Development of Guidelines for Generating Shoreline Situation Reports Establishing Protocols for Data Collection and Dissemination

Final Report

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by

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Establishing Protocols for Data Collection and Dissemination

Introduction

Shoreline Situation Reports have been the cornerstone of shoreline information in Virginia for more than twenty years. The next generation of Shoreline Situation Reports must enable managers to improve their decision making capacity in light of current management challenges. This assistance grant provided funds to decipher the shoreline management needs among practitioners working within Virginia's tidal shoreline management area. Strategies to build consensus on the subject were intertwined with information building exercises and presentations. Two workshops were held to gather decision makers, evaluate the options, and make final recommendations based on need, and feasibility.

This final report documents the procedures, events, and final recommendations. Two workshops were held on December 16, 1998, and May 24, 1999. The first workshop introduced the subject matter and queried participants on their data needs. The interim period was spent field testing, and evaluating logistics, economics, and time constraints imposed by the data needs. Results were presented at the workshop in May. Highlights from each of these workshops are presented. Final recommendations are explained in detail.

Workshop I: December 16, 1998

A group of approximately fifty (50) experts with an interest or need in shoreline information gathered at the University Center on the campus of the College of William and Mary. The purpose of the workshop was defined in a brief mission statement, "... to define the data needs", and "... to provide some insight into the logistics of collecting and reporting shoreline data". The workshop was hosted by the Comprehensive Coastal Inventory Program (CCI) of the Virginia Institute of Marine Science. CCI has a commitment to develop innovative techniques to map and catalogue conditions along shorelines within the Commonwealth of Virginia. The program has a long history of providing tools to support resource management and improve decision making capabilities. A sophisticated array of surveying and recording devices have been assembled to make this possible. This includes a state-of-the-art image processing, and geographic information system (GIS) facility supporting mapping and remote sensing activities. CCI is leading the development of revised Shoreline Situation Reports. The goal of this workshop is to engage agency personnel in formulating guidelines that meet their needs.

1) Introduction

The workshop was divided into three parts. Part one introduced the audience to a brief history of the Shoreline Situation Reports with an emphasis on data content, format, and uses. This was followed by an introduction to current shoreline inventory efforts, and new technologies available to support inventory development were presented. Sample products were available for review. This briefing was intended to inform conference participants on the subject, and enable them to assist in the decision making process throughout the workshop activities.

2) Open Forum Discussion

The audience participated in an open forum discussion where shoreline practitioners were asked to respond to a specifics set of questions. Each question was debated at length until a consensus was reached among the group. Four specific areas were discussed: product need, timeliness of the data, scale of the data, and mechanisms for distribution. Each of these questions are reviewed separately.

a. establishing need

The open forum began with the question, "Do we need to be developing shoreline inventories?". The group quickly reached a consensus that there was a definite need for a shoreline inventory.

b. how frequently?

The frequency with which shorelines in Virginia should be surveyed for changing conditions and properties was a subject of considerable debate and discussion. It has been more than twenty years since the first series of VIMS Shoreline Situation Reports were published for each locality. These have served as the only comprehensive source of shoreline data available to coastal planners. Participants agreed that this frequency was not suitable, and that any effective inventory must be generated more often to be useful.

With five thousand miles of tidal shoreline, an agreement was reached that an inventory every year was not practical. The group recognized that some conditions, or activities occur more regularly, and promote changes which should be monitored. These include shoreline permits, sensitive area designation, and natural heritage status. Most agreed it was appropriate for agencies with responsibilities to these issues continue their monitoring in-house. A future mechanism for sharing and updating this level of information between agencies would be desirable.

Other extreme events such as hurricanes and northeast storms were also noted as short term impacts which should be monitored. No mechanism is in place for this type of assessment. The Commonwealth currently has no single agency responsible for evaluating storm related impacts.

Anthropogenic impacts, or those changes induced by human activity along the shore, were argued to be continuous. This speaks again to permits issued through the various state and federal agencies during the year, or conversion of land uses, etc. However, experts agreed that it was reasonable to survey these activities on a cycle of once every five years, and still observe any resultant shoreline responses. This discussion recognized that responses from shoreline alteration projects could be observed within this time frame, and data reporting these impacts would not lose their value if reported every five years.

