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A natural resources survey and habitat evaluation of the Willoughby Disposal Area, U.S. Naval Base, Norfolk, Virginia

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Natural Resources Survey of Willoughby Disposal Area

INTRODUCTION

The purpose of this study is to determine the living natural resources utilizing the U.S. Navy's dredged material disposal area located adjacent to Willoughby Bay in Norfolk, Virginia and to determine the habitat value of this area to these resources.

The Willoughby Disposal Area was created by constructing an earthen dike around approximately 75 to 80 acres of the eastern portion of Willoughby Bay. It was constructed in the early 1950's to provide a disposal area for material dredged for the seaplane landing channels at the Naval Air Station. The dredged material pumped into the site was primarily sand. Upon completion of the dredging the area was apparently rough graded and a series of drainage ditches excavated to facilitate drainage. These ditches were connected to Willoughby Bay by an outlet channel on the northern perimeter of the diked area. The bottom elevations of the ditches are below mean high water allowing daily inundation by tidal waters.

In the ensuing thirty years the disposal area has been colonized by numerous plants ranging from upland to intertidal wetland plants depending on elevation and the amount of inundation by tidal waters. As a result, the disposal area provided habitat for numerous invertebrates, fish and wildlife species.

The Navy plans to use the area again for the placement of dredged material from a new aircraft carrier berth. This will fill the area eliminating the habitat which has developed over the years.

METHODS

All of the data for this project were obtained during the month of December, 1981.

The tidal heights were determined by tide staff observations during spring tides during the study. These were correlated with a mean sea level benchmark provided by the Navy. It was not possible to correlate these tide heights with the tide guage at Sewells Point or because of possible vandalism to install a tide guage in the study area.

The wetlands and other plant communities were mapped with aerial photographs taken by VIMS for this project with a Hassellblad 70 mm format camera using Kodak Aerochrome 2443 infra-red transparency and VPS color print film. The basic outline of the vegetation map was taken from the 36" x 36" black and white VDH&T aerial photograph supplied by the Navy. The general distribution of the community types was initially determined from this imagery. It was then ground-truthed and transferred to the vegetation map using a Bausch and Lomb Zoom Transfer Scope. Each community type was planimetered with a Numonics Graphic Calculator to determine the acreage.

The benthic community in the ditches was sampled using the method developed by Diaz (1981)[1]. This consisted of five 3.75 inch diameter cores taken on each of three 80 foot transects along the ditches at low tide. One transect was located along the upper end of the main stem ditch, one along the lower end near its exit point and one along a tributary ditch on the north side of the main ditch. Each set of 5 cores was combined and sieved through a 1.0 mm mesh screen. Material retained on the screen was preserved in 10% formalin and stained with rose bengal. All invertebrates were removed and separated into three groups;annelids, molluscs and crustaceans, counted and weighed for use in the evaluation procedure.

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[1]Diaz, R. J. 1981. Examination of tidal flats: Vol. 3, Evaluation Methodology. Final Contract Report, DOT-FH-11-9360, Federal Highway Administration, Washington, D.C. 20590

Fish utilizing the study area were sampled by deploying a block net across the mouth of the western most tributary ditch running north. The net was left in place until low tide when the ditch was almost dry. Presumably the majority of the fish in the ditch at high tide were caught in the net. These fish were separated by species, counted and measured.

Bird utilization was determined by observation in the field over two full days. Additionally, the observer, based on the type of habitat and its location, prepared a list of birds which might be expected to utilize the area at other times of the year.

The small mammal population was surveyed by setting live traps baited with sunflower seeds at approximately 10 meter intervals. The study area was divided into sub-areas which were sampled in succession. Two consecutive nights of trapping were obtained in most of the areas. Traps were inspected daily with one exception and animals captured were identified and either released or taken to the Laboratory of Endocrinology and Population Ecology at the College of William and Mary for autopsy and further analysis. An attempt was made to capture larger species but due to vandalism and theft of two large traps, it was necessary to remove all large traps from the study area. Thus, estimates of larger mammal species are based on signs only.

RESULTS

During the winter most animal populations are at their lowest level of the year and many species which might occur in relatively large numbers at other times of the year are completely absent or present in reduced numbers. Consequently, this seasonal bias must be taken into consideration when interpreting the data presented in this report.

The mean tide range data for Sewells Point, the closest established tide station to Willoughby Bay are as follows:

Mean Tide Range	2.5 ft.
Average Spring Tide Range	3.0 ft.
Mean Tide Level	1.2 ft. MLW (MSL)

The highest tide observed during the study was on 11 December 1981 during the full moon. It peaked at 2.25 ft. MLW inside the disposal area and 2.03 ft. MLW in Willoughby Bay according to the MSL datum supplied by the Navy. The predicted high at Sewells Point was 3.2 ft. MLW. The discrepancy between the predicted and observed heights in the Bay can probably be attributed to a 20-30 mph NW wind which had been blowing for the preceding two days. The +0.2 ft. difference between the tide height inside the disposal area and the Bay is probably the result of a funneling effect which causes tides to be higher at the upper end of a narrow creek than at the lower end. The ditches ebbed dry at low tide.

The spring tide of 11 December 81 inundated almost all of the saltmarsh cordgrass, Spartina alterniflora, stands in the study area but did not affect the saltmeadow, Distichlis spicata, or saltbush, Iva frutescens, stands.

Application of the tidal requirement of the Virginia definition of tidal wetlands, i.e. those areas contiguous to mean low water up to an elevation above MLW of 1.5 times the mean tide range, would indicate the upper limit of tidal wetlands is 3.75 ft. MLW (2.5 ft. mean tide range x 1.5) based on Sewells Point.

Assuming the increase in tide height inside the study area as compared to that in Willoughby Bay noted on 11 December is a regularly occurring phenomenon the tide range within the study are may be larger than that at Sewells Point. If the mean tide range within the study area is as much as 2.6 ft. or possibly 2.7 ft. which is the highest it would probably be, the upper limit of tidal wetlands as defined by the Commonwealth of Virginia would be 3.9 ft. MLW or 4.05 MLW respectively or approximately the 4.0 MLW contour shown on Figure 1.

