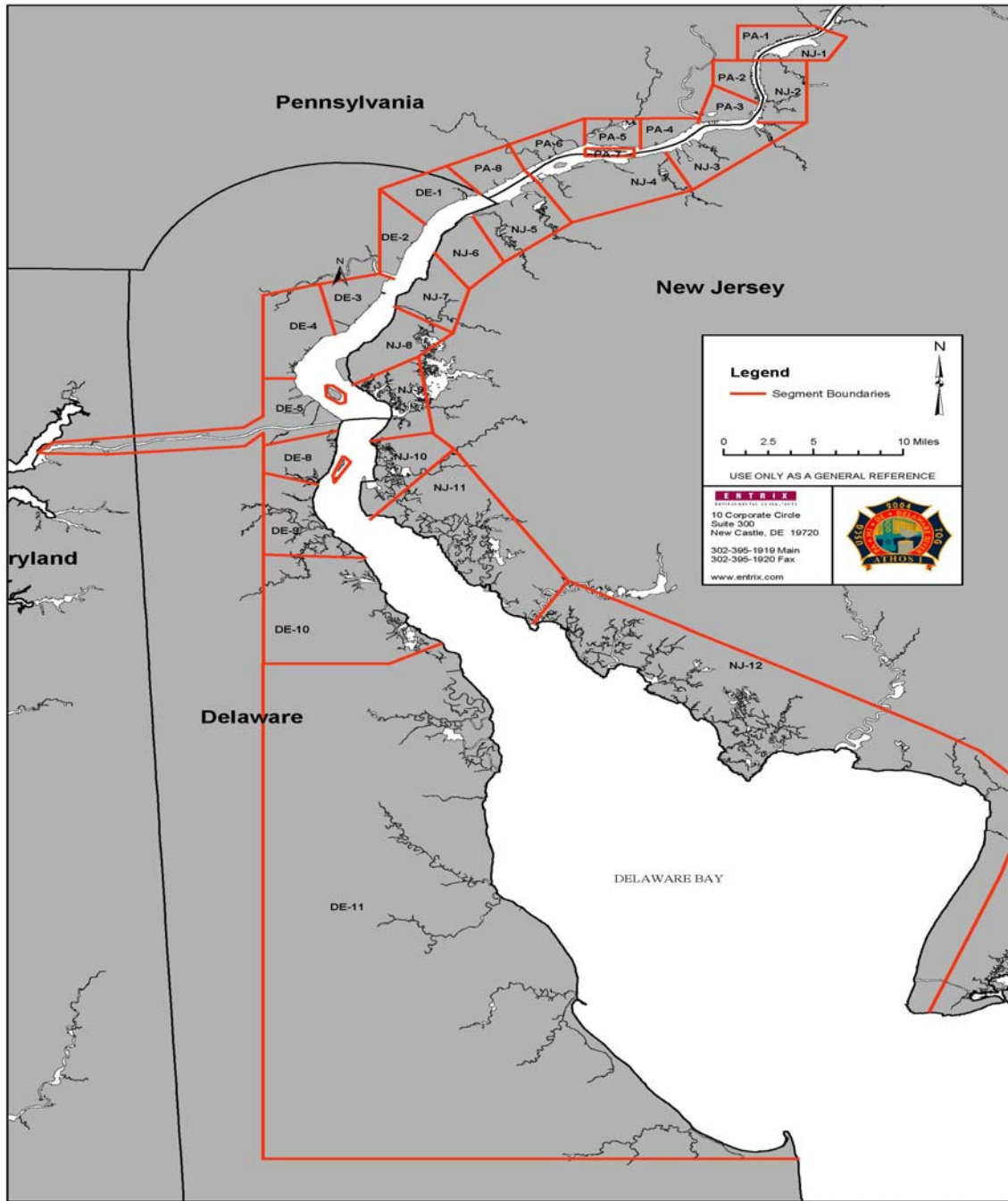


APPENDIX H

Shoreline Assessment Results

- H.1. Delineation of shoreline segments designated for shoreline (SCAT) surveys.
- H.2. Shoreline oiling categories (Very Light, Light, Moderate, and Heavy) as derived for shoreline oiling data.
- H.3. Shoreline classification from the Environmental Sensitivity index (ESI) for Delaware, New Jersey, and Pennsylvania.
- H.4. Summary of shoreline oiling data.
- H.5. Report to the Pennsylvania Bureau of Forestry on a Visit to Inspect Oil Damage to Tidal Marshes of Little Tinicum Island from the Athos I Oil Spill of November 26, 2004.