Ten years was considered an appropriate time frame within which to revisit changes in physical parameters of the shore. This would include nearshore width, shoreline orientation, and sediment properties. Consensus was quickly built that these parameters generally respond more slowly, and therefore did not require the same frequency of updates in order to monitor change effectively.

c. at what scale?

Scale, with respect to landscapes, was discussed in the open forum. Workshop attendees were asked to think about scale with respect to regions, watersheds, localities, creek bodies, and property parcels. These landscape perspectives, listed in increasing order of detail, come at a price, both in cost and time. The more detailed your view, the longer it will take to collect the data, and the more costly it will be. Participants were asked to think about their uses for shoreline data before coming to a decision; to be realistic about the impending costs; and to consider the time associated with data collection and processing.

Consensus was built around two facts. First, it was not necessary to view data at the parcel level, but it was necessary to have data available which could be observed at the small creek or tributary level. Data presented at smaller scales would begin to reduce the utility of the information for most planning and management needs. Second, data should be accurate to +/- 5 meters to meet most management needs. This is irrespective of the publication scale.

d. how should data be reported?

Historically, shoreline inventories were distributed as hard copy documents. In the 1970s and early1980s there were few other options available. Today, technology offers many other possibilities. The goal of this debate was to identify a medium for distributing the shoreline inventory which could reach the widest audience, be an effective product, and offer a mechanism for efficient updates. Five options were reviewed: hardbound documents, slides/video, Internet based website map gallery, an Internet based interactive mapping web site, or cd-rom.

A poll revealed that at least one member of the audience did not have Internet access. Others indicated that their access was limited, and some did not have personal desktop access. The group maintained a preference for hardbound documents, and was content that a limited distribution would be sufficient. The Internet was considered an ideal place to view maps and to provide updates to the material as data become available. Cdrom is also a potential for distributing map information. However, CD distribution must be repeated whenever updates are made.

Consensus, therefore, appears to support a limited distribution of hardcopy material. This material should also reside at a website where updates can periodically be made as data become available. CCI will continue to explore and experiment with interactive web applications, which is a highly useful technology, becoming more widely available.

Summary of the Open Forum Discussion

The open forum discussion addressed four major areas of inventory development. The discussion reached several conclusions. The need for revised Shoreline Situation Reports was evident, even overwhelming. Repeatability was critical for maintaining a useful product over time. Shoreline conditions and responses imposed by human activity could with stand five years of cumulative change before data revisions would be required. Shoreline responses to natural processes were much slower, and would need to be addressed every ten years. Neither of these cycles would capture impacts associated with catastrophic events, nor would they address the day to day, site by site changes associated with individual parcels. Data collection must meet accuracies of 5 meters. However, conditions need not be surveyed to a specific parcel, but rather to a piece of creek shore. The primary distribution of data should be through hard copy publications. The Internet can be used as an archive, and a site for updates.

3) Delphi Survey - Assessing Data Needs

The third and final component of this workshop asked the audience to participate in a survey modeled after the Delphi Survey techniques. This survey was to specifically address the question of data needs. In the exercise,participants identified, and ranked, information needs in order of importance. The results are discussed below.

A Delphi format survey was initiated with a basic list of seven (7) major shoreline attributes (Table 1). These general categories were expanded in Table 2 with a sub-list of specific features for each of these seven major headings. For example, riprap is a specific feature under the major category "Shoreline Protection/Stabilization Structures"

Table 1. Major Shoreline Attributes

Shoreline protection/stabilization structures (SP)
Water access and recreational facilities (WA)
Shoreline composition (SC)
Shoreline Stability (SS)
Bank Condition (BC)
Adjacent Land Use/Land Cover (LU/LC)
Ownership (OW)

Table 2. Shoreline Attribute Sub-Categories

SP	WA	SC	SS	BC	LU/LC	OW
bulkhead	pier	beach	stable	height	forested	public
riprap	wharf	marsh	eroding	stability	scrub/shrub	private
groins	boathouse				grass	
jetties	boatramp				residential	
breakwater	marina				bare	
miscellaneous					commercial	
					timbered	

SP=shoreline protection
WA= water access
SC=shoreline composition
SS=shoreline stability
BC=bank condition
LU/LC=land use/land cover
OW=ownership

The group was presented with both tables, and asked to modify the lists by adding major or minor categories they felt were missing. Here they were permitted to add additional major attributes to Table 1, or expand on the current list of features in Table 2. A revised master table was developed from the changes (Table 3). Four additional major categories were added: land cover, physical parameters, historic shoreline change, and aquatic resources. Sixty-five additional features were added. The revised list was re-distributed, and participants asked to rank the attributes and features in two ways.

