



CMar Consulting, LLC Environmental & GIS Services

Alexandra Carvalho, Ph.D., GISP

EDUCATION

- 12/2000 Doctor of Philosophy, Oceanography - Coastal Zone Management
FLORIDA INSTITUTE OF TECHNOLOGY, Melbourne, Florida, USA
- 5/1993 Licenciatura Marine Biology and Fisheries
UNIVERSIDADE DO ALGARVE, Faro, Portugal

EMPLOYMENT

- 3/2011 – Present Principal, CMAR CONSULTING, LLC
Jacksonville, FL
- 1/2001 – 2/2011 Senior Scientist, TAYLOR ENGINEERING, INC. Jacksonville, FL
- 8/1998 – 12/2000 Research Assistant, DIVISION OF MARINE & ENVIRONMENTAL SCIENCES, FLORIDA INSTITUTE OF TECHNOLOGY. Melbourne, FL

CERTIFICATIONS

CERTIFIED GEOGRAPHIC INFORMATION PROFESSIONAL (GISP)
since 2011. GISP # 67414

PROFESSIONAL AFFILIATIONS

FL URBAN AND REGIONAL INFORMATION SYSTEMS ASSOCIATION
since 2012
FL ASSOCIATION ENVIRONMENTAL PROFESSIONALS *since 2012*
ASSOCIATION OF PORTUGUESE BIOLOGISTS *since 1988*

BACKGROUND

Dr. Carvalho received her "Licenciatura" degree in Marine Biology and Fisheries in 1993 from the University of Algarve (UA) in Portugal. At UA she developed a strong foundation in marine and coastal sciences, resource management, statistics, and geospatial data application to the coastal and marine environment. In 1994 she earned a Fulbright scholarship to study in the US. In 1995, she earned a second scholarship from the Portuguese Science and Technology Foundation.

Dr. Carvalho earned her a Ph.D. in Oceanography - Coastal Zone Management in 2000 from the Florida Institute of Technology in Melbourne, Florida, US. During her doctoral program Dr. Carvalho continued working with coastal and marine statistical and GIS applications, and started developing her own.

In January 2001 Dr. Carvalho joined Taylor Engineering, Inc. Her responsibilities included providing scientific, planning, and data management support to the environmental, coastal, waterfront, water resources and GIS groups. At Taylor Dr. Carvalho supported or managed more than 100 projects for private, government and federal clients. Project areas included environmental planning; scientific and engineering statistical and geostatistical analysis; spatial data consolidation, QA/QC, management and analysis; land, coastal and marine spatial planning and environmental permitting.

Dr. Carvalho founded CMar Consulting, LLC in March 2011. CMar Consulting, LLC's services include marine and coastal information management, coastal and marine planning and management, environmental permitting, GIS training and technical writing support. Dr. Carvalho strong foundation in marine and coastal science, planning, and management combined with 15 years of working experience in the field supports the company coastal and marine environmental and GIS services.

RECENT PROJECTS

- **Martin County Hutchinson Island Shore Protection Project Spatial Data Analysis 2015 Update (2015 - ongoing)** — subcontracted by Taylor Engineering, Inc. — organized, consolidated, and uploaded into the Martin County Coastal GIS, the 2015 permitting and monitoring engineering, natural resources, and sediment and water quality data for Hutchinson Island Shore Protection project. Upload to the Coastal GIS of current and historical biological community species inventories from biological



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monitoring reports. Updated the Hutchinson Island Shore Protection Project ArcGIS planning tool.

