Integrated Information Processing: A Methodology for Comparative Analysis of Three Basins to Enable the Development of Controls of Nonpoint Pollution Sources and Habitat Restoration Strategies

A Response to the National Oceanic and Atmospheric Administration, Center for Coastal Ecosystem Health Request for Proposals

Prepared by the Delaware Coastal Management and National Estuarine Research Reserve Program

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1995

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Overview

Our goal is to implement a structured process that will result in a database and desktop mapping system to enable resource managers to view the relationships between selected nonpoint pollution sources, land use activities, habitat trends, and the species associated with the habitats in the Delaware Estuary Region. Two of the watersheds, the St. Jones and Blackbird Creek, contain National Estuarine Research Reserve (NERR) sites. The remaining watershed, the Appoquinimink, has been experiencing problems due to eutrophication caused by nutrient enrichment from point and nonpoint sources.

This project will demonstrate the application of "knowledge engineering" using four integrated project tasks. There is significant overlap in data collection, acquisition and formatting between each of the tasks. This team effort will result in significant cost savings for data that could not be realized otherwise.

The major tasks are:

1. Development of the Coastal Ocean Management, Planning and Assessment System (COMPAS) in ArcView 2 to evaluate impacts of BMPs.

2. Development of data sets for use in hydrodynamic modeling on Delaware NERR Basins.

3. Comparative analysis of the effects of currents and wetlands on eutrophication in Delaware Bay tidal creeks.

4. Habitat modeling for the analysis of the effects of land use activities on terrestrial wildlife habitats.

Project oversight will be conducted by the recently merged Delaware Coastal Management /National Estuarine Research Reserve Program (DCMP/DNERR), NOAA's Center for Coastal Ecosystem Health, NOAA's Office of Ocean Resources Conservation & Assessment, Strategic Environmental Assessment Division (SEA), and the US Fish and Wildlife Service's Delaware Bay Estuary Project (DBEP). Section IV includes a description of all local, state, and regional project participants.

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I. Background

The primary constraint to adequately evaluating environmental impacts, and to making sound management decisions on environmental improvement actions, is the lack of information that is readily accessible for utilization. In addition, the lack of electronic communication between local, regional, and national centralized data repositories is directly responsible for frequent unnecessary expenditures on repetitive data collection.

In Delaware, several notable efforts involving the joint Delaware Coastal Management/National Estuarine Research Reserve Program (DCMP/DNERR) are underway that involve extensive data collection and/or data reformatting for habitat evaluation and restoration projects, mitigation of habitat impacts caused by major projects, and non-point source pollution reductions efforts. Projects include:

1. ***The Dover/Silver Lake/St. Jones River Watershed Protection Project***
2. ***The Northern Delaware Wetlands Restoration Project***
3. ***Characterization of the Delaware National Estuarine Research Reserve Sites***
4. ***Development of the Section 6217 Coastal Nonpoint Source Pollution Control Program***
5. ***A Southeast/Mid-Atlantic Regional Demonstration of the Impact of Agricultural Best Management Practices on the Nonpoint Source Pollution of Coastal Waters***
6. ***Appoquinimink National Monitoring Project***

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7. ***Christina River Basin Watershed Restoration Project***
8. ***Development of a DCMP/DNERR Geospatially Referenced Database in ARC/INFO***
9. ***The Delaware Estuary Program Action Plan Demonstration Project for the Restoration of the Thousand Acre Marsh***
10. ***USFWS National Gap Analysis Project***
11. ***Delaware Component of National Marine Mammal Stranding and Sea Turtle Program***
12. ***Wading Bird Biomonitoring for the Assessment of Regional Habitat Conditions on a Tertiary Consumer***
13. ***Central Data Management Office (CDMO) Project in Support of the NERRS System-Wide Environmental Monitoring Program***
14. ***Selecting and Managing Wetland Restoration Sites with a GIS Database and Remote Sensed Data Including Biomass***

Data management problems are ubiquitous throughout these projects as well as numerous other data intensive projects underway in the region. Recognizing this problem, a cooperative project between the DCMP/DNERR and SEA was recently initiated with assistance from NOAA, Office of Ocean and Coastal Resource Management, to assist the state with its data management problems. SEA is developing the first phase of a data management system incorporating Geographic Information System (GIS) components. This Arc/Info based (ArcView2) desktop mapping and analysis system (COMPAS) is currently being developed to evaluate the impacts of BMP's on nonpoint source pollution for the St. Jones Watershed. The St. Jones Watershed includes the largest component of the Delaware NERR and the Dover/Silver Lake Watershed that is being evaluated with an extensive hydrologic model under CZMA Section 309.

II. Project Summary

Specific objectives for each of the tasks are as follows:

1. Develop COMPAS in ArcView 2 to evaluate impacts of BMPs.

The problem of effectively managing conflicting resource uses within the U.S. coastal zone continues to frustrate environmental managers and decision-makers. One of the reasons often cited for these problems is the poor application of our existing information base to specific management needs. All too often information suited to assisting in a particular management question is not accessible to those charged with the management responsibility. The COMPAS program was designed to specifically address this information delivery dilemma. COMPAS is a desktop information system designed to bring information to state resource managers responsible for oversight and guidance of coastal resource use.

Desktop information systems have several characteristics. First, they are developed to be theme specific so that the logic of how the information is to be used is clear to the user. Second, they are designed to answer a limited number of questions well, and do not attempt to provide the type of open-ended capabilities of standard geographic information systems. Consequently, a desktop system typically contains a subset of synthesized information derived from a larger data base. Third, they typically are more user-friendly than most mainframe systems. This means complex operations can be performed with minimal training. The user does not need to understand programming or specialized syntax. This can lead to broader and innovative uses that encourage a new look at more orthodox information management systems and extended use of information in the decision-making process.

SEA, in coordination with the DCMP/DNERR, Delaware Division of Water Resources, and Delaware Nonpoint Source Pollution Control Program is currently developing COMPAS to evaluate the impacts of BMPs on nonpoint source pollution for the St. Jones Watershed. Additional funding will support the development of additional data for assessing nonpoint source pollution in two more watersheds in Delaware, the Appoquinimink and Blackbird Creek.

This task will result in the ability to compare the impacts of BMP's in three watersheds. Some of the proposed data sets include livestock inventories, the distribution of BMPs, financial assistance to farmers for BMPs, soils information, point source discharge facilities, sediment data, surface water quality monitoring and vegetative cover. The data management system will be developed on a stand alone version of ORACLE for two platforms, UNIX and PC Windows NT. This will then be integrated with ArcView 2 software.

The design of the COMPAS system is a structured process that identifies issues, resource management questions, and data sets that can help to answer those questions. Participants will characterize information requirements and identify the system capabilities required to access and manage the information. The result of this process is a desktop system containing the most important information needed to make management decisions related to a particular theme or module. The data will be collected by various agencies and will be delivered in different formats. SEA has considerable experience in extracting and synthesizing "raw" data into a form best suited for management needs. This requires work sessions designed to define the system and information requirements for each of the modules. Disparate data sets are then structured into a relational framework using SQL compliant database management systems like ORACLE.