Appendix H.1. Delineation of shoreline segments designated for shoreline (SCAT) surveys.



Appendix H.2. Shoreline oiling categories (Very Light, Light, Moderate, and Heavy) as derived for shoreline oiling data.

Shoreline Oiling Width	% Oiling within Shoreline Oiling Width	Oil Thickness	Oil Characterization
<0.5 feet	<1%	<.01 cm (film)	Very Light
		>.01-.1 cm (coat)	Very Light
		>.1-1.0 cm (cover)	Light
		>1 cm (thick or pooled)	Light
	1-10%	<.01 cm (film)	Very Light
		>.01-.1 cm (coat)	Very Light
		>.1-1.0 cm (cover)	Light
		>1 cm (thick or pooled)	Light
	11-50%	<.01 cm (film)	Very Light
		>.01-.1 cm (coat)	Very Light
		>.1-1.0 cm (cover)	Light
		>1 cm (thick or pooled)	Light
	51-90%	<.01 cm (film)	Very Light
		>.01-.1 cm (coat)	Light
		>.1-1.0 cm (cover)	Moderate
		>1 cm (thick or pooled)	Moderate
	91-100%	<.01 cm (film)	Light
		>.01-.1 cm (coat)	Moderate
		>.1-1.0 cm (cover)	Moderate
		>1 cm (thick or pooled)	Heavy
>0.5-3 feet	<1%	<.01 cm (film)	Very Light
		>.01-.1 cm (coat)	Very Light
		>.1-1.0 cm (cover)	Light
		>1 cm (thick or pooled)	Light
	1-10%	<.01 cm (film)	Very Light
		>.01-.1 cm (coat)	Very Light
		>.1-1.0 cm (cover)	Light
		>1 cm (thick or pooled)	Light
	11-50%	<.01 cm (film)	Very Light
		>.01-.1 cm (coat)	Light
		>.1-1.0 cm (cover)	Moderate
		>1 cm (thick or pooled)	Moderate

Shoreline Oiling Width	% Oiling within Shoreline Oiling Width	Oil Thickness	Oil Characterization
>0.5-3 feet	51-90%	<.01 cm (film)	Light
		>.01-.1 cm (coat)	Moderate
		>.1-1.0 cm (cover)	Moderate
		>1 cm (thick or pooled)	Heavy
	91-100%	<.01 cm (film)	Light
		>.01-.1 cm (coat)	Moderate
		>.1-1.0 cm (cover)	Heavy
		>1 cm (thick or pooled)	Heavy
>3-6 feet	<1%	<.01 cm (film)	Very Light
		>.01-.1 cm (coat)	Very Light
		.1-1.0 cm (cover)	Light
		>1 cm (thick or pooled)	Light
	1-10%	<.01 cm (film)	Very Light
		>.01-.1 cm (coat)	Light
		>.1-1.0 cm (cover)	Moderate
		>1 cm (thick or pooled)	Moderate
	11-50%	<.01 cm (film)	Light
		>.01-.1 cm (coat)	Moderate
		.1-1.0 cm (cover)	Moderate
		>1 cm (thick or pooled)	Heavy
	51-90%	<.01 cm (film)	Light
		>.01-.1 cm (coat)	Moderate
		>.1-1.0 cm (cover)	Heavy
		>1 cm (thick or pooled)	Heavy
	91-100%	<.01 cm (film)	Light
		>.01-.1 cm (coat)	Moderate
		>.1-1.0 cm (cover)	Heavy
		>1 cm (thick or pooled)	Heavy