The basic community types found within the study area and the acreage of each are given in Table 1. The percent of the total acreage is based on the outline of the study area depicted in Figure 1. The mudflat, saltmarsh cordgrass and saltmeadow communities are all definitely tidal wetlands comprising a total of 5.72 acres.

The saltbush community occupies the ecotone or transition zone between the tidal wetlands and the non-tidal communities. However, based on the limited tide data obtained during this study I do not believe that the entire 5.71 acres should be considered tidal wetlands. Community members including groundsel tree, Baccharis halimifolia, saltmeadow hay, Spartina patens, and common reed, Phragmites australis can and do grow in both tidal and non-tidal situations. Also, there is no clear vegetation zonation within this community and no real indication of tidal inundation except for stunted growth of groundsel tree and common reed in some areas that can be used to determine the upper limit of wetlands (ULW) based on vegetation alone. Hence, I feel that a reasonable ULW is the 4 ft. MLW contour shown on Figure 1. This is consistent with the Virginia definition of tidal wetlands based on the available tide data and should satisfy most, if not all, of the requirement of periodic inundation of wetlands by Section 404 of the Clean Water Act.

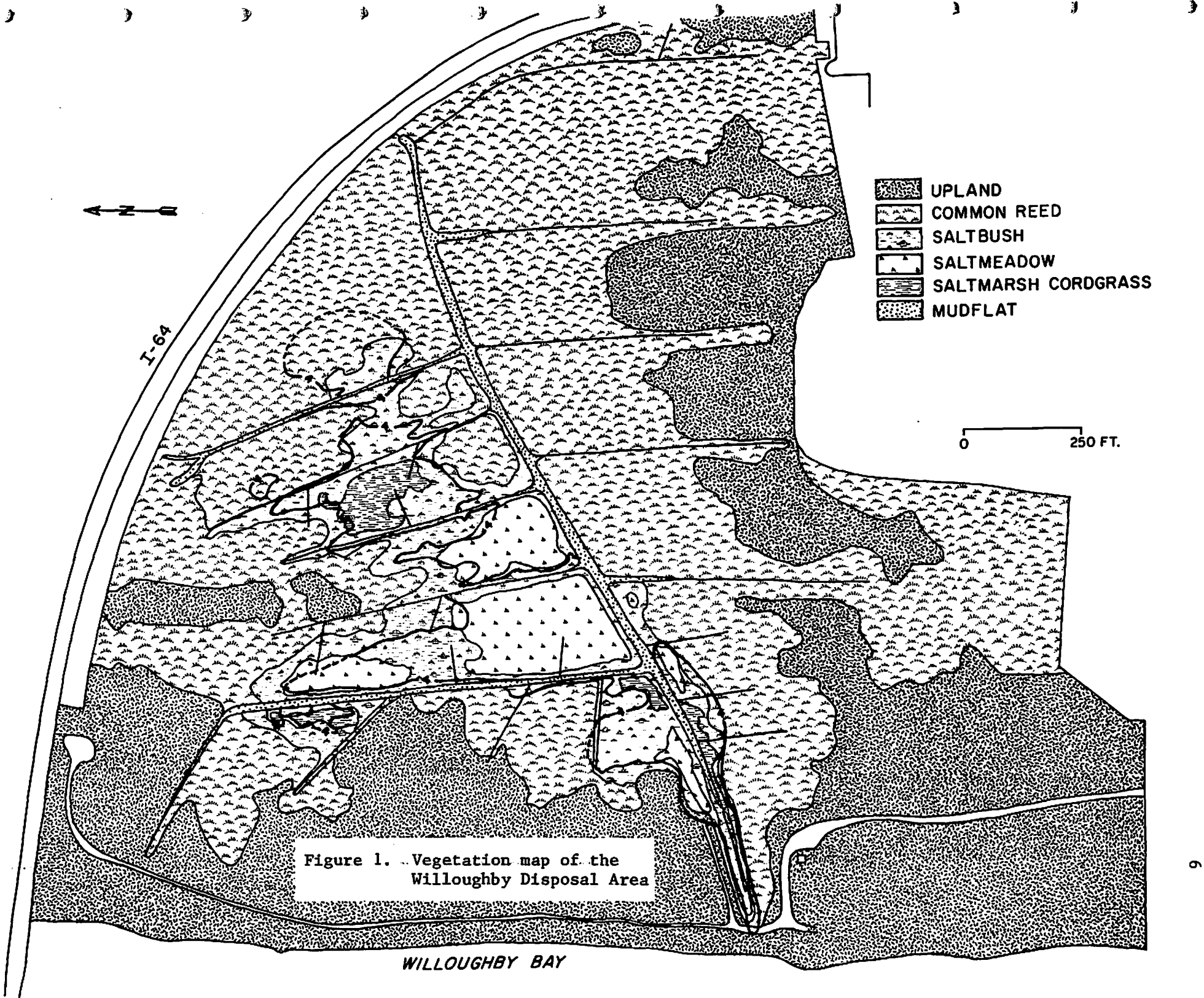

Figure 1. Vegetation map of the Willoughby Disposal Area

Table 1 . Descriptions and acreages of the non-vegetated and vegetated community types in the Willoughby Disposal Area.