The conference participants were asked to rank the major column headings in Table 3 by order of importance. Importance was defined as being important information in order to address the types of management problems they deal with on a regular basis. Of the twelve potential categories available, seven were from the original list (Table 1). Many considered only the original seven when ranking. Table 4 lists the results of this step.

The final phase of the Delphi survey asked the practitioners to review all the features under the column headings in Table 3. Under each major column heading, the group was asked to identify the attributes they considered most important. A minimum of three, and no more than five, were to be selected. These were not to be ranked in any special order; only checked if they are believed to be of the most critical data to have.

Table 3. Revised Shoreline Attribute Sub-Categories

SP	WA	SC	SS	BC	LU/LC	OW	LU	HT	PP	AR
bulkhead	pier	beach	stable	height	forested	public	plans	*	fetch	shellfish areas
riprap	wharf	marsh	eroding	stability	scrub/shrub	private	subdivision		depth	sav (potential)
groins	boathouse	mud flat	accreting	vegetated	grass	fed.			orient.	sav (existing)
jetties	boatramp	tidal wet.	undercut	springs	residential	state			wind	aquaculture
breakwater	marina	oyster reef		veg.type	bare	local				fish traps
miscellaneous	trails	sed type		slope	commercial	community				endangered sp.
fallen trees	public beach	dunes		soil comp.	timbered	NGO				
back fill	boat lift	bank-edge		runoff	agriculture	military				
created wet.	casino	created wet.			impervious surface					
toe stabil.	pub.access				recreational					
nourished	right of way				road right of way					
geo-tubes .	duck blind				marine preserve					
masonry	rope swing	.			industrial					
	boat traffic type				invasive vegetation					
	house boat				game preserve					
	navigation channel				buffers					
	mooring piles				mining					
	parking				transitional zone					
	community pier									
	pier length									

SP=shoreline protection
WA= water access
SC=shoreline composition
SS=shoreline stability
BC=bank condition
LU/LC=land use/land cover
OW=ownership
LU=landuse
HT=shoreline trends only
PP=physical parameters
AR=aquatic resources

Table 4. Major Shoreline Attribute Categories - In Order of Importance

Shoreline Protection/Stabilization Structures
Shoreline Stability
Bank Condition
Water Access and Recreational Facilities
Shoreline Composition
Land Use/Land Cover
Ownership
Historic Trends
Physical Parameters
Aquatic Resources
Land Cover

Table 5 summarizes the most frequently selected features. These are the specific shoreline features, defined under the broader categories, which resource managers feel are particularly necessary for performing their roles. These sub-classes are ordered according to the number of votes received. The columns have been reordered to reflect the importance values assigned to the broader categories from Table 4.

Summary of the Delphi Survey Results

Major shoreline attributes from the survey results are listed in Table 4 in order of importance. Data related to conditions at the shoreline rank highest among the attributes selected. Ownership, aquatic resources, and land cover were among categories of lesser importance. Important sub-classes, or features, within each of the major categories are denoted in Table 5. A broad range of features are proposed.

Table 5. Most Favored Shoreline Features

SP	SS	BC	WA	SC	LU/LC	OW	Other
bulkhead	eroding	vegetated	pier	beach	forested	private	shoreline trends
riprap	stable	height	marina	marsh	agriculture	public(by type)	aquatic resources
groin field	accreting	steepness	boat ramp	tidal wetland	residential	public	sav potenial
jetties	boat house	stability		dune	grass	subdivision	depth
breakwater	public beach	composition		mudflat	commercial	military	separate lu from lc

SP=shoreline protection
WA= water access
SC=shoreline composition
SS=shoreline stability
BC=bank condition
LU/LC=land use/land cover
OW=ownership
Other = includes land use, aquatic resources, physical parameters, and historic trends.

