801	Air Photo
Panhandle	CM8201	Behm Narrows	20030730	NOAA/NOS/NGS (SE)	Behm Narrows area	19820601	Air Photo
Panhandle	CM8202	Walker Cove	20030730	NOAA/NOS/NGS (SE)	Walker Cove area	19820601	Air Photo
Panhandle	CM8203	Seymore Canal	20030730	NOAA/NOS/NGS (SE)	Seymore Canal area	19830701	Air Photo
Panhandle	CM8204	Kelp Bay	20030730	NOAA/NOS/NGS (SE)	Kelp Bay area	19830801	Air Photo
Bering Sea	CM8206	Bristol Bay 1	20030730	NOAA/NOS/NGS (SE)	Bristol Bay west area	19850701-19850801	Air Photo
Bering Sea	CM8207	Bristol Bay 2	20030730	NOAA/NOS/NGS (SE)	Bristol Bay east area	19830701-19830801	Air Photo
Aleutian Is	CM8306	Dutch Harbor	20030730	NOAA/NOS/NGS (SE)	Dutch Harbor	19830601	Air Photo
Alaskan Pen.	CM8309	Shelikof Strait 2	20030730	NOAA/NOS/NGS (SE)	Shelikof Strait	19870701	Air Photo
Panhandle	CM8314	Rudyard Bay-Behm Canal	20030730	NOAA/NOS/NGS (SE)	Rudyard Bay-Behm Canal	19840501	Air Photo
Panhandle	CM8402	Hawk Inlet-Chatham Strait	20030730	NOAA/NOS/NGS (SE)	Hawk Inlet-Chatham Strait	19850601	Air Photo
Panhandle	CM8404	Icy Strait 1	20030730	NOAA/NOS/NGS (SE)	Icy Strait east area	19870601	Air Photo
Panhandle	CM8405	Icy Strait 2	20030730	NOAA/NOS/NGS (SE)	Icy Strait west area	19850601-19850701	Air Photo
Panhandle	CM8408	Washington & Rowan Bays	20030730	NOAA/NOS/NGS (SE)	Washington & Rowan Bays	19870601	Air Photo
Panhandle	CM8410	Icy Strait Entrance	20030730	NOAA/NOS/NGS (SE)	Icy Strait Entrance area	19850701	Air Photo
Panhandle	CM8503	Stephens Passage 1	20030730	NOAA/NOS/NGS (SE)	Stephens Passage north	19870601	Air Photo

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Table 7. Alaska Base Shoreline NOAA High-Resolution Shoreline Metadata							
Panhandle	CM8508	Stephens Passage 2	20030730	NOAA/NOS/NGS (SE)	Stephens Passage south	19880601-19880801	Air Photo
Panhandle	CM8600	College & Harriman Fjord	20030730	NOAA/NOS/NGS (SE)	College & Harriman Fjord	19880801	Air Photo
Artic Ocn	CM8708	Camden Bay	20030730	NOAA/NOS/NGS (SE)	Camden Bay	19870801	Air Photo
Panhandle	CM8709	Lynn Canal - west side	20030730	NOAA/NOS/NGS (SE)	Lynn Canal - west side	19880801	Air Photo
Artic Ocn	CM8712	North Slope Beaufort Sea	20030730	NOAA/NOS/NGS (SE)	North Slope coast	19870801	Air Photo
Alaskan Pen.	CS317	Upper Alaskan Peninsula 1	20030730	NOAA/NOS/NGS (SE)	Upper Alaskan Peninsula	19470101-19500401	Air Photo
Alaskan Pen.	CS319	Upper Alaskan Peninsula 2	20030730	NOAA/NOS/NGS (SE)	Upper Alaskan Peninsula	19470101-19510701	Air Photo
Alaskan Pen.	CS319B	Semidi Islands	20030730	NOAA/NOS/NGS (SE)	Semidi Islands	19470101	Air Photo
Artic Ocn	PH27	Atanik to Point Borrow	20030730	NOAA/NOS/NGS (SE)	Atanik to Point Borrow	19470801	Air Photo
Chukchi Sea	PH28	Chukchi Sea	20030731	NOAA/NOS/NGS (SE)	Chukchi Sea	19500101-19520701	Air Photo
	PH34A	Aleutian Islands 1			NO DATA		
Aleutian Islands	PH34B	Aleutian Islands 2	20030731	NOAA/NOS/NGS (SE)	Adak Island area	19530101-19610101	Air Photo
Aleutian Islands	PH34D	Aleutian Islands 3	20030731	NOAA/NOS/NGS (SE)	Nikolski area	19390101-19430101	Air Photo
Aleutian Islands	PH34E	Aleutian Islands 4	20030731	NOAA/NOS/NGS (SE)	Akutan area	19510601	Air Photo
	PH34F	Aleutian Islands 5			NO DATA		
Aleutian Islands	PH34G	Aleutian Islands 6	20030731	NOAA/NOS/NGS (SE)	Amchitka Pass area	19480101-19520101	Air Photo
Gulf of Alaska	PH39	Prince William Sound	20030731	NOAA/NOS/NGS (SE)	vicinity of Prince William Sound	19470601-19500801	Air Photo
Alaskan Pen.	PH40	Port Moller to Egegik Bay	20030731	NOAA/NOS/NGS (SE)	Port Moller to Egegik Bay	19420901-19450601	Air Photo

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Table 7. Alaska Base Shoreline NOAA High-Resolution Shoreline Metadata							
Bering Sea	PH41	Bering Sea	20030731	NOAA/NOS/NGS (SE)	Kuskokwim Bay area	19500101-19511201	Air Photo
Chukchi Sea	PH42	Chukchi Sea 2	20030731	NOAA/NOS/NGS (SE)	Icy Cape area	19480801-19490701	Air Photo
Bering Sea	PH43	Alaskan Peninsula	20030801	NOAA/NOS/NGS (SE)	St. Mathew, Hall & Pinnacle Islands	19490101-19500901	Air Photo
Alaskan Pen.	PH44	Gulf of Alaska	20030801	NOAA/NOS/NGS (SE)	Hallo Bay opposite Kodiak Is.	19490101-19490901	Air Photo
Panhandle	PH49	Sitka Sound	20030801	NOAA/NOS/NGS (SE)	vicinity of Sitka Sound	19540601-19540901	Air Photo
Bering Sea	PH53	Bering Sea 2	20030801	NOAA/NOS/NGS (SE)	St Lawrence Island	19480801-19550901	Air Photo
Bering Sea	PH56	Bering Sea 3	20030801	NOAA/NOS/NGS (SE)	Etolin Strait & Nunivak Island	19500101-19540801	Air Photo
Panhandle	PH6303	Clarence Strait	20030801	NOAA/NOS/NGS (SE)	Clarence Strait area	19630701-19670701	Air Photo
Panhandle	PH6306	Hoonah Sound & Peril Strait	20030801	NOAA/NOS/NGS (SE)	Hoonah Sound & Peril Strait	19670601	Air Photo
Panhandle	PH6310	Annette Island	20030801	NOAA/NOS/NGS (SE)	Annette Island	19800701-19860501	Air Photo
Gulf of Alaska	PH6409	Orca Inlet	20030801	NOAA/NOS/NGS (SE)	Orca Inlet-Cordova area	19640801-19660701	Air Photo
Gulf of Alaska	PH6411	Valdez Arm	20030801	NOAA/NOS/NGS (SE)	Valdez Arm east side	19650701-19720701	Air Photo
Gulf of Alaska	PH6412	Seward-Resurrection Bay	20030801	NOAA/NOS/NGS (SE)	Seward-Resurrection Bay	19640801-19650801	Air Photo
Panhandle	PH6627	Duncan Bay	20030801	NOAA/NOS/NGS (SE)	Duncan Bay-Kupreanof Island	19720601	Air Photo
Panhandle	PH6705	Thorne Is & Whale Passage	20030801	NOAA/NOS/NGS (SE)	Thorne Is & Whale Passage	10660701	Air Photo
Gulf of Alaska	PH6906	Controller Bay	20030801	NOAA/NOS/NGS (SE)	Controller Bay area/Kayak Is.	10690801-19700701	Air Photo
Panhandle	PH6909	Somner Strait	20030801	NOAA/NOS/NGS (SE)	Somner Strait	19711201-19790901	Air Photo
Pacific Ocean	PH7017	Afognak & Kodiack Islands	20030801	NOAA/NOS/NGS (SE)	Afognak & Kodiack Islands	19710701-19710801	Air Photo
Bering Sea	PH92	North Shore Alaskan Pen.	20030801	NOAA/NOS/NGS (SE)	Izembek NWR	19430601-19520801	Air Photo

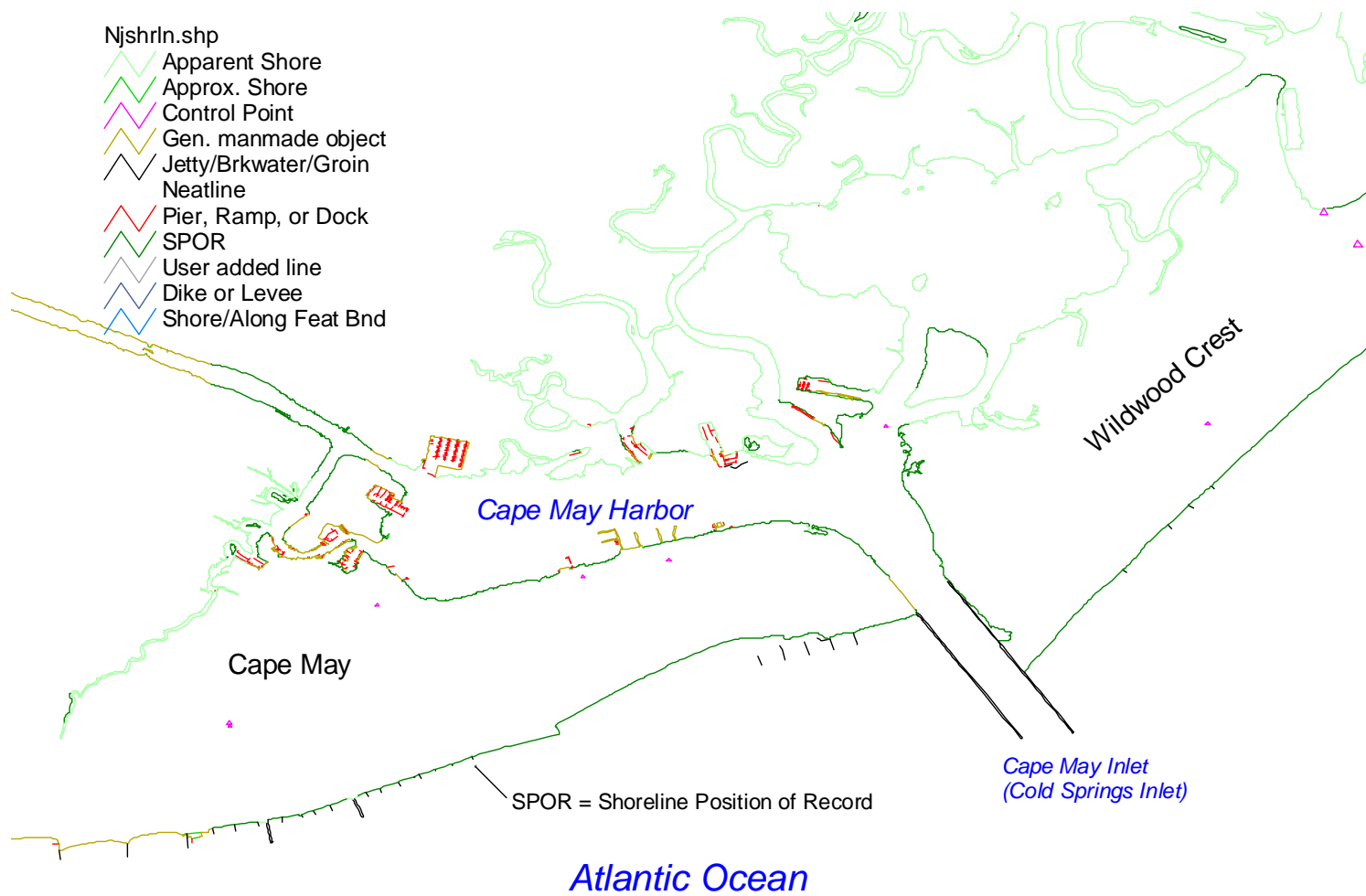


Figure 1. Example of high-resolution NOAA shoreline showing detailed shoreline types at Cape May, New Jersey.

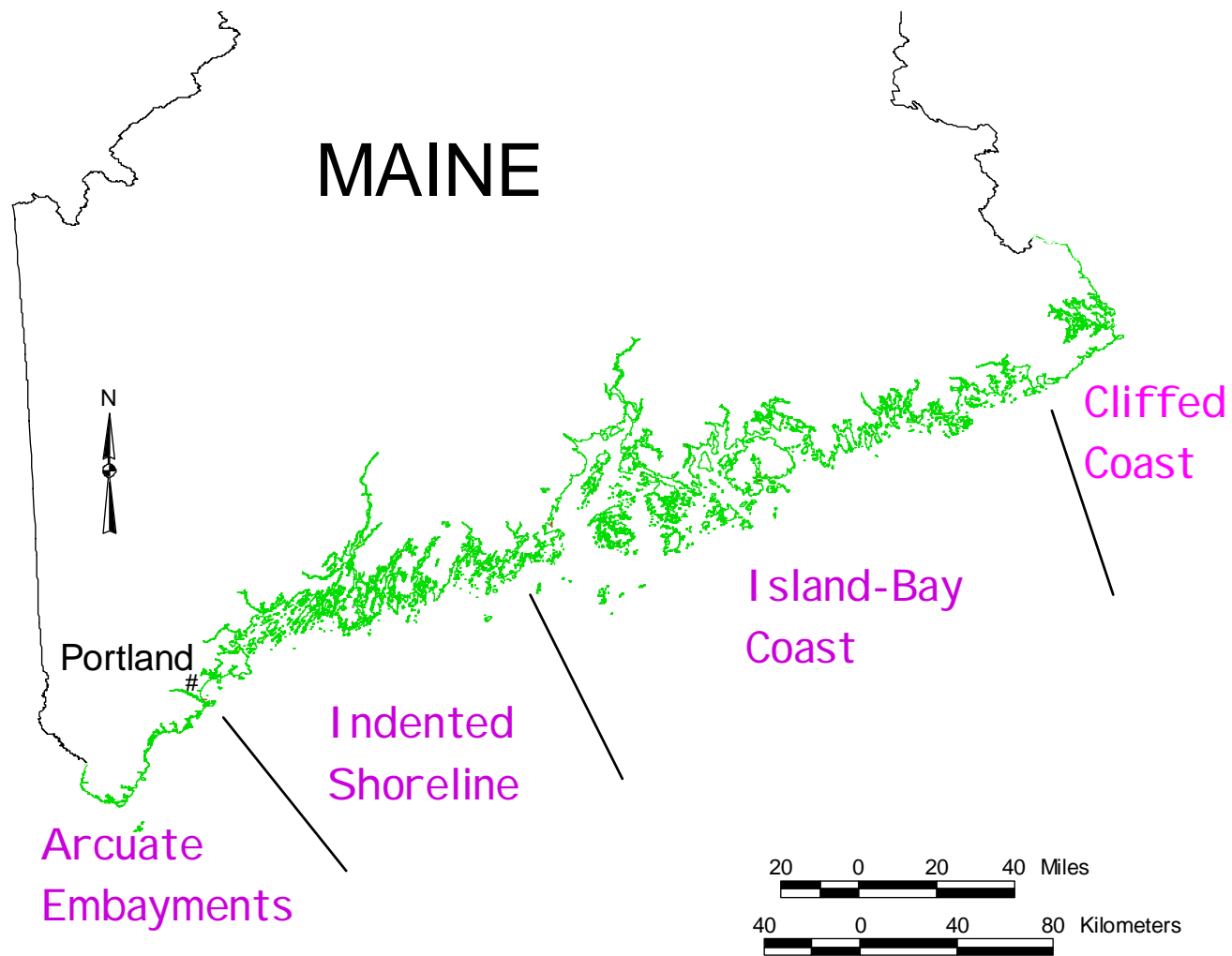


Figure 2. High-resolution shoreline of Maine coast, with geomorphic divisions after University of Maine Geology Department