- **Martin County St Lucie Inlet Management Program Spatial Data Analysis 2015 Update (2015 - ongoing)** — organize, consolidate, and perform spatial data analysis in support of the St. Lucie Inlet Management program. 2015. Updated the St. Lucie Inlet management program ArcGIS planning tool. Upload to the Coastal GIS of current and historical biological community species inventories from biological monitoring reports. Preparation of a web GIS application to share information with the public.
- **Martin County Bathtub Beach Park and Sailfish Point Beach Restoration Project Spatial Data Analysis Services (2015 - ongoing)** — subcontracted by Olsen & Associates, Inc. — organize, consolidate, and perform spatial data analysis in support of the Bathtub Beach Park and Sailfish Point Beach Restoration Project. Project includes historical and current project data inclusion in the Coastal GIS and the update of the ArcGIS planning tool for data access, visualization and analysis for the restoration area.
- **St. Lucie County Erosion District Coastal Data Organization – Phase I (2014 - 2015)** — subcontracted by Taylor Engineering, Inc. and Coastal Tech - GEC. — consolidation and organization of over 20 years of coastal data from projects initiated and/or sponsored by the District into a file structure (Phase I) compatible with future integration into a Geographic Information System (GIS) (Phase II).
- **Martin County Artificial Reefs Multi-beam Survey Data Consolidation (2015)** — subcontracted by Maxwell Marine Consulting Engineers, Inc. — consolidation of multi-beam surveys performed for selected artificial reefs. Update of the project ArcGIS planning tool for data access and visualization.
- **Hole-in-the-Donut (HID) Restoration Project GIS Services (2015)** — subcontracted by Floravista, Inc. — Analyzed elevation data and boundary data collected

for the new restoration area scraped during 2014. Used ArcGIS tools to randomly generate locations for new vegetation monitoring plots within the same area according to specifications provided by client and ENP. Delivered results in map and table format for display and future analysis by client.

- **Martin County St. Lucie Inlet Spatial Data Analysis Services (2014 - 2015)** — subcontracted by Atkins North America, Inc. — organize, consolidate, and perform spatial data analysis in support of the St. Lucie Inlet Management program. 2014 datasets included new permit dredging and beach placement engineering plans, hydrographic surveys, construction and physical and natural resources (sea turtles, shorebirds, hardbottom), sediment and water quality monitoring data of the inlet sediment basin and navigation channel dredging, beach placement of by-passed sediment, and navigation project. Updated the ArcGIS planning tool for data access, visualization and analysis for the St. Lucie Inlet area.
- **Martin County Hutchinson Island Shore protection Project Spatial Data Analysis Services (2014)** — subcontracted by Taylor Engineering, Inc. — organized, consolidate, and perform spatial data analysis in support of the Hutchinson Island Shore protection Project. 2014 datasets included hydrographic surveys, physical and natural resources (sea turtles, shorebirds, hardbottom) monitoring data. Updated the ArcGIS planning tool for data access, visualization and analysis for the Hutchinson Island Beach Restoration area. Datasets also included in this task are 2012 - 2013 sea turtle monitoring data collected under a grant, ICWW surveys and other small project data initiated by the County.
- **Martin County Artificial Reef Biological Monitoring Spatial Data Analysis (2014)** — subcontracted by Coastal Eco-Group Inc. — organization and spatial analysis of 10 years of biological reef monitoring data (fish census and benthic community assessments). Consolidated information into the County Coastal GIS; conducted preliminary time series data analysis (abundance, species richness,



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presence of managed fisheries species and of coral protected species); and prepared ArcGIS planning tool for data access, visualization and analysis.