Interim Field Investigations

Following the December 16 workshop, a thorough evaluation of the survey results occurred. In this evaluation, several primary issues were considered. Was the data requested being collected by another agency or program? Could the collection of the data be integrated into a single field operation? At what rate could the data be collected, and still maintain the desired accuracies, and the cycles for repeatability.

With these questions in mind, CCI embarked on a short season of field trials to develop protocols for surveying shoreline conditions. The program began with a review of existing data collection methods which have been incorporated in other field programs. These include: remote sensing techniques, on the ground surveys, and boat operated surveys. Remotely sensed products could not be used to collect all the desired attribute data, and could not yield the accuracies desired. Ground surveys on foot were extremely time consuming. Shorelines could be surveyed in this manner at a rate of less than five miles per day on foot. Access to private property would inhibit progress, and travel costs would be high. Although data would be of relatively high quality, the efficiency level excludes this as practical for regional inventory development. Surveys by boat can collect a lot of information relatively quickly. As much as twenty miles per day can be surveyed, depending upon conditions, and the need to stop. Use of small boats is also relatively inexpensive.

CCI has had several projects where data was collected from a small boat operating in shoal waters. Using the data needs defined in the tables, a protocol was developed. Several important consideration narrowed the scope of the data collection. First, attributes to be collected had to be surveyed from the vessel. No onshore survey work could be incorporated since nearshore shoals might prohibit access, and stopping would dramatically increase the length of time in the field. Measurements would be logged on a hand-held GPS receiver. No other method of sampling would be included. Measurements would be qualitative or quantify ranges which could be observed. Attributes which could not be surveyed in this manner would be excluded. Finally, to the extent possible, the boat would navigate continuously along the shore. Frequent stops would extend the survey time, and should be reserved for only critical attributes. Employing these rules, CCI developed final protocols which were recommended to the agencies in the May 24, 1999 workshop. The protocol is discussed below.

Workshop II: May 24, 1999

1) Introduction

The May 24th workshop contained two parts. Part one reviewed highlights from the December workshop, and presented the shoreline inventory protocols developed over the following months. The final recommendations are presented below. The second half of the workshop was an exercise in decision making, and examined the impacts data availability has on the process. A description of the exercise, and the results are given.

2) Shoreline Inventory Protocols

The protocols developed for the Shoreline Situation Reports is based on a three-tiered shoreline assessment approach. This assessment characterizes conditions in the shorezone, which extends from a narrow portion of the riparian zone seaward to the shoreline. This assessment approach was developed to use observations which could be made from a moving boat. To that end, the survey is a collection of descriptive measurements which characterize conditions as ranges. Hand-held GPS units will be used to log the location of the conditions observed from the boat. Aside from the GPS data, no other field measurements are performed.

The three tiered shoreline assessment approach divides the shorezone into three regions: the immediate riparian zone, evaluated for land use; the bank, evaluated for height, stability, vegetative cover, and natural protection; and the shoreline, describing the presence of shoreline structures for protection or recreational purposes. The three tiered approach maximizes the collection of data attributes identified in Table 5. Each of these tiers is described in detail below.

a) Riparian Land Use: Land use immediately adjacent to the bank will be classified into one of nine categories (Table 6). The categories provide a simple assessment of the land use, and give rise to land management practices which may be anticipated. Land use integrates all the features designated in Table 5 under Land Use/Land Cover. Additional land use types have been added for a more complete assessment.

The linear extent of the shore along which the practice is observed can be measured using GPS. The width of this zone will not measured, and is limited by what can be seen from the boat. In most cases, the zone will extend beyond the viewing field. It is possible, however, for a dense, narrow, forest buffer, observed from the water, to obscure the primary land use at a site (e.g. agriculture or residential use). In the field, the zone may be classified as forested. However, by most standards, the zone may be to thin (< 30 feet) to be able to perform all the functions of a riparian forest buffer. Quality control in data processing will correct for many of these observations using digital imagery.