The BMP module will support ongoing nonpoint efforts in Delaware required by Federal legislation. It will initially address nonpoint source pollution issues relating to nutrient over enrichment of water resources. Questions for investigation include effectiveness of best management practices in reducing nonpoint pollutants such as sediments and nutrients, and an analysis of water quality trends. Questions that will be addressed include the density of poultry houses by watershed; the distribution of different types of BMPs by watershed; and the distribution and location of confined animal feeding lots by watershed.

The project will be conducted in four stages.

1st Stage. A planning and design session to develop the detailed framework to guide the project will be developed within the first quarter. The session will be held in Silver Spring, Maryland, with all the project participants. The purpose of these meetings will be to define the final product. To be successful this process must be applied in a comprehensive and continuous manner. It will involve periodic updates and reviews by the participants. The preliminary system design will be developed, task elements defined, and an implementation plan developed. During this period the necessary hardware and software required for the project will be purchased.

2nd Stage. During the 2nd and 3rd quarters information for the BMP module will be collected and evaluated. Data will be collected on livestock operations; best management practices such as conservation tillage, filter strips and settling ponds; water quality; and point source permitting data.

3rd Stage. During the third and fourth quarters we will incorporate existing information into the COMPAS software. The goal of COMPAS is to suit the information needs of individual coastal programs. A certain level of standardization is maintained to achieve one of the basic objectives: information transfer. This will include data synthesis, database design, digitizing or scanning, and encoding. Quality control procedures will be used where required. Potential problems will be identified and cleaned up.

4th Stage. System integration, documentation and training will be conducted during the fourth and fifth quarters. SEA will work with the project team to finalize the software functions desired for the final product. Once the product has been assembled training will be provided to the resource managers who will be using the system.

Work sessions will be held throughout the duration of the project to review progress and refine the implementation plan if necessary.

Project personnel will be trained to use the COMPAS methods for managing data and providing properly formatted digital information for each of the remaining three tasks. It is expected that after working directly with SEA, Delaware will have acquired the necessary expertise to modify and/or expand their system with minimal assistance from NOAA.

2. Development of Data Sets for Use in Hydrodynamic Modeling on DNERR Basins

The recently merged DCMP/DNERR Program will demonstrate the indirect utility of COMPAS by utilizing the COMPAS process to build data layers for use in hydrodynamic modeling. The DCMP recently completed the development of an Arc/Info interface to the EPA Stormwater Management Model model (SWMM). The initial runs of this model are underway in the Dover/Silver Lake Watershed at the headwaters of the St. Jones River Basin. Delaware's Coastal Programs would like to extend this modeling effort to include the full hydrologic reach of both of the Delaware NERRS Sites. The primary constraint is the availability of properly formatted data. Once formatted, data developed for this modeling will also be made available to resource managers.

The DCMP/DNERR Environmental Engineer and Systems Network Specialist, with guidance from SEA, will assist with the overall project by building the GIS data layers required for project tasks 1 and 2. These will include soils coverages, digital elevation models, major conduits and water control structures, drainage systems, land use, and surface coverage. A digitizer compatible with the existing IBM 41T workstation will be purchased to enable the creation of these data layers. Additional DCMP/DNERR staff will collect detailed stormwater runoff data as part of the *Southeast/Mid-Atlantic Regional Demonstration of the Impact of Agricultural Best Management Practices on the Nonpoint Source Pollution of Coastal Waters, The Dover/Silver Lake Watershed Protection Project,* and monitoring in accordance with *Delaware's Coastal Non-point Pollution Control Program (Section 6217)*. The DCMP/DNERR will utilize existing automated stormwater sampling equipment for collecting water quality data.

This task will be completed in four stages:

1st Stage. At the Planning and Design Session, priorities for data to be included in COMPAS will be set. The availability and adequacy of these data sets will then be evaluated for inclusion in the COMPAS database. Based on this evaluation, the priorities of data sets determined at the planning and design session, and a detailed understanding of the data requirements both for hydrologic modeling and COMPAS, a work-order priority will be set for the uploading/creation of data layers useful to both project components. Where coverages are not available in digital form they will be created by the DCMP/DNERR Environmental Engineer, Systems Network Specialist, or other DNREC GIS staff.

2nd Stage. During the 2nd and 3rd quarters existing data sets will be collected and reformatted or standardized to fit into the data scheme. Proposed data sets include: soils, digital elevation models, drainage systems, and water control structures. At this point, coordination between the National NERR Project *Selecting and Managing Wetland Restoration Sites with a GIS Database and Remote Sensed Data Including Biomass* (Klemas, Univ. of DE) and COMPAS will begin to ensure that the landuse/land cover data collected in this effort is compatible and complimentary.

3rd Stage. The 3rd, 4th, and 5th quarters will see the most activity in data creation and inclusion. Data sets that are incomplete or non-existent will be created in this phase. Activities in this stage would include the creation of DEMs from mylar separates of elevation. This is accomplished by first scanning the separate, then using a process called *heads-up-digitizing*, digitizing over the image on-screen to convert the image into a vector file. The next step will be to attach attribute data (i.e. elevation data) to each of the lines. After each line is associated with an elevation, ARC/INFO routines are then used to create the DEM. (This is the least desirable option for the creation of a DEM but may be necessary if digital information cannot be obtained.)

4th Stage. The combining of data from other projects into COMPAS will be conducted during the 5th and 6th quarters. DCMP/DNERR staff are involved in several projects that overlap with the modeling and data that this project utilizes. Specifically, the *Southeast/Mid-Atlantic Regional Demonstration of the Impact of Agricultural Best Management Practices on the Nonpoint Source Pollution of Coastal Waters, The Dover/Silver Lake Watershed Protection Project*, and monitoring in relation to *Delaware's Coastal Nonpoint Pollution Control Program (Section 6217)* will have generated data relating to BMP implementation, storm event driven water quality data, and the effects of varying landuse on water quality, that can be included in COMPAS.

This project component will demonstrate that the methodology used by the COMPAS system, by crossing computer platforms, will provide dual functionality. The synthesized data will be accessed through the desktop system by managers and resource planners working in ArcView2 for administrative decision making, and the raw data will still provide the detail required by Engineers and Scientists for detailed computational hydraulics work on the Unix platform.

3. Comparative Analysis of the Effects of Currents and Wetlands on Eutrophication in Delaware Bay Tidal Creeks

This project component will advance the level of knowledge pertaining to natural versus human caused eutrophication problems in Delaware tidal creeks through a comparative study of three basins. One of these basins, the Blackbird Creek NERR, is probably the least impacted by human activity of any tidal creek in Delaware. Data collected over the past 15 years by the DNREC indicates that it also has recurring low summer dissolved oxygen levels, in addition to high total phosphorus and total suspended solids concentrations throughout the year which are similar to those of other tidal creeks which are shown to be more heavily impacted by human activity. Levels of total phosphorus which are sufficient to fuel explosive algae growth, which can lead to DO deficits, exist consistently in all three creeks. This finding led to the development of our hypothesis that: low dissolved oxygen levels, high total phosphorus concentrations and high total suspended solids concentrations in tidal creeks are highly, although by no means solely, attributable to natural factors. The two impacted basins in the study include the Appoquinimink River and the St. Jones River.