- **Martin County Artificial Reefs ArcGIS Online Application (2014)** — organized, consolidated, and quality controlled artificial reef data needed to create an ArcGIS Online application (Version 1.0) to show the location, photos and recent monitoring reports of the County Artificial Reefs. Coordinated with the IT and Engineering County staff the data maintenance component of the application, as well as the deployment of the ArcGIS Online application on the County ArcGIS Online account and on the County's artificial reefs website September 7, 2014. Version 1.0 of this application placed second place in the 2014 ESRI Ocean Forum, Redlands California. Updated and coordinated with County IT the upgrade of the application to version 1.1 to include reef material information.
- **Martin County St. Lucie Inlet and Natural Reefs, Water Quality and Community Data Consolidation (2014)** — subcontracted by Maxwell Marine Consulting Engineers, Inc. — consolidation and characterization of the SFWMD, FDEP, FOS and MRC water quality data for the St. Lucie Inlet area. Consolidation and organization of the SEFCRI, FRRP/Nature Conservancy, and other coral and biological community data for the natural reefs offshore of the St. Lucie Inlet. Prepared summary report of available water quality data for the region as well as ArcGIS planning tool for data access and visualization.
- **Hole-in-the-Donut (HID) Restoration Project GIS Services (2013 - 2014)** — subcontracted by Floravista, Inc. — updated 2013 Hole in the Donut Everglades wetland restoration area spatial data to reflect 2013 changes and additions to the restoration areas. Used ArcGIS tools to randomly generate locations for new vegetation monitoring plots distributed along elevation gradients within the new restoration area scraped during 2013. Evaluated the restoration area's fire history (1989 - 2013) and historical farming intensity spatial data for the HID

region area provided by the Everglades National Park to determine data and metadata gaps. Consolidated and organized both datasets in map format for discussion with client to determine analysis requirements and deliverables. Identified, through spatial analysis, all overlapping vegetation monitoring plots, and assigned to each plot the correspondent farming intensity values and fire years where prescribed fires occurred in the plot region. Delivered results in map and table format for display and future analysis by client.

- **Martin County Coastal Geodatabase 2013 Update: St. Lucie Inlet Management Program (2013 - 2014)** — subcontracted by Atkins North America, Inc. — organized, consolidated, and uploaded into the Martin County Coastal GIS, the 2013 permitting, construction, and monitoring of engineering, natural resources (sea turtles, shorebirds, hardbottom), and sediment and water quality data for several inlet, beach nourishment, waterways, and artificial reef projects. 2013 datasets included hydrographic surveys, construction and physical and natural resources (sea turtles, shorebirds, hardbottom), sediment and water quality monitoring data of the inlet sediment basin and navigation channel dredging, beach placement of by-passed sediment, and navigation project. Updated the St. Lucie Inlet management program ArcGIS planning tool.
- **Martin County Coastal Geodatabase 2013 Update: Hutchinson Island Shore Protection Project (2013-2014)** — subcontracted by Taylor Engineering, Inc. — organized, consolidated, and uploaded into the Martin County Coastal GIS, the 2010 - 2013 permitting, construction, and monitoring engineering, natural resources (sea turtles, shorebirds, hardbottom), and sediment and water quality data for Hutchinson Island, Bathtub Beach Park and Sailfish Point beach nourishment projects. Updated the ArcGIS planning tools for the Hutchinson Island, Bathtub Beach Park and Sailfish Point beach restoration areas. Created a sea turtle nesting time enabled simulation to visualize the influence of beach nourishment on sea turtle nesting for the 2013 nesting season.