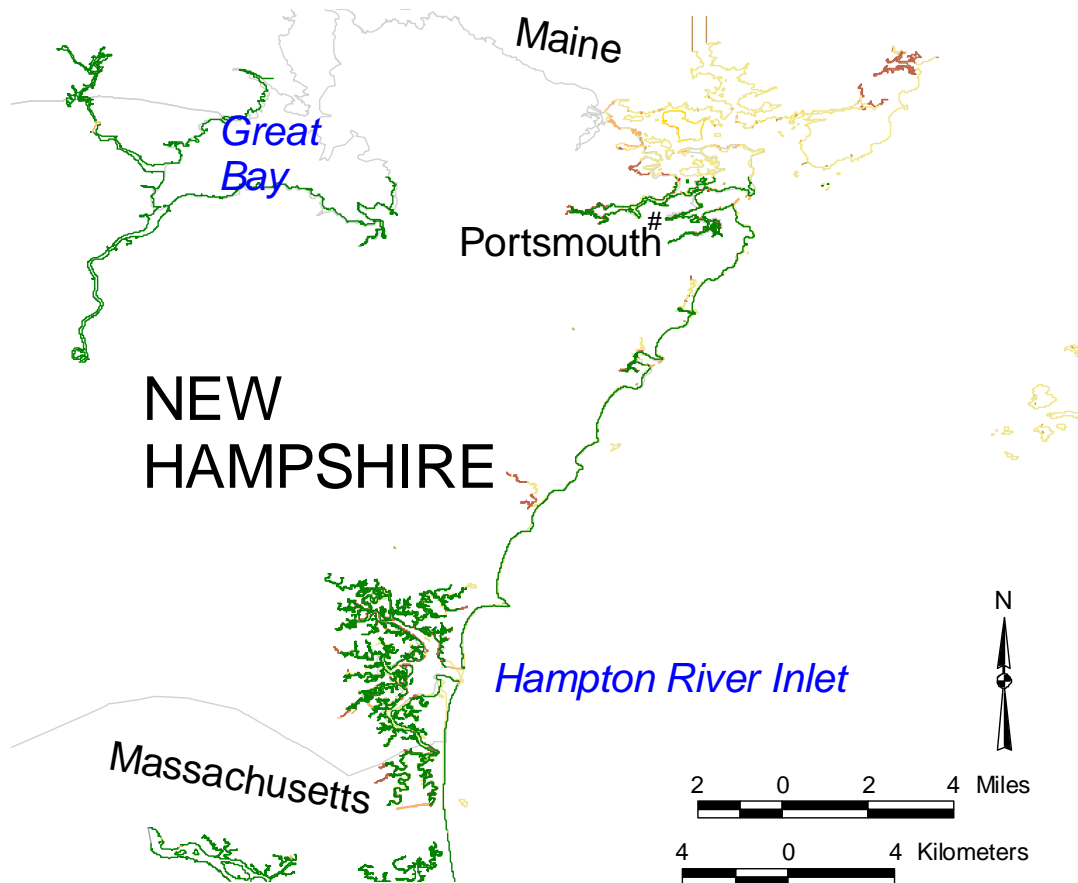


Figure 3. Composite high-resolution shoreline for New Hampshire

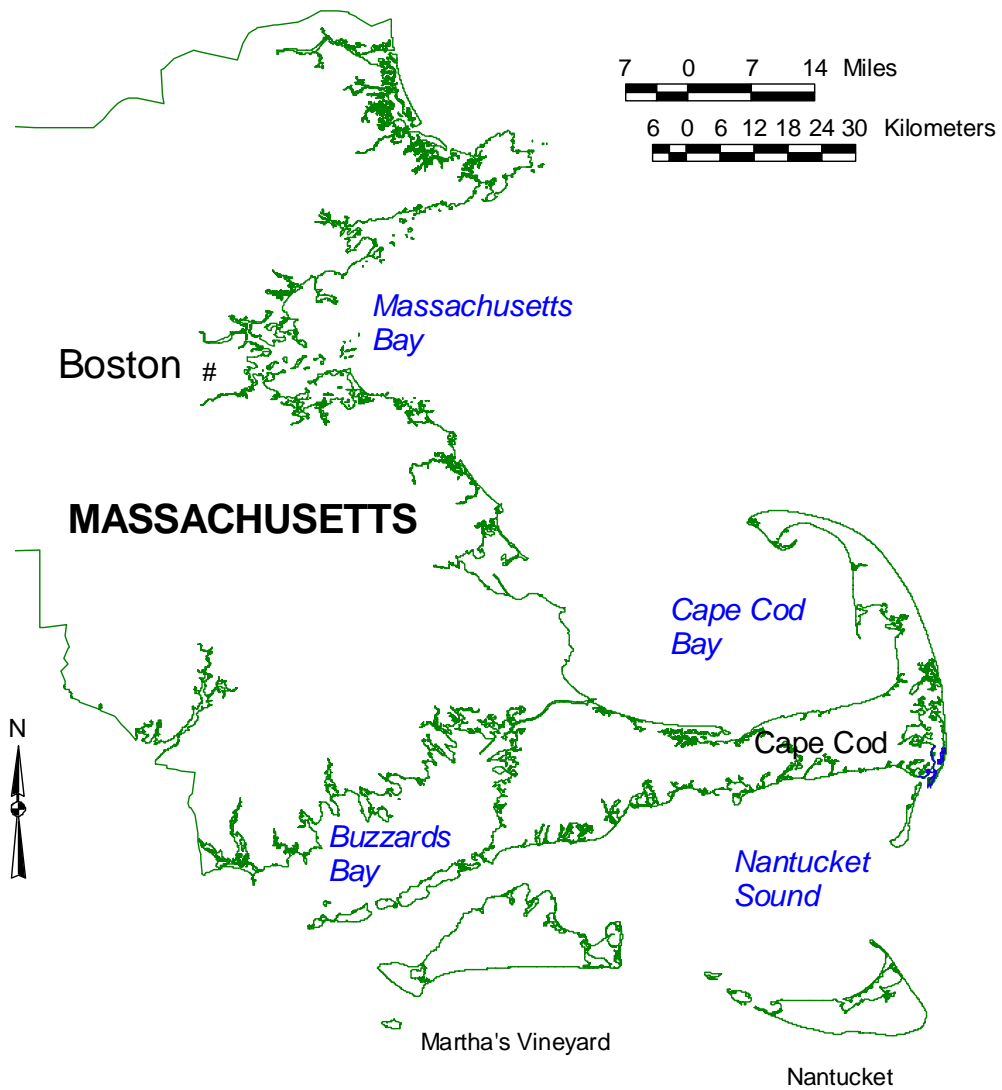


Figure 4. High-resolution shoreline for Massachusetts from state mapping program

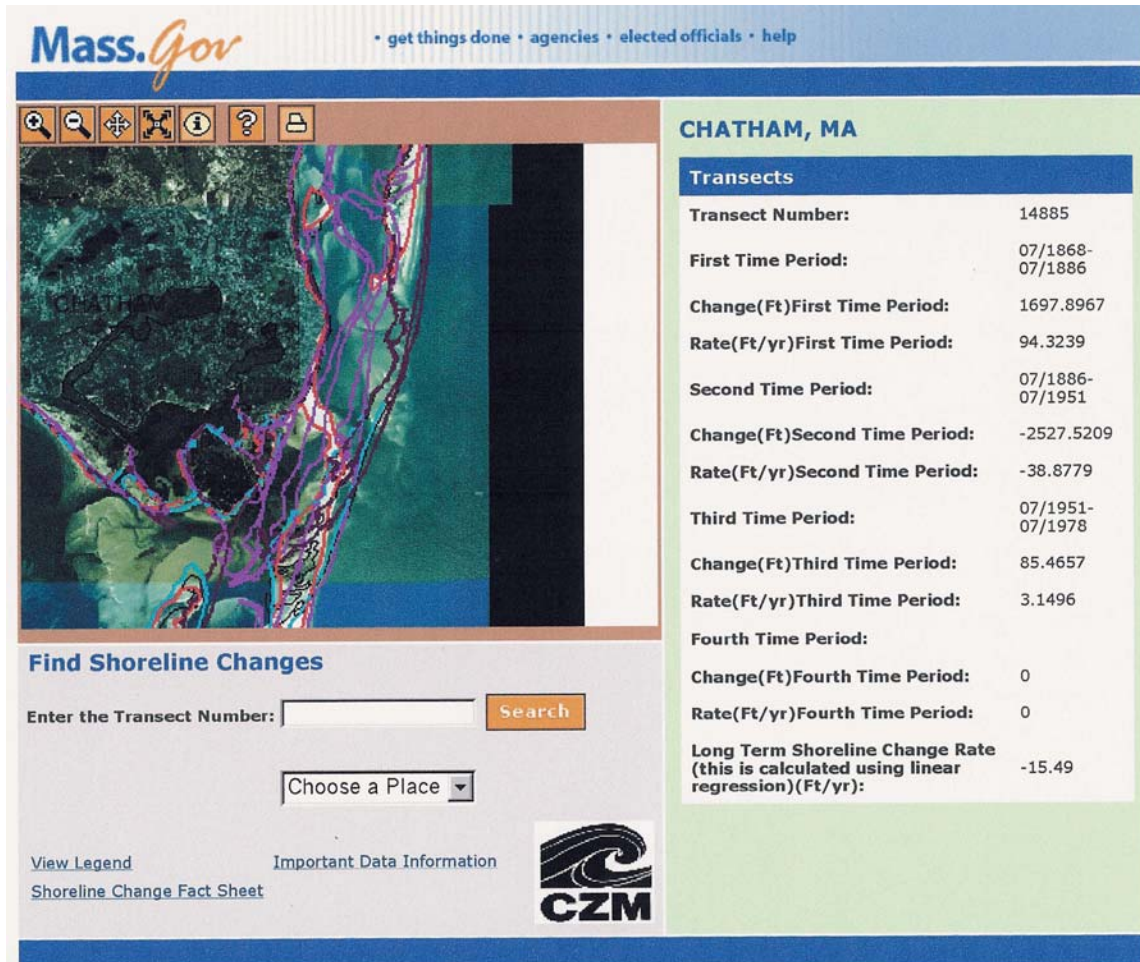


Figure 5. Example of Massachusetts Shoreline Change Project of Chatham Inlet area on Cape Cod

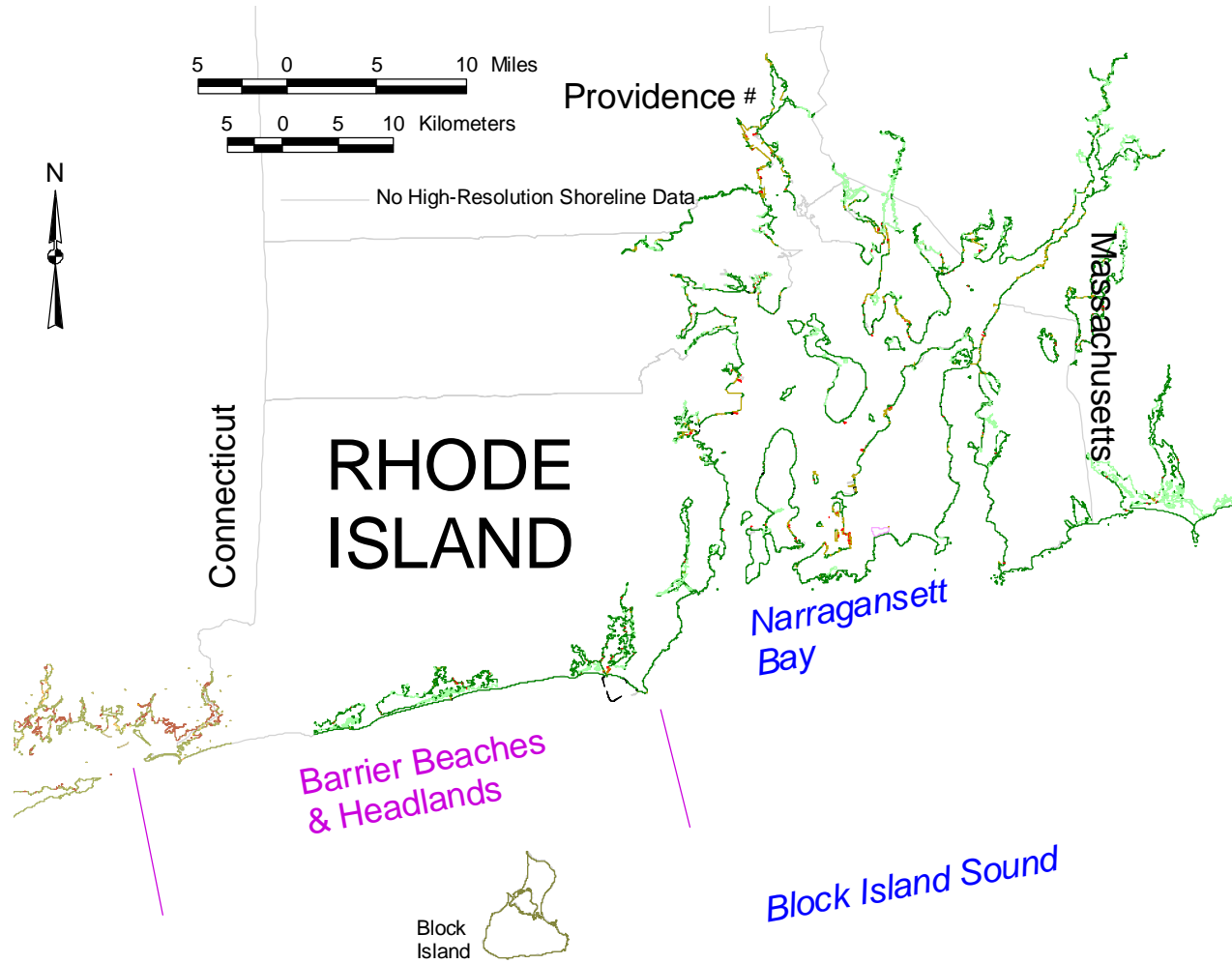


Figure 6. High-resolution composite shoreline of Rhode Island

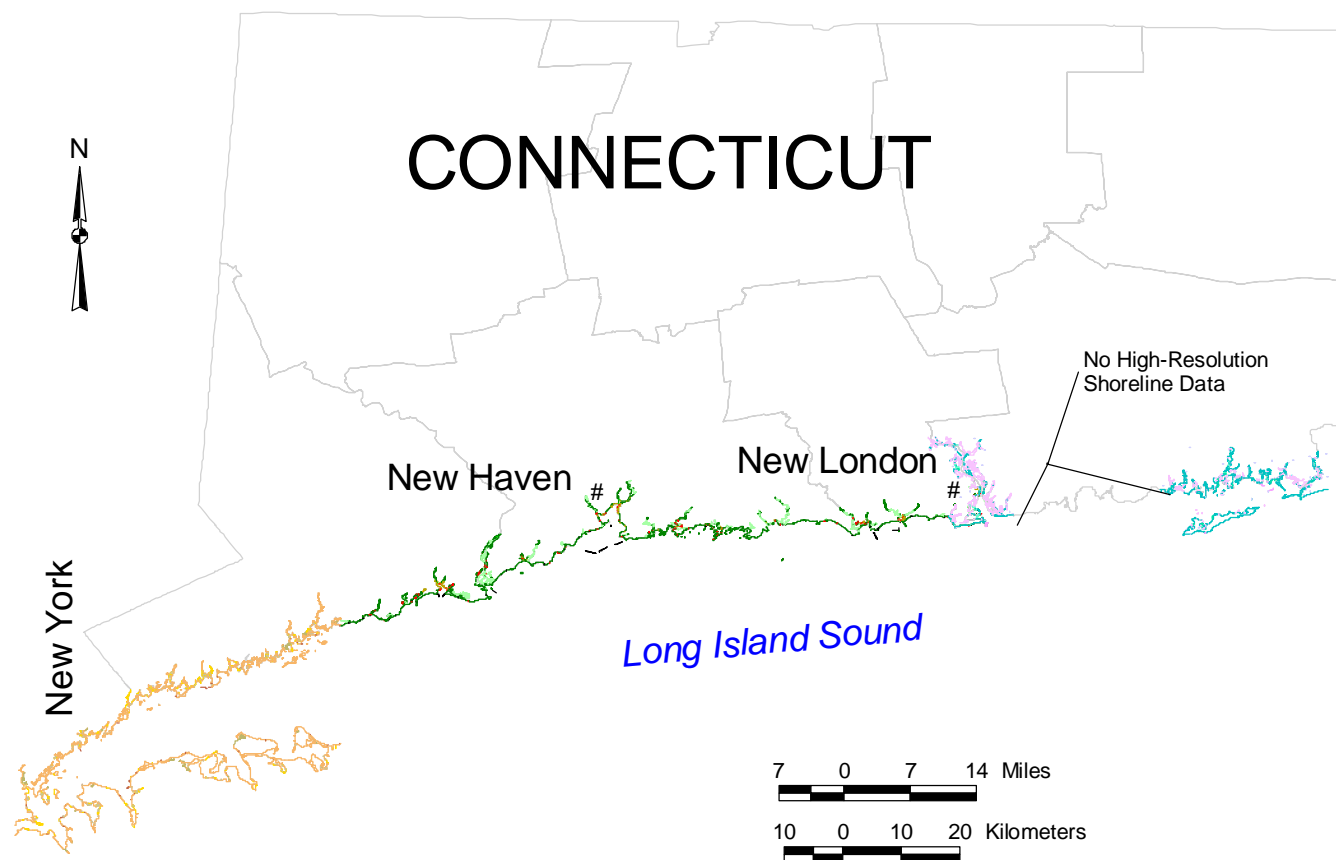


Figure 7. Three high-resolution shoreline segments for Connecticut's Long Island Sound shore