Two natural factors which appear to exert a major influence upon eutrophication dynamics in Delaware tidal creeks include strong tidal currents and wetlands (marshes). The velocity of these currents is sufficient to keep fine grained material (suspended solids) in a constant state of suspension. We have observed that these creeks are turbid and muddy in appearance even during extended dry periods. It is known that phosphorus adsorbs to particle surfaces and may be expected to increase as suspended solids levels increase. Also, it is generally true that a relationship exists between high suspended solids levels and biological oxygen demand, possibly leading to depressed DO levels.

It is notable that each of these tidal creeks are similar in the sense that they are bordered by expansive marshes which flood twice per day to some extent. We have not directly measured nutrient levels in this flood water before it drains off the marsh and back into the creek. A better understanding of the importance of nutrient transport from the marsh into Delaware tidal creek mainstems as a function of tidal action is needed.

In addition, we also wish to investigate temperature and dissolved oxygen responses in water that floods over the creek banks and into the marshes on high tide. It is possible that substantial reductions in DO occur in this water due to solar heating and biological oxygen demand exerted by the marshes. Transport of DO-reduced water back into the mainstem of the creek on ebb tide may result in a lowering of the DO concentration within the creek. Such a demand on oxygen may be expected to continue during night tidal cycles when there is no photosynthetic activity to bolster levels upward.

This project task is a multi-year study which includes a four-pronged approach to advancing our knowledge of eutrophication dynamics in Delaware tidal creeks.

This project component will be conducted in the following stages.

1st Stage. During the first month of the first quarter, a detailed site review will be conducted in order to identify the optimal locations for all water quality and sediment sampling. In addition, the QA/QC for field sampling and laboratory procedures will completed.

2nd Stage. Monthly sampling of water quality parameters that are indicative of eutrophication will be conducted over an annual cycle at six (6) stations including two (2) stations per river for two (2) consecutive years to account for annual variability. The parameters to be tested will include nutrients, dissolved oxygen, chlorophyll-a, total suspended solids, biological oxygen demand and several others .

3rd Stage. Composite samples of sediments will be collected at each river station and from the marshes adjacent to these stations to compare differences in background substrate nutrient and organic content levels between the three basins. Each station will be sampled twice, during late winter and late summer to account for periods of minimal and peak vegetative biomass in the marshes.

4th Stage. During the second summer an existing DCMP/DNERR ISCO automated sampler will be deployed at each river station once per month during the summer (June, July and August). The sampler will be programmed to collect samples at timed intervals through a full tidal cycle. These samples will be tested for total phosphorus, total suspended solids and turbidity to ascertain whether levels of these constituents are elevated during the early part of ebb tide as a result of transport from the marshes.

5th Stage. DCMP/DNERR YSI 6000 continuous monitoring instruments will be deployed with the ISCO samplers and programmed to record dissolved oxygen, conductivity, salinity and pH levels at intervals coordinated with the ISCO sampler.

All data will be digitally formatted and spatially referenced for use in 1) COMPAS and 2) the hydrodynamic modeling in the St. Jones Watershed. This data will conform to the CDMO metadata standard that is likely to be based on the National Geospatial Data Transfer Standard. The DCMP/DNERR staff, following training by SEA staff, will incorporate this data as it becomes available.

4. Habitat Modeling for Analysis of the Effects of Land Use Activities on Terrestrial Wildlife Habitats

This project component will integrate wildlife habitat restoration priorities with NPS pollution control strategies by making spatial and temporal land cover/habitat data available to decision makers through COMPAS. Using a combination of predictive habitat modeling, intensive field inventories, and land cover change analysis, a USFWS staff biologist will provide information on the status and trends of terrestrial (including vegetated wetlands) wildlife communities within the Blackbird Creek NERR Watershed, and as time allows, within the St. Jones and Appoquinimink watersheds as well. At a minimum, the vegetation and wildlife species distributions will be mapped for these other watersheds.

To accomplish this goal, this project component will be carried out four stages.

1st Stage. A map and digital coverage of vegetation in the project area will be developed. Vegetation and land use will be mapped in cooperation with the National Gap Analysis Project. The digital coverage will be developed using a combination of satellite imagery, aerial photography and ground-truthing. Spring and fall Landsat Thematic Mapper scenes will be used as a basis for classifying general land use/land cover categories. Relatively cloud-free scenes from the 1992-1994 time period will be used. 1:40,000 scale color-infrared aerial photography and Digital Orthophoto Quads, air videography, and ground-truthing will be used in refining the vegetation types. The initial image processing will be carried out using a raster-based GIS. The processed image will then be vectorized into an Arc/Info coverage consisting of classified vegetation and land use polygons. Some of the vegetation refinement may involve on-screen digitizing using aerial photography and field data as a reference.

The vegetation will be classified according to The Nature Conservancy's Terrestrial Community Alliance Classification System (Sneddon et al., 1994), which has been developed by the state Natural Heritage Programs. These community alliances are a modification of the UNESCO land cover classification system (1973). This system is being used in classifying vegetation types for the National Gap Analysis Project in Delaware. The vegetation map will be used as a basis for mapping the habitats of all terrestrial vertebrates and butterflies known to breed in the DNERR watersheds. Land use will be classified according to the Anderson system, while non-vegetated wetlands will be classified according to the Cowardin system.

The final vegetation map will be refined to a level of detail that distinguishes the specific habitats of terrestrial vertebrates in the DNERR watersheds, and will be in Arc/Info format.

2nd Stage. A combination of range maps and habitat modeling will be utilized to map the distributions of all terrestrial vertebrates occurring in the project area, assigning species to vegetation polygons in Arc/Info coverages. This stage will also involve an intensive field inventory of vertebrate species (including small mammal trapping), followed by a statistical accuracy assessment of predicted vertebrate distributions.

In cooperation with Gap Analysis investigators, and through extensive literature review, a comprehensive species-habitat association matrix will be developed. This matrix will identify vegetation types that represent appropriate habitat for each of the common terrestrial vertebrate and butterfly species that are likely to breed in the NERR watersheds. The vegetation types identified in this matrix will correspond with The Nature Conservancy's community alliances that exist in the project area. Existing range maps, museum records and other data sources will be used in developing detailed range maps which will indicate whether or not a species is known to breed in the project area.

After the comprehensive species-vegetation matrix is completed, a simpler matrix will be developed. Where there are no significant differences in their animal communities, vegetation cover-types (i.e. community alliances) will be aggregated into more general habitat types within the UNESCO vegetation classification hierarchy. The result will be a matrix of habitats and their associated animal species. Plant communities that are aggregated into more general habitat types will still be retained in the GIS as polygon attributes, and will still exist in a separate vegetation coverage. The species-habitat association matrix will form one of the basic components of the species' habitat models as it will be used as a reference in assigning species to polygons on the habitat base map.