COMMUNITY	DESCRIPTION	ACREAGE	%
Mudflat	Non-vegetated intertidal area in the center of the ditches consisting of organic silt and clay with a surface layer of microalgae	1.62	2.2
Saltmarsh Cordgrass	Dominated by saltmarsh cordgrass, Spartina alterniflora along ditches with some scattered glasswort, Salicornia spp., in higher areas	1.56	2.1
Saltmeadow	Primarily saltgrass, Distichlis spicata, with scattered small stands and individuals of marsh elder, Iva frutescens, and saltmeadow hay, Spartina patens	2.54	3.4
Saltbush	Dominated by marsh elder, Iva frutescens, and groundsel tree, Baccharis halimifolia, with small areas of saltmeadow hay, saltgrass and common reed intermixed	5.71	7.7
Common reed	Most extensive type dominated by common reed, Phragmites australis, with scattered stands of saltbush primarily groundsel tree	32.13	43.5
Upland	Highest areas dominated by typical terrestrial old field grasses, weeds and shrubs	30.36	41.1
	TOTAL	73.92	100

The acreage of the saltbush community below the 4.0 ft. MLW contour in the study area is 1.88 acres. This combined with the 5.72 acres of wetlands already mentioned totals 7.60 acres. This I feel is a reasonable and accurate estimate of the tidal and/or periodically inundated wetlands found within the Willoughby Disposal Area.

The benthic invertebrate data and value indices on a scale of one to three are given in Table 2. These data indicate that the mudflat community in the study area supports a generally moderate population of annelid worms and a moderate population of molluscs in some areas. The population of crustaceans appears to be somewhat low. These estimates are by no means quantitative or definitive but represent the relative value of these populations based on the criteria developed by Diaz (1981).

The fish caught during the block net sampling were as follows:

Mummichog	Fundulus heteroclitus	339
Atlantic silversides	Menidia menidia	4
Stargazer	Astroscopus guttatus	1

The length frequences of the F. heteroclitus caught are given in Figure 2. The four M. menidia ranged from 44-55 mm in length. The one A. guttatus was 19 mm in length. The total area of marsh and mudflat sampled was approximately 25,000 square feet.

The number of F. heteroclitus caught is about what would be expected at this time of year. During the summer months numbers would be much higher. The fish are probably all young-of-the year overwintering in the marsh. The number of M. menidia is very low compared with the numbers that would be found during the summer. A. guttatus is a resident lower Bay species which spawns near the mouth of the Bay. The larvae and juveniles use the shallow creeks as a nursery area.

Table 2 . Evaluation of benthic cores

	Sample Location								
	Main ditch upper end			Main ditch lower end			Tributary Ditch		
Population	Abundance Ind/m^2	Biomass g/m^2	Value Index	Abundance Ind/m^2	Biomass g/m^2	Value Index	Abundance Ind/m^2	Biomass g/m^2	Value Index
Annelids	3,342.7	16.29	2	1,376.4	3.37	1 or 2	1,320.2	9.27	2
Molluscs	112.4	94.66	2	None Found			84.3	24.16	1 or 2
Crustaceans	84.3	0.56	1	196.3	2.25	1	112.4	0.84	1

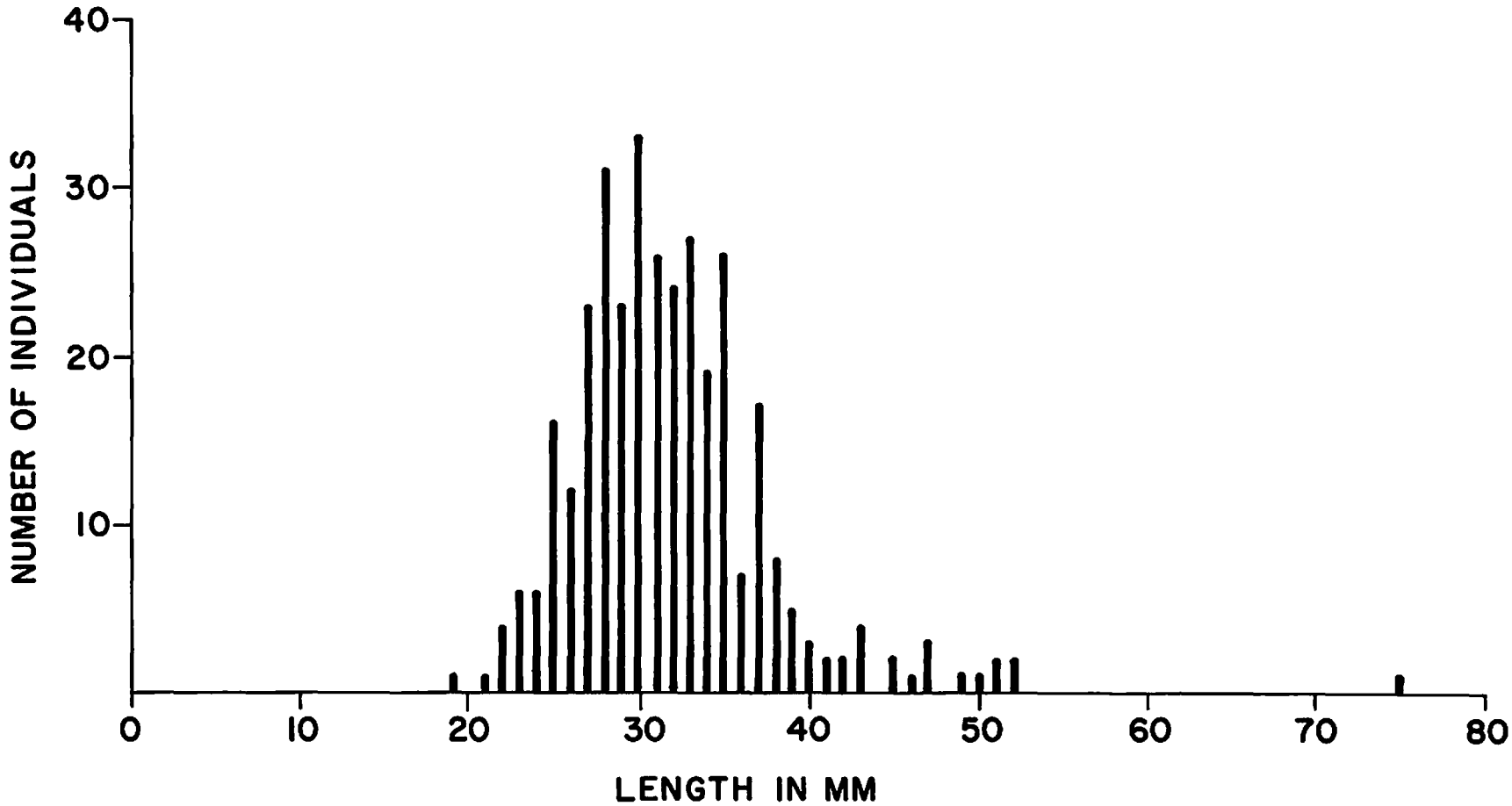

Figure 2. Length frequencies of Fundulus heteroclitus caught 11 Dec. 1981 by block net in Willoughby Disposal Area.

