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## Cumulative Impacts of Shoreline Construction Activity on Tidal Wetlands in Virginia

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## Technical Report

College of William and Mary  
Virginia Institute of Marine Science  
School of Marine Science  
Wetlands Program  
Gloucester Point, Virginia 23062

Dr. Carl Hershner, Program Director

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# CUMULATIVE IMPACTS OF SHORELINE CONSTRUCTION ACTIVITY ON TIDAL WETLANDS IN VIRGINIA

by

Walter L. Priest, III, Kirk J. Havens, Thomas A. Barnard, Jr., Julie  
G. Bradshaw and Maryann Wohlgemuth

**W**etlands have been protected in Virginia since the passage of the Wetlands Act in 1972 which requires a permit for the use or development of tidal wetlands. These were defined as that land contiguous to mean low water extending up to an elevation of one and one-half times the local mean tide range and upon which is growing any of a number of wetland plant species listed in the Act. The Wetlands Act was amended in 1982 to include all non-vegetated areas between mean low water and mean high water.

This legislation applies to approximately 5,242 miles of shoreline in Tidewater Virginia and approximately 213,686 acres of vegetated tidal wetlands.

Management of these wetland resources has always been hampered by the lack of knowledge regarding the rates of wetlands loss from permitted activities. These statistics have usually been the most intractable data to acquire because of the numerous agencies involved in the permitting process, the frequent modifications of permit applications and the difficulties involved with ensuring the inclusion of all projects proposed. The development of a database documenting the permitted wetland resource losses in Virginia will provide a number of new perspectives on the management process. First, it can help determine the effectiveness of management efforts by documenting the permitted losses of wetlands. Secondly, it will allow an assessment of the cumulative impact of incremental wetland losses on the resource as a whole. Thirdly, the data are a critical baseline element necessary to assess the Commonwealth's relationship to the goal of "no net loss" of wetlands, a current management priority. Lastly, interpretation of these data may illuminate trends in construction activity or impacts requiring special management attention.

This report summarizes a pilot program utilizing information from the database on the type and extent of shoreline modifications authorized by 1988 wetland permit actions. It was undertaken to test the effectiveness and further develop the permit database developed by the Wetlands Advisory Program at the Virginia Institute of Marine Science (VIMS). The software program, "Info Text", was selected and modified by VIMS Computer Center personnel to provide an integrated database which could accommodate the different aspects of the tidal wetlands management program in Virginia.

A record is created for each permit application reviewed. This record contains a number of data fields which can be divided into four major groups:

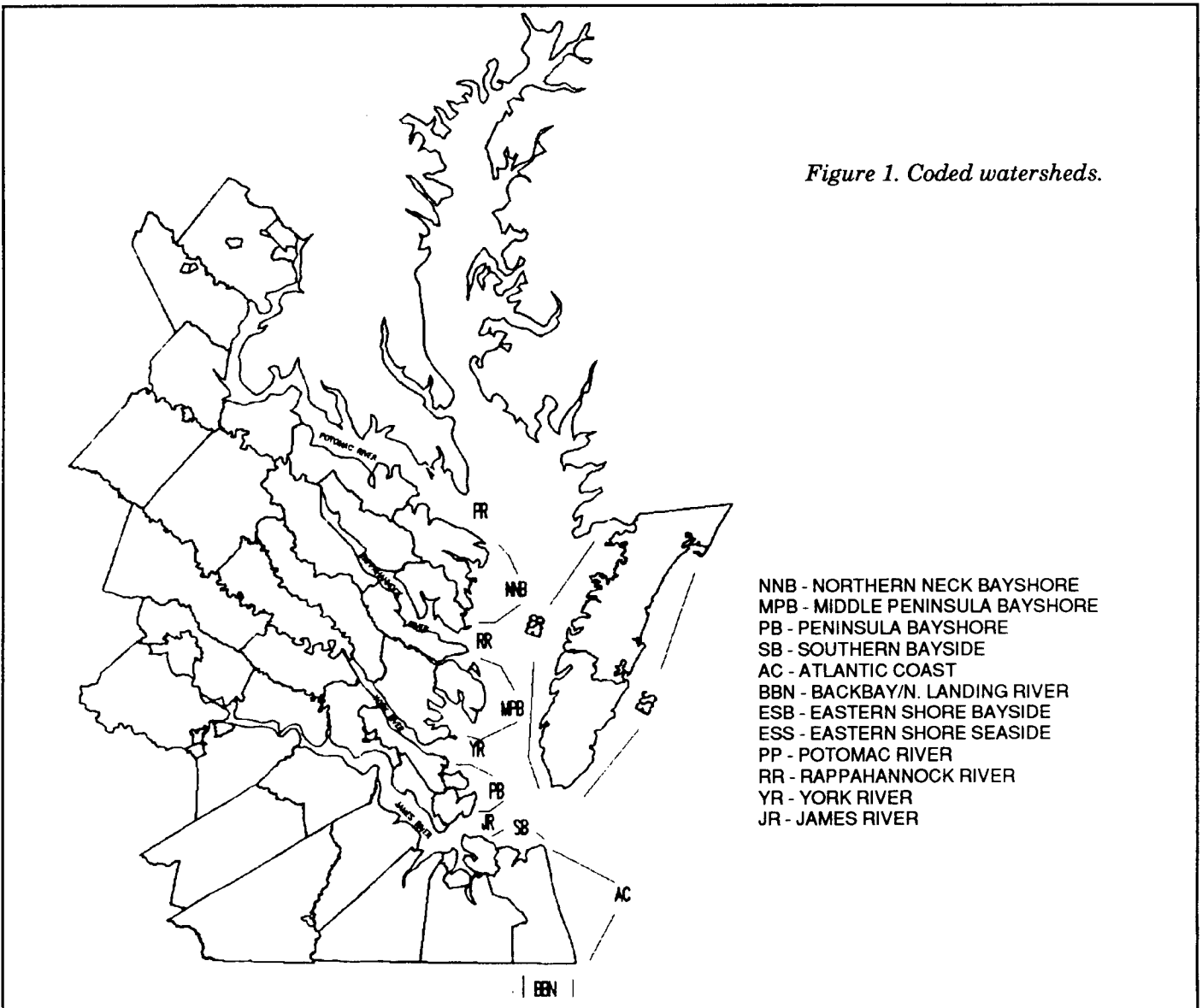
- Applicant - name, application number, agent, purpose and cost
- Location - locality (county, city or town), waterway and watershed
- Project description - dimensions of bulkhead, riprap, fill, etc.
- Impacts - type and extent of wetlands and subtidal bottom impacted.

The database is designed to be able to sort the data according to almost any combination of these fields. They are also organized according to a standard set of watersheds to simplify geographical interpretation (Figure 1.).

The impacts reported for the 1988 data include both habitat lost to filling and habitat impacted but

not lost to the system, such as the conversion of intertidal mudflat to subtidal bottom by dredging or conversion of a sand beach to intertidal riprap. Impacts to vegetated wetlands usually result in the loss of the vegetation. The impacts estimated in the database are based on those activities actually permitted by the local wetlands boards and the Virginia Marine Resources Commission.

The database has several limitations which should be taken into account when analyzing or interpreting the data. These permitted losses must be viewed in the context of natural changes from erosion and accretion as well as unpermitted activities which could involve larger or smaller areas than the losses reported here but are currently unquantified. In most instances, permitted projects are eventually constructed, however there may be occasions where the projects are never constructed and the impacts never accrue to the environment.



Additionally, the 1988 database does not exclude projects approved by a locality or the state that may have been subsequently denied by the Corps of Engineers. It also does not account for any compensation which may have been required.

**Results**

The tidal wetlands permitted to be impacted in 1988 totalled 21.0 acres (914,704 square feet). The vegetated area, 4.44 acres (193,574 square feet), and the non-vegetated area, 16.56 acres (721,130 square feet), impacted are summarized by watershed in Figure 2. The data are presented on a county-by-county basis by wetland type in Table 1. The permit activities of each board as a per cent of the state totals are summarized in Table 2. the vegetated and non-

vegetated impacts are reviewed by watershed in Table 3.

In 1988 a total of 19.11 miles (100,879 linear feet) of shoreline alterations were authorized (Figure 3.). Bulkheading comprised 8.33 miles (43,958 linear feet) and riprap 10.78 miles (56,921 linear feet). Currently, the database does not allow distinction between newly and previously hardened shorelines. Consequently, these figures include new structures as well as the repair and replacement of existing structures. These data are depicted on a watershed basis in Figure 3 and on a county-by-county basis in Table 4.