Habitat descriptions are rarely provided in detail comparable to the vegetation types defined on the GAP vegetation cover type map (Csuti, 1994). As a result, many errors of commission might be made in assigning species to vegetation cover types. Therefore, in addition to their use in identifying suitable habitat on the vegetation map, habitat models may be used to identify additional "filters" that might be used in the GIS to refine predicted species distributions. For example, a model might state that a reptile species occurs within a certain distance of freshwater streams. In this example, the model for this species would be used to identify appropriate vegetation on the base map, and then a hydrography layer could be overlaid and buffered to the specified distance (done in the GIS) to identify only those patches of appropriate vegetation that occur along streams.

Due to the potential for overestimating their distributions, habitat models will not be developed for rare species such as those listed as threatened or endangered, or species that are considered globally rare (e.g., G1, G2) or rare within the project area (e.g., S1, S2). For these species, field data, museum data, Natural Heritage Inventory data and other reliable site records will be used in mapping their breeding distributions.

In Arc/Info GIS, the polygons or grid cells that represent species' distributional limits (i.e. range maps) will be overlaid on the habitat map. Where suitable habitat for a particular species falls within the species' range limits, the species will be assigned to the appropriate habitat polygons as attributes in the database. Once this is done, other variables such as patch size and shape, or distance from water or roads may be used to further refine predicted species distributions. Where suitable habitat patches fall partly within a species range but extend beyond the known range limit, the species will be expected to occur throughout that habitat patch and the range will be extended only if other habitat requirements (e.g., patch size) are met.

The final data base associated with the habitat base map will contain records for all habitat polygons and will include all species expected to occur in each habitat polygon based on range maps and modeling. This data base will include full citations for all references used in assigning species to habitat polygons.

Using field data that were withheld from the above steps, a statistical accuracy assessment of predicted vertebrate and butterfly distributions will be conducted. This assessment will involve the comparison of predicted and observed lists of species, as suggested by Cassidy et al., 1994. Observed lists of species come from intensive field inventories and previously developed checklists that are considered accurate and complete.

Field inventories will be conducted for all taxa. For mammals, a combination of Havahart and Sherman live traps will be used, and an Azel Reptile Snare will be used to aid in capture and identification of snakes. Pit-fall traps may also be used for capturing reptiles and amphibians. All traps will be monitored daily. For birds, frogs and toads,

species will be identified by sight as well as by song/call. All other taxa will be documented through visual observations. A GPS/GIS data collector will also be used to pin-point the locations of observed species, and to record habitat attributes associated with observations. As suggested by Cassidy et al. (1994), transects or point counts for diurnal birds will be done at the same time that trap lines for nocturnal small mammals are visited in the early morning, and searches for tracks and sign of larger mammals will be done simultaneously with searches for reptiles as mammal trap lines are established in the afternoon.

Comparison of predicted species lists with observed species lists will include the following:

1. The number and identity of species predicted and number and identity of species observed.

2. The number and identity of species predicted to occur but not observed (errors of commission).

3. The number and identity of species observed but not predicted (errors of omission).

Based on the above tabulations, the total percent commission error and total percent omission error will be calculated. No attempt will be made to detect rare species during field inventories, although observations of these species will be recorded. Other species that are not considered rare but are nonetheless difficult to detect will also be excluded from validation, even though habitat modeling may include these species.

Using existing data sets such as the USFWS Mid-Winter Waterfowl Survey data and Christmas Bird Count data, and data that are collected during field inventories, important bird migration and overwintering habitats within the project area will also be mapped.

3rd Stage. The types of habitats that have been lost will be determined by analysis of historic data and photography, soils data, and other information.

Where various land uses have resulted in changes in wildlife habitats, approximate percent losses/gains in habitat types will be calculated. Historic aerial photography, dating back at least as far as the mid-1930s, will be acquired. In addition, soil surveys and any other available information that might provide evidence of historic land cover will be utilized in reconstructing historic land cover. Methods for this step will be carefully documented. Using these pieces of information, historic land cover will be compared to that of the present, and trends (losses and gains) will be identified and quantified for the habitats that were mapped in phases I and II. This will involve scanning/digitizing and rectification of historic photography and soils maps to allow accurate comparisons of historic and present areal coverages of the different habitat types. Each habitat polygon will then be assigned attribute fields (in the GIS data base) that list estimated losses or gains of the particular habitat type.

Based on these identified changes in land cover/habitat, the current status of existing wildlife habitats and associated wildlife populations will be assessed.

4th Stage. The final phase of this project component will be to integrate this land cover/habitat coverage into COMPAS. Wildlife habitat restoration, protection and management strategies will be developed based on the above status and trends analysis, and integrated with NPS pollution control strategies. This will be accomplished by incorporating the final land cover/habitat coverage into the COMPAS. Each habitat polygon in the final Arc/Info coverage will have attribute data, including the vertebrate species found there and the status of the habitat type (i.e. losses/gains), that decision-makers can easily access through the COMPAS. In addition, the original vegetation coverage (i.e. before plant communities were aggregated to more general habitat types) will be incorporated into the COMPAS. Through coordination with Tasks 1, 2 and 3, detailed vegetation mapping and habitat improvement strategies will be integrated with NPS pollution control strategies, directly linking habitat and NPS efforts in Delaware for the first time.

III. Budget

Salaries & OEC

• Environmental Engineer III (50%)	$ 25,209	
Subtotal		***$ 25,209***

Travel

• National Conferences	2000	
• NERRS CDMO Site	1,000	
Subtotal		***3,000***

Contractual Services

• Laboratory Analysis	25,000	
• USFWS Staff Biologist IPA (10%)	8,000	
• Data Processing , printing, copying	1,500	
• Digitizing, database design & creation	11,051	
• Contractual Development of Desktop Mapping and Assessment System	55,000	
Subtotal		***101,000***

Supplies

• Sampling Bottles, Survey Books, Rain Gear Computer Tapes (4 Gegabyte), Film, Sherman/Havahart live traps, Azel Reptile Snare, Boat & Vehicle Fuel, etc.	2,950	
• Historic Aerial Photography	550	
Subtotal		***3,500***

Equipment

• Digitizer	5,000	
• MC-GPS/GIS Receiver/Data Collector	5,000	
• ORACLE Software	5,000	
• ArcView2 Software	2,000	
Subtotal		***17,000***
Audit Costs		***449***
Total Project Cost		***$ 149,709***

IV. Partners

Active project participants from the local level will include the New Castle Conservation District, the Kent Conservation District, the Kent County Planning Office, and the New Castle County Water Resources Agency. At the State level it will include the Delaware Non-Point Source Pollution Control Program, the Delaware Division of Water Resources, the Delaware Division of Fish and Wildlife, and the University of Delaware, Department of Agricultural Engineering. Regional and/or national participants will include the USDA, Natural Resources Conservation Service, the NERRS Central Data Management Office, and the Environmental Systems Research Institute (ESRI). These project partners will provide access to existing but difficult to access data sets, input into the types of information most needed by managers and planners to enable them to make informed natural resources management decisions, and technical assistance for various tasks under each of the projects major components.