Other fish and macroinvertebrates which probably utilize the study area in substantial numbers during other times of the year include but are not limited to:

Spot	Leiostomus xanthurus
Croaker	Micropogon undulatus
Bay Anchovy	Anchoa mitchilli
Menhaden	Brevoortia tyrannus
Striped Killifish	Fundulus majalis
Sheepshead Minnow	Cyprinodon variegatus
Mullet	Mugil spp.
Blue Crab	Callinectes sapidus
Grass Shrimp	Palaemonetes pugio

The birds observed in the disposal area during the study are listed in Table 3 along with the number observed and habitat. The most abundant species observed in all community types was the song sparrow. The largest numbers of song sparrows were observed in the saltmeadow area with only one or two being sighted in the common reed community. The meadowlark was the next most abundant bird preferring the upland scrub areas. It appeared to be a permanent resident of the study site. The common grackle, although sighted in relatively high numbers, was considered to be more of a transient flying in and out of the disposal area.

The highly mobile and transient nature of birds makes the assessment of their use of an area very difficult without extended observations, particularly during the nesting season and spring and fall migrations. However, lists were compiled indicating species which would probably utilize the area as permanent residents, winter residents, spring and summer residents and during spring and fall migrations (Tables 4-7).

The results of the small mammal trapping survey are presented in Table 8. Comments on the relative abundance of the species trapped and the species whose presence was indicated by tracks, droppings or other signs are provided below.

Table 3 . Birds observed during field studies in the Willoughby Disposal Area.

Species observed on 12/19/81
8:30 am to 4:50 pm
conditions: very cold, windy (20 mph)

Middle of marsh:
*(1) Sharp-Shinned Hawk
(12) Song Sparrow
(1) Clapper Rail (found dead)
(2) Killdeer
(15) Common Grackle
(2) Dunlin

Scrub:
(2) Meadowlark
(5) Song Sparrow

Species observed on 12/20/81
8:50 am to 5:05 pm
colder but less windy (5-10 mph)

Middle of marsh:
(1) Great Blue Heron (tidal creek)
(1) Clapper Rail
(5) Killdeer
(2) Kestrel
(20) Song Sparrow

Scrub area:
(9) Meadowlark
(6) Song Sparrow

*( ) = number of individuals sighted

Note: numerous Double-Crested Cormorants were seen flying over the marsh on both days (approx. 20 to 25 birds each day), but none were actually seen <u>in</u> the marsh.

Table 4 . Permanent year-round resident birds expected to utilize the Willoughby Disposal area.

Pied Billed Grebe	Podilymbus podiceps
Black Duck	Anas rubripes
Mallard	Anas platyrynchos
Clapper Rail	Rallus longirostris
Red-Tailed Hawk	Buteo jamaicensis
Belted Kingfisher	Megaceryle alcyon
Fish Crow	Corvus ossifragus
Common Yellowthroat	Geothlypis trichas
Red-Winged Blackbird	Agelius phoenicious
Brown-Headed Cowbird	Molothrus ater
Starling	Sturnus vulgaris
Northern Cardinal	Cardinalis cardinalis
Sharp-Tailed Sparrow	Ammospiza caudacuta
Marsh Wren	Cistothorus palustris
Great Black-Backed Gull	Larus marinus
Eastern Meadowlark	Sturnella magna
American Goldfinch	Carduelis tristis
Killdeer	Charadrius vociferus
American Kestrel	Falco sparverius

Table 5 . Winter resident birds expected to utilize the Willoughby Disposal area and adjacent waters of Willoughby Bay.

Disposal Area

American Coot	Fulica americana
Ring-Billed Gull	Larus delawarensis
Great Blue Heron	Ardea herodias
Common Snipe	Capella gallinago
Sharp-Shinned Hawk	Accipiter striatus
Northern Harrier	Circus cyaneus
Merlin	Falco columbarius
Short-Eared Owl	Asio flammeus
Dunlin	Calidris alpina
Sanderling	Calidris alba
Sedge Wren	Cistothorus platensis
Yellow-Rumped Warbler	Dendrioca coronata
Swamp Sparrow	Melospiza georgiana
Savannah Sparrow	Passerculus sandwichensis
Horned Grebe	Podiceps auritus
Field Sparrow	Spizella pusilla
White Throated Sparrow	Zonotrichia albicollis
Northern Junco	Junco hyemalis
Song Sparrow	Melospiza melodia
American Bittern	Botaurus lentiginosis
Virginia Rail	Rallus limicola
Woodcock	Philohela minor
Cooper's Hawk	Accipiter cooperi

Willoughby Bay

Double-Crested Cormorant	Phalacrocorax auritus
Atlantic Brant	Branta bernicula
Canada Goose	Branta canadensis
Gadwall	Anas strepera
Common Pintail	Anas acuta
American Widgeon	Anas americana
Green-Winged Teal	Anas crecca
Lesser Scaup	Athya affinis
Bufflehead	Bucephala albeola
Ruddy Duck	Oxyura jamaicensis
Redhead	Aythya americana
Canvasback	Aythya valisineria
Common Goldeneye	Bucephela clangula
Common Loon	Gavia immer

Table 6 . Spring and summer resident birds expected to utilize the Willoughby Disposal area.