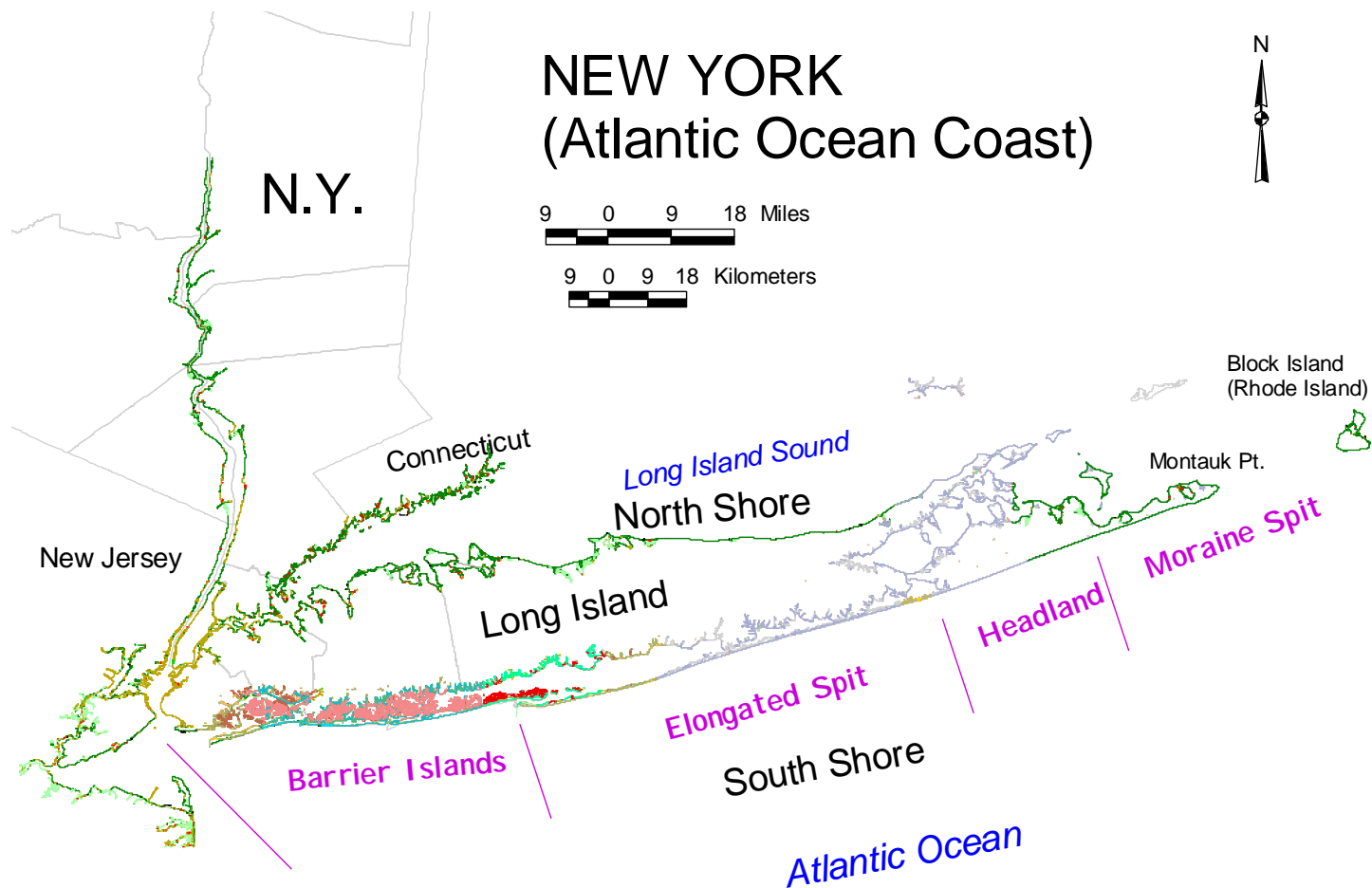


Figure 8. High-resolution shore segments of New York's Atlantic coast

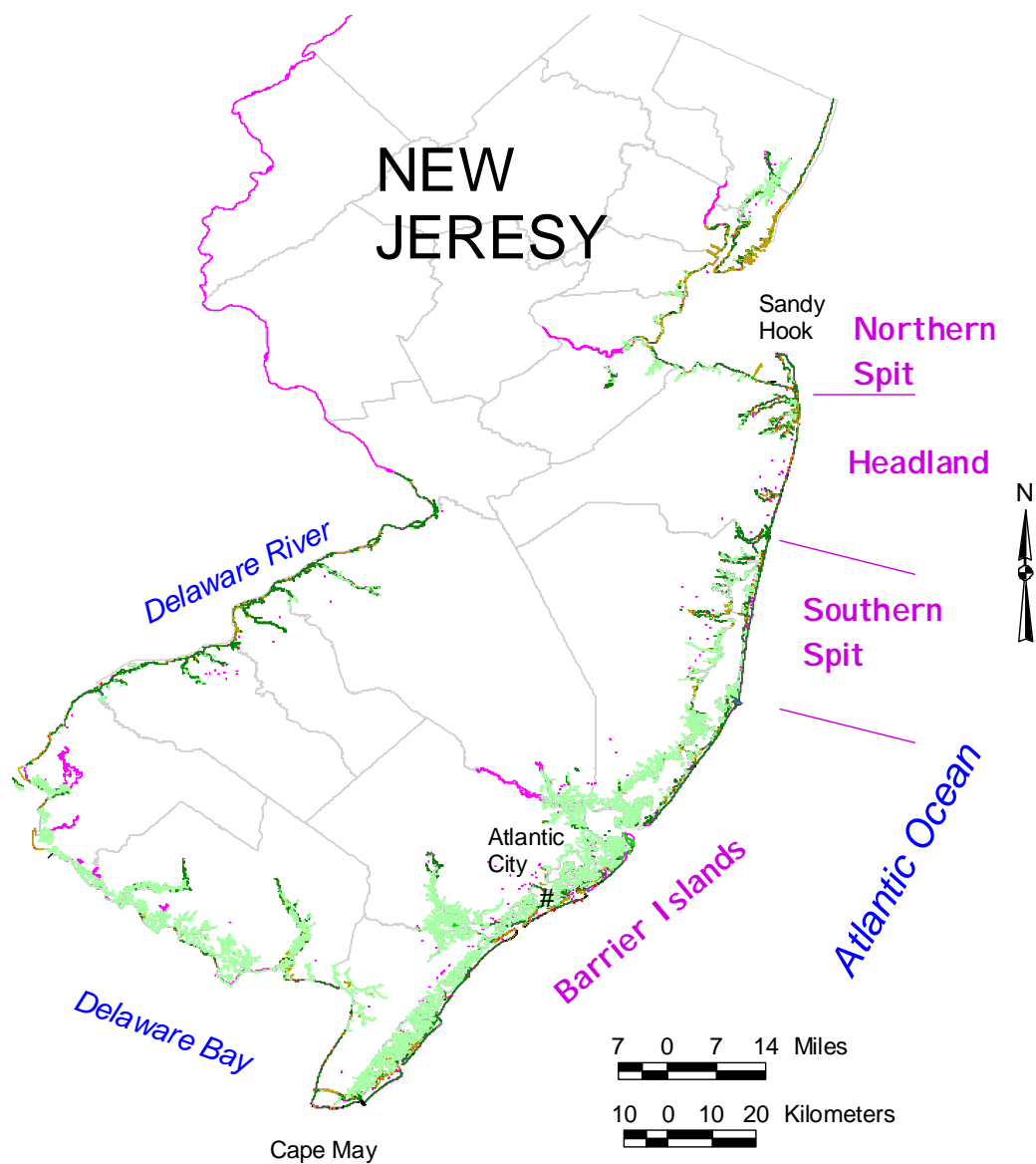


Figure 9. Combined NOAA and State of New Jersey high-resolution shore

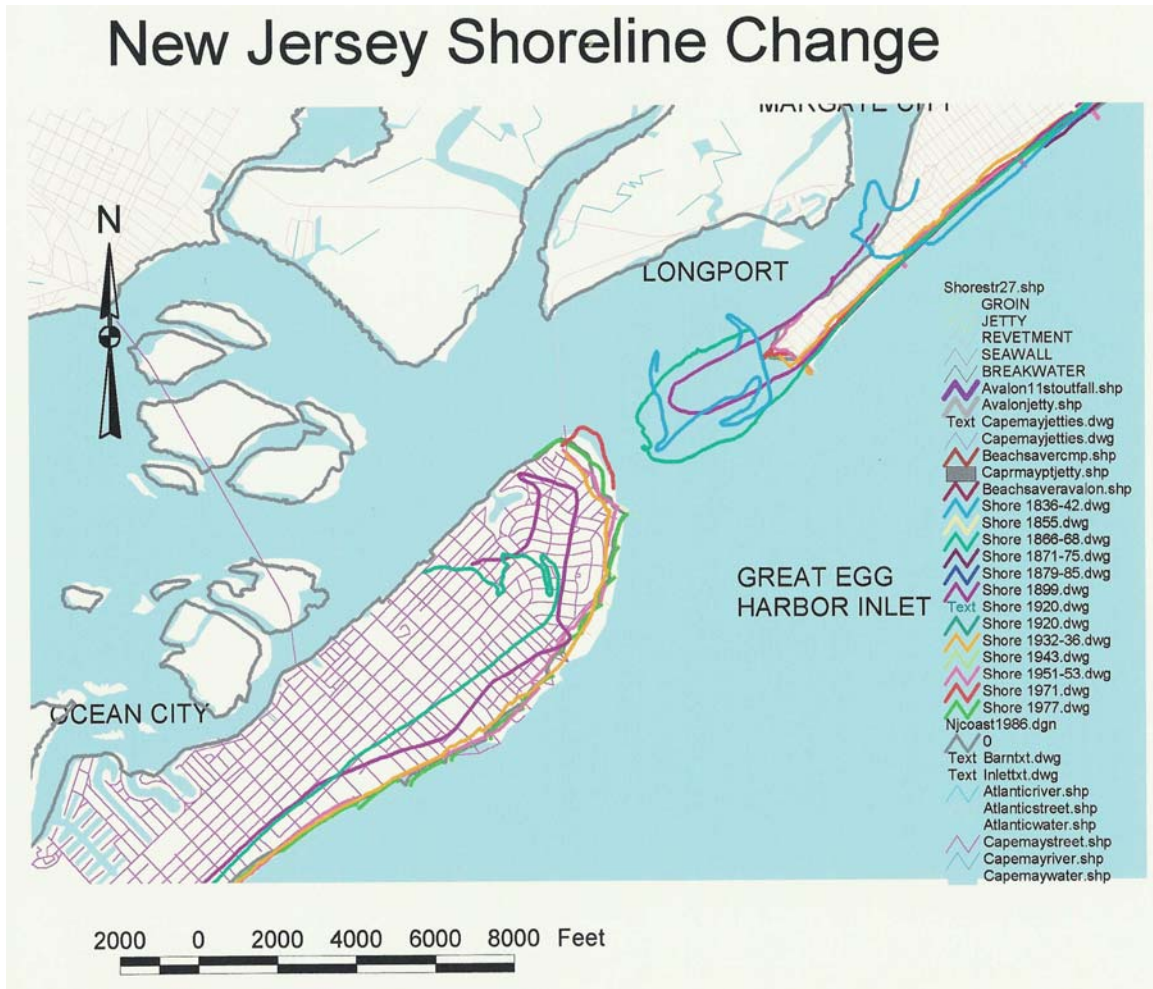


Figure 10. Example of historic shorelines assembled for the NSMS from State of New Jersey

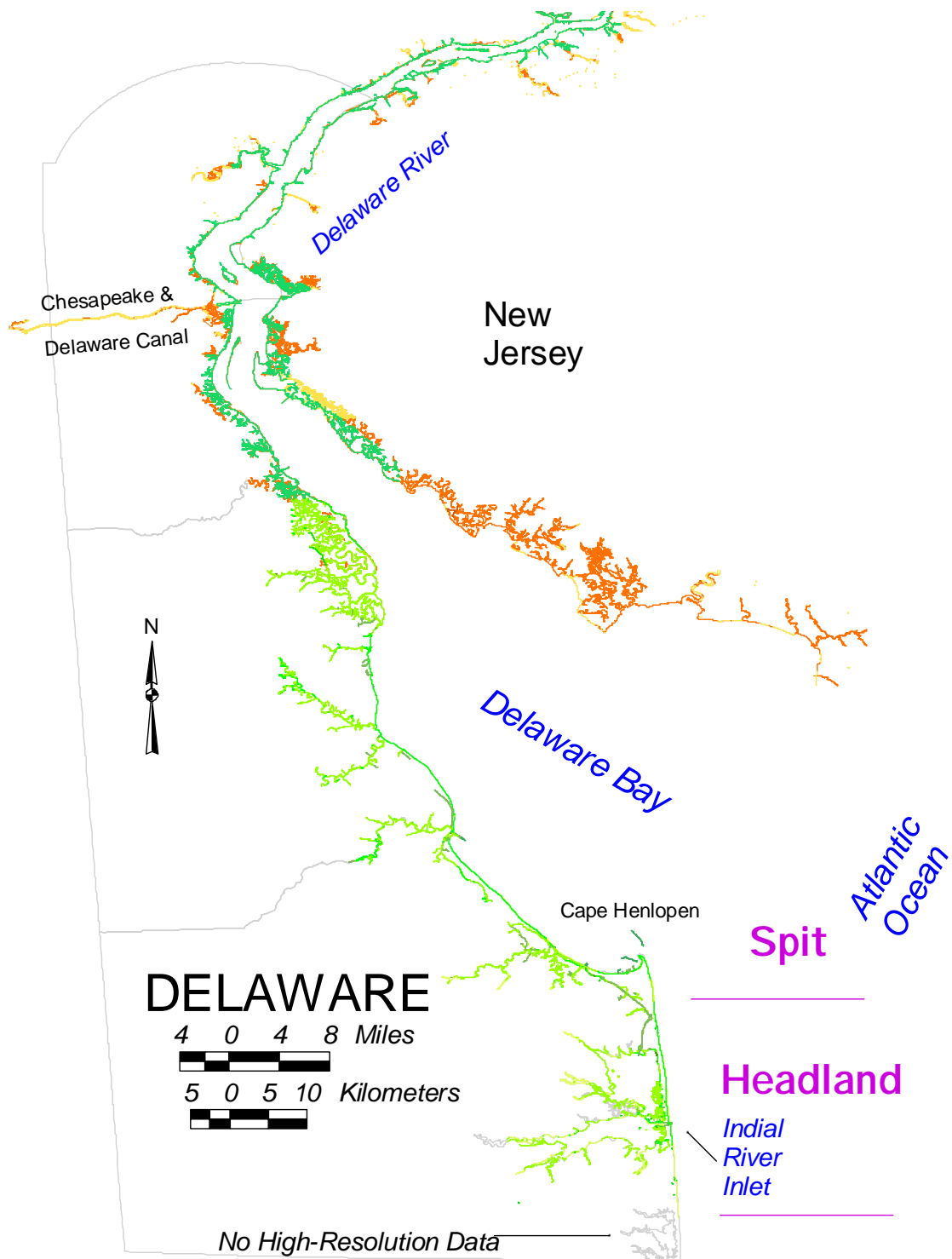


Figure 11. Composite high-resolution shore of Delaware

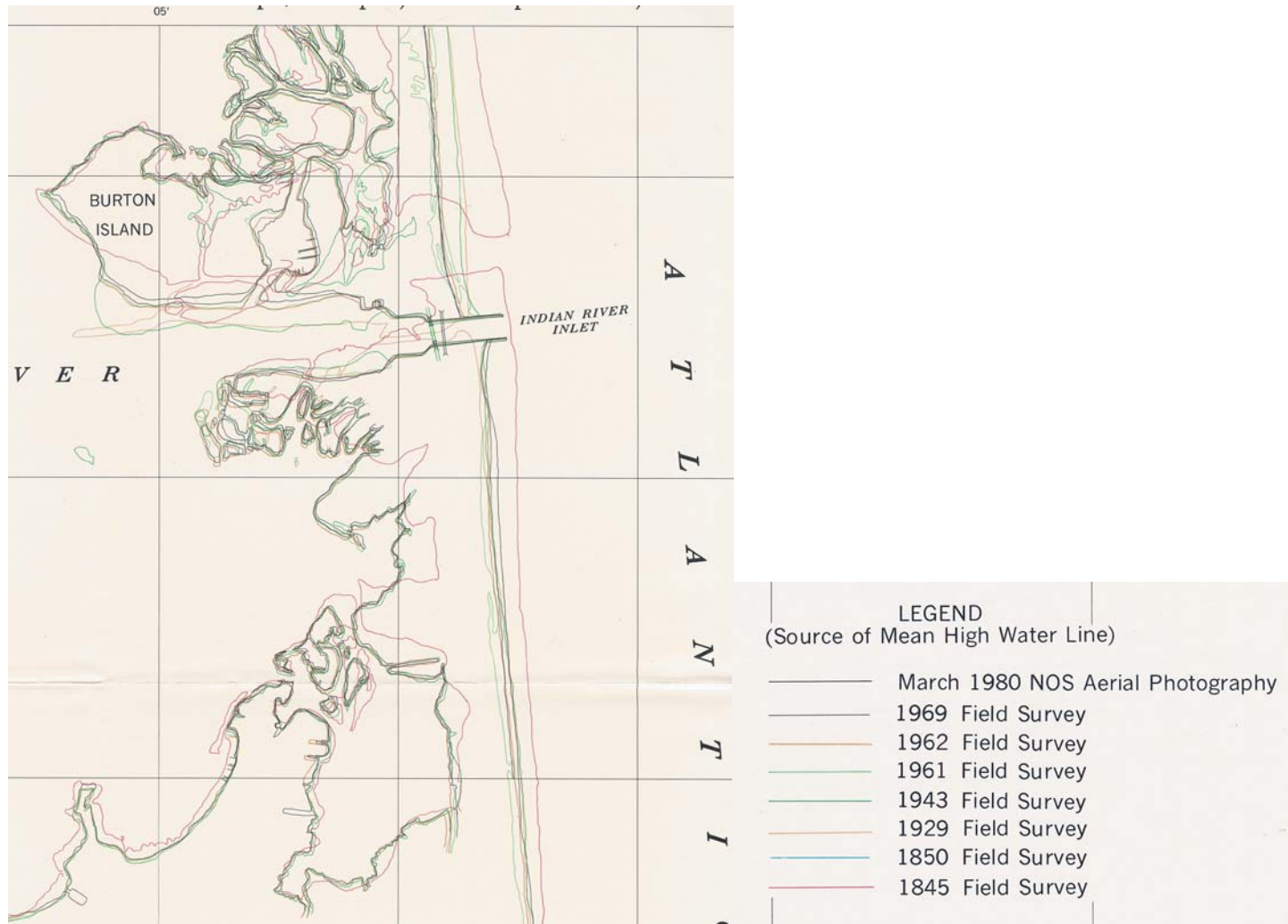


Figure 12. Example of historic shorelines from NOAA/CERC Cooperative Shoreline Movement Study for area around Indian River Inlet, DE.

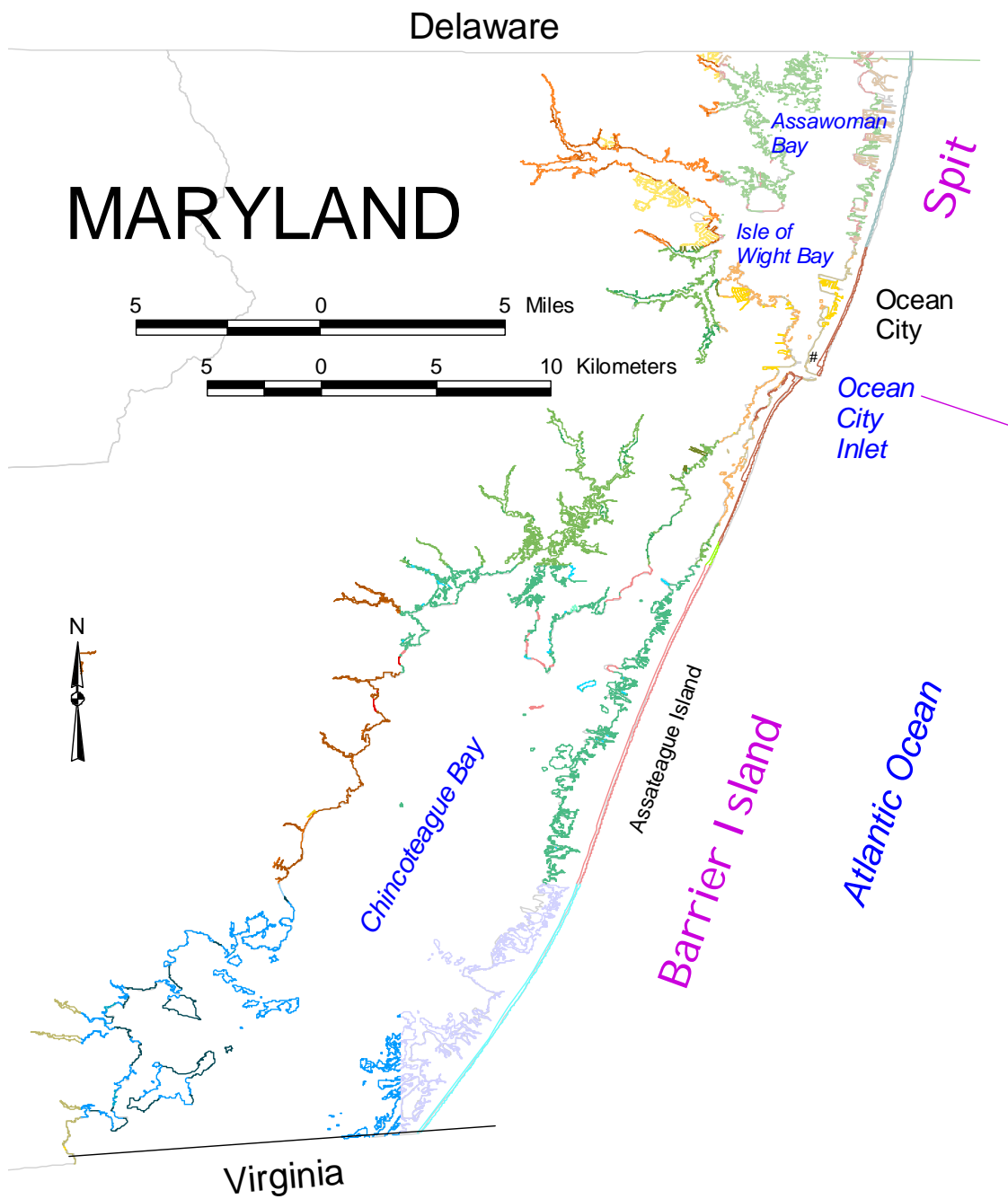


Figure 13. Composite of State of Maryland Atlantic coast quad shoreline maps from the State of Maryland shoreline mapping program