The methodology and information provided by this project can and will be transferred to the project participants. Selected portions of the data management system and data sets will also be made available through a Delaware Coastal Program Internet Home Page developed in conjunction with the NERRS Central Data Management Office. It will also provide the potential framework for data management using an Arc/Info based Geographic Information System (GIS) to assist other agencies such as the Florida Department of Environmental Protection, Marine Research Institute, the Delaware Estuary Program, and the Pennsylvania Coastal Management Program.

V. *Project Duration*

This project will be completed over a two (2) year period in accordance with the summary schedule below.

Schedule of Major Benchmarks and Deliverables

Grant Quarter (Date of Quarter)	*Project Task Number*	*Benchmark or Deliverable*
1st Quarter (July 1 - Sept. 30, 1995)	Task 1	• Planning & Design Session to Develop Detailed Framework for COMPAS
	Task 2	• Select Data Layers Most Important for both Modeling and COMPAS based on Task 1 P&D Session
	Task 3	• Select Water Quality and Sediment Sampling Sites for all Three Basins, Spatially Reference site via GPS for Future Use in COMPAS & Modeling. • Complete QA/QC for Water Quality and Sediment Sampling • Initiate Monthly WQ Sampling. • Collect Late Summer Sediment Samples
	Task 4	• Initiate Field Surveys and the Acquisition of Vertebrate Data. Complete Summer Season Survey.
2nd Quarter (Oct. 1 - Dec. 31, 1995)	Task 1	• Initiate Collection & Evaluation of BMP Data for Three Basins.
	Task 2	• Initiate Data Set (GIS Layers) Development of Data Layers Identified during COMPAS P&D Session. • Initiate Coordination with National NERR Research Project.
	Task 3	• Continue Monthly WQ sampling.
	Task 4	• Complete Fall Season Field Surveys • Begin Preliminary Synthesis of Habitat Requirements Information. • Obtain & Initiate Refinement of Vegetation Mapping.
3rd Quarter (Jan. 1 - Mar. 31, 1996)	Task 1	• Expand Collection & Evaluation of BMP Data. • Initiate Incorporation of BMP Data into COMPAS Software.
	Task 2	• Develop Additional Data Sets • Begin Development of DEM's.
	Task 3	• Continue Monthly WQ sampling. • Collect Late Winter Sediment Samples.
	Task 4	• Complete Winter Season Field Surveys. • Complete Vegetation Mapping for Blackbird Creek Basin.
4th Quarter (Apr. 1 - June 31, 1996)	Task 1	• Complete incorporation of BMP data into COMPAS Software. • Initiate System Integration, Documentation, and Training.
	Task 2	• Continue Data Set Development
	Task 3	• Continue Monthly WQ sampling. • Deploy ISCO Samplers and Data Loggers for June Water Quality Sampling Throughout Tidal Cycle.
	Task 4	• Complete Spring Season Field Surveys. • Complete Synthesis of Habitat Requirements Information.

Grant Quarter (Date of Quarter)	*Project Task Number*	*Benchmark or Deliverable*
5th Quarter (July 1 - Sept. 30, 1996)	Task 1	• Finalize Software Functions for Final Product. • Assemble Final COMPAS Product.
	Task 2	• Complete Development of Data Sets • Initiate Incorporation of Data Sets into COMPAS
	Task 3	• Continue Monthly WQ Sampling. • Deploy ISCO Samplers and Data Loggers for July and August Water Quality Sampling Throughout Tidal Cycle.
	Task 4	• Complete Vegetation Mapping for St. Jones River Basin and Appoquinimink River Basin. • Initiate Habitat Modeling. • Obtain Historic Photography and Data
6th Quarter (Oct. 1 - Dec. 31, 1996)	Task 1	• Provide Training to the Resource Managers using the COMPAS System.
	Task 2	• Complete Incorporation of Data Sets into COMPAS
	Task 3	• Continue Monthly WQ Sampling. • Initiate Initial Data Reduction & Data Formatting for Inclusion in COMPAS.
	Task 4	• Complete Habitat Modeling.
7th Quarter (Jan. 1 - Mar. 31, 1997)	Task 1	• All Tasks Completed.
	Task 2	• All Tasks Completed.
	Task 3	• Continue Monthly WQ Sampling. • Complete Data Reduction. • Draft an Interim Report.
	Task 4	• Conduct Accuracy Assessment and Trend Analysis. • Complete Draft Final Report
8th Quarter (Apr. 1 - June 31, 1997)	Task 1	• All Tasks Completed.
	Task 2	• All Tasks Completed.
	Task 3	• Complete the final monthly WQ sampling. • Load Data into COMPAS. • Complete a Final Report.
	Task 4	• Integrate Data into COMPAS for Comparison of Habitat Restoration and NPS Pollution Control Needs. • Complete Final Report.

VI. Project Contacts

David B. Carter, Environmental Program Manager
Delaware Coastal Management/National Estuarine Research Reserve Program
Department of Natural Resources and Environmental Control
Division of Soil & Water Conservation
P.O. Box 1401
Dover, Delaware 19903

Phone: (302) 739-3451
Internet: dcarter@dnrec.state.de.us

Betsy Archer, Physical Scientist
National Oceanic and Atmospheric Administration
Office of Ocean Resources Conservation & Assessment
Strategic Environmental Assessment Division
1305 East-West Highway
Silver Spring, MD 20910

Phone: (301) 713-3000 x207
Internet: barcher@SEAMAIL.NOS.NOAA.GOV

Richard C. McCorkle, Fish & Wildlife Biologist
US Fish & Wildlife Service
Delaware Bay Estuary Project
2610 Whitehall Neck Road
Smyrna, DE 19977

Phone: (302) 653-9152
Internet: DBEPGAP@strauss.udel.edu

Robin Tyler, Environmental Scientist
Environmental Services Section
Delaware Department of Natural Resources and Environmental Control
Division of Water Resources
P.O. Box 1401
Dover, Delaware 19903

Phone: (302) 739-4771

Appendix

Letters of Endorsement from Partners

Federal

NOAA's Strategic Environmental Assessments Division
U.S. Fish & Wildlife Service's Delaware Bay Estuary Project
USDA's Natural Resources Conservation Service
NERRS Central Data Management Office
EPA's Delaware Estuary Program

State

Delaware Nonpoint Source Pollution Program (CWA Section 319)
Delaware Division of Water Resources, Analytical Chemistry Laboratory Branch
Delaware Division of Fish and Wildlife
University of Delaware, Department of Agricultural Engineering

Local

Kent County Department of Planning
Kent Conservation District
New Castle Conservation District
New Castle County Water Resources Agency

Regional

Pennsylvania Coastal Zone Management Program
Environmental Systems Research Institute
Florida Department of Environmental Protection, Marine Research Institute

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Office of Ocean Resources Conservation and Assessment
Silver Spring, Maryland 20910

JAN 25 1995

Dr. Joseph A. Uravitch
Associate Director
Office of Ocean and Coastal Resource Management
1305 East west Highway
Silver Spring, MD 20235

Dear Dr. Uravitch:

I am sending this letter as an enclosure to the proposal being submitted by Sarah Cooksey, Delaware's Coastal Management/National Estuarine Research Reserves Programs (DCMP/NERR), Department of Natural Resources and Environmental Control. This confirms that NOAA's Strategic Environmental Assessments Division (SEA) will participate in the work being proposed by Delaware for the regional demonstration project for coastal nonpoint source reduction and habitat evaluation, restoration and management. This project is an extension of ongoing work in Delaware. It is our plan to add two more watersheds to a desktop mapping and analysis system (COMPAS) initiated in the St. Jones basin. The system will be used to evaluate the impacts of BMPs on nonpoint source pollution. In addition, we will assist the DCMP/NERR by training their project personnel in the COMPAS data management methodology and process.