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- **Martin County Hutchinson Island Shore Protection Project Web GIS application Design and Data Gathering (2013)** — subcontracted by Taylor Engineering, Inc. — organized, consolidated, and quality controlled the data needed to create a ArcGIS Online application to show the advancement of the Hutchinson Island beach nourishment project as it progresses. Designed the prototype for the application and coordinated with IT and Engineering County staff the incorporation of the data into the application, as well as the deployment of the ArcGIS Online application on the County's project website.
- **Everglades National Park (ENP) Hole-in-the-Donut (HID) Restoration Project GIS Analysis Update (2013)** — subcontracted by Floravista, Inc. — Updated the GIS products produced during the 2012 contract. Quality controlled the GIS data for the entire project, specifically assessed its integrity in accordance with the hydrological, survey, biological, statistical and Park area management data. Prepared recommendation to client regarding the identified data issues and gaps. Incorporated, upon client review, the recommended changes into the project data ESRI geodatabase. Updated the FGDC compliant metadata.
- **Ft. Pierce Beach Shore Protection Project Monitoring Report, St. Lucie County, Florida (2013)** — provided assistance to Taylor Engineering Inc. with the project's 2012 annual monitoring report. Conducted multivariate statistical analysis (cluster analysis) of quadrat data collected along the nearshore hardbottom monitoring transects.
- **Everglades National Park Hole-in-the-Donut (HID) Restoration Project GIS Analysis (2012)** — subcontracted by Floravista, Inc. — evaluated the temporal and spatial data relationships between the growth of specific vegetative communities, and elevation and hydroperiod in the Hole in the Donut Everglades wetland restoration area. Mapped habitat cluster classification (Rutcher et al. 2009 habitat classification) analysis results, and the location of exotic species within restored areas. Identified issues and data gaps in the project GIS data. Consolidated project data into an ESRI geodatabase, created FGDC compliant metadata.
- **Martin County Coastal Geodatabase: St. Lucie Inlet Data Upload (2012)** — subcontracted by Atkins North America, Inc. — organized, consolidated, and uploaded into the Martin County Coastal GIS, the St. Lucie Inlet program data (1995 -2011).
- **Martin County ArcGIS Online Training (2012)** — subcontracted by Atkins North America, Inc. — Provided County staff training on how to use ArcGIS Online to manage its projects' spatial information and how to create multiple web GIS applications for easy access to the project data stored in the County's coastal geodatabase. Coordination with the County IT staff to setup the resources required for the training and future implementation of the applications.
- **Ft. Pierce Beach Shore Protection Project Monitoring Report, St. Lucie County, Florida (2012)** — provided assistance to Taylor Engineering Inc. with the project's 2011 annual monitoring report. Conducted multivariate statistical analysis (cluster analysis) of quadrat data collected along the nearshore hardbottom monitoring transects.
- **Floravista, Inc. GIS Services: Titusville Property Mapping and Arc Pad Training, Florida (2011)** — provided training with ArcPad 7.1 data upload and creation for a Trimble GPS. Converted data from GPS format to ArcGIS format for GIS visualization and QA/QC, and prepared a preliminary wetland delineation survey map for a private property in the Titusville area.

SELECTED DATA MANAGEMENT AND SPATIAL PLANNING (GIS) PROJECTS*

- **Wilmington District U.S. Army Corps of Engineers Waterway Planning and Management Projects (2005-2011).** *U.S. Army Corps Of Engineers Dredged Material Management Plan For The Atlantic Intracoastal Waterway (AIWW) (2011); NE Cape Fear, Morehead City Harbor, and Wilmington Harbor DMS Data Manager Applications, North Carolina (2005-2007)* — Project



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Manager. Organized and consolidated historical and current navigation channel spatial and bathymetric information for several federal waterways (i.e. NE Cape Fear: 2003-2005, Morehead City: 1996-2005, and Wilmington Harbor channels: 2002-2006; AIWW channel from Norfolk, Virginia to St. Johns River, Florida: 2000-2010). Prepared project reports, created maps and GIS applications (Arc Map, Publisher, and .NET), and other GIS products for projects. Coordinated the upgrades of data management tools to import survey data, extract and plot profile data from bathymetric data, calculate volume differences, between bathymetric surfaces, calculate historical and current shoal areas and volumes. Coordinated data acquisition and standardization between channels with multiple clients (Five USACE Districts) and conducted demonstrations and staff training in utilization of some of the tools developed.