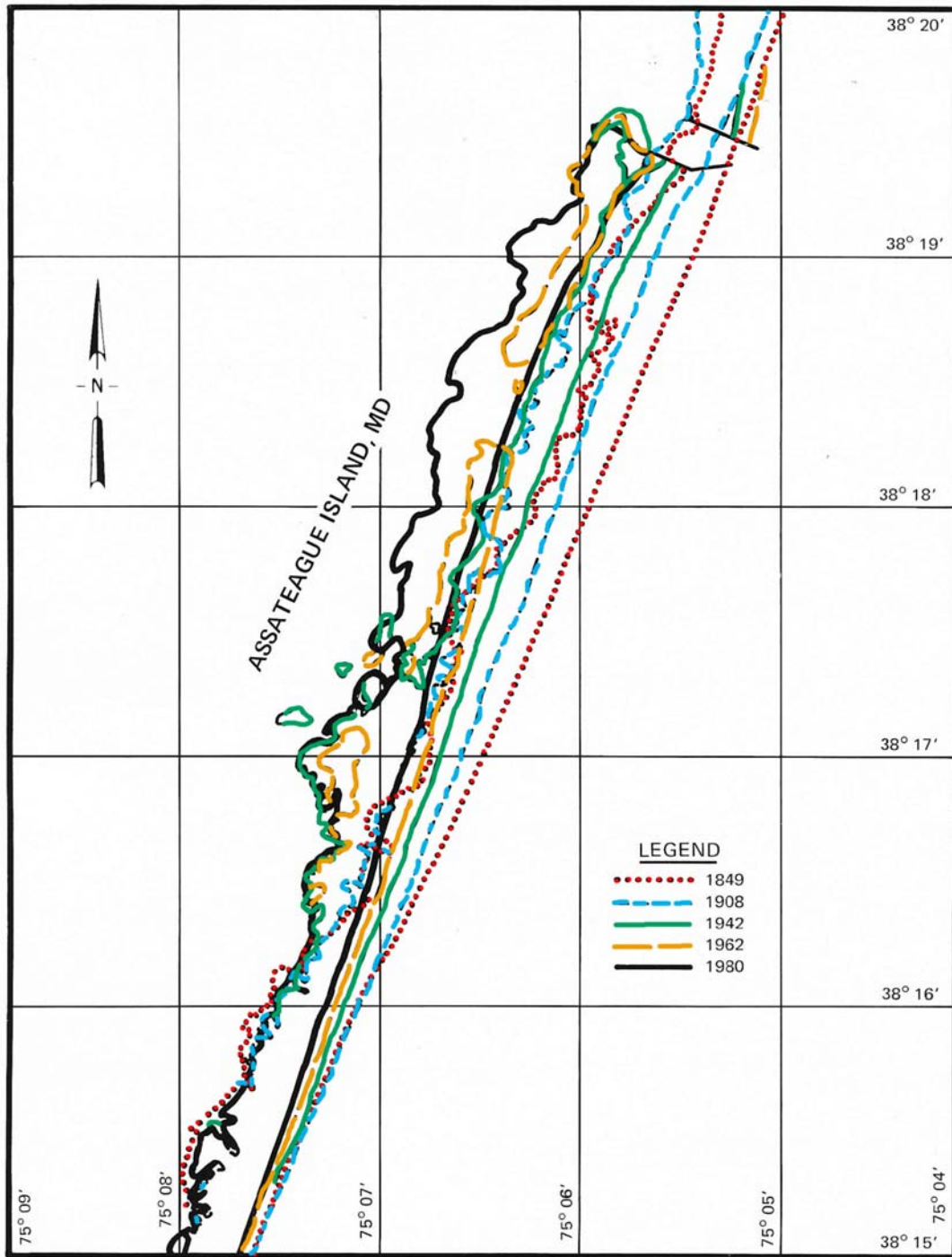


Figure 14. Example of NOAA/CERC Cooperative Shoreline Movement Mapping Program historic shorelines around Ocean City Inlet, MD

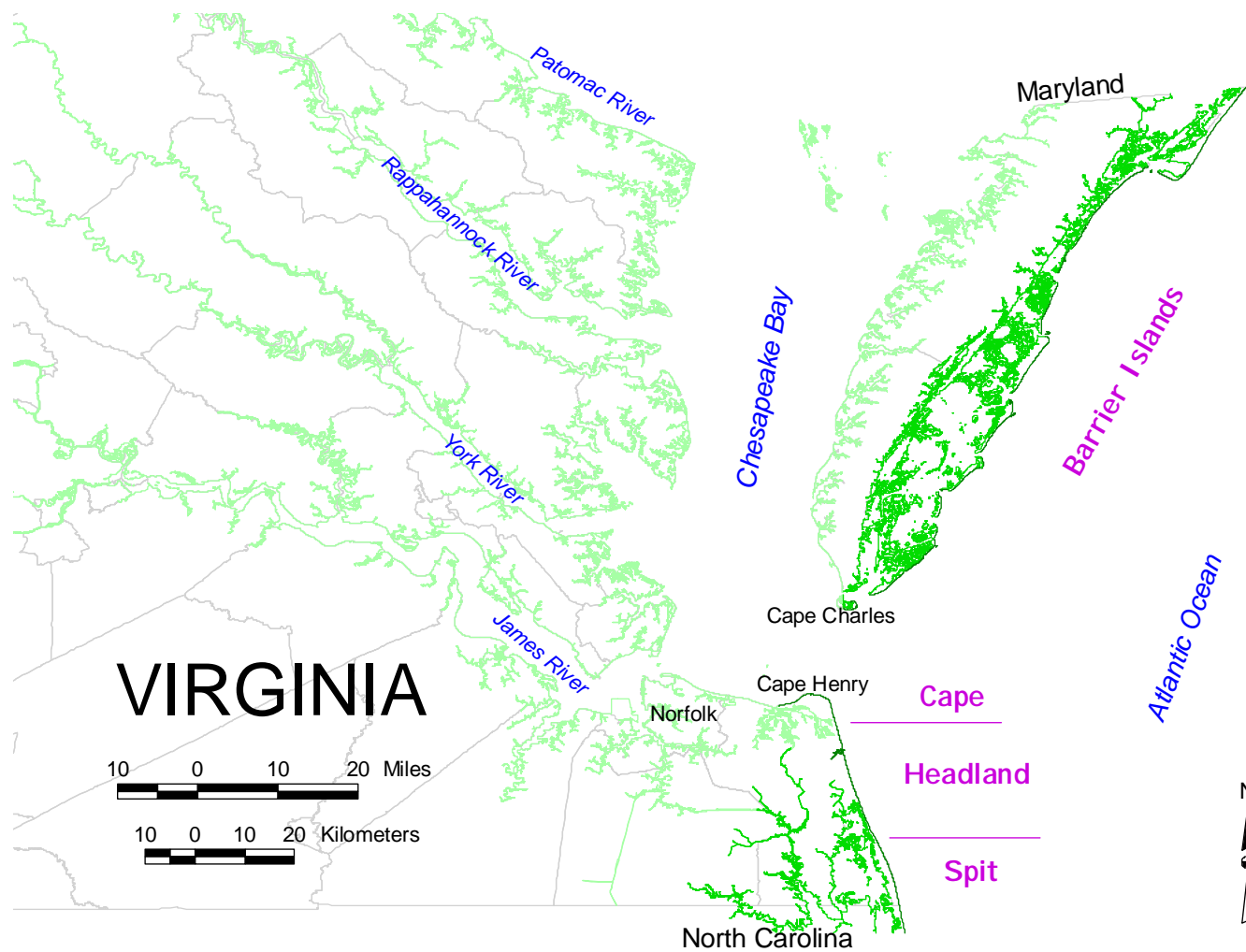


Figure 15. High-resolution shore of the Atlantic coast and Chesapeake Bay of Virginia from the State of Virginia shoreline mapping program

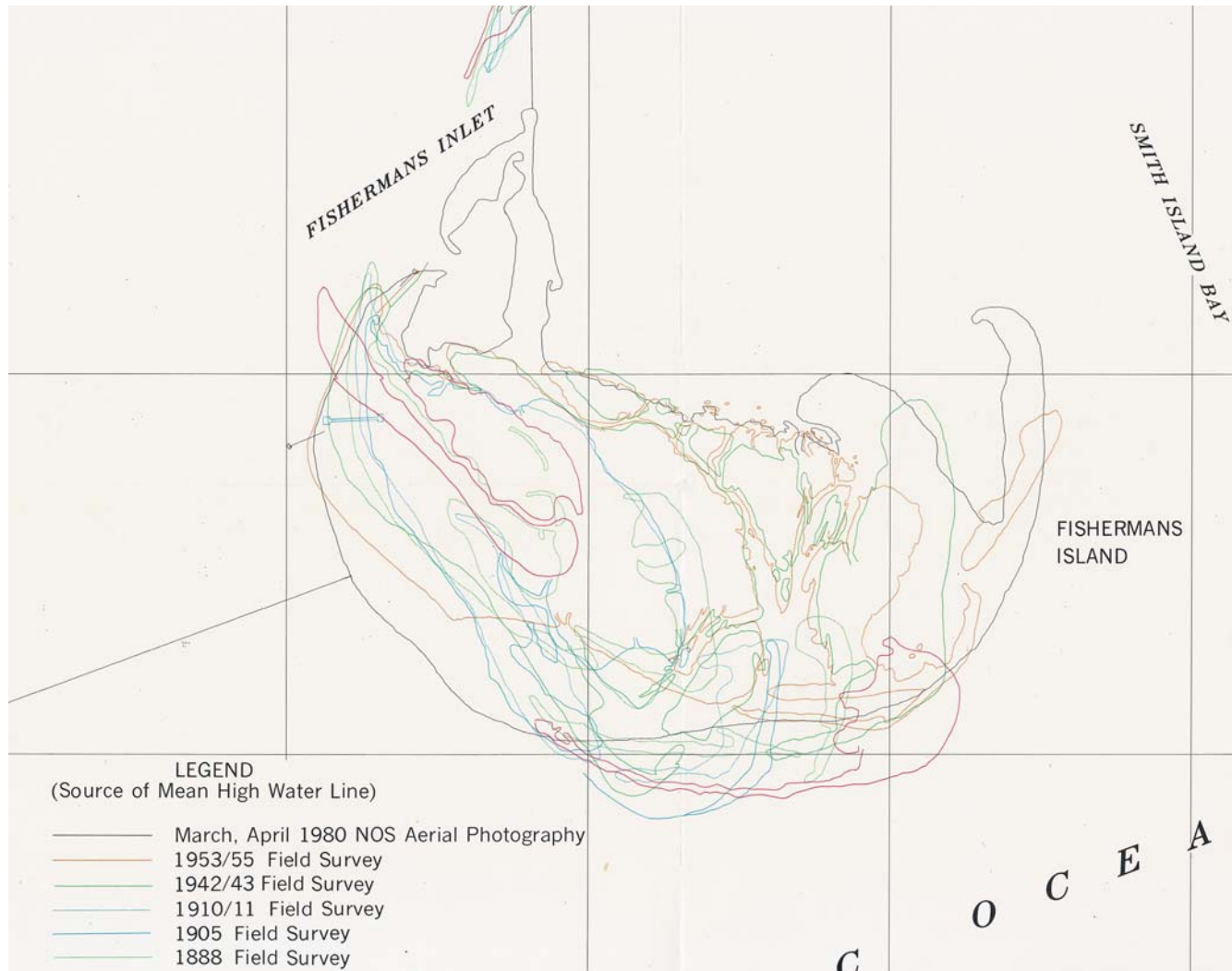


Figure 16. Example of historic shorelines of Fishermans Island at mouth of Chesapeake Bay from NOAA/CERC cooperative Shoreline Movement Mapping Program

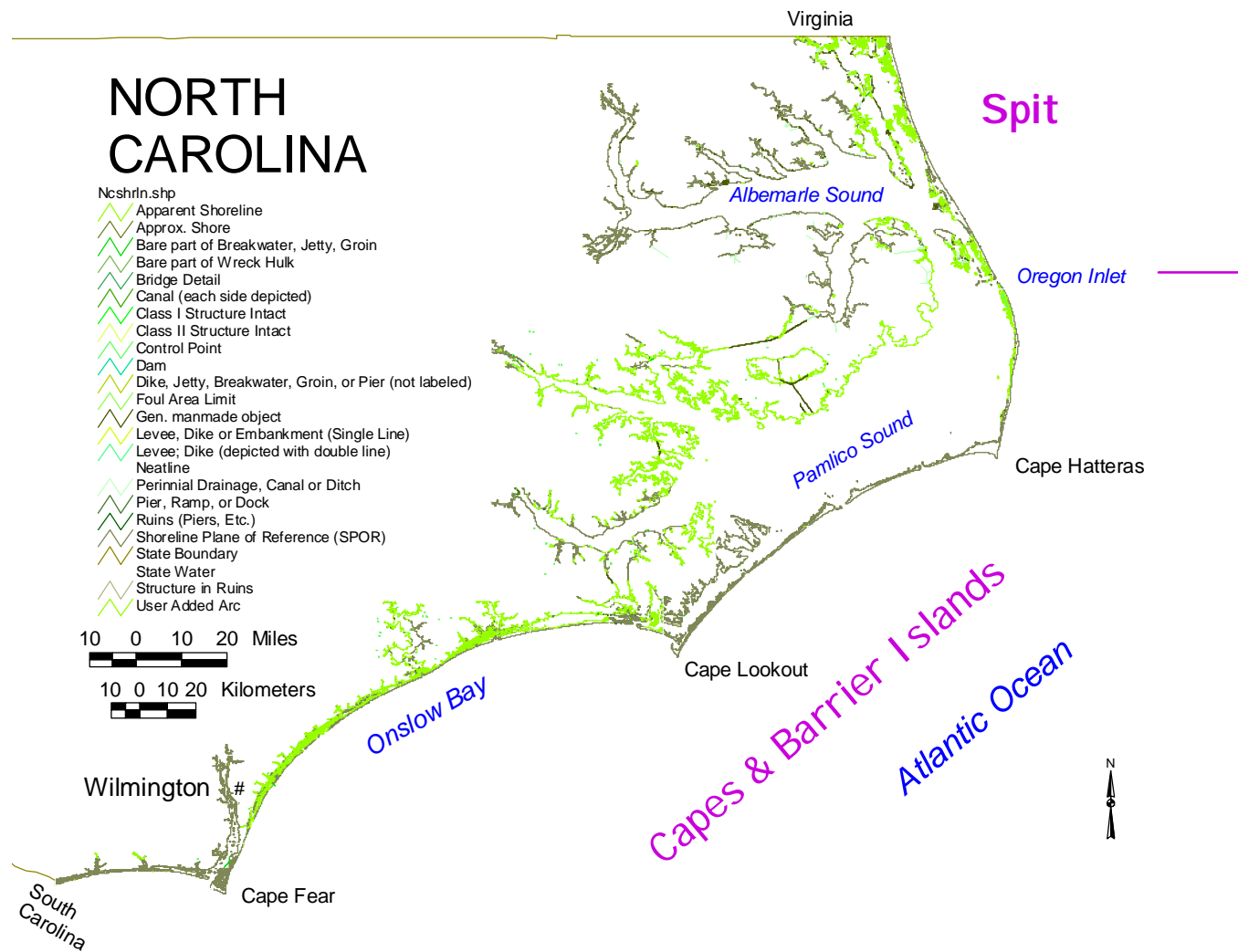


Figure 17. High-resolution base shoreline of North Carolina showing the NOAA identified shoreline types

Long Term Average Annual Shoreline Change Rates Updated Through 1992

North Carolina
Division of Coastal Management

For More Information Contact us at:

P.O. Box 27687

Raleigh, N.C. 27611-7687

(919)-733-2293

Scale: 1 inch = 2 miles

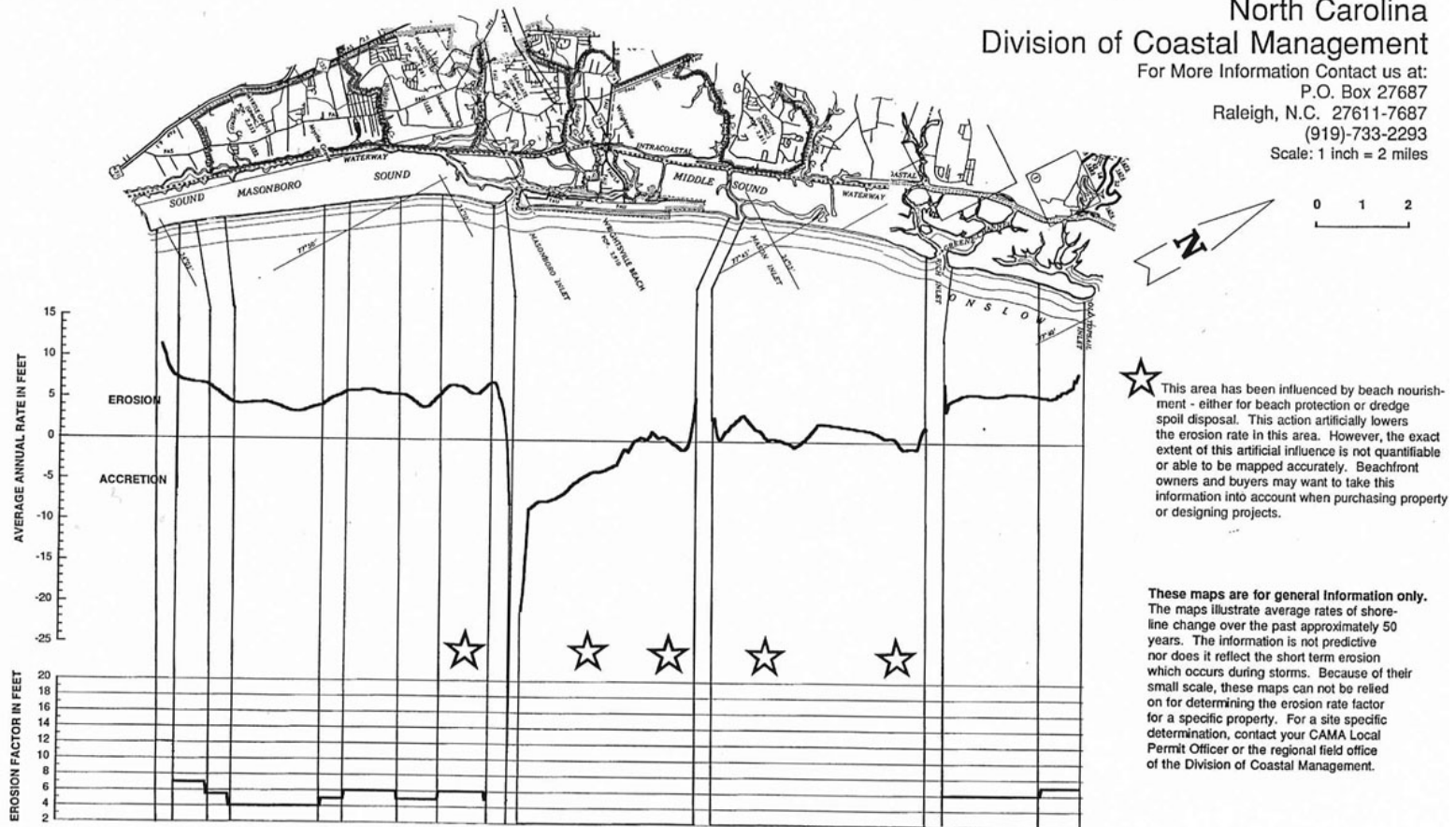


Figure 18. Example of Erosion Rate Maps of North Carolina Division of Coastal Management (stars indicate beach nourishment projects)