Common Gallinule	Gallinula chloropus
Laughing Gull	Larus atricilla
Common Tern	Sterna hirundo
Forster's Tern	Sterna forsteri
Little Blue Heron	Florida caerulea
Great Egret	Casmerodius albus
Black-Crowned Night Heron	Nycticorax nycticorax
Yellow-Crowned Night Heron	Nyctinassa violacea
Green Heron	Butorides striatus
Least Bittern	Ixobrychus exilis
Glossy Ibis	Plegadis falcinellis
Black Rail	Laterallus jamaicensis
Osprey	Pandion haliaetus
Seaside Sparrow	Ammospiza maritima
Barn Swallow	Hirundo rustica

Table 7 . Birds expected to utilize the Willoughby Disposal area during spring and fall migrations

Short-Billed Dowitcher	Limnodromus griseus
Greater Yellowlegs	Tringa melonoleuca
Lesser Yellowlegs	Tringa flavipes
Least Sandpiper	Calidris minutella
Western Sandpiper	Calidris mauri
Tree Swallow	Iridoprocne bicolor
Blue-Winged Teal	Anas discors
Whimbrel	Numenius phaeopus
Spotted Sandpiper	Actitis macularia
Willet	Catoptrophorus semipalmatus
Ruddy Turnstone	Arenaria interpres
Royal Tern	Sterna maxima
Boat-tailed Grackle	Quiscalus major
King Rail	Rallus elegans
Black-Bellied Plover	Pluvialis squatarola
Semipalmated Plover	Charadrius semipalmatus

Table 8. Trap captures during mammal survey of the Willoughby Disposal Area.

Habitat/Species	House mouse *Mus musculus*	White-footed mouse *Peromyscus leucopus noveboracensis*	Meadow vole *Microtus pennsylvanicus*	Rice rat *Oryzomys palustris*	Norway rat *Rattus norvegicus*
Upland	110	18	2	0	0
Reed	156	11	0	5	1
Shrub	97	47	1	2	0
Marsh	86	0	0	1	1
TOTAL	449 83.5%	74 14%	3 0.5%	8 1.5%	2 0.4%

Total animals caught = 539
Total traps set = 993
Success ratio = .54

House Mouse (Mus musculus). There were 449 captures of this species, which represented83.5% of the total number of animals captured. While some of these captures were no doubt the same animals captured twice, this is never-the-less an extremely high population and an unusual occurrence. As such, the situation presently offers an unusual opportunity for significant further study. One might predict an outbreak into the surrounding area or a population crash.

White-footed Mouse (Peromyscus leucopus noveboracensis). This species was recorded 76 times (14% of all captures), 47 of which were in shrub habitat, an expected occurrence. Considering the proportion of the area which was of upland shrub habitat, the population level of this mouse is fairly high.

Rice Rat (Oryzomys palustris) and Norway Rat (Rattus norvegicus) populations appear to be lower than expected for this area. This may be due to the fact that the traps are somewhat small to capture adults of these species.

Meadow Vole (Microtus pennsylvanicus). The population of this species appears low probably influenced by relatively little preferred habitat for this species.

Raccoon (Procyon lotor) and Muskrat (Ondatra zibethica) populations appear moderate to high based on tracks and feces occurrence primarily along the drainage ditches.

Eastern Cottontail rabbit (Sylvilagus floridanus). This species appears to be very numerous in the upland areas as indicated by feces density.

Striped Skunk (Mephitis mephitis)and Opossum (Didelphis virginiana). No individuals of this species were seen. Also, no signs were seen. One would expect, however, a few animals to be living on the area.

No Red Fox (Vulpes fulva)or Gray Fox (Urocyon cinereoargenteus) were seen, perhaps due to the large number of dogs that frequent the area. Since the area is fenced and surrounded by a major highway and high density human housing, the fox population would be expected to be low or non-existent.

No shrews were captured but it may be that the traps were too large for some of the small species such as the Southeastern Shrew (Sorex longirostris) or the Least Shrew (Cryptotis parva). I would expect that there would be populations of each of these species present.

DISCUSSION

The data collected during this study indicate that the Willoughby Disposal Area supplies a number of ecological support functions and provides habitat for a wide variety of both estuarine and terrestrial plants and animals.

Approximately 10% (7.6 acres) of the area is tidal or at least periodically inundated by storm tides. Of this 7.6 acres the areas most valuable to estuarine resources are the intertidal mudflats (1.62 acres) and the saltmarsh cordgrass marsh (1.56 acres). They are a highly productive source of organic material in the form of detritus which supports large portions of many estuarine food webs. They also provide habitat for numerous fishes, invertebrates, waterfowl and furbearers. They serve as a nursery area for the juveniles of many commercially important finfish and shellfish as well as the spawning areas and year round habitat for important forage species, e.g. Fundulus heteroclitus. The mudflats and intertidal marsh soils also play major roles in the cycling of nutrients, nitrogen and phosphorus, vital to maintaining the high level of productivity characteristic of estuaries.

The remainder of the tidal wetlands in the disposal area, 2.54 acres of saltmeadow and 1.88 acres of saltbush, are slightly less valuable to the estuary because they are inundated probably only five to ten days a month

during the new and full moons and also during storms. They perform many of the same functions as the intertidal marsh and provide habitat similar in nature when inundated by tidal waters. The results of this study also indicate that they provide valuable habitat to many of the birds and mammals utilizing the area.

The physical configuration of the wetlands drainage system, particularly the outlet culvert under I-64 which is the only connection to tidal waters, compromises somewhat the value of the area to the estuary. The most important value affected is that of detritus export. Also affected is the value of the area as a buffer against flooding by storm tides. This restriction limits the amount of water which can be exchanged with the area during a tidal cycle.

There is every indication that the benthic invertebrates and forage fish communities are healthy, productive and providing food chain support for larger fish, birds and mammals utilizing the area and adjacent waters.