- **Martin County Comprehensive Geodatabase Creation, Scoping, Assessment, Data Transfer, and Aerial Photography (2003-2011)** — Project Manager. Planned, designed, and developed a geodatabase to support Martin County Coastal Engineering Division's data management needs. Coordinated and prepared project prototype database development structure, schema, user interface tools, and functional requirements documentation. Consolidated 10 years of environmental and engineering project data and uploaded the data to the coastal geodatabase. Coordinated acquisition and performed quality control of annual shoreline aerial photography between 2007 and 2010. Created visualization tools (ESRI Arc Map and Google Earth) to allow the county coastal managers and engineers, quick access to project information.
- **Florida Inlet Navigation District (FIND) Waterway Planning and Management projects (2004 - 2007)**. *Okeechobee Waterway 2006 Survey (2007) and FIND Survey 2004 (2004-2006)* — Project Manager. Organized and consolidated historical and current spatial information and bathymetric surveys for several for the Atlantic, Intracoastal, and Okeechobee

waterway channels. Designed, developed, and coordinated the upgrades of data management tools to import survey data, calculate historical and current shoal areas and volumes. The later used to identify problem areas, calculate dredge volumes and to estimate upland dredged material disposal requirements. Coordinated with engineers the identified of potential upland area availability for future dredge material disposal. Prepared project reports, created maps and GIS applications (ESRI ArcMap and Publisher), and other GIS products for projects.

- **South Florida Water Management District (SFWMD) Hydrological Stage Network Optimization projects (2004-2008)**. *Stage Network Optimization for the Everglades Wetlands Areas (2004 - 2007); Flow and Stage Network Optimization Studies: Lakes Okeechobee and Kissimmee, Florida (2007); Storage Treatment Areas (STAs) (2008)* — Project Manager. Performed a wetland network optimization study that involved designing and testing spatial and statistical analysis methodologies to identify stage gage network gaps and clustering. In collaboration with University of Texas managed gathering and quality control of hydrological (stage) data time series for the lakes two lakes in the SFWMD network; tested GIS applications developed by the University of Texas, and conducted a spatial and statistical analysis of the stage gage data for Lake Kissimmee an Okeechobee. Analyzed and consolidated the data in a geodatabase. Performed geospatial and statistical analysis to help with the identification of redundant gauges within the SFWMD STA network. Prepared recommendations to assist the District in determining which gages were redundant and candidate for relocation and to identify areas where there were significant data gaps. Coordinated with client and participated in project meetings with stakeholders.
- **Jacksonville District U.S. Army Corps of Engineers Waterway Planning and Management Projects (2001-2006)**. *Jacksonville District DMS Data Manager Applications (DMS) (2001-2006). Jacksonville District Regional Sediment Management GIS Database*



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(2003). — Project Manager. Organized and consolidated historical and current navigation channel spatial and bathymetric information for the Jacksonville Harbor federal channel. Coordinated with engineers the identified of potential upland area availability for future dredge material disposal. Prepared an historical shoaling and dredging analysis for the Jacksonville harbor. Designed, developed, and coordinated the data management tools to import survey data, extract and plot profile data from bathymetric data, calculate volume differences, between bathymetric surfaces, calculate historical and current shoal areas and volumes. Prepared project reports, created maps and GIS applications (Arc Map, Publisher, and .NET), and other GIS products for projects. Conducted demonstrations and staff training in utilization of some of the tools developed. Coordinated coastal hydrographic dataset assembly, consolidation, and transfer between the Jacksonville District and the Mobile District.

- **Permit Application GIS Support (2002-2013).**

Prepared GIS products, consolidated and analyzed environmental, coastal, and socio-economic GIS data for over 25 permit applications and environmental and engineering reports. Examples include: *Ft Pierce Shore Protection Project (2012, 2013)*; *Volusia County Artificial Reef Site Management Plan and Permit Application (2011)*; *Martin County Shore Protection Project (2010)*; *City of St. Augustine Mooring Fields (2009)*; *St. Johns County College Park Drainage Improvement EID (2009)*. *Palm Harbor Marina Renovation (2008)*; *St. Augustine Lighthouse Boat Ramp Dredging (2007)*; *BP Oil Terminal Dredging (2006)*. *City of West Palm Beach Waterfront Commons (2006)*; *Avenida Menendez Seawall (2004)* *St. Johns County, Florida Habitat Conservation Plan / Environmental Assessment (2002)*.