Shoreline Oiling Width	% Oiling within Shoreline Oiling Width	Oil Thickness	Oil Characterization
>6 feet	<1%	<.01 cm (film)	Very Light
		>.01-.1 cm (coat)	Very Light
		>.1-1.0 cm (cover)	Light
		>1 cm (thick or pooled)	Light
	1-10%	<.01 cm (film)	Very Light
		>.01-.1 cm (coat)	Light
		>.1-1.0 cm (cover)	Moderate
		>1 cm (thick or pooled)	Moderate
	11-50%	<.01 cm (film)	Light
		>.01-.1 cm (coat)	Moderate
		>.1-1.0 cm (cover)	Moderate
		>1 cm (thick or pooled)	Heavy
	51-90%	<.01 cm (film)	Light
		>.01-.1 cm (coat)	Moderate
		>.1-1.0 cm (cover)	Heavy
		>1 cm (thick or pooled)	Heavy
	91-100%	<.01 cm (film)	Light
		>.01-.1 cm (coat)	Moderate
		>.1-1.0 cm (cover)	Heavy
		>1 cm (thick or pooled)	Heavy

Appendix H.3. Shoreline classification from the Environmental Sensitivity Index (ESI) for Delaware, New Jersey, and Pennsylvania.

ESI No.	Estuarine Shoreline Classification (ESI)
1B	Exposed seawalls and other solid structures made of concrete, wood, or metal
2A	Eroding bluffs
2B	Wave-cut clay platforms
3	Fine-grained sand beaches
4	Medium- to coarse-grained sand beaches
5	Mixed sand and gravel beaches
6A	Gravel beaches
6B	Riprap structures
7	Exposed tidal flats
8A	Vegetated, steeply sloping riverine bluffs
8B	Sheltered seawalls and other solid structures made of concrete, wood, or metal
9	Sheltered tidal flats
10A	Salt and brackish -water marshes
U	Unranked

From: NOAA (2000). Delaware, New Jersey, Pennsylvania Environmental Sensitivity Index Metadata. November 2000.

Appendix H.4. Summary of shoreline oiling data. See Appendix H.1 for delineation of shoreline segments; Appendix H.2 for definition of degree of oiling; and Appendix H.3 for description of ESI habitat type.

Segment	Degree of Oiling	ESI	Shoreline Segment Length (mi.)
DE-1	UNSURVEYED	6B	0.69
	LIGHT	10A/5	0.49
		1B	1.43
		6B	1.93
	MEDIUM	10A/5	0.17
		5	0.58
		6B	1.19
VERY LIGHT	6B	0.80	
DE-2	LIGHT	10A	0.38
		6B	1.26
	MEDIUM	6B	0.09
	VERY LIGHT	10A	0.56
		1B	0.29
		5	0.79
6B	3.28		
DE-3	UNSURVEYED	10A	3.84
	CLEAN	10A	3.88
		1B	0.24
		5	0.49
		6B	2.82
	VERY LIGHT	10A	0.23
		1B	1.17
6B		0.12	
DE-4	UNSURVEYED	10A	6.61
		5	0.14
		6B	0.31
	CLEAN	10A	3.24
		10A/5	0.19
		5	1.39
		6A	0.26
6B	0.95		

Segment	Degree of Oiling	ESI	Shoreline Segment Length (mi.)
DE-5	UNSURVEYED	10A	1.42
		6B	0.45
		8A	3.68
	CLEAN	10A	7.42
		1B	0.23
		2A	0.06
		5	0.27
		6B	2.38
		6B/10A	0.32
	LIGHT	10A	0.55
	VERY LIGHT	10A	3.61
		1B	0.46
		6B	22.41
8A		0.54	
DE-6	UNSURVEYED	10A	0.75
		6B	0.37
	VERY LIGHT	10A	2.44
		1B	0.23
		1B/10A	0.11
		6B	0.92
DE-7	UNSURVEYED	6B	0.17
	LIGHT	10A	0.62
		6B	0.52
	VERY LIGHT	10A	0.92
DE-8	UNSURVEYED	10A	0.72
	LIGHT	10A	4.19
		1B	0.17
	VERY LIGHT	10A	3.29
		6B	0.30
		6B/5	0.08
DE-9	UNSURVEYED	10A	28.06
	CLEAN	10A	3.51
		4	0.07
		5	0.14
		10A	29.41
	VERY LIGHT	1B	0.06
		1B/5	0.27
		4	0.11
		5	0.36
		6B	0.22