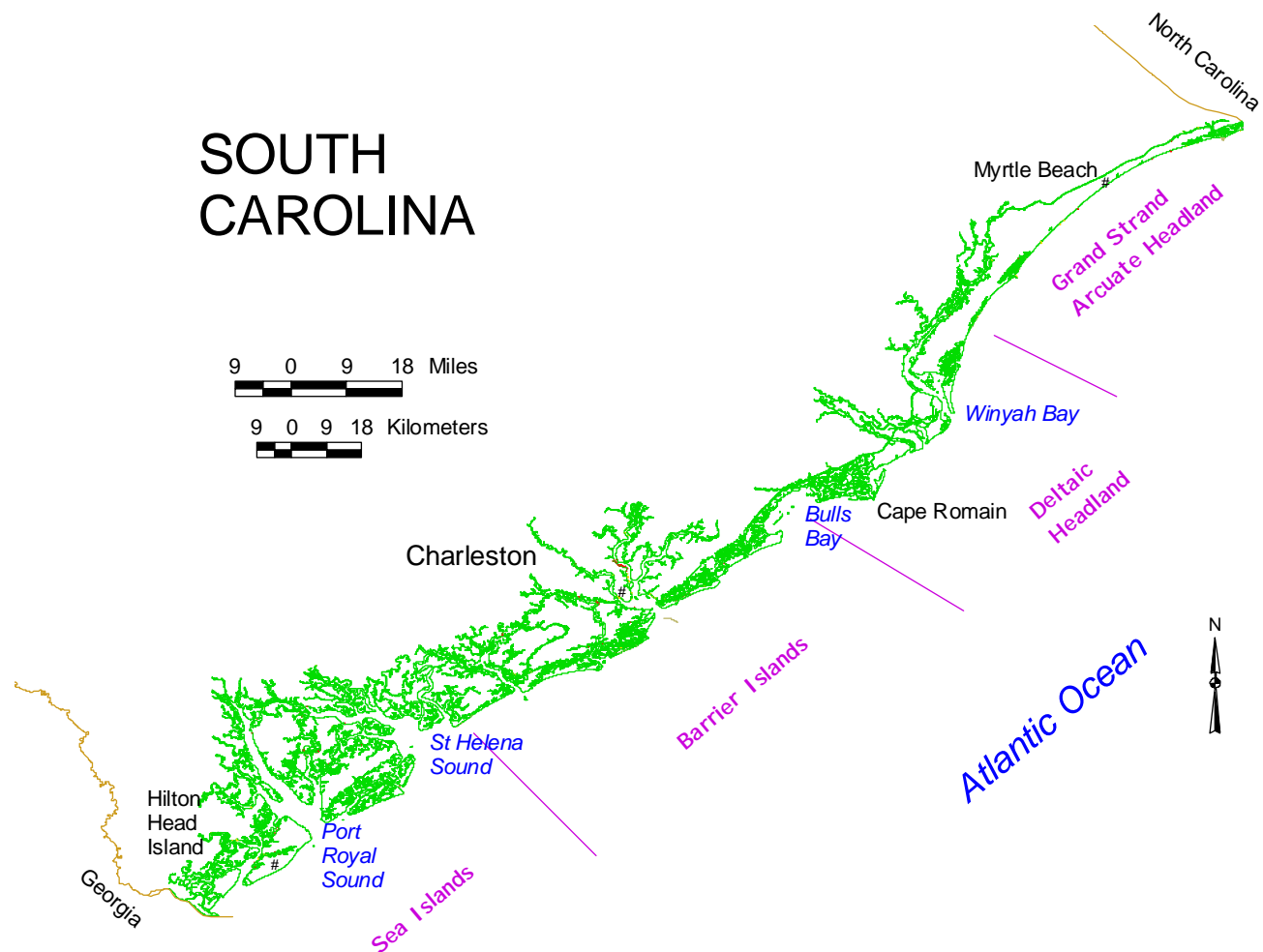


Figure 19. High-resolution base shoreline of South Carolina

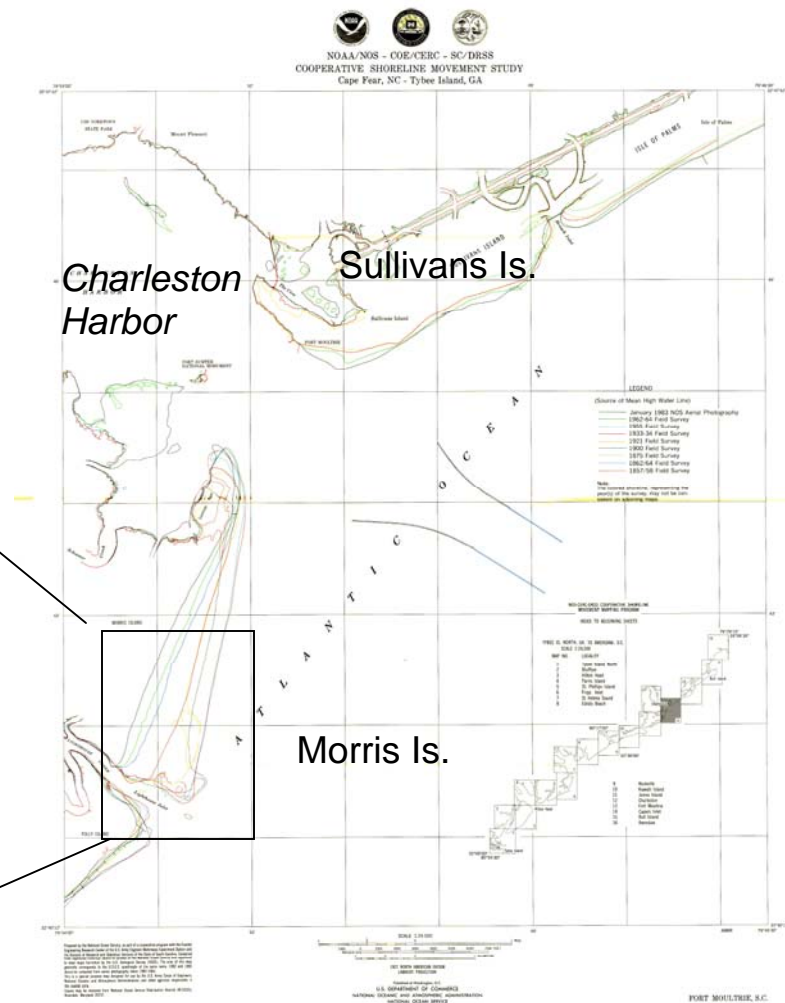
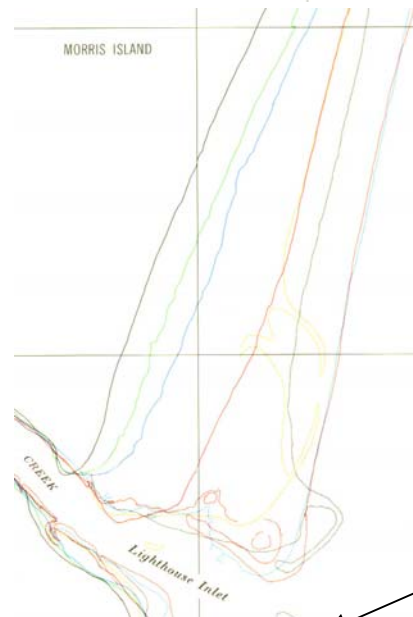
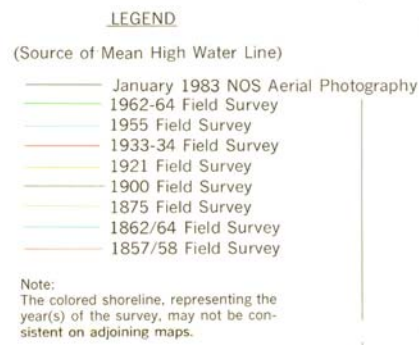


Figure 20. Example of NOAA/CERC Shoreline Movement Mapping Project for South Carolina coast near Charleston

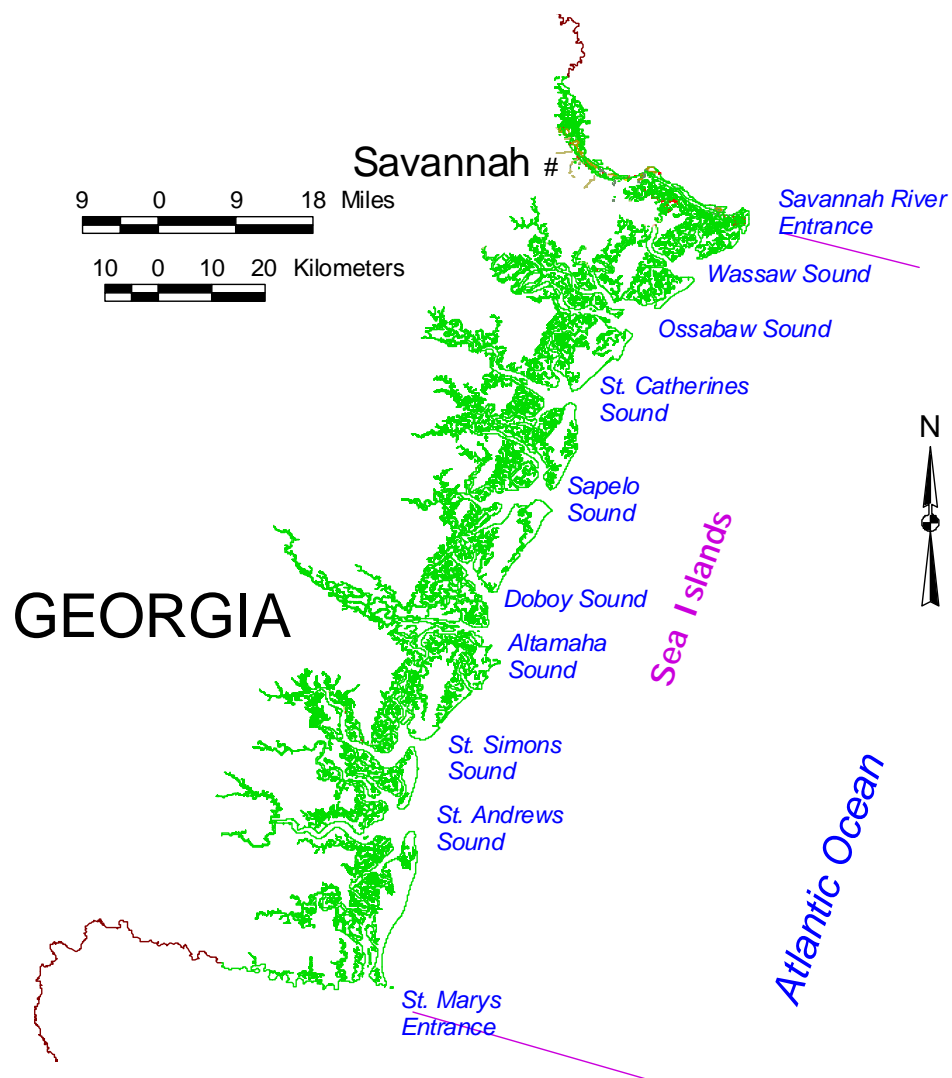


Figure 21. High-resolution base shoreline of Georgia

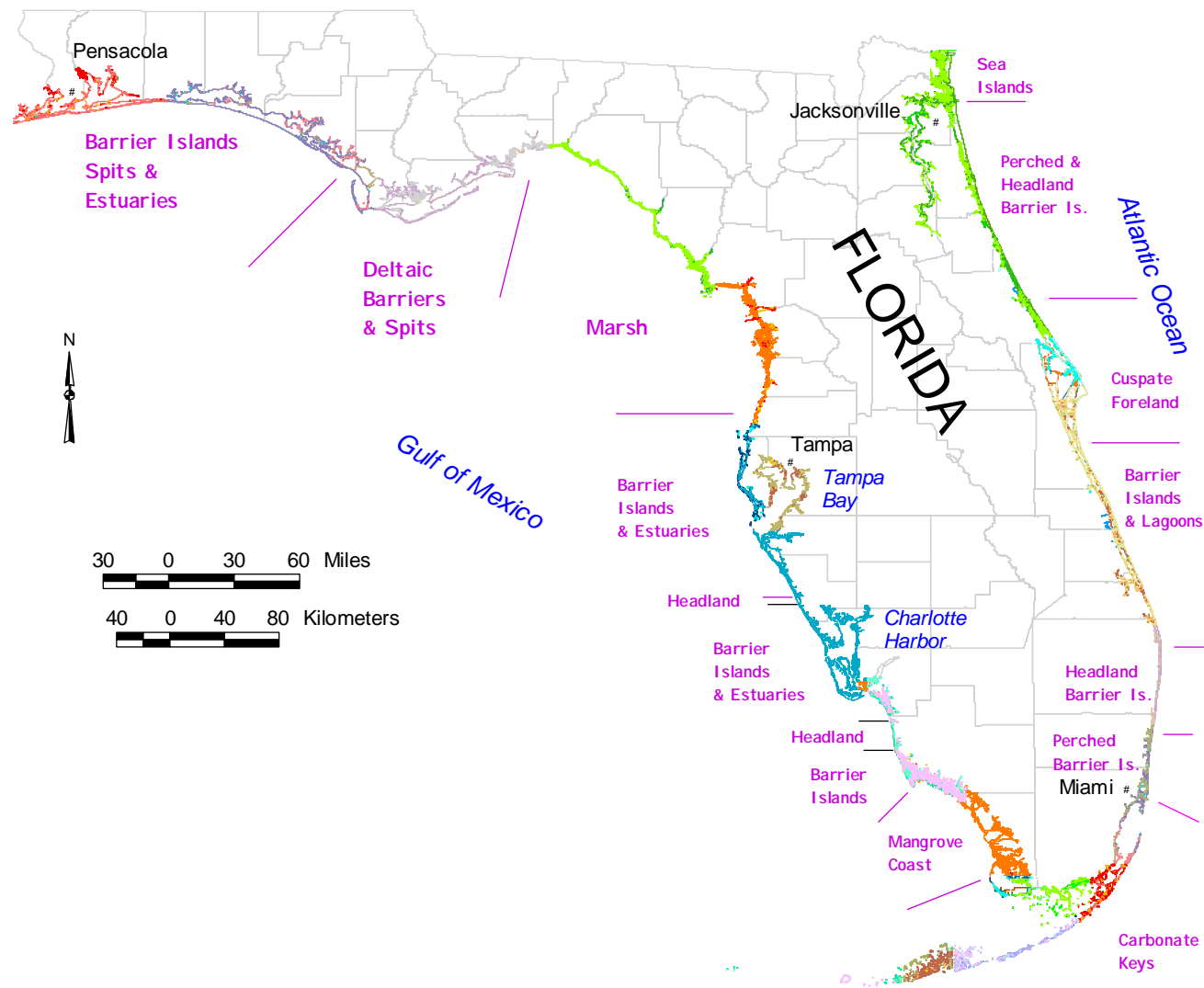


Figure 22. High-resolution segments comprising the base shore of Florida

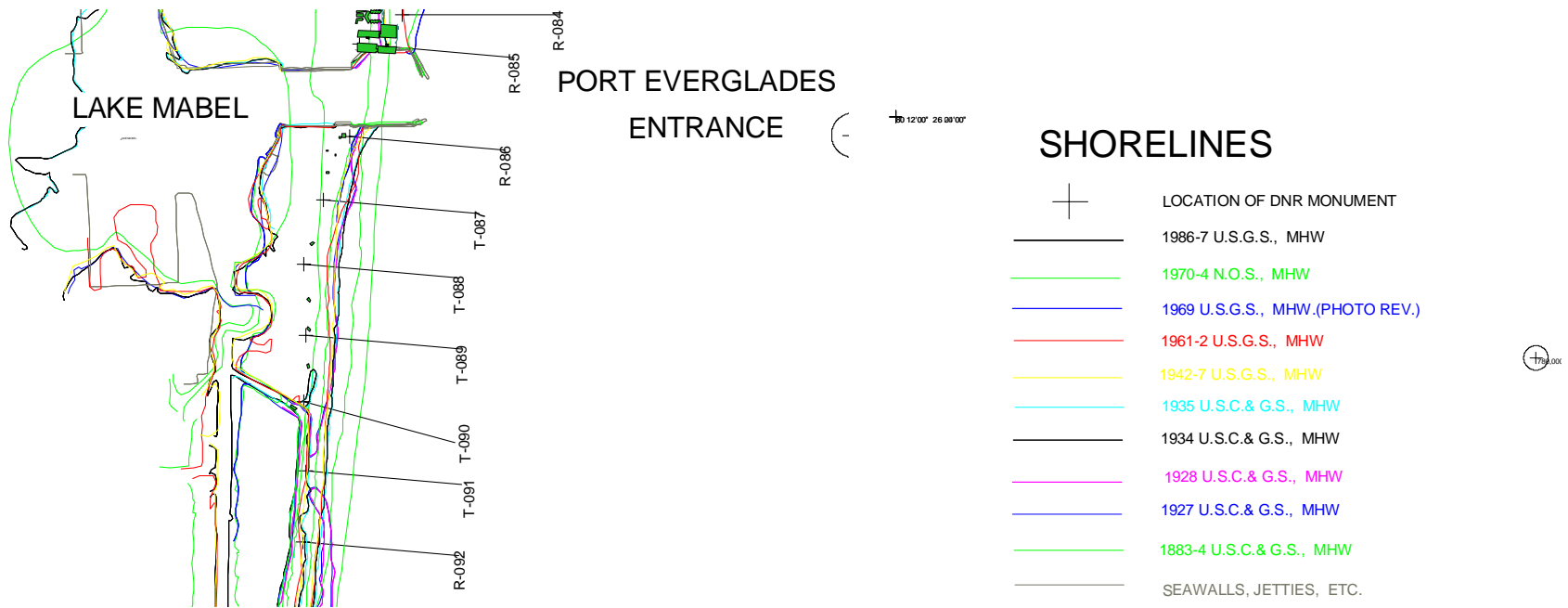


Figure 23a. Example of historic shorelines from a portion of Broward County at Port Everglades Entrance (Florida DEP)

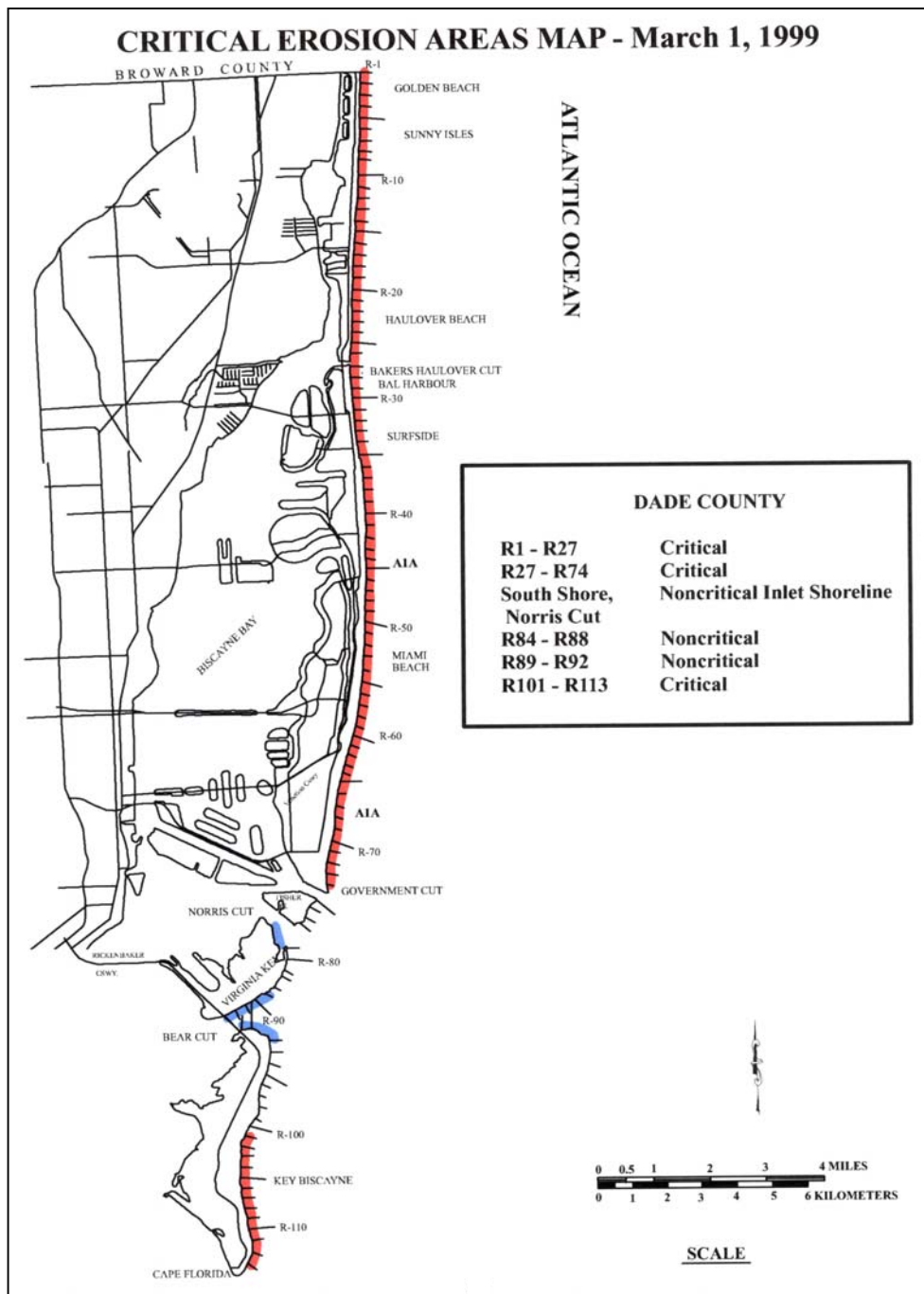


Figure 23b. Example of Dade County critical erosion area map (Florida DEP)

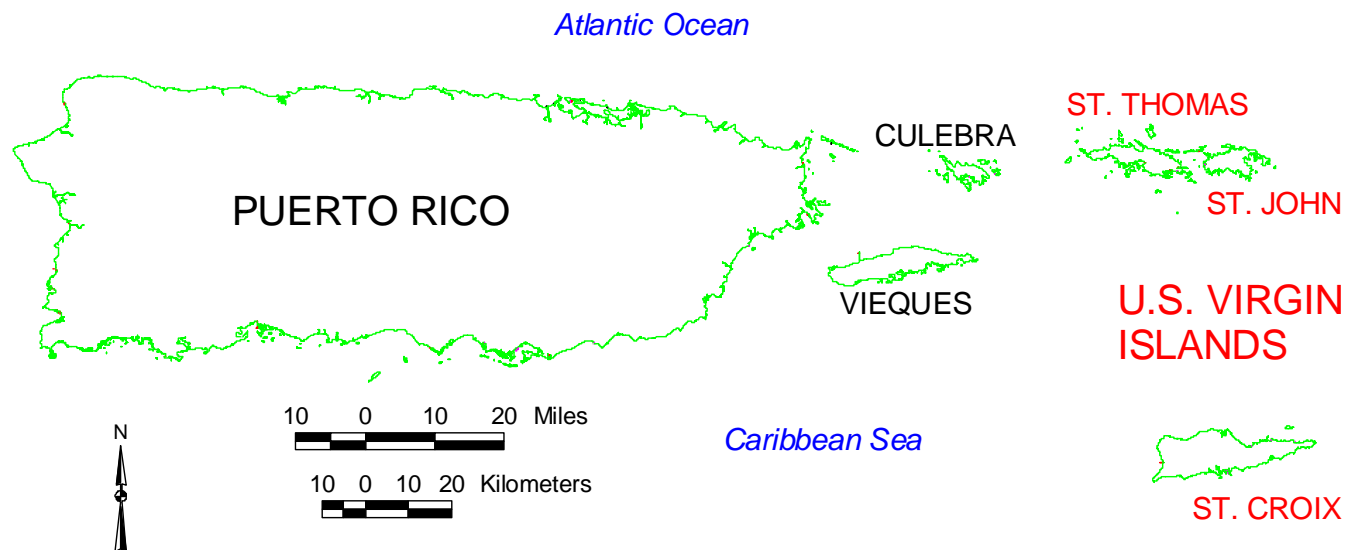


Figure 24. High-resolution shoreline of Puerto Rico and the U.S. Virgin Islands.