Although, very difficult to assess due to the time of year of the study, the study area appears to provide habitat for a wide diversity of bird species. Of particular note is the number of raptors, hawks and owls, sighted or indicated including an owl bolus containing the remains of a large rodent found in the saltmeadow area. They are probably being attracted to the area by the unusually large number of small mammals found in the study area. The study area also appears to provide habitat for substantial populations of rabbits, raccoons and muskrats in an otherwise highly developed area.

In summary, despite the seasonal bias and one month time frame of the study the results indicate a diverse and productive habitat has developed within the disposal area since its construction 30 years ago.

Proposed Mitigation Site

The proposed mitigation site consists of approximately 9.15 acres located immediately north of Interstate 64 from the proposed disposal area (Fig.3). It appears to be part of the original disposal area with remnants of the perimeter dike still apparent.

The mitigation site itself is divided into two parts by a large dredged ditch which connects to Willoughby Bay. The eastern portion is the largest, approximately 7.27 acres, and is almost entirely upland with only a very narrow fringe of saltbush marsh along the ditch. It is presently enclosed with a high chain link fence. The western portion, approximately 1.88 acres, consists of an isolated section of the old dike and a narrow strip of land along the I-64 right-of-way bordering an arm of Willoughby Bay. There is a fairly well developed fringe marsh along the seaward perimeter of this area.

The vegetation on the proposed mitigation site was mapped using the same methods as were employed for the disposal area. The plant communities present are depicted in Figure 3. A description of these communities and their respective acreages are presented in Table 9.

The data on the bird observations were included in Table 3 for the entire study site. Those birds observed in the mitigation area included two meadow larks and six song sparrows.

The small mammal capture data presented in Table 8 included seventeen house mice and one white-footed mouse captured in the mitigation area. A total of 53 traps were set, for a trap success ratio of .34.

The number of birds and small mammals found in the proposed mitigation area appear to indicate a lower utilization of this area by these species than comparable upland habitat in the disposal area.

No tidal, finfish or benthic community data were taken for the proposed mitigation area because it did not appear to be necessary due to the relatively small area of aquatic habitat involved.

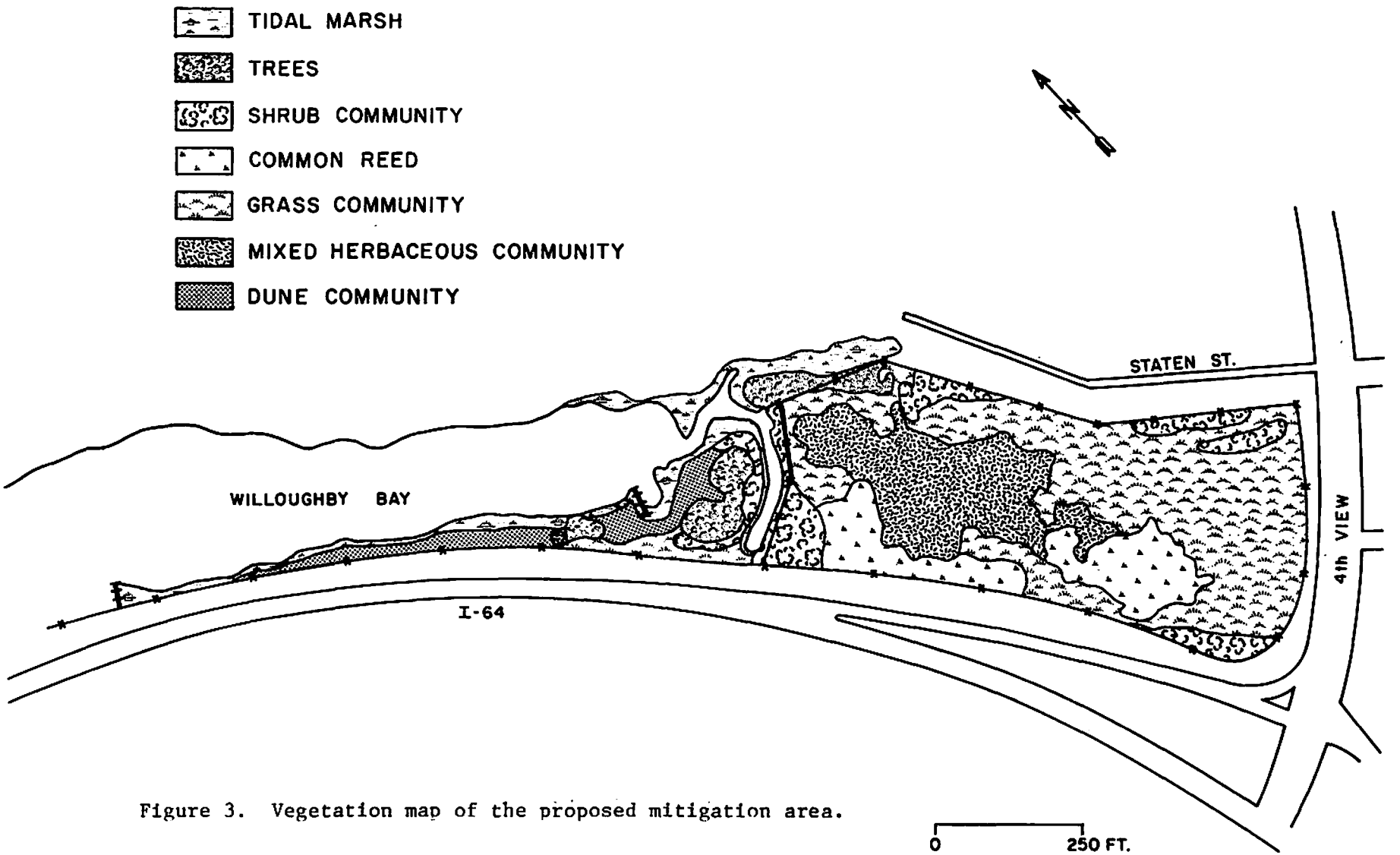

Figure 3. Vegetation map of the proposed mitigation area.