Segment	Degree of Oiling	ESI	Shoreline Segment Length (mi.)
DE-10	UNSURVEYED	10A	37.08
		1B	0.34
		5	1.24
		6B	0.14
	CLEAN	10A	10.03
		10A/5	0.18
		1B	0.63
		5	2.86
		6B	0.09
	VERY LIGHT	10A	6.74
DE-12	CLEAN	1B	0.20
		4	6.14
		4/10A	1.29
		5	4.29
		5/10A	0.11
		6A	0.27
		6B	0.15
MD-1	UNSURVEYED	6B	11.08
NJ-1	CLEAN	10A	0.58
		1B	1.05
		5	0.26
		6A	0.10
		6B	1.63
		8A	2.71
	HEAVY	5	0.02
	LIGHT	1B	3.35
		5	0.66
		6B	0.38
	MEDIUM	5	0.75
	VERY LIGHT	1B	1.05
		5	0.26
		6B	0.72
8A		1.01	
NJ-2	LIGHT	1B	6.04
		5	0.32
		6B	0.45
		8B	0.41
	MEDIUM	1B	3.32
	VERY LIGHT	1B	0.31

Segment	Degree of Oiling	ESI	Shoreline Segment Length (mi.)
NJ-3	UNSURVEYED	10A	5.91
		1B	0.56
		5	0.67
	CLEAN	10A	0.44
	HEAVY	10A	0.76
		1B	0.90
		1B/5	0.16
		5	1.49
		6A	0.03
		6B	0.62
		10A	0.46
	LIGHT	5	0.66
		8A	1.66
		8B	0.21
		10A	0.89
	MEDIUM	1B	0.16
		5	2.75
		6A	0.20
		6B	0.73
		8A	0.08
10A		3.07	
VERY LIGHT	5	0.57	
	6B	0.08	
	10A	13.50	
NJ-4	UNSURVEYED	8A	2.13
		10A	0.87
	CLEAN	5	0.04
		10A	0.53
	HEAVY	1B	0.36
		1B/5	0.65
		5	0.98
		6B	0.68
		10A	1.12
	LIGHT	1B	0.20
		1B/5	0.10
		5	1.99
		6A	0.03
		6B	0.28
		10A	2.36
	MEDIUM	1B	0.92
		5	2.43
		6B	1.88
		10A	3.64
	VERY LIGHT	1A	1.89
1B		0.40	
5		0.05	
6B		0.49	
8A		0.10	

Segment	Degree of Oiling	ESI	Shoreline Segment Length (mi.)
NJ-5	UNSURVEYED	10A	3.30
	CLEAN	10A	0.66
	HEAVY	5	0.23
	LIGHT	10A	20.17
		10A/5	0.29
		10A/6A	0.09
		1B	0.21
		4	0.07
		5	2.76
		6A	0.51
		8A	3.25
	MEDIUM	10A	2.82
		10A/5	0.08
		10A/6A	0.12
		5	0.18
8A	0.41		
VERY LIGHT	5	0.39	
NJ-6	LIGHT	10A	0.33
		6B	0.17
	VERY LIGHT	10A	0.32
		1B	0.62
		5	1.85
		6B	0.72
NJ-7	UNSURVEYED	10A	7.64
		5	0.08
		6B	0.45
		8A	1.88
	LIGHT	10A	0.22
		1B	0.91
		5	0.48
		6B	4.68
NJ-8	UNSURVEYED	10A	0.90
	VERY LIGHT	10A	0.30
		1B	2.49
		1B/6A	0.15
		1B/6B	1.53
		5	1.67
		6B	3.36
NJ-9	UNSURVEYED	10A	16.61
	LIGHT	10A	1.31
		6B	0.14
	VERY LIGHT	10A	8.80
		1B	1.65
		4	0.11
		5	0.15
		6B	0.42