SELECTED WATER AND SEDIMENT QUALITY DATA MANAGEMENT AND ANALYSIS PROJECTS*

- **South Florida Water Management District (SFWMD) Lake Worth Lagoon (LWL) Watershed**

and Stormwater Loading Analysis, Palm Beach County, FL (2009) — Project Manager. Led and performed meteorological, hydrological and water quality data gathering, quality assurance/ control and consolidation (DBHYDRO, STORET); analyzed the data (statistical and geospatial analysis), identified and characterized trends, and data gaps, summarized, reported and presented (plots and GIS maps) the results. Developed GIS data project databases LWL watershed. Calculated pollutant loads to the Lagoon from the LWL watershed. Helped with the preparation of a 3 year EMC monitoring plan for the watershed. Participated in project meetings with client to discuss and present project milestones and strategies.

- **South Florida Water Management District (SFWMD) Naples Bay Bathymetry and Data Review Collier County, FL (2005)** —

Performed meteorological, hydrological and water quality data gathering, quality assurance/ control and consolidation (DBHYDRO, STORET); analyzed the data (statistical and geospatial analysis), identified and characterized trends, and data gaps, summarized, reported and presented (plots and GIS maps) the results. Developed GIS data project databases for the Naples Bay.

- **St Johns River Water Management District (SJRWMD) North Indian River Lagoon (IRL) Feasibility Study - Sediment Management Strategies (2005)** —

Identified (Data Sources: literature review and SJRWMD staff) and located (GIS) muck deposits, dredging management areas, shoreline and spoil island erosion and accretion areas. Conducted a historical shoreline analysis, prepared summary, report and maps. Assisted with the historical sediment load analysis and ranking of past and present sediment loads, categorized watershed landuse and percent impervious surface, prepared maps (GIS) for this analysis. Summarized long-term dredging needs for the lagoon. Participated in project meetings with client to discuss project milestones and strategies.

- **Interpretation Tool to Evaluate Metal Concentrations in Freshwater Sediments (2001)**

— Analyzed metal concentrations in the Florida



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Department of Environmental Protection freshwater "clean" sediment sample database. Conducted statistical analysis and determined prediction limits to characterize the natural metal concentrations in freshwater sediments in Florida. Designed a PC based interpretation tool to be used by FDEP and the general public in the assessment of sediment quality in Florida's freshwater sediments.