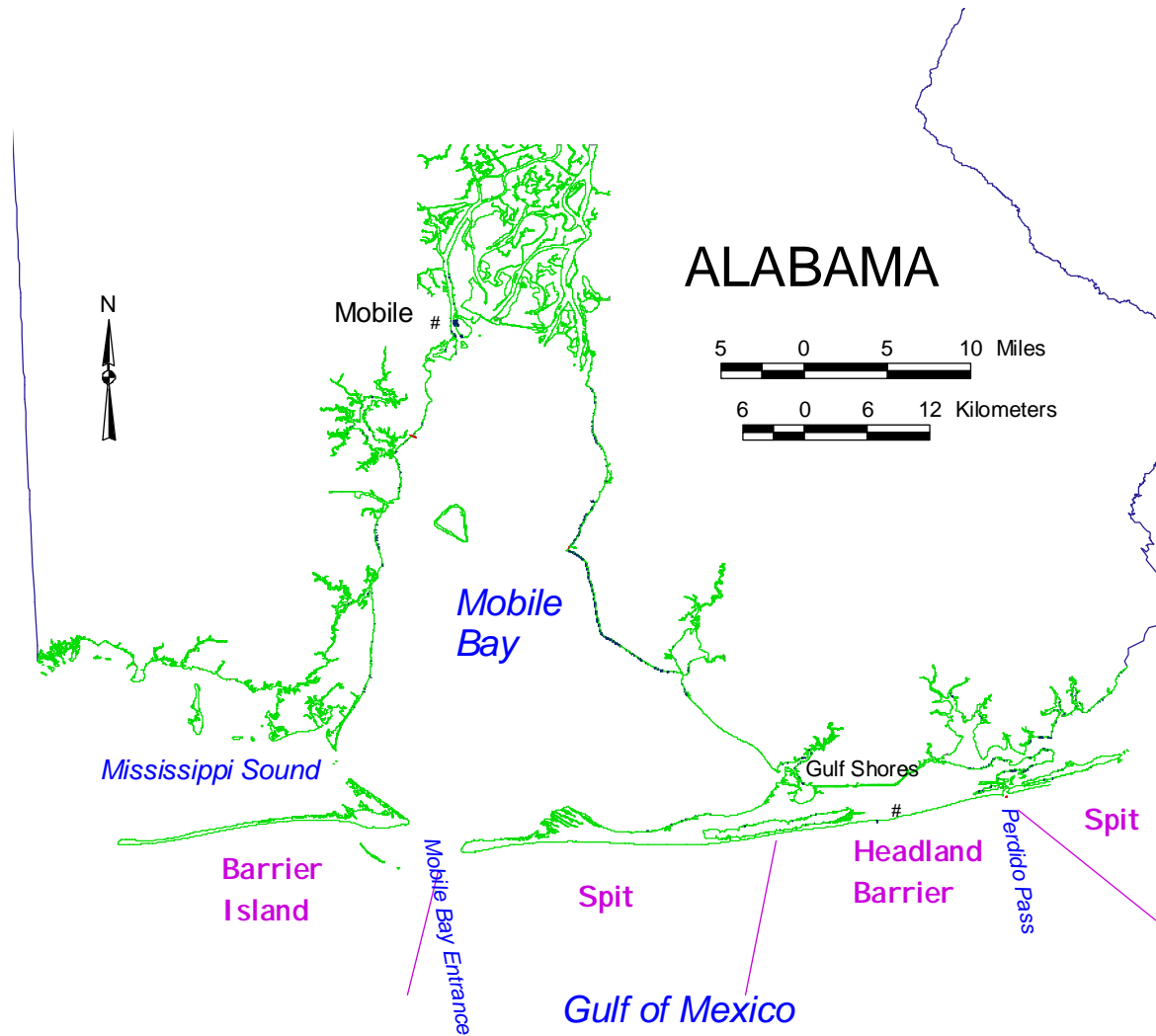


Figure 25. High-resolution base shore of Alabama

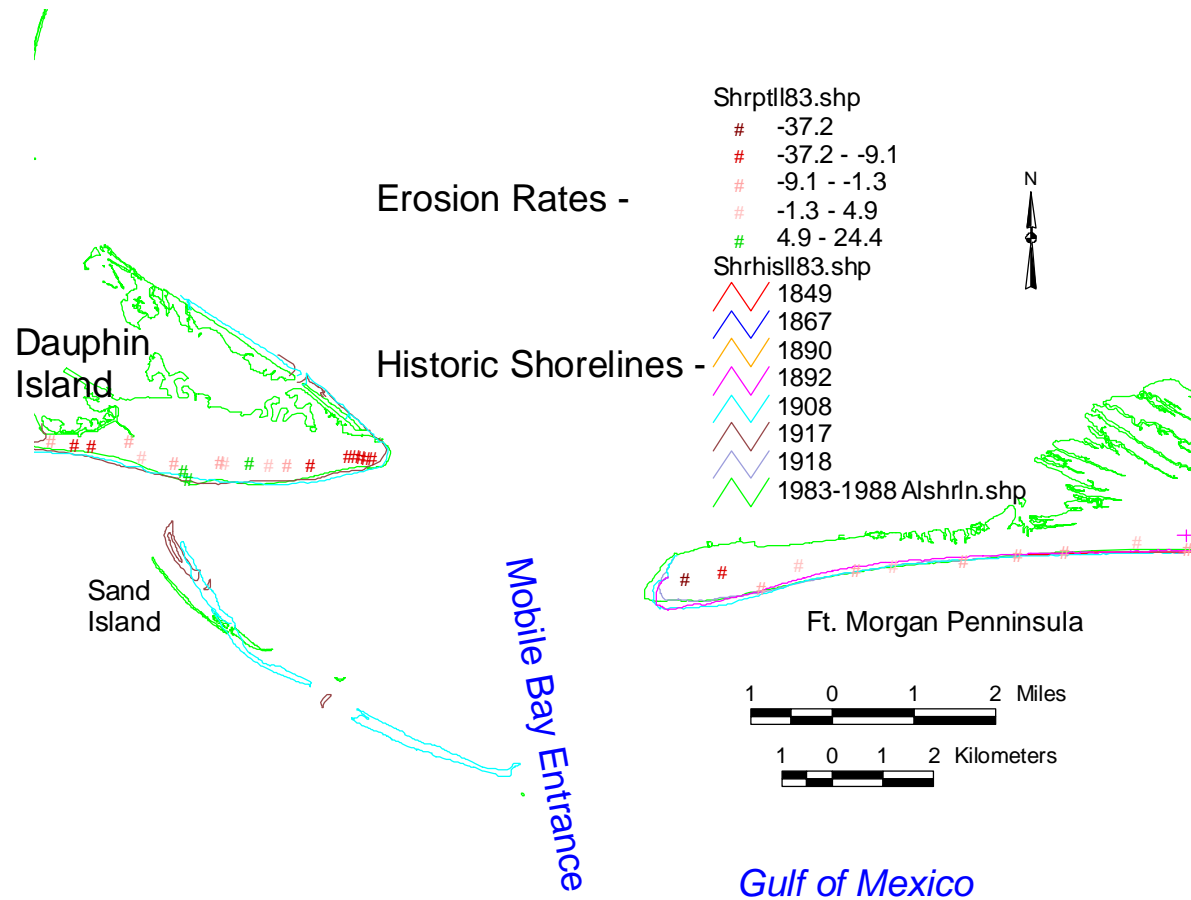


Figure 26. Historic shorelines and erosion rates for Alabama coast based on Univ. of South Alabama Study (NOAA)

MISSISSIPPI

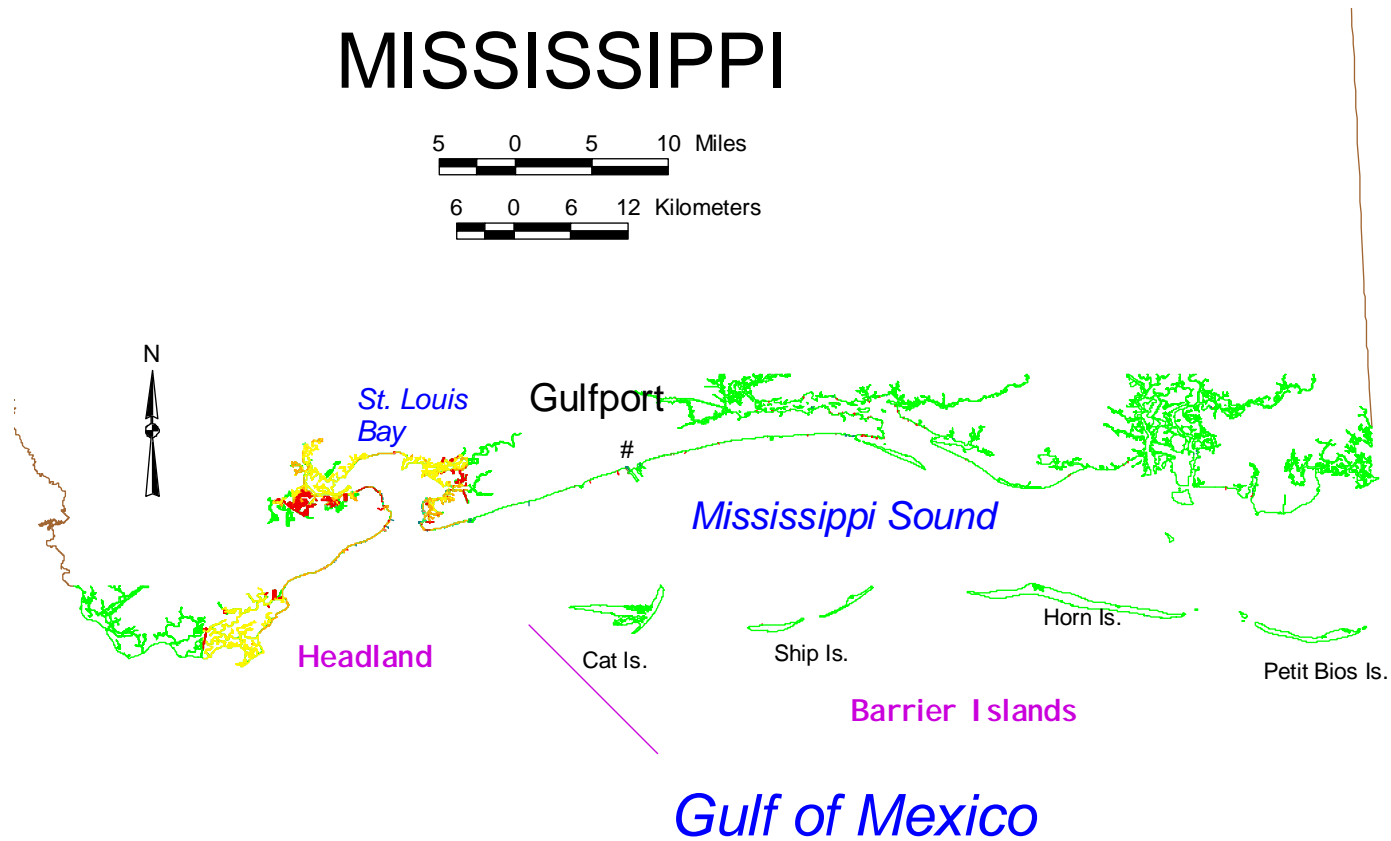


Figure 27. High-resolution base shore of Mississippi

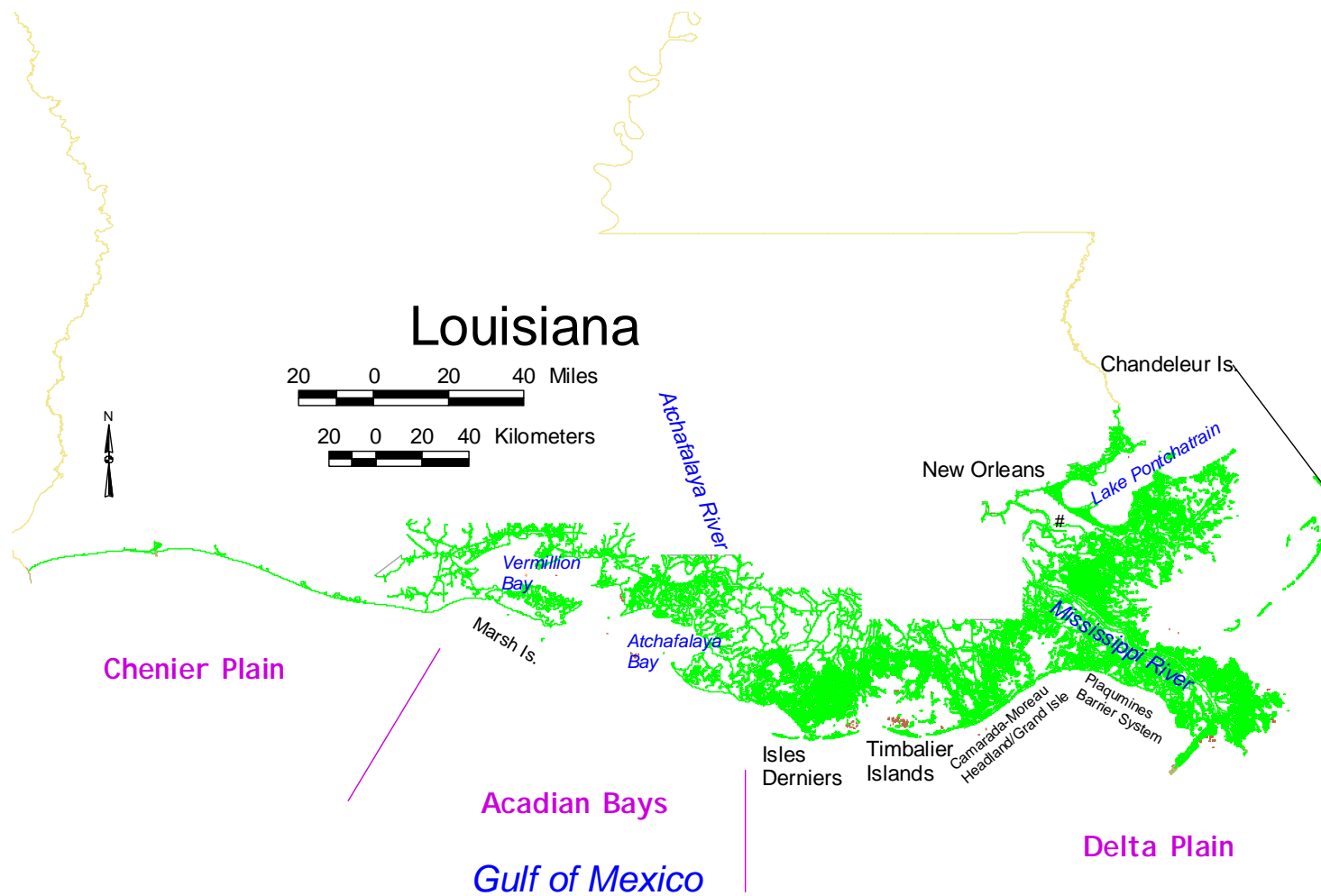


Figure 28. High-resolution base shore of Louisiana

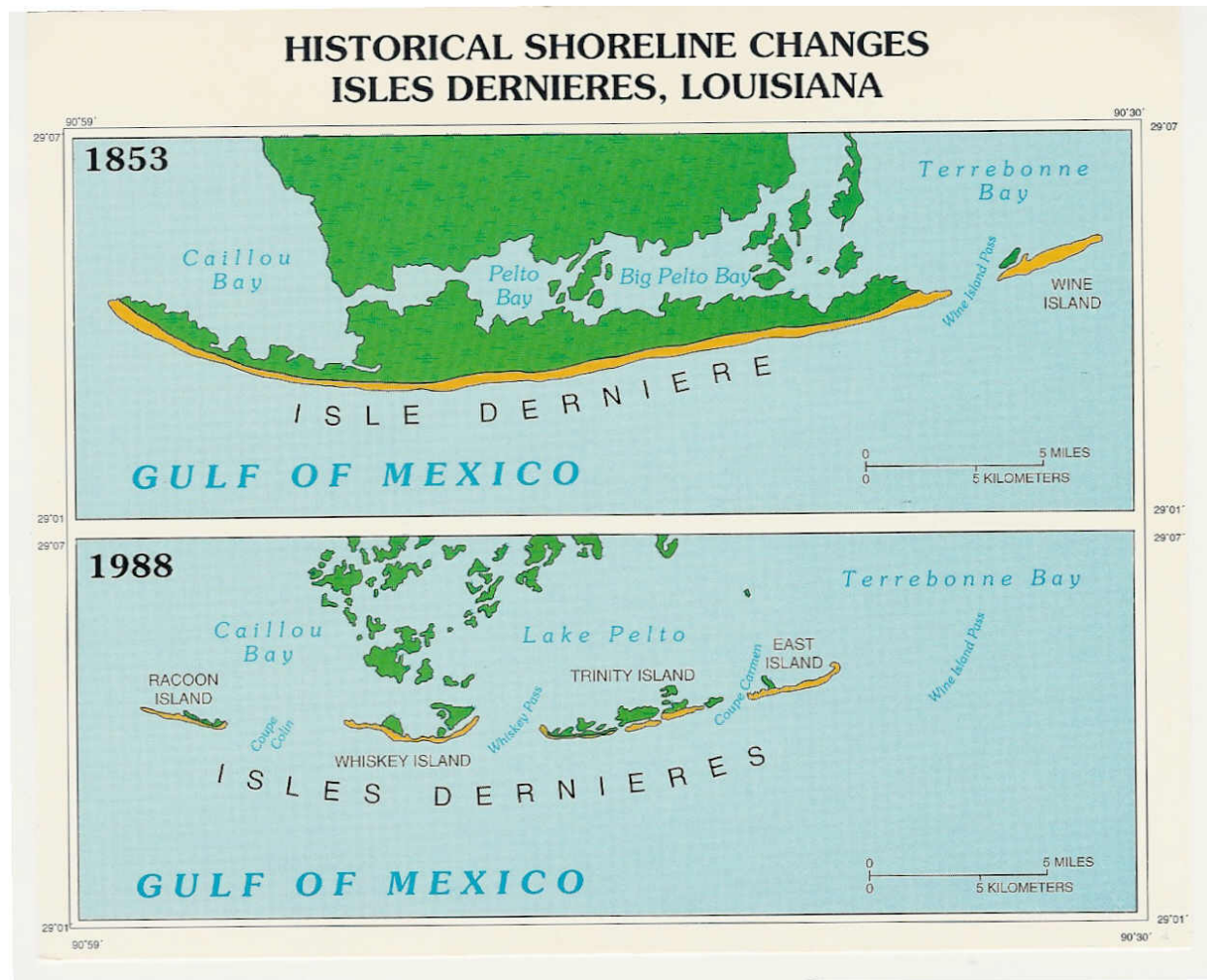


Figure 29. Example of shoreline change along the Isles Dernieres Barrier System section of the Louisiana coast (from Louisiana Geologic Survey, 1992)