If you have any questions I can be reached at 713-3000.

Sincerely,

Daniel J. Basta
Chief, Strategic Environmental
Assessments Division

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U. S. Department of the Interior
FISH AND WILDLIFE SERVICE

Delaware Bay Estuary Project
2610 Whitehall Neck Road
Smyrna, DE 19977
302-653-9152
FAX 302-653-9421
INTERNET DBEPGEN@STRAUSS.UDEL.EDU
CC:MAIL R5ES_DBEP
TDD Relay - 1-800-232-5460

January 30, 1995

Dr. Joseph A. Uravitch
Associate Director
Office of Ocean and Coastal Resource Management
1305 East west Highway
Silver Spring, MD 20235

Dear Dr. Uravitch:

I am writing to express my support for the proposal being submitted by Sarah Cooksey, who represents Delaware's Coastal Management/National Estuarine Research Reserves Program (DCMP/NERR), Department of Natural Resources and Environmental Control. The U.S. Fish & Wildlife Service's Delaware Bay Estuary Project will be participating in the proposed project. A member of my staff will provide a detailed digital coverage of vegetation and associated wildlife species within the three proposed project areas, as well as spatial analyses of land cover change and associated trends in habitat for one of the three sites. All of this information will be integrated into the COMPAS desktop mapping and analysis system to enable decision-makers to examine habitat status and trends information as they relate to land use activities and NPS pollution control strategies, thus ensuring that these strategies consider wildlife habitat restoration and management needs.

If you have any questions, please give me a call at 302-653-9152.

Sincerely,

, acting

David J. Stout
Project Leader, Delaware Bay Estuary Project

United States Department of Agriculture

Soil Conservation Service Now: Natural Resources Conservation Service

1203 College Park Dr.
Suite 101
Dover, DE 19904-8713

Dr. Joseph A. Uravich
Associate Director
Office of Ocean and Coastal Resource Management
1305 East-West Highway
Silver Spring, MD 20235

January 27, 1995

RE: Delaware's Project Proposal to NOAA's Center for Coastal Ecosystem Health - Regional Demonstration Project for Coastal Nonpoint Source Reductions and Habitat Evaluation

This letter is an enclosure to the proposal being submitted by Sarah W. Cooksey, Administrator of Delaware's Coastal Management/National Estuarine Research Reserve Program (DCMP/DNERR). This letter confirms that the United States Department of Agriculture, Natural Resources Conservation Service (NRCS) will participate in this project. NRCS will provide data and technical assistance to DCMP/DNERR to fully carry out the intent of this proposal.

NRCS is moving toward a comprehensive ecosystem-based approach to planning. This demonstration project will enhance our ability to make informed ecosystem-based planning decisions.

If you have any questions, please contact me at (302)-678-4160.

ELESA K. COTTRELL
State Conservationist

The Soil Conservation Service is an agency of the Department of Agriculture

North Inlet – Winyah Bay
National Estuarine Research Reserve

Baruch Marine Laboratory
University of South Carolina
P.O. Box 1630
Georgetown, SC 29442

TELEPHONE: (803) 546-6219
FAX: (803) 546-1632
E-MAIL: dallen@belle.baruch.scarolina.edu

27 January 1995

Dr. Joseph A. Uravich
Associate Director
Office of Ocean and Coastal Resource Management
1305 East-West Highway
Silver Spring, MD 20235

RE: Delaware's project proposal to NOAA's Center for Coastal Ecosystem Health - Regional Demonstration Project for Coastal Nonpoint Source Reduction and Habitat Evaluation

Dear Dr. Uravich:

I am submitting this letter as an enclosure to the proposal being submitted by Sarah W. Cooksey, Administrator of Delaware's Coastal Management / National Estuarine Research Reserve Program (DCMP/DNERR). This letter confirms that the Centralized Data Management Office (CDMO) of the National Estuarine Research Reserve System will work with the DCMP/DNERR to assist with the exchange of data, metadata and informational products developed in conjunction with each respective project. This is but another example of cooperation between NOAA, NERRS and state coastal zone management agencies, fostered by advances in technology, providing agencies access to data and information for improved resource management.

If you have any questions, please contact me at 803-777-4615.

Sincerely,

Dwayne E. Porter

Dwayne E. Porter
Research Assistant Professor and
Director, NERRS CDMO

DELAWARE ESTUARY PROGRAM

c/o United States Environmental Protection Agency
841 Chestnut Building
Philadelphia, Pennsylvania 19107

January 27, 1995

Dr. Joseph A. Uravitch
Associate Director
Office of Ocean and Coastal Resource Management
1305 East-West Highway
Silver Spring, MD 20235

Dear Dr. Uravitch:

I am writing on behalf of the Delaware Estuary Program to endorse the proposal by the Delaware Coastal Management and National Estuarine Research Program. That proposal, which involves integrated information processing to evaluate impacts of BMP's, model watershed hydrodynamics and assess effects of land use activities on both habitat and wetland systems, is entirely consistent with the management strategy being advocated by the Delaware Estuary Program.

I am attaching a draft copy of the Executive Summary of the Delaware Estuary Plan to be released for public review in the next few weeks. In particular, I direct your attention to the Action Plan Summary contained on pages 23 through 25. This proposal would help execute Actions L2, L3, L4 and L5 of our Land Management Strategy. It also relates to Action W3 of our Water Use Management Strategy.

The whole idea behind the Delaware Estuary Program is to provide local communities with the information and technology they need to help them customize approaches to do better land, water and living resource management. This proposal represents an ideal opportunity to develop a new partnership among federal agencies, state agencies and local communities.

I hope you will agree with me that this is a worthwhile proposal and fund it.

Sincerely,

Robert Tudor

Robert Tudor
Program Coordinator

RT:dp
enclosure

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DIVISION OF SOIL AND WATER CONSERVATION
89 KINGS HIGHWAY
P.O. BOX 1401
DOVER, DELAWARE 19903

OFFICE OF THE DIRECTOR

TELEPHONE: (302) 739 - 3451

February 1, 1995

Dr. Joseph A. Uravitch
Associate Director
Office of Ocean and Coastal Resource Management
1305 East-West Hwy.
Silver Spring, Maryland 20235

Dear Dr. Uravitch:

The Nonpoint Source Pollution Program of the Department of Natural Resources and Environmental Control supports the proposal "Integrated Information Processing: A Methodology for Comparative Analysis of Three Watershed Basins to Enable the Development of Controls of Nonpoint Pollution Sources and Habitat Restoration Strategies". Our program is currently working in one of the watersheds, the Appoquinimink, included in this project. The issues addressed in this proposal and in our work are very compatible and the information developed will integrate well.