Table 9. Plant communities and acreages of the proposed mitigation site north of I-64. The important plants in each community are listed in decreasing order of coverage within the community.

Community	Species		Acreage	%
Dune	*Panicum amarum*	bitter panicum	.55	6.0
	Carex kobomugi	Japanese sedge		
	Spartina patens	saltmeadow hay		
	Diodia teres			
	Solidago sp.	goldenrod		
	Lechea maritima var. *virginica*	Virginia pinweed		
Tidal Marsh	*Spartina alterniflora*	saltmarsh cordgrass	.62	6.8
	Iva frutescens	marsh elder		
	Spartina patens	saltmeadow hay		
Tree	*Quercus virginiana*	live oak	.41	4.5
	Prunus serotina	black cherry		
	Robinia pseudoacacia	black locust		
	Myrica cerifera	wax myrtle		
	Albizia julibrissin	mimosa		
Shrub	*Baccharis halimifolia*	groundsel tree	1.02	11.1
	Rhus glubra	smooth sumac		
	P. serotina	black cherry		
Reed	*Phragmites australis*	common reed	1.18	12.9
Mixed Herbaceous	*Eupatorium capillifolium*	dog fennel	1.64	17.9
	Asteraceae	asters		
	Echinochloa sp.	wild millet		
	Polygonum sp.	knotweed		
	Rubus sp.	blackberry		
	Lonicera sp.	honeysuckle		
	Solidago sp.	goldenrod		
	B. halimifolia	groundsel tree		
	P. australis	common reed		
	Phytolacca americana	pokeweed		
Grass	*Panicum* spp.	panic grass	3.73	40.8
	Digitaria sp.	crab grass		
	Andropogon virginica	broomsedge		
	S. patens	saltmeadow hay		
	Setaria sp.	foxtail grass		
		TOTAL	9.15	100%

The vegetation of the large eastern portion of the mitigation site is unremarkable, being typical of old field or disturbed area succession in the Norfolk area. None of the plants identified in this area are of exceptional value to wildlife with the possible exception of wild millet which produces a large number of seeds which are commonly eaten by birds. The other grasses, herbs and shrubs present provide food, cover, and nesting habitat for some birds and small mammals but none is of particular significance.

The western portion of the mitigation site, however, does contain two areas of some ecological importance. One is the tidal marsh and shallow water habitat which is an important component of the estuarine ecosystem as previously described in the disposal area section. The other is the dune community. This relatively small area is important because it supports a small stand, five to ten individuals, of the Virginia pinweed, Lechea maritima var. virginica, which is listed by Porter (1979)[2] as a threatened plant species in Virginia. I am not sure whether this plant has colonized the area since the construction of the dike or whether the stand is located on a remnant of the old dune system which according to an aerial photograph taken in 1937 was located in this general area. In either case the area should be preserved because the habitat for this plant is becoming increasingly scarce due to development in the Willoughby-Ocean View area.

The Virginia pinweed is neither on nor is it being considered for inclusion in the federal Endangered Species Act according to the U.S. Fish and Wildlife Service office in Gloucester Point. To the best of my knowledge there are no statutory requirements for preservation of this species under Virginia law even though it is listed as threatened by Porter (1979).

In summary, if the proposed mitigation site is chosen for this purpose, its use should be restricted to the eastern 7.27 acre portion, essentially

[2]Porter, Duncan M. 1979. Vascular Plants. In: "Proceedings of the Symposium on Endangered and Threatened Plants and Animals of Virginia", D. W. Linzey (ed.), Center for Environmental Studies, VPI&SU, Blacksburg, Va. p. 31-122.

the fenced area. This would result in displacement of the relatively small amount of wildlife currently using the area, but would preserve the more ecologically important tidal marsh and dune habitat discussed above.

Evaluation of Mitigation Alternatives

The following alternatives were considered for mitigation of the wetlands to be destroyed by the proposed project:

1. No mitigation
2. Off-site mitigation
3. Subaqueous filling for wetland creation
4. Using a portion of the proposed disposal area for wetland creation
5. Using the site north of I-64 for wetland creation

The no mitigation alternative would result in the loss to the estuarine ecosystem of 7.60 acres of tidal wetlands and associated resources. Mobile organisms, fishes, crabs, birds and mammals, that could possibly avoid destruction by the proposed project would be displaced to adjacent existing habitats where they might be able to survive if sufficient food and cover were available to them. Non-mobile resources, benthic invertebrates and wetlands vegetation would be completely destroyed.

The off-site mitigation alternative would involve the creation of wetland habitat at some location removed from the immediate project area. Generally, the further away from the project site, the less valuable this type of mitigation is to the resources being impacted. If the off-site location is in another river system its mitigative value to the affected resources is questionable.

To fill subaqueous bottom in Willoughby Bay or adjacent waters would require the destruction of already productive estuarine habitat of value to finfish, shellfish and waterfowl in order to create another type of estuarine habitat. Justification for this type of mitigation is very difficult unless

there is absolutely no other alternative for disposal of the dredged material. Permission would have to be obtained from the Virginia Marine Resources Commission to fill state-owned bottom. It would also probably be opposed by the holders of any shellfish leases in the area.

Using a portion of the proposed disposal site would simply involve reducing the size of the area used for spoil disposal to create the appropriate amount of wetlands. The feasibility of this alternative would, of course, depend on engineering considerations of the reduced capacity and future plans for the disposal area. The displacement of mobile species and destruction of habitat involved in this alternative would be restricted to the disposal area only.

Utilizing the area north of I-64 for the mitigation would result in the conversion of the existing grassland-shrub habitat to a wetland habitat and the displacement of resident species to adjacent areas. The bird and small mammal populations do not appear to be as high as similar habitat within the disposal area.

From the viewpoint of the environment, using a portion of the disposal area for the mitigation site is probably the best alternative followed by the site north of I-64. The other three alternatives are, in all probability, not realistic options because of the problems inherent in each case that were described above.