Figure 2. Construction activity by watershed.

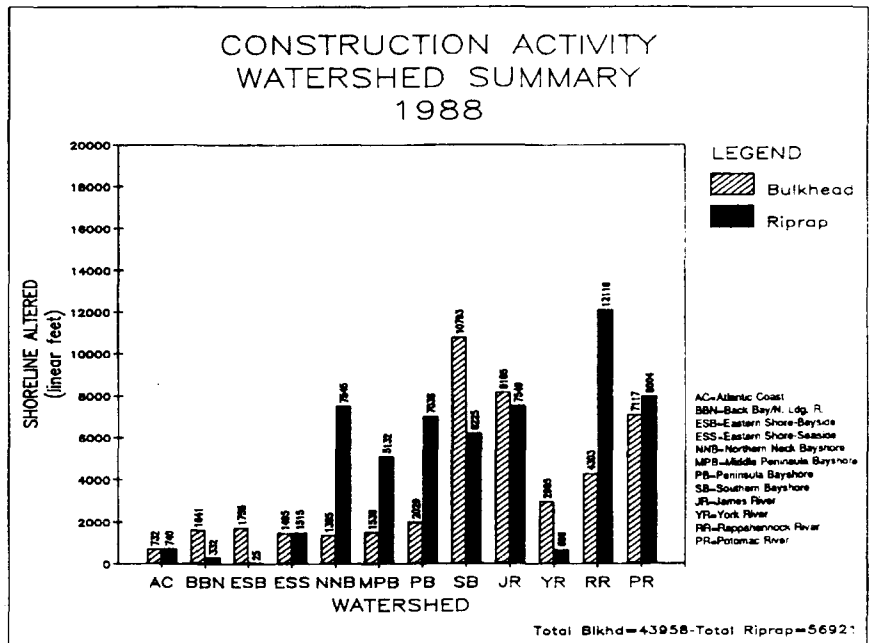


Figure 3. Tidal wetlands impacts by watershed.

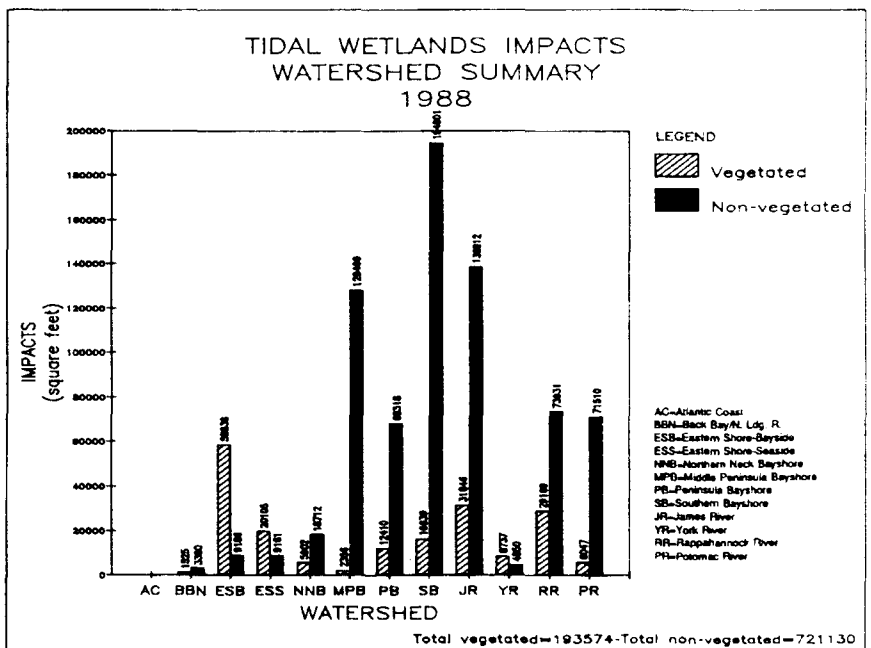


Table 1. Tidal wetlands impacts permitted in 1988 by county and wetlands type.