I have worked with those developing COMPAS strategies in the past. I fully support the use of COMPAS as described in this proposal and will maintain our existing rapport during proposed development efforts.

Sincerely,

Jenny G. McDermott for

Nancy B. Goggin
Program Manager
Nonpoint Source Pollution Program

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES
& ENVIRONMENTAL CONTROL
DIVISION OF WATER RESOURCES
89 KINGS HIGHWAY, P.O. BOX 1401
DOVER, DELAWARE 19903

February 1, 1995

ENVIRONMENTAL SERVICES
SECTION

TELEPHONE: (302) 739 - 4771
FAX: (302) 739 - 3491

Dr. Joseph A. Uravitch
Associate Director, Office of Ocean
and Coastal Resource Management
National Oceanographic and
Atmospheric Administration
1305 East west Highway
Silver Spring, MD 20235

Dear Dr. Uravitch:

This letter is an enclosure to the proposal entitled, "Integrated Information Processing: A Methodology for Comparative Analysis of Three Basins to Enable the Development of Controls of Nonpoint Source Pollution Sources and Habitat Restoration Strategies" being submitted by Sarah Cooksey, Program Administrator of the Delaware Coastal Management and National Estuarine Research Reserve Program.

The Environmental Services' Analytical Chemistry Laboratory Branch will participate in the sub-part of the project entitled "Comparative Analysis of the Effects of Currents and Wetlands On Eutrophication in Delaware Bay Tidal Creeks". The Laboratory is approved by the United States Environmental Protection Agency to conduct all of the parameter analyses included under this sub-part of the project.

Assistance will be provided by our Support Branch in developing the workplan and quality assurance/quality control aspects of this sub-part. Also, our Ecological Assessment Branch will provide a staff person to oversee the collection of water and sediment samples.

If you have further questions or needs please do not hesitate to contact me.

Sincerely,

Harry W. Otto, Ph.D.
Administrator

FY96DCMP.LTR

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES
& ENVIRONMENTAL CONTROL
DIVISION OF FISH AND WILDLIFE
89 KINGS HIGHWAY
P.O. BOX 1401
DOVER, DELAWARE 19903

OFFICE OF THE
DIRECTOR

February 1, 1995

Dr. Joseph A. Uravitch
Associate Director
Office of Ocean and Coastal Resource Management
1305 East-West Highway
Silver Spring, Maryland 20235

RE: Delaware's Project Proposal to NOAA's Center for Coastal Ecosystem Health - Regional Demonstration Project for Coastal Nonpoint Source Reduction and Habitat Evaluation

Dear Dr. Uravitch:

This letter is being sent as an enclosure to the proposal being submitted by Sarah W. Cooksey, Administrator of Delaware's Coastal Management/National Estuarine Research Reserve Program. This letter confirms that the Delaware Division of Fish and Wildlife will participate in the project by providing any pertinent data that we have about habitats in the watersheds.

In addition, we believe the desk top management system being developed will drastically improve our ability to carry out resource management work. We intend to have Division of Fish and Wildlife staff trained to utilize the COMPAS system once it has been developed for Delaware.

Sincerely,

Andrew T. Manus

Andrew T. Manus
Director

ATM/rdr

Delaware's good nature depends on you!

UNIVERSITY OF DELAWARE

COLLEGE OF AGRICULTURAL SCIENCES

DEPARTMENT OF
AGRICULTURAL ENGINEERING

Townsend Hall
University of Delaware
Newark, Delaware 19717-1303
Ph: 302/831-2468
Fax: 302/831-3651

January 30, 1995

Dr. Joseph A. Uravitch
Associate Director
Office of Ocean & Coastal Resource Mgt.
1305 East-West Highway
Silver Spring, MD 20235

Dear Dr. Uravitch:

The Agricultural Engineering Department at the University of Delaware endorses the proposal "Integrated Information Processing: A Methodology for Comparative Analysis of Three Watershed Basins to Enable the Development of Controls of Nonpoint Pollution Sources and Habitat Restoration Strategies" that DNREC is submitting to the National Oceanic and Atmospheric Administration, Center for Coastal Ecosystem Health. The Agricultural Engineering Department has worked cooperatively with DNREC for over 15 years on projects. The present proposal complements the research priorities of the Department. Dr. Carmine Balascio of the Department has the technical expertise to assist DNREC in task 2 "Development of Data Sets for Using in Hydrodynamic Modeling on DNERR basins". Dr. Balascio at the present time is assisting DNREC with stormwater modeling and stormwater data collection.

The Agricultural Engineering Department looks forward to working with DNREC on the project.

Sincerely,

William F. Ritter
Professor and Chair

WFR/fsm

Kent County

Department of Planning

CONSTANCE C. HOLLAND
Director

Day Phone 302/736-2020
FAX: 302/736-2200

February 2, 1995

Dr. Joseph A. Uravich
Associate Director
Office of Ocean and Coastal Resource Management
1305 East-West Highway
Silver Spring, MD 20235

RE: Delaware's Project Proposal to NOAA's Center for Coastal Ecosystem Health - Regional Demonstration Project for Coastal Nonpoint Source Reduction and Habitat Evaluation

Dear Dr. Uravich:

I am sending this letter as an enclosure to the proposal being submitted by Sarah W. Cooksey, Administrator of Delaware's Coastal Management/National Estuarine Research Reserve Program (DCMP/DNERR). This letter confirms that the Kent County Department of Planning will participate in this project. The County is in the process of updating its Comprehensive Land Use Plan; this project will tie in nicely with our Plan update, as well as provide useful data for future long-range planning efforts.

If you have any questions, please contact me at (302) 736-2020.

Sincerely,

Constance C. Holland

Constance C. Holland
Director

CCH/KFC

County Administration Building
Room Number 320
414 Federal Street, Dover, Del. 19901
(Handicapped Accessible)

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KENT CONSERVATION DISTRICT

"Total Conservation Management"

January 27, 1995

Dr. Joseph A. Uravich
Associate Director
Office of Ocean and Coastal Resource Management
1305 East-West Highway
Silver Spring, MD 20235

RE: Delaware's Project Proposal to NOAA's Center for Coastal Ecosystem Health - Regional Demonstration Project for Coastal Nonpoint Source Reduction and Habitat Evaluation

Dear Dr. Uravich:

This letter is being sent as an enclosure to the proposal being submitted by Sarah W. Cooksey, Administrator of Delaware's Coastal Management/National Estuarine Research Reserve Program (DCMP/DNERR). This letter confirms that the Kent Conservation District will participate in this project by providing access to data, providing input to the types of natural resource information most needed by managers & planners, providing technical assistance, and assigning staff liaison to the project.

This methodology and information will provide our agency with the ability to make better land use decisions, and facilitate better direct funding.