MITIGATION PLAN

In the event that mitigation of the wetland area within the disposal area is required there are a number of factors which must be considered in order to satisfy this requirement. The most critical of these are:

-A reasonable proximity to the project site

-At least the same acreage as the wetlands to be lost

-Habitat similar to what is being used must be created

-Must be a non-wetland area

With these factors in mind there appear to be only two suitable sites for mitigation. One is the parcel of land north of I-64 owned by the Navy and the other is to use part of the disposal area as the mitigation site.

The parcel north of I-64 contains approximately 7.27 acres of suitable upland which is reasonably close to the 7.6 acres to be filled. It is close to the project site and could be graded down and converted into an intertidal marsh similar to that being lost.

Using a portion of the disposal area also meets all of these requirements except that the location and configuration of the mitigation site would have to be established. There is a considerable amount of flexibility in this regard which can be used to accommodate future plants for the area. One suggested location would be to use an area along the northern perimeter adjacent to I-64 as shown in Figure 4. This would provide sufficient width relative to length to ensure adequate tidal circulation and flushing and adequate protection from wave action. It could also provide material for the dike construction or at least minimize the distance the material removed to create the marsh has to be hauled to the disposal area.

In either case the site must be graded to an elevation of MSL at the lower end and sloped up to MHW at the upper or landward end of the site.

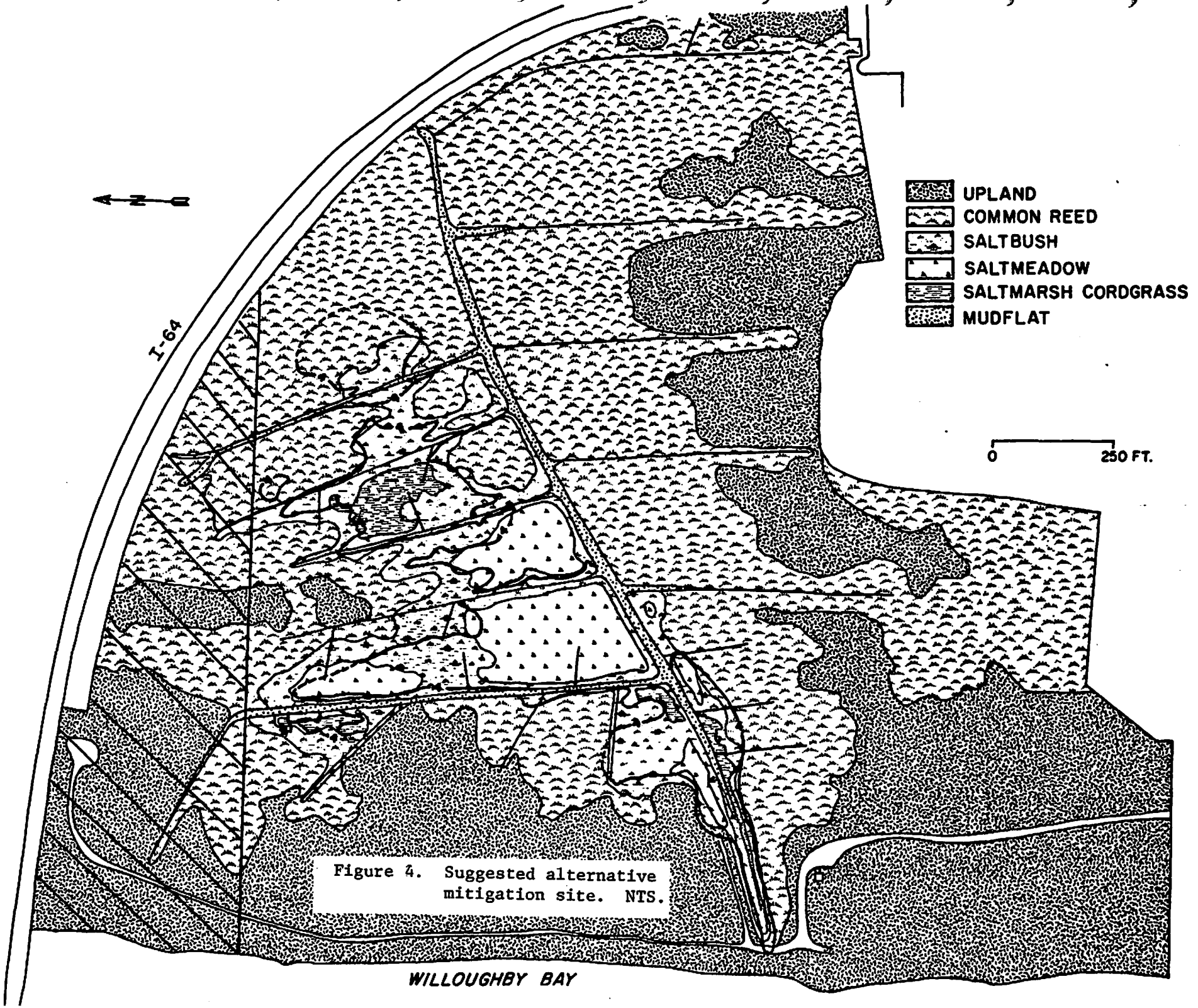

Figure 4. Suggested alternative mitigation site. NTS.

This grading is absolutely the most critical factor in creating a marsh. If it is not done correctly attempts to plant marsh grasses will meet with only limited success. The excavation should be done in the dry with the berm along the shoreline left in place. Once the grading is complete an opening should be dug through the berm to allow tidal inundation of the area to establish a natural drainage pattern. Once this is done the berm should be plugged to allow fertilizing and planting with saltmarsh cordgrass, Spartina alterniflora, seeds. The berm should then be removed to allow unrestricted tidal inundation. Mitigation with this type of wetland provides the most benefits to estuarine resources because of its high ecological value. Several small islands or hummocks of approximately .25 acres each might also be left scattered within the mitigation area to provide some diversity of habitat.