SELECTED ENVIRONMENTAL AND PERMITTING PROJECTS*

- **Volusia County Artificial Reef Management Plan and New Site Permitting (2011)** — Project Manager. Prepared documentation, presentation, and posters for three public meetings. Helped prepare a management plan for an artificial reef site management plan which addressed existing reefs and reef program expansion (20 year plan). Help prepare guidelines, policies, and data collection protocols to establish and permit new artificial reef sites.
- **Ft. Pierce Beach Shore Protection Project Permit Monitoring Efforts Evaluation St. Lucie County, (2011)** — Project Manager. Evaluated and analyzed data from permit required monitoring - eight years of nearshore hardbottom and sea turtle nesting, and five years of shorebird nesting. Prepared recommendations for future monitoring efforts.
- **Hutchinson Island Shore Protection Project Permit Application, Martin County, Florida (2011)** — provided environmental and GIS analysis assistance in the preparation of the permit application. Tasks included revising and updating existing biological monitoring and mitigation contingency plans; coordination with engineers and permitting agencies to identify monitoring effort and data acquisition requirements for the pre-, construction, and post-construction monitoring phases the project.
- **2010 Martin County Baseline Hardbottom Nearshore Survey (2010)** — Project Manager. Coordinated with client and subcontractor the acquisition of the nearshore hardbottom baseline data for the Martin County Shore Protection Project. Reviewed data and report from subcontractor. Analyzed data collected and incorporated the data in the Biological Monitoring Plan for the same project. Digitized hardbottom nearshore reef from aerial photography between 2008 and 2010. Data was subsequently ground verified by subcontractors in the field who conducted the 2010 nearshore hardbottom baseline survey for the project. Consolidated and analyzed the GIS data provided by the subcontractor for the project.
- **Bathtub Beach Construction Administration, Martin County, FL (2010)** — Project Manager. Coordinated with clients, contractors, subcontractors, permitting compliance agencies and engineering and scientist team during pre-construction and construction project phases to facilitate communication, and project completion. Oversaw contractor and subcontractor compliance with project specs, permit conditions, and monitoring requirements. Assured contractor compliance with project progress submittals and construction monitoring reports. Prepared pay applications.
- **Regulatory Permitting Projects (2001–2011).** Prepared or managed over 20 different State and Federal permit applications (ERP, CCCL, JCP, PATON, FWC) for artificial reef sites and reef deployments, mooring fields, historical seawall, bulkheads, seawalls, and revetments, beach nourishment, marina developments, boat ramp and terminal berths dredging, and information and aids to navigation signs. Gathered, consolidated and analyzed GIS data to characterize each site. Coordinated with client and permitting agencies, prepared and participated in pre-application meetings, public workshops, and pre-construction meetings. Examples include: Volusia County Artificial Reef Site Management Plan and Permit Application (2011); City of St. Augustine Mooring Fields (2009); Palm Harbor Marina Renovation (2008); St. Augustine Lighthouse Boat Ramp Dredging (2007); BP Oil Terminal Dredging (2006). City of West Palm Beach Waterfront Commons (2006); Avenida Menendez



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Seawall (2004) St. Johns County, Florida Habitat Conservation Plan / Environmental Assessment (2002).

hazards impact prediction tool to help assess the risk of each implemented policy.

- **St. Johns County, Florida Environmental Information Document (EID) for College Park Drainage Improvement (2009)** — Project Manager. Prepared an EID for the College Park/West King Street Drainage Improvements and Fox Creek Regional Stormwater Pond St. Augustine, St Johns County. The County needed to submit an EID to demonstrate the project's compliance with the National Environmental Policy Act (NEPA) and receive a significant Stormwater Construction Grant from the U.S. Environmental Protection Agency (EPA) Special Appropriations Project. Tasks included coordination with St. Johns County environmental and engineering division, engineering consultants, and the EPA program managers the successful preparation of the grant application; reviewing available project information (construction plans, permits, and environmental documentation), identifying apparent data gaps, gathering additional data, developing and submitting the EID, and responding to EPA requests for final document revisions.
- **Sebastian Inlet and Martin County Wave, Weather, and Tide Monitoring (1998 – 2000)** — Processed and analyzed data from weather station and tide gage in Sebastian Inlet and two wave gages Sebastian Inlet and Martin County. Maintained the weather station and wave and tide gauges monitoring equipment. Restructured and maintained real-time web site for monitored the data. Analyzed data collected and prepared monthly and annual reports for delivery to the Sebastian Inlet Tax District and Martin County Coastal Engineering Division.

RESEARCH PROJECTS AT FLORIDA INSTITUTE OF TECHNOLOGY, MELBOURNE, FLORIDA

- **Decision Support System for Brevard County Barrier Island (2000)** — Dissertation. Designed a GIS based simulation tool, capable of modeling coastal development and to project future land use patterns based on the choice of different coastal development policies. Characterized and inventory past, and present socio-economic, environmental, regulatory and political trends and realities of the Brevard County's barrier island municipalities and unincorporated areas. Evaluated and established coastal development policy criteria and alternatives for sustainable coastal zone development for the simulation tool. Created a tool to perform land use compatibility and suitability analysis for the Brevard County barrier island communities; Developed based on land use projections a natural