COUNTY	TP1	TP2	TP3	TP4	TP5	TP8	TP11	TP12	TOTVEG	TP13	TP14	TP15	TP16	TOTNV
ACM	1000	675	0	1200	0	480	0	61678	65033	1440	4740	4066	3061	13307
ALEX	0	0	0	0	0	0	0	0	0	0	3000	2000	0	5000
CAROL	0	0	0	0	0	0	0	0	0	0	60	10	0	70
C.CTY	0	0	0	0	0	0	1100	0	1100	1900	0	0	0	1900
CHES	426	0	0	5300	0	1350	0	5085	12161	41900	12000	11620	2344	67864
CHEST	0	0	0	0	0	0	0	0	0	0	1000	0	0	1000
ESSEX	0	1375	0	0	0	0	10000	4356	15731	0	20365	2540	0	22905
FAIRF	0	0	0	0	0	0	0	0	0	0	0	10	0	10
GLOU	412	179	0	0	0	0	0	0	591	0	3393	1546	1564	6503
HAMP	530	75	2300	1225	0	2550	0	3000	9680	30000	0	0	1000	31000
HOPEW	0	0	0	0	0	0	0	0	0	21780	0	14000	0	35780
ISL.W	0	0	0	0	1000	0	0	0	1000	0	0	800	0	800
JAMES	0	0	0	0	0	0	0	120	120	0	0	1500	3410	4910
K&Q	0	0	0	0	0	0	0	0	0	0	0	360	0	360
K.GEO	0	0	0	0	0	0	0	0	0	0	240	0	0	240
K.WIL	0	0	0	0	0	0	0	0	0	0	0	0	672	672
LAN	1879	129	8056	10	0	0	0	445	10519	0	7648	32619	63	40330
MATH	157	1520	0	120	0	0	0	0	1797	0	96648	8184	2500	107332
MSEX	639	173	0	212	100	0	0	96	1220	3819	20327	4077	115	28338
N.KNT	0	0	0	0	0	0	0	50	50	0	430	400	0	830
N.NEW	0	0	0	0	0	0	0	0	0	1250	10	0	300	1560
NOR	7087	0	0	1423	0	1025	75	630	10240	0	10411	5650	9272	25333
NH	13265	765	0	0	0	0	0	0	14030	2630	2280	250	0	5160
NUB	6860	415	80	256	60	0	0	1836	9507	0	1250	29306	0	30556
POQ	675	0	0	575	0	0	0	1000	2250	0	0	3263	2960	6223
PORT	200	0	0	1900	0	0	0	1816	3916	0	1000	0	1200	2200
PR.WL	0	0	0	0	0	0	0	0	0	0	0	15252	0	15252
RCITY	0	885	0	0	0	0	0	0	885	0	15	440	0	455
RCOUN	0	0	0	0	0	0	0	0	0	0	0	540	0	540
STAFF	0	0	10	0	0	0	50	0	60	0	0	5634	0	5634
SUFF	0	0	0	0	0	0	0	2228	2228	0	100	0	0	100
SURRY	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VB	5840	5945	0	5020	30	10	0	1800	18645	0	18395	25361	154885	198641
WPT	300	0	0	0	0	0	0	0	300	0	0	0	0	0
WESM	244	15	0	0	0	1300	0	1732	3291	0	3010	29730	0	32740
WBURG	0	0	0	0	0	0	0	550	550	0	0	0	400	400
YORK	460	10	0	100	8100	0	0	0	8670	150	160	23700	3175	27185
<b>TOTAL</b>									<b>193574</b>					<b>721130</b>

TP1 = SALTMARSH CORDGRASS COMMUNITY = 39,974 sq. ft.

TP2 = SALTMEADOW HAY COMMUNITY = 12,161 sq. ft.

TP3 = BLACK NEEDLERUSH COMMUNITY = 10,446 sq. ft.

TP4 = SALTBUSH COMMUNITY = 17,341 sq. ft.

TP5 = BIG CORDGRASS COMMUNITY = 9,290 sq. ft.

TP8 = REED GRASS COMMUNITY = 6,715 sq. ft.

TP11 = FRESHWATER MIXED VEGETATION COMMUNITY = 11,225 sq. ft.

TP12 = BRACKISH WATER MIXED VEGETATION COMMUNITY = 86,422 sq. ft.

TP13 = INTERTIDAL BEACH COMMUNITY = 104,869 sq. ft.

TP14 = SAND FLAT COMMUNITY = 206,482 sq. ft.

TP15 = SAND/MUD MIXED FLAT COMMUNITY = 222,858 sq. ft.