Table 6. Tier One - Riparian Land Use Classes	
Forest	stands greater than 18 feet
Scrub-shrub	stands less than 18 feet
Grass	includes grass fields and pasture land
Agriculture	includes crop land
Residential	includes single or multi family dwellings
Commercial	includes industrial, small business, recreational facilities
Bare	lot cleared to bare soil
Timbered	clear-cuts
Unknown	land use undetectable from the vessel

b) Bank Condition: The bank extends off the fastland, and serves as an interface between the upland and the shore. It is the source of sediment and nutrient fluxes from the fastland, and carries many of the upland soil characteristics which determine water quality in the receiving waters. The stability of the bank is important for several reasons. The bank protects the upland by receiving much of the wave energy during storm activity. The faster the bank erodes, the sooner the upland will be at risk. The sediment load to the receiving waters will be greatest where the bank is actively eroding. Bank stability depends on several factors: the height, the slope, state of erosion, composition of the sediment, vegetative cover, and the presence of buffers to absorb wave energy.

The bank assessment proposed for this inventory will address four major bank characteristics: bank height, bank stability, bank cover, and the presence of stable or unstable natural buffers at the toe of the bank. The features proposed integrate data needs identified in Table 5 under Bank Condition (BC), Shoreline Stability (SS), and Shoreline Condition (SC). Although identified as important features in the survey, sediment composition and bank slope cannot be surveyed from a boat, and are not included. Mudlflats are not considered since this would require sampling the nearshore for sediment composition. Dunes are being surveyed as a component of another state-wide effort at VIMS. Inclusion of these data may be possible when the study is complete.

Table 7 summarizes the extent of bank conditions to be recorded in the field. These conditions can be recorded continuously in a kinematic GPS mode as the boat moves along the shoreline. The GPS log will reflect any changes occurring in the conditions evaluated.

Table 7. Tier 2 - Bank Conditions

Bank Attribute	Range	Description
bank height	0-5 ft	from the toe to the edge of the fastland
	5-10 ft	from the toe to the edge of the fastland
	> 10 ft	from the toe to the edge of the fastland
bank stability	low erosion	minimal erosion on bank face or toe
	high erosion	includes slumping, scarps, exposed roots
bank cover	total	> 75% of the bank face is covered
	partial	25%-75% of the bank face is covered
	bare	< 25% of the bank is covered; where cover includes vegetation or armor
marsh buffer	no	no marsh vegetation along the bank toe
	yes	fringe or pocket marsh present at bank toe
marsh stability (if present)	stable	no obvious signs of erosion
	unstable	marsh is eroding at edge or vegetation loss
beach buffer	no	no sand beach present
	yes	sand beach present
beach stability (if present)	stable	accreting beach
	unstable	eroding beach or non emergent at low tide

2.c) Shoreline Features: Features added to the shoreline by property owners will be recorded as a combination of points or lines. These features include defense structures, which are constructed to protect shorelines from erosion; offense structures, designed to accumulate sand in longshore transport; and recreational structures, built to enhance recreational use of the water. This coverage is developed from features defined under the headings Shoreline Protection (SP), and Water Access (WA) in Table 5. Public beaches have been omitted since this determination can not be made in the field.

The location of these features along the shore will be measured using the GPS unit. Linear features can be surveyed kinematically along the length of the structure without stopping the boat. Structures such as docks, and boat ramps are point features, and a static ten second GPS observation is collected at the site. Table 8 summarizes the shoreline features to be surveyed. Linear features are denoted with an "L" and point features are denoted by a "P".

Table 8. Tier 3 - Shoreline Features

Feature	Feature Type	Comments
Control Structures		
riprap	L	
bulkhead	L	
breakwaters	L	first and last of a series is surveyed
groinfield	L	first and last of a series is surveyed
miscellaneous	L	can include tires, rubble, tubes, etc.
Recreational Structures		
piers	P	includes private and public
boat ramp	P	includes private and public
boat house	P	all covered structures, assumes a pier
marina	L	includes piers, bulkheads, wharfs

Data processing will be fairly intensive, and a rigorous quality control and assurance plan is proposed which uses imagery to verify the shoreline coding. The desired accuracies of 5 meters or better can be achieved with this method. At the recommendation of the workshop participants, the inventories will be distributed as hard copy documents. Plans to serve these data at a website are already being investigated. Cost share monies will be sought to assist in the development of the Shoreline Situation Reports. This will move the publication schedule closer to the preferred five year cycle.