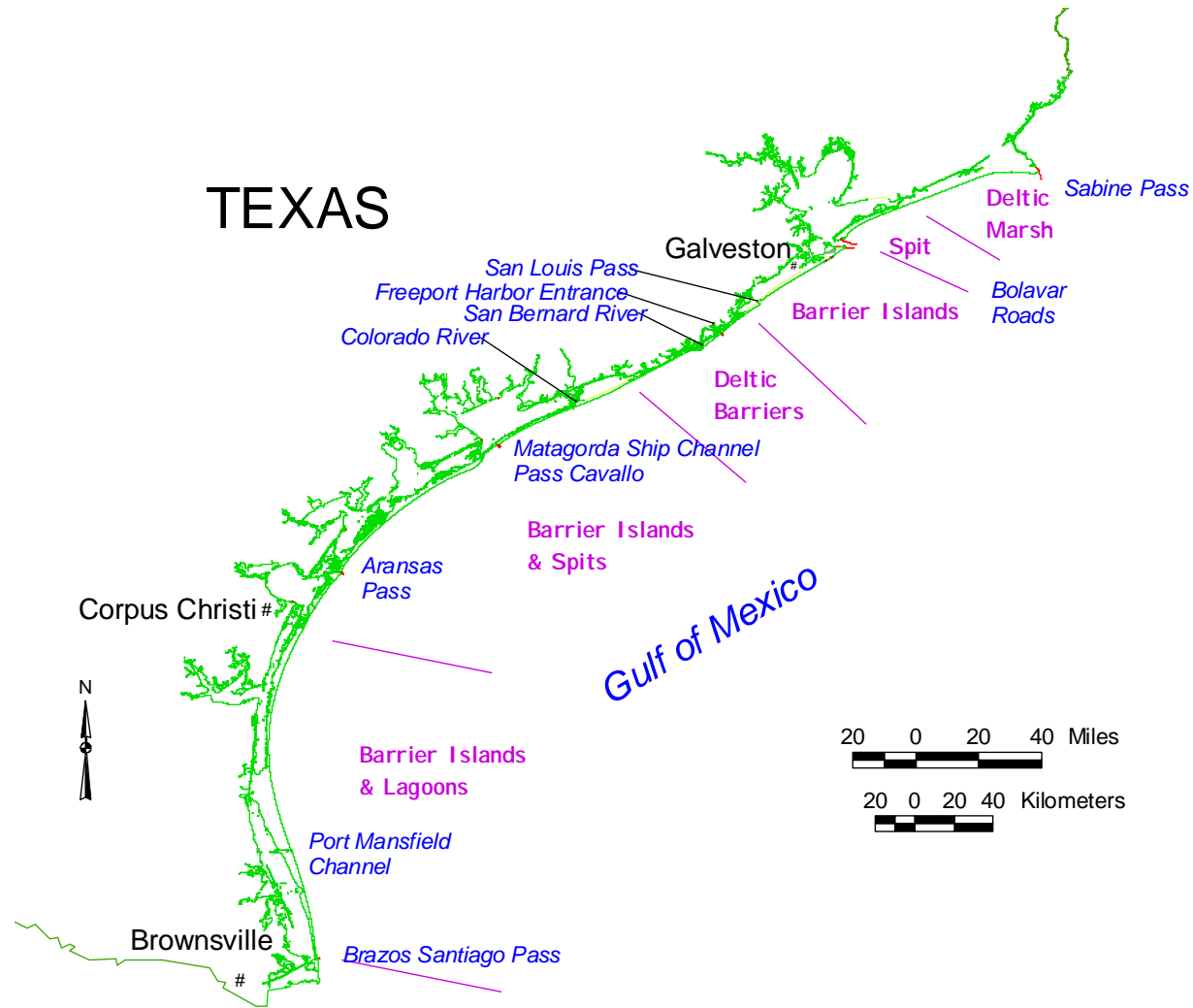


Figure 30. High-resolution base shore of Texas

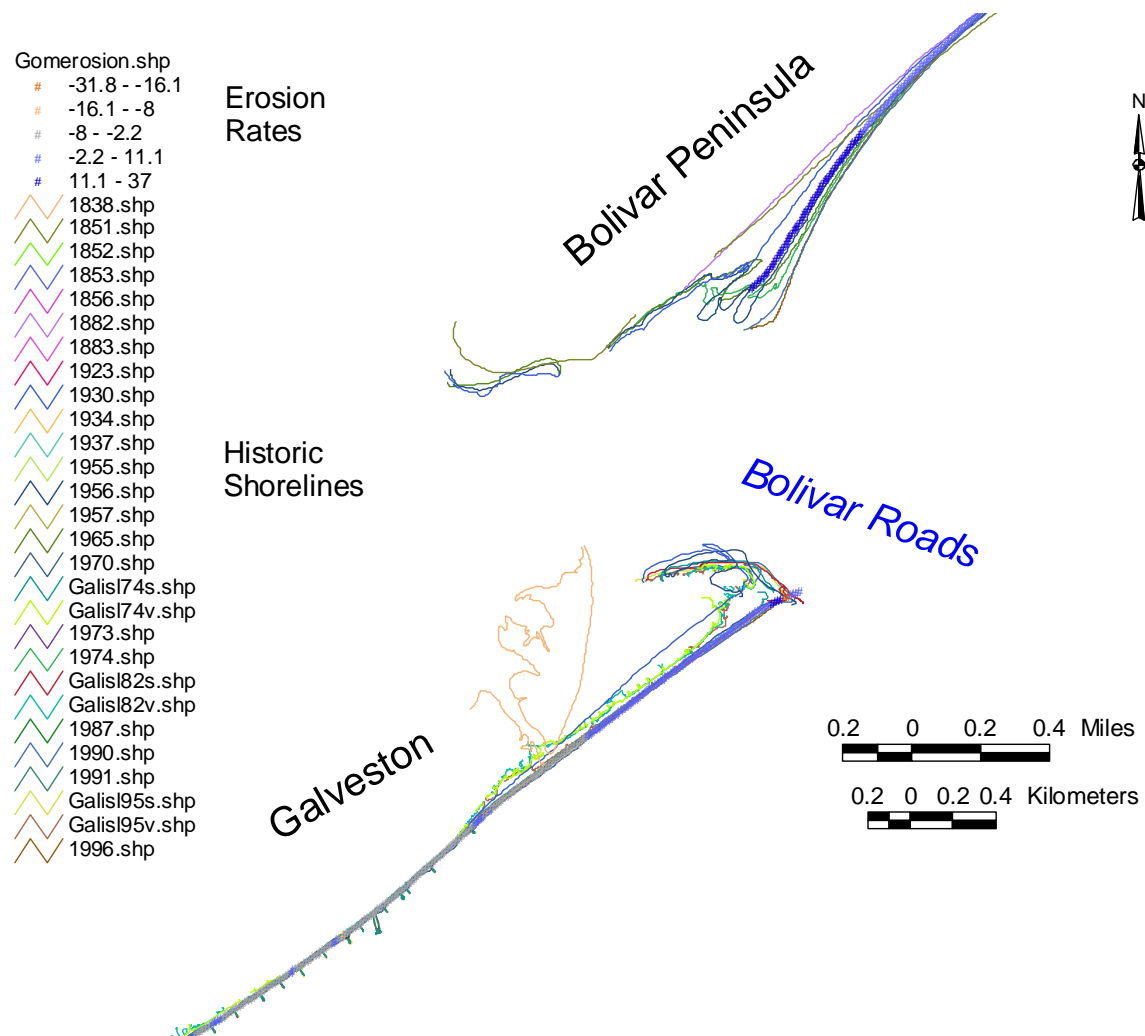


Figure 31. Example of historic shorelines and erosion rates at Galveston, Texas (Texas Bureau of Geology)

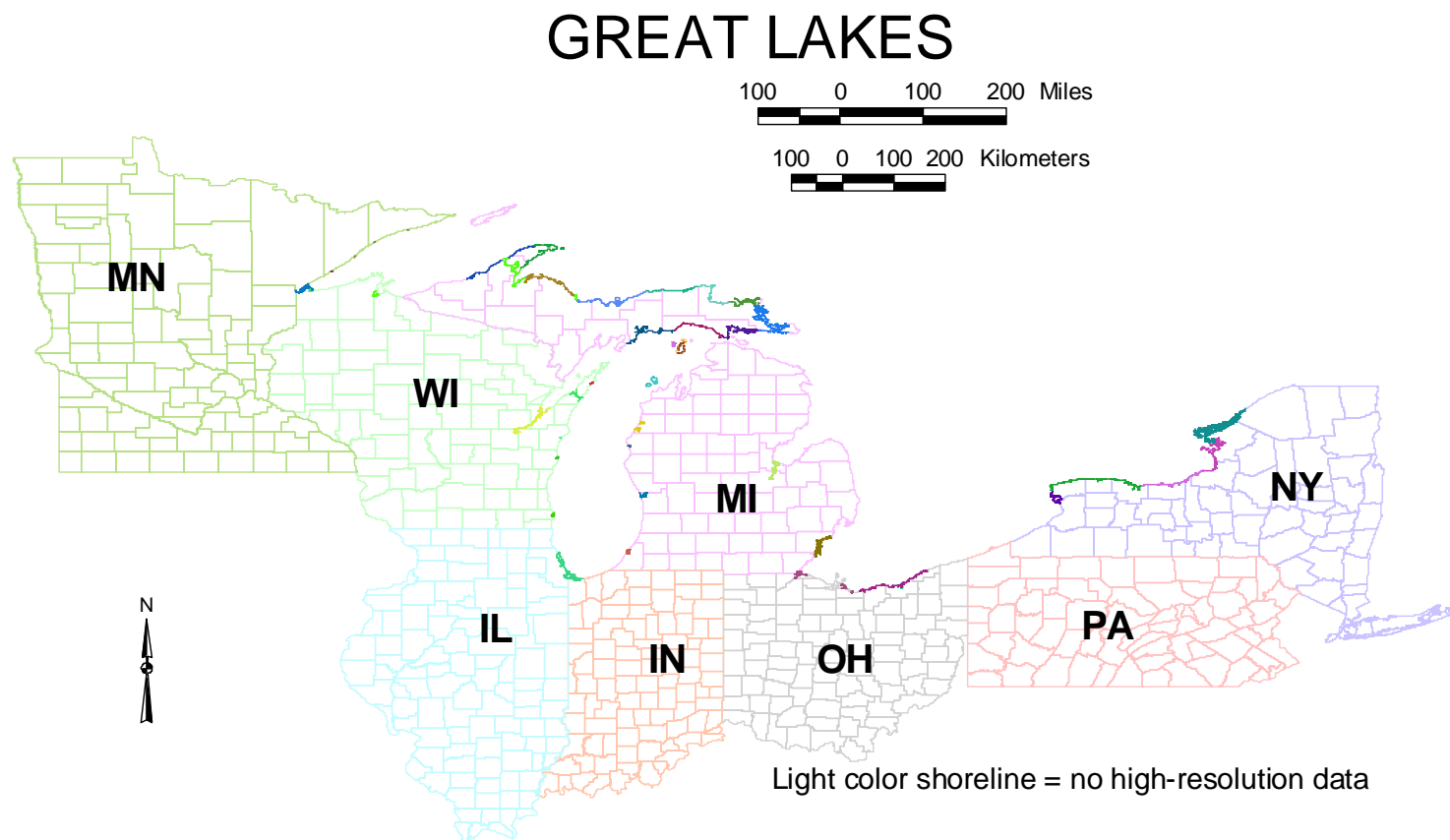


Figure 32. Portions of the Great Lakes shoreline with high-resolution NOAA data

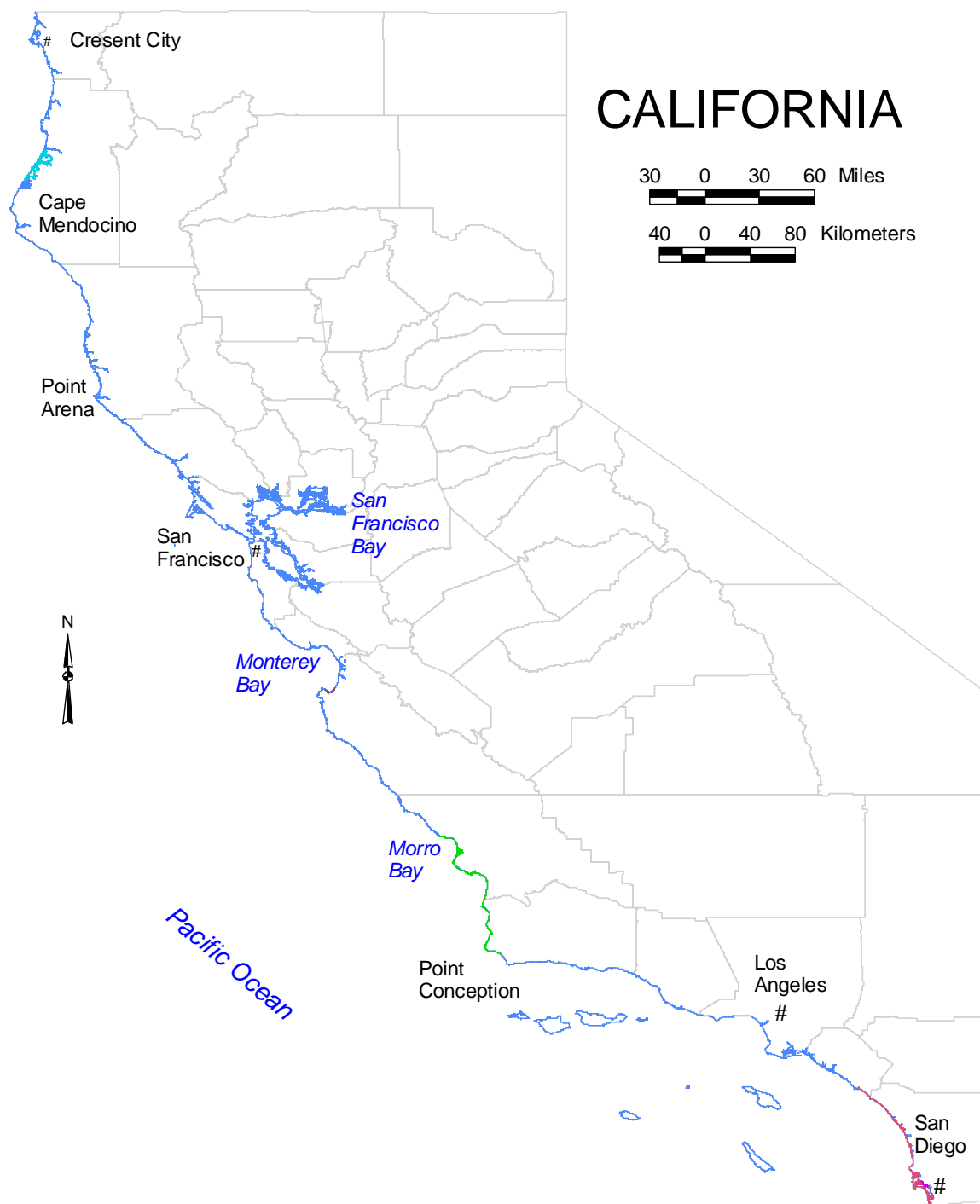


Figure 33. High-resolution composite base shoreline of California from NOAA and State of California

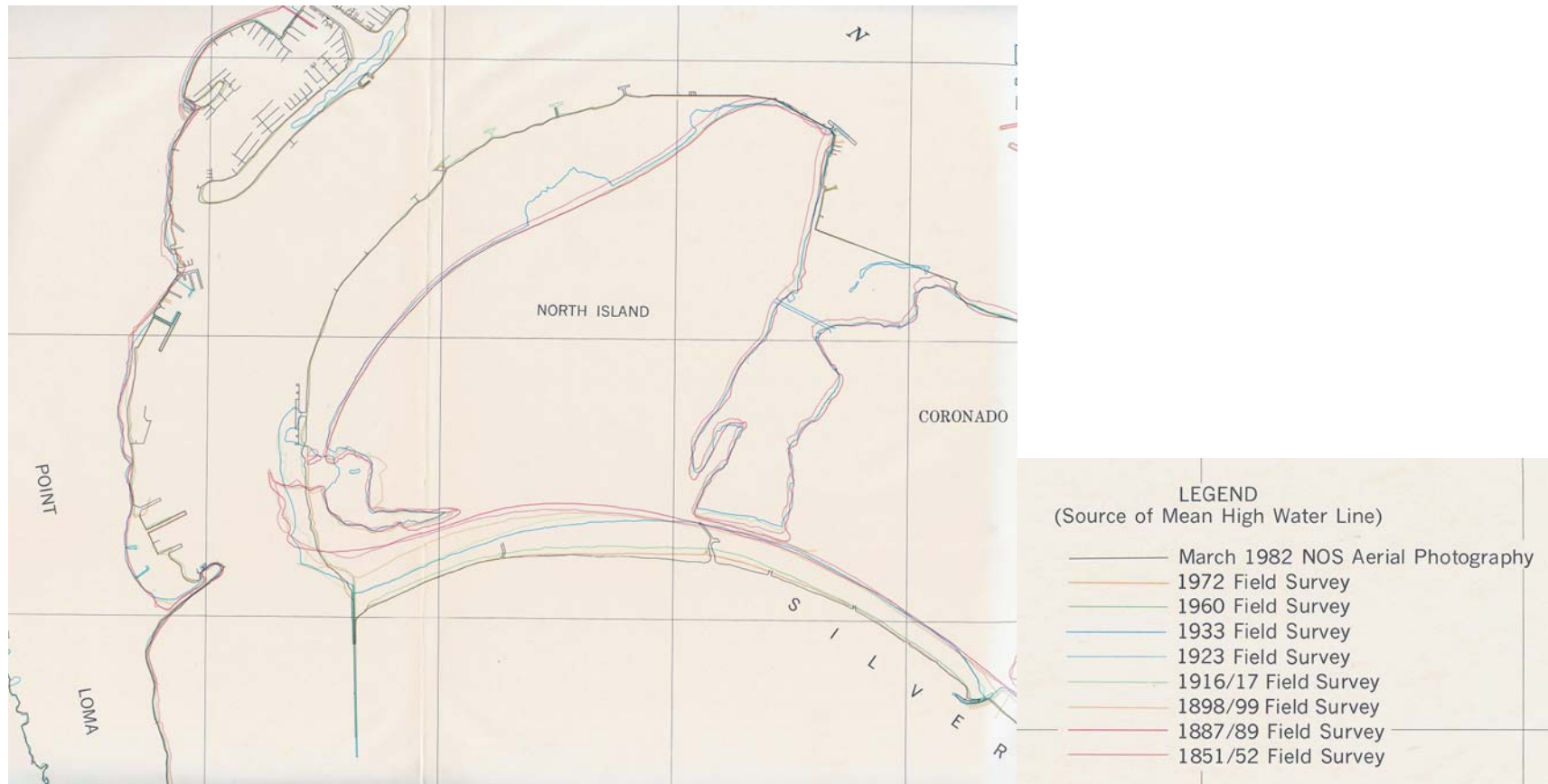


Figure 34a. Example of San Diego area NOAA/LAD Cooperative Shoreline Movement Study map series of historic shorelines of Southern California