TP16 = MUD FLAT COMMUNITY = 186,921 sq. ft.

Table 2. Summary of locality permit activity in 1988 and tidal wetlands impacted.

COUNTY	TOTAL WETLANDS IMPACTED(SQ.FT.)	APPLICATIONS REVIEWED(%)	TOT NVEG IMPACT%	TOT VEG IMPACT%	TOT WETL IMPACT%
Accomack	78340	6.20%	1.85%	33.59%	8.56%
Alexandria	5000	.33%	.70%	0.00%	.55%
Caroline Co.	70	.33%	.01%	0.00%	.00%
Charles City	3000	.33%	.26%	.57%	.33%
Chesapeake	80025	2.12%	9.41%	6.28%	8.75%
Chesterfield	1000	.16%	.14%	0.00%	.11%
Essex	38636	2.45%	3.18%	8.13%	4.22%
Fairfax	10	.65%	0.00%	0.00%	0.00%
Gloucester	7094	3.59%	.90%	.30%	.78%
Hampton	40680	1.96%	4.30%	5.00%	4.45%
Hopewell	35780	.33%	4.46%	0.00%	3.91%
Isle of Wight	1800	.33%	.11%	.52%	.20%
James City	5030	1.31%	.68%	.06%	.55%
King & Queen	360	.16%	.05%	0.00%	.04%
King George	240	.33%	.03%	0.00%	.03%
King William	672	.33%	.09%	0.00%	.07%
Lancaster	50849	9.62%	5.59%	5.43%	5.56%
Mathews	109129	5.71%	14.88%	.93%	11.93%
Middlesex	29558	8.81%	3.93%	.63%	3.23%
New Kent	880	.49%	.12%	.03%	.01%
Newport News	1560	.98%	.22%	0.00%	.17%
Norfolk	35573	7.67%	3.51%	5.29%	3.89%
Northampton	19190	1.79%	.72%	7.25%	2.10%
Northumberland	40063	12.56%	4.24%	4.91%	4.38%
Poquoson	8473	2.28%	.86%	1.16%	.93%
Portsmouth	6116	1.30%	.30%	2.02%	.67%
Prince William	15252	.16%	2.12%	0.00%	1.67%
Richmond City	1340	.33%	.06%	.46%	.15%
Richmond County	540	.16%	.07%	0.00%	.06%
Stafford	5694	2.45%	.78%	.03%	.62%
Suffolk	2328	.49%	.01%	1.15%	.25%
Surry	0	.16%	0.00%	0.00%	0.00%
Virginia Beach	217286	15.50%	27.55%	9.63%	23.75%
West Point	300	.16%	0.00%	.15%	.03%
Westmoreland	36031	5.06%	4.54%	1.70%	3.94%
Williamsburg	950	.49%	.06%	.28%	.10%
York	<u>35855</u>	<u>2.94%</u>	<u>3.77%</u>	<u>4.48%</u>	<u>3.92%</u>
<b>TOTAL</b>	<b>914704</b>	<b>100.02%</b>	<b>99.50%</b>	<b>99.98%</b>	<b>99.91%</b>

Table 3. Tidal wetlands impacts permitted in 1988 by watershed.

Vegetated Wetlands										
WS	TP1	TP2	TP3	TP4	TP5	TP8	TP11	TP12	TOTAL	%
AC	0	0	0	0	0	0	0	0	0	0.00%
BBN	0	625	0	50	0	0	0	850	1525	.79%
ESB	735	675	0	0	0	0	0	57428	58838	30.40%
ESS	13530	765	0	1200	0	360	0	4250	20105	10.39%
JR	8227	0	0	8560	1030	2375	1175	10479	31846	16.45%
MPB	389	1717	0	250	0	0	0	0	2356	1.22%
NNB	4920	246	0	150	0	0	0	586	5902	3.05%
PB	1585	75	2300	1900	0	2550	0	4000	12410	6.41%
PR	1324	205	10	116	60	1300	50	2982	6047	3.12%
RR	3378	2456	8136	82	100	120	10000	4897	29169	15.07%
SB	5326	5320	0	5033	0	10	0	950	16639	8.60%
YR	560	77	0	0	8100	0	0	0	8737	4.51%