If you have any questions, please contact me at (302)697-6176.

Sincerely,
KENT CONSERVATION DISTRICT

Timothy M. Riley
District Coordinator

3500 South DuPont Highway Dover, Delaware 19901 (302) 697-6176 FAX (302) 697-0670

New Castle Conservation District
6 Peoples Plaza - Newark, Delaware 19702 - (302) 834-3560

January 31, 1995

Dr. Joseph A. Uravich
Associate Director
Office of Ocean and Coastal Resource Management
1305 East-West Highway
Silver Spring, MD 20235

Dear Dr. Uravich:

I am sending this letter as an enclosure to the proposal being submitted by Sarah W. Cooksey, Administrator of Delaware's Coastal Management/National Esturaine Research Reserve Program (DCMP/DNERR). This letter confirms that the New Castle Conservation District will work with the DCMP/DNERR to assist in locating, building, and providing selected data sets for use in this project. In addition, one of our staff will be included in ArcView2 training to facilitate the transfer of this technology to our agency.

The information and methodology being developed by this project will provide our agency with the ability to make better landuse decisions. This project is yet another link that can strengthen the working relationship between Federal, State and Local government agencies.

Sincerely,

Laurance R. Irelan
District Coordinator

Dave

WATER RESOURCES AGENCY
FOR NEW CASTLE COUNTY

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POLICY BOARD
Governor, State of Delaware
New Castle County Executive
Mayor, City of Wilmington
Mayor, City of Newark
WRA Administrator, Secretary

January 27, 1995

Dr. Joseph A. Uravitch
Associate Director
Office of Ocean and Coastal Resource Management
1305 East-West Highway
Silver Spring, MD 20235

Dear Dr. Uravitch:

I am sending this letter as an enclosure to the proposal being submitted by Sarah Cooksey, Delaware's Coastal Management Program/National Estuarine Research Reserve (DCMP/NERR), Delaware Department of Natural Resources & Environmental Control (DNREC). This letter confirms that the Water Resources Agency for New Castle County (WRA) will participate in the work as proposed by Delaware for the regional demonstration project for coastal non-point source reduction and habitat evaluation, restoration and management. This project represents an extension of and a complement to ongoing work activities in Delaware. The WRA will utilize its Automated Environmental Resource Information system (AERI II), an ARC/INFO based system already employed in similar watershed management and planning activities, as part of this project. It will assist in assembling and accessing data sets toward the development of a data management system and provide technical assistance for various tasks under each of the project's major components. In addition, we will work with the DCMP/NERR in the training of project personnel in the COMPAS data management methodology and process and in the transfer of raw data into the COMPAS system for use by managers and planners.

If you have any questions or need additional information, please contact me or Mr. Gerald Kauffman, Water Resources Engineer, who will coordinate this project for the WRA.

Regards,

Bernard L. Dworsky
Administrator

BLD:cg

2701 CAPITOL TRAIL, NEWARK, DELAWARE 19711 (302) 731-7670

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
P.O. Box 8555
Harrisburg, PA 17105-8555
February 2, 1995

717-787-2529

Bureau of Land and Water Conservation

Dr. Joseph A. Uravitch
Associate Director
Office of Ocean & Coastal Resource Mgmt.
1305 East-West Highway
Silver Spring, MD 20235

Dear Dr. Uravitch:

This letter is to state the support of the Pennsylvania Coastal Zone Management Program for the proposal being submitted by David Carter, Delaware's Coastal Management Program (DCMP), Department of Natural Resources and Environmental Control. The Pennsylvania Coastal Zone Management Program has been coordinating with DCMP on both the Delaware Estuary Program and both states' Coastal Nonpoint Pollution Control Programs (Section 6217 of the Coastal Zone Act Reauthorization Amendments). We anticipate that the proposed project will support the goals of both of these programs, and will further coordination efforts between the states. We look forward to sending staff to Delaware to be trained on the system so that we might extend its use to Pennsylvania's Delaware River drainage.

Sincerely,

E. James Tabor

E. James Tabor
Chief
Division of Coastal Programs

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Environmental Systems Research Institute, Inc. - Charlotte

8000 Corportate Center Drive; Suite 111
Charlotte, North Carolina 28226

Phone 704-541-9810 Fax 704-541-7620

DATE: January 30, 1995

Dr. Joseph A. Uravich
Associate Director
Office of Ocean and Coastal Resource Management
1305 East-West Highway
Silver Spring, MD 20235

RE: Delaware's Project Proposal to NOAA's Center for Coastal Ecosystem Health
Regional Demonstration Project for Coastal Nonpoint Source Reduction and Habitat Evaluation

Dear Doctor Uravich:

I am sending this letter as an enclosure to the proposal being submitted by Sarah W. Cooksey, Administrator of Delaware's Coastal Management/National Estuarine Research Reserve Program (DCMP/DNERR). This letter confirms that Environmental Systems Research Institute, Inc. (ESRI) will participate in this project by providing technical assistance to project personnel which are developing GIS applications (e.g., COMPAS Delaware) using ArcView2.

If you have any questions, please contact me at 704-541-9810.

Sincerely:

Paul Gallimore
Delaware Technical Marketing Representative
ESRI - Charlotte

Department of Environmental Protection

Lawton Chiles
Governor

Florida Marine Research Institute
100 Eighth Avenue S.E.
St. Petersburg, Florida 33701-5095

Virginia B. Wetherell
Secretary

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January 30, 1995

Dave Carter, Administrator
Delaware Coastal Management/National Estuarine Research Reserve Program
Department of Natural Resources and Environmental Control
Division of Soil and Water Conservation
P.O. Box 1401
Dover, Delaware 19903

Dear Mr. Carter:

I am sending this letter in support of the proposal being submitted by Sarah Cooksey, Delaware's Coastal Management/National Estuarine Research Reserves Program (DCMP/NERR), Department of Natural Resources and Environmental Control. This confirms that the Florida Department of Environmental Protection, Florida Marine Research Institute (FMRI) will participate in the work being proposed by Delaware for the regional demonstration for coastal nonpoint source reduction and habitat evaluation, restoration and management. This project would make a positive contribution to several ongoing projects at the FMRI. FMRI is continuing development of the Florida COMPAS desktop mapping and analysis system and our chosen development path of ArcView2 is completely compatible with the proposed project approach. Coordinating our COMPAS development efforts with the proposed project would lead to a more robust desktop analysis system with widespread utility for coastal zone analysts and managers.

In addition, the FMRI has developed an integrated geographic information system (GIS) database for the Little Manatee River watershed in west-central Florida that would lend itself to the assessment of nonpoint source pollution. The analytical modules developed under the proposed project would have direct applicability for assessing nonpoint pollution in the Little Manatee River watershed and we are most interested in providing input to the module specification. If you have any questions please phone me.

Sincerely,

DIVISION OF MARINE RESOURCES

Christopher A. Friel
Research Administrator II
Florida Marine Research Institute

cc. D. Basta
B. Archer
K. Haddad

"Protect, Conserve and Manage Florida's Environment and Natural Resources"

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