3) Does Data Availability Impact the Decision Making Process?

As we struggle with meeting data needs, and formulate mechanisms for distributing data, it is interesting to understand how data can impact professional judgements and decisions. Are the best answers produced from the most data? Does technology enhance or inhibit the decision making process? These questions were analyzed in a special exercise added to the workshop.

Conference participants were divided into four groups. Each group was asked to address the same set of management questions pertaining to resource protection in the coastal zone. A packet of information was provided to each group. The packet contained all the information the group could use to address the questions. Each packet was different. Group 1 was data poor, and had only very basic and fundamental data products, such as USGS topographic maps. Group 4 was data rich, and was given a laptop computer loaded with ArcView GIS, and a host of GIS

data layers. Groups 2 and 3 had intermediate levels of data, including GIS maps and aerial imagery.

Among the management questions the groups had to address, was the identification of resources at risk to storm surge, and the development of a management strategy for protection of these resources. Several interesting observations were derived. First, the approach to addressing the management questions was basically the same in all groups. Best professional judgement, combined with experience, provided the basis for the organizational thought process. Each group was able to complete the task, although it took the data rich group considerably longer to assimilate all the data provided. Several factors were observed to impede the process: currency of the data, data scale, and data quality. The degree that these factors were limiting varied between the groups. For example, groups with very outdated information saw this as a greater impediment to the decision making process than the group with fairly recent data.

The activity concluded with very comparable strategies for addressing the questions. Management techniques learned through experience prevailed in all cases, with all groups seeking out the same data. Discrepancies were noted in groups with less data. Only slight variations in management plans were evident among the groups

Conclusion

This project has developed a protocol for collecting and reporting shoreline conditions within Tidewater Virginia. Meeting the needs of the shoreline practitioners and managers in the region was paramount in the development process. These needs were balanced with feasibility and a suite of underlying requirements. The final protocols are presented here and recommended as the basis for all future collection techniques. CCI is now actively engaged in the collection of data for following this protocol. The first Shoreline Situation Reports are expected to be published by the end of the calendar year.

List of Workshop Participants

R. Gary Allen - Essex County
Hank Badger - Virginia Marine Resources Commission
Tom Barnard - VIMS/Wetlands Advisory Program
Nadine Barnes - Chesapeake Bay Local Assistance Department
Robert Bates - City of Newport News
Marcia Berman - VIMS/Comprehensive Coastal Inventory Program
Harry Berquist - VIMS/Comprehensive Coastal Inventory Program
David Bower - Virginia Marine Resources Commission
Dana Bradshaw - James River Association
John Bragg - Charles City County
Joseph Brogan - County of York
Bob Byrne - VIMS/Director of Research and Advisory Services (retired)
Keith Cannady - City of Norfolk
Steve Carter-Lovejoy - Dept. of Conservation and Recreation/Div.of Natural Heritage
Patty Clancy - VIMS/Wetlands Advisory Program
Daryl Cook - James City County
Wayne Couch - City of Virginia Beach
Kenny Eades - Northumberland County
Anamarija Frankic - Coastal States Organization
Sylvia Gazzera - Dept. of Environmental Quality
Al Greg - Dept. of Conservation and Recreation
Kirk Havens - VIMS/Wetlands Advisory Program
Carl Hershner - VIMS/Center for Coastal Resources Management
Karl Huber - Dept of Conservation and Recreation/Div. of Soil and Water Conservation
Ann Jennings - Alliance for the Chesapeake Bay
John King - City of Chesapeake
Scott Kudlas - Chesapeake Bay Local Assistance Department
Lewie Lawrence - Middle Peninsula Planning District Commission
Mike Lestyan - City of Chesapeake
Jerome Maa - VIMS/Department of Physical Sciences
James Davis-Martin - Dept of Conservation and Recreation/Shoreline Erosion Advisory Service
Stuart McKenzie - Northern Neck Planning District Commission
Billy Mills - Mattaponi and Pamunkey Rivers Association/King and Queen County
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