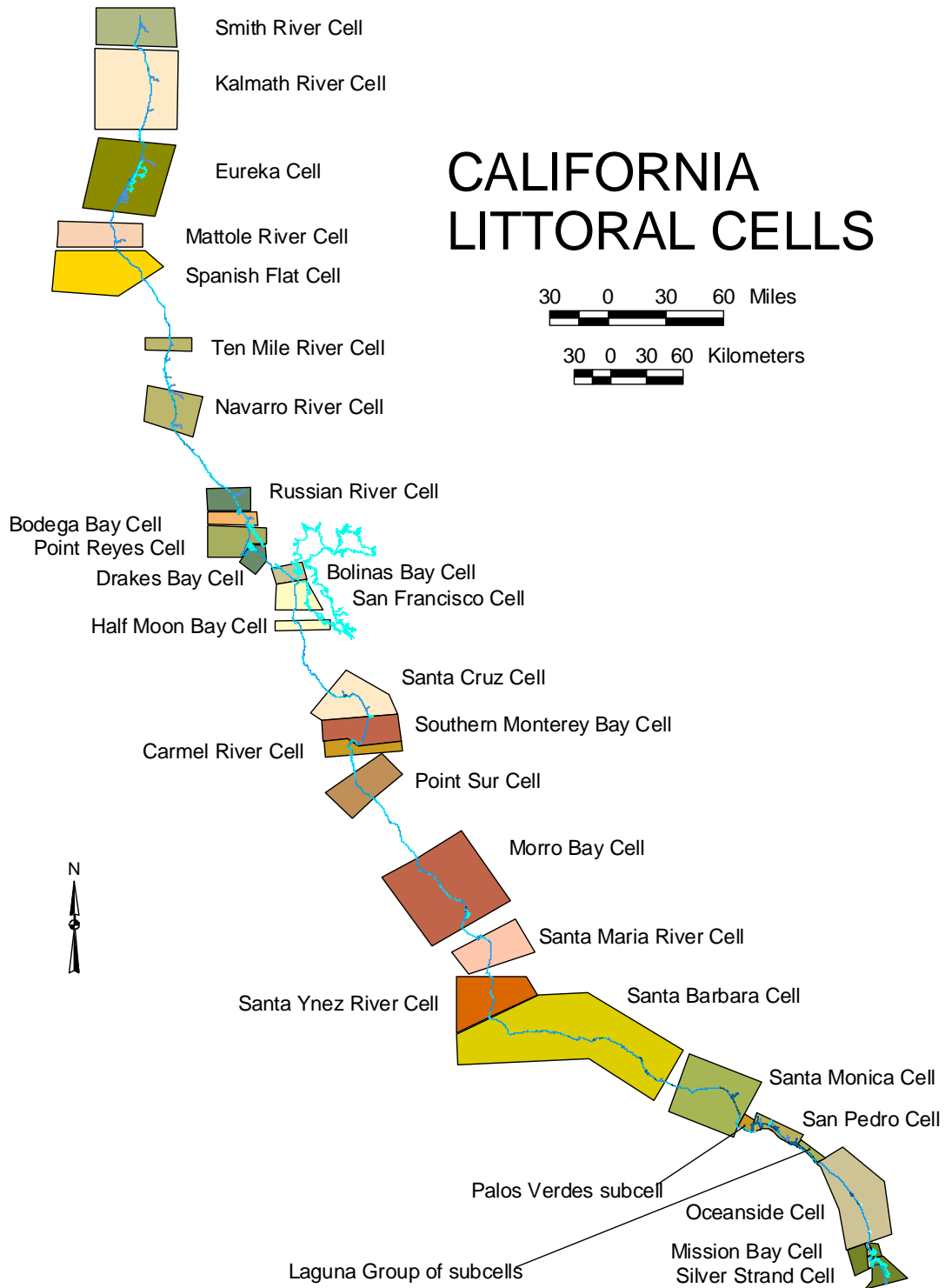


Figure 34b. Littoral Cells along the California Coast from the State of California Spatial Information Library

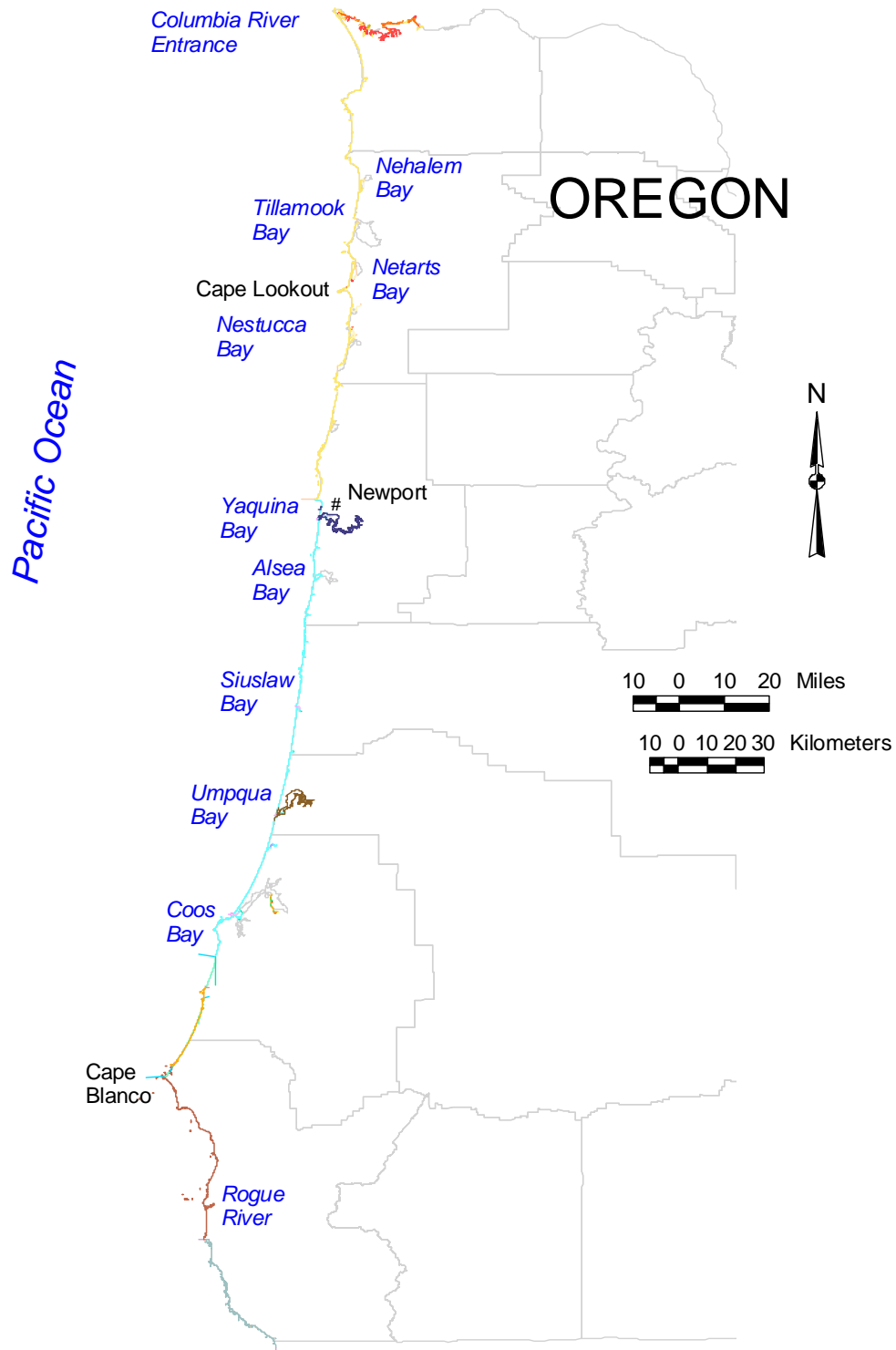


Figure 35. High-resolution composite base shoreline of Oregon

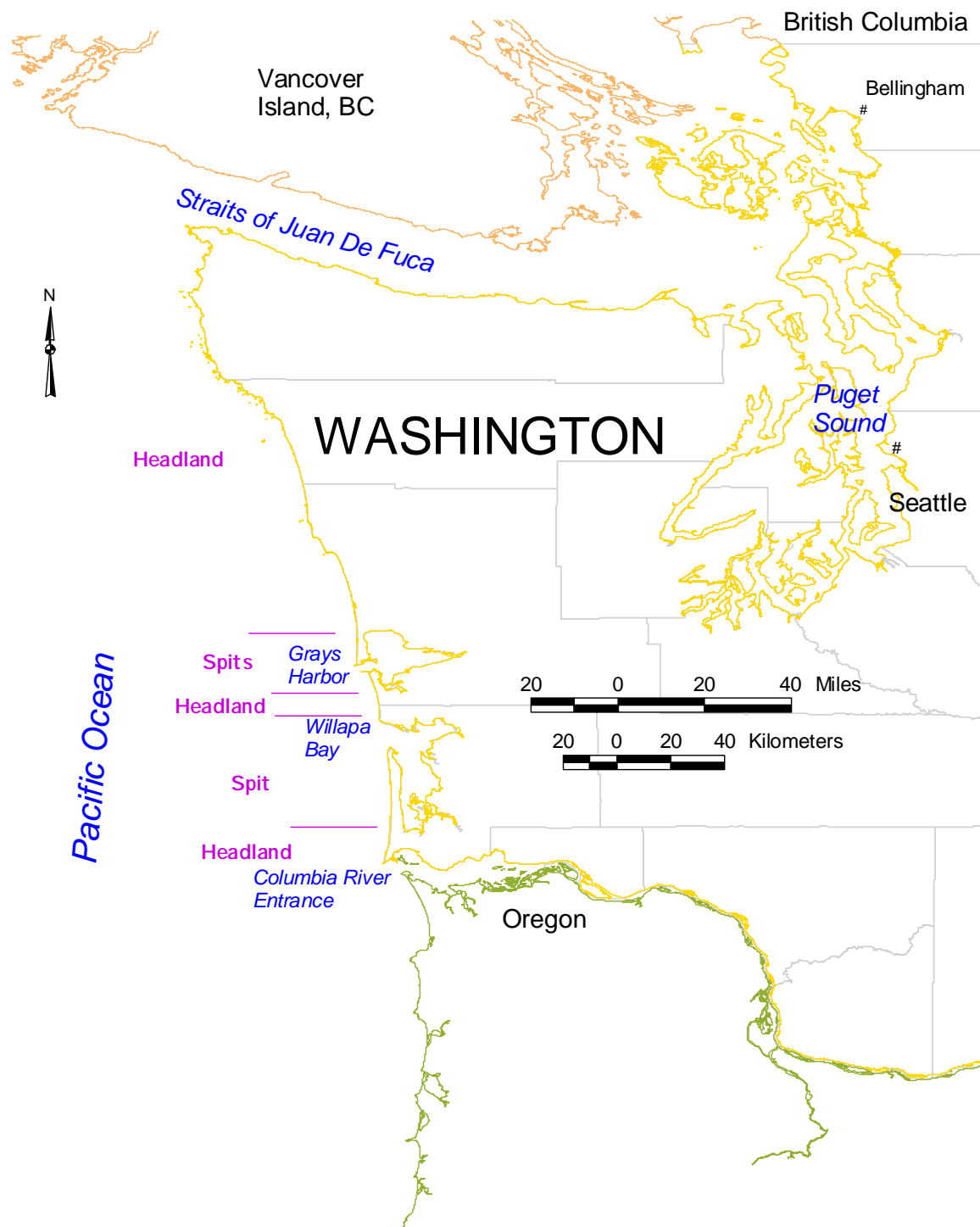


Figure 36. High-resolution base shoreline by State of Washington

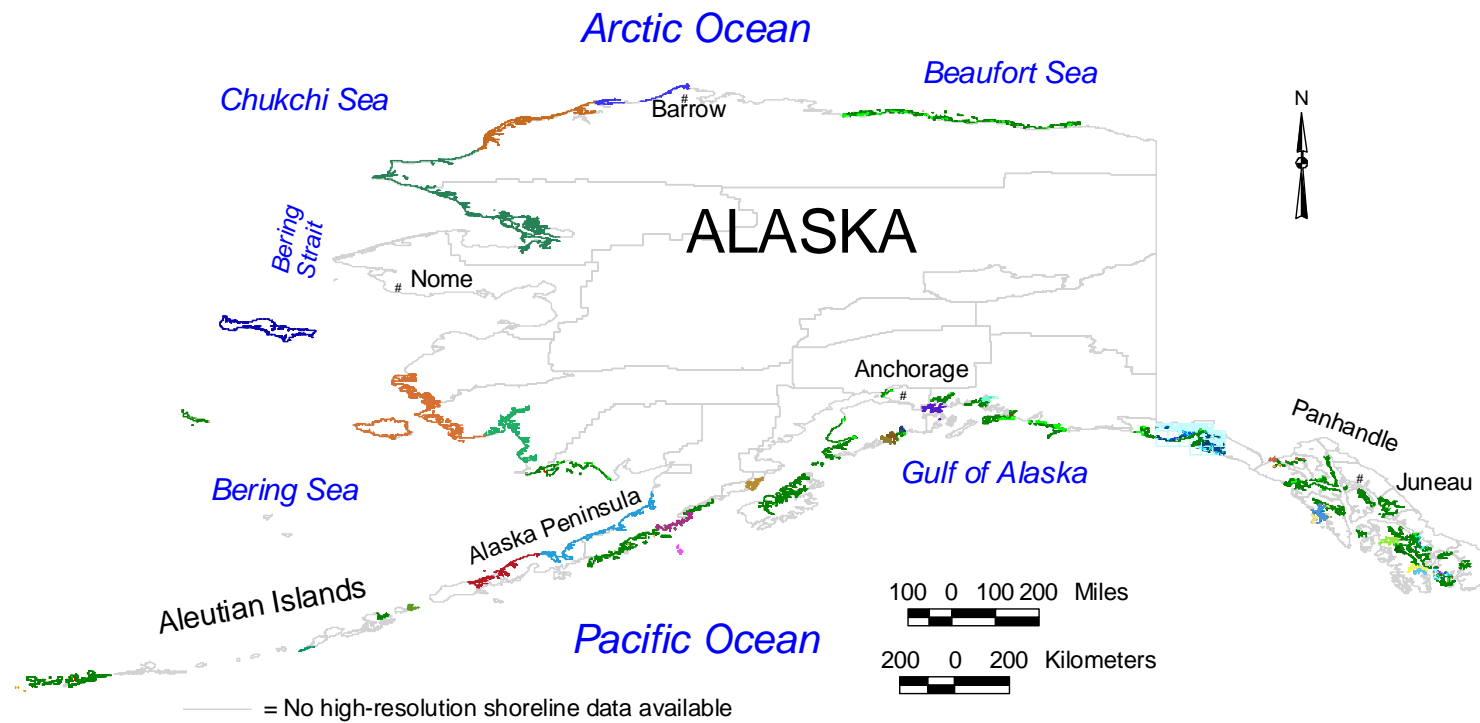


Figure 37. Composite high-resolution base shoreline segments for Alaska

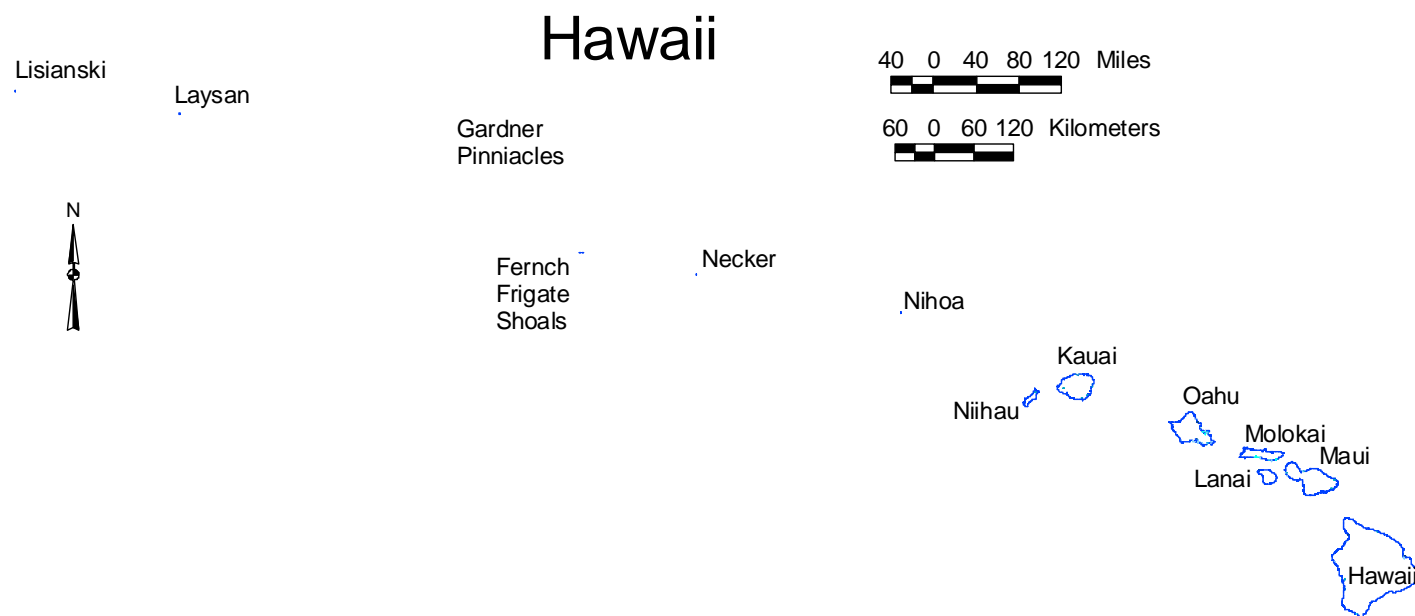


Figure 38. High-resolution base shoreline of Hawaiian Islands