## Non-vegetated Wetlands

WS	TP13	TP14	TP15	TP16	TOTAL	%
AC	0	0	0	0	0	0.00%
BBN	0	530	1350	1500	3380	.47%
ESB	2630	1520	3916	1120	9186	1.27%
ESS	1440	5500	400	1821	9161	1.27%
JR	66830	20326	33830	17826	138812	19.25%
MPB	0	112715	11690	4064	128469	17.81%
NNB	0	2120	16592	0	18712	2.59%
PB	30150	4325	26963	6880	68318	9.47%
PR	0	6900	64610	0	71510	9.92%
RR	3819	31228	38586	298	73931	10.25%
SB	0	18165	24151	152485	194801	27.01%
YR	0	3153	770	927	4850	.67%

## WATERSHED

AC	=	Atlantic Coast - Virginia Beach
BBN	=	Back Bay North Landing River
ESB	=	Eastern Shore Bayside
ESS	=	Eastern Shore Seaside
JR	=	James River Basin
MPB	=	Middle Peninsula Bayshore
NNB	=	Northern Neck Bayshore
PB	=	Peninsula Bayshore
PR	=	Potomac River Basin
RR	=	Rappahannock River Basin
SB	=	Southern Bayshore
YR	=	York River Basin



Table 4. Shoreline alterations permitted during 1988 in tidal Virginia by county.

COUNTY	BULKHEAD (linear ft.)	RIPRAP (linear ft.)	TOTAL
Accomack	2674	625	3299
Alexandria	254	202	456
Caroline Co.	200	0	0
Charles City	200	145	345
Chesapeake	990	2245	3235
Chesterfield	0	0	0
Essex	846	910	1756
Fairfax	378	760	1138
Gloucester	2644	920	3564
Hampton	323	4125	4448
Hopewell	115	1500	1615
Isle of Wight	0	0	0
James City	943	0	943
King & Queen	80	0	80
King George	84	0	84
King William	200	0	0
Lancaster	768	9711	10479
Mathews	1032	3023	4055
Middlesex	1643	4213	5856
New Kent	311	0	0
Newport News	300	438	738
Norfolk	4204	3217	7421
Northampton	636	765	1401
Northumberland	3850	9639	13489
Poquoson	559	1328	1887
Portsmouth	836	314	1150
Prince William	1060	0	1060
Richmond City	145	0	145
Richmond County	0	120	120
Stafford	1463	323	1786
Suffolk	90	194	284
Surry	0	0	0
Virginia Beach	12987	7268	20255
West Point	330	0	0
Westmoreland	2079	3626	5705
Williamsburg	375	0	375
York	<u>1359</u>	<u>1310</u>	<u>2669</u>
<b>TOTAL</b>	<b>43958</b>	<b>56921</b>	<b>100879</b>

## Discussion

The majority of the tidal wetlands authorized to be impacted in 1988 were non-vegetated. However, of the vegetated impacts authorized, the majority was in the Group I marshes, Saltmarsh Cordgrass Community (Type I), Freshwater Mixed Vegetation Community (Type XI) and Brackish Water Mixed Vegetation Community (Type XII). These types are normally to be afforded the highest order of protection but appear to be accruing most of the impacts, perhaps because of their wide occurrence as fringe marshes.

Vegetated tidal wetlands permitted to be impacted were greatest on the Eastern Shore where losses on the Bayside were higher than the Seaside. This was primarily due to a single project impacting over one acre.

The data appear to indicate a certain affinity for particular types of structures in the four watersheds showing the greatest amount of shoreline alterations permitted, Potomac River (PR), Rappahannock (RR), James River (JR) and Southern Bayshore (SB). The predominantly rural areas, PR

and RR, permitted more riprap, 20,122 LF, than bulkheading, 11,420 LF. The opposite was true in the more urban areas, JR and SB, where more bulkheading, 18,977 LF, than riprap, 13,774 LF, was permitted. It is unknown whether this is a true preference or rather something dictated by local circumstances such as the nature of adjacent shoreline structures, economics or engineering considerations.

## Summary

The Pilot Program reported here has demonstrated that the database can be an effective tool in compiling data on the cumulative impact of permitted wetlands losses. Future efforts will be directed at modifications to improve the versatility of the database and its value to the wetlands management process. Those already proposed include expanding the types of construction activities covered, creating a fill category that will indicate the actual area of habitat permitted to be lost and providing a summary of required compensation.



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