Segment	Degree of Oiling	ESI	Shoreline Segment Length (mi.)
NJ-10	UNSURVEYED	10A	22.34
		1B	0.07
		5	0.05
	CLEAN	10A	0.72
		10A/6B	0.57
		1B	0.16
		5	0.05
		6B	3.54
	VERY LIGHT	10A	5.47
NJ-11	UNSURVEYED	10A	70.46
		1B	2.06
		5	0.94
		5/10A	0.17
		6B	1.69
		8A	1.18
	CLEAN	10A	104.74
		1B	2.05
		5	0.64
		6B	0.92
		8A	5.43
		8B	0.21
NJ-12	UNSURVEYED	10A	148.32
		10A/5	3.20
		1B	2.19
		1B/5	0.44
		1B/6B	0.24
		3	0.08
		4	1.50
		5	17.64
		5/10A	1.13
		6A	0.35
		6B	4.12
		6B/4	0.13
		8B	0.40
		CLEAN	10A
	1B		1.13
	1B/5		0.50
	1B/6B		0.36
	3		0.01
	4		0.31
	5		2.66
	6A		0.11
	6B	0.76	
	VERY LIGHT	10A/5	0.14
6B/5		0.10	

Segment	Degree of Oiling	ESI	Shoreline Segment Length (mi.)
PA-1	UNSURVEYED	6B	0.60
		8A	0.44
		8B	0.38
	CLEAN	1B	1.10
		5	0.78
		6A	0.15
		6B	1.38
		8A/6A	0.17
	Medium	1B	10.36
		5	0.17
		6B	2.59
PA-2	MEDIUM	1B	11.09
		5	0.28
		6B	0.36
		8B	0.66
PA-3	UNSURVEYED	1B	1.09
		5	0.07
		6B	0.04
	CLEAN	10A	0.07
		1B	2.40
		6B	0.14
		8A	0.16
		8B	3.06
	HEAVY	1B	0.12
	LIGHT	1B	2.62
		5	0.07
		6B	1.09
		8A	0.13
	MEDIUM	1B	8.27
6B		0.28	
VERY LIGHT	1B	0.02	
PA-4	UNSURVEYED	1B	0.07
	HEAVY	10A	0.11
		10A/5	0.22
		1B	1.62
		5	0.15
		6B	3.30
	MEDIUM	1B	0.40
		5	0.85

Segment	Degree of Oiling	ESI	Shoreline Segment Length (mi.)
PA-5	UNSURVEYED	10A	0.32
		1B	0.33
		6B	0.25
		8A	1.18
	CLEAN	10A	2.79
		1B/6B	0.25
		6B	0.44
		8A	0.54
	HEAVY	1B	0.05
		5	0.63
		6B	0.00
	LIGHT	1B	0.49
		1B/6B	0.95
		6B	0.83
	MEDIUM	10A	0.67
		6B	1.18
	VERY LIGHT	10A	0.47
		1B	0.27
6B		0.05	
8A		0.58	
8A/6A		0.20	
PA-6	UNSURVEYED	8A	0.62
	CLEAN	6A	0.01
		8A	0.77
	LIGHT	8B	1.27
		1B	2.22
		5	0.28
		6B	1.28
		6B/1B	1.90
	MEDIUM	8A	0.05
		1B	1.21
		6A	0.14
	VERY LIGHT	6B	0.38
		1B	1.55
6A		0.04	
PA-7	HEAVY	8A	0.19
		3	0.53
	LIGHT	5	0.54
		3	0.20
	MEDIUM	5	0.92
		3	1.13
5		0.94	
		6A	0.08

Segment	Degree of Oiling	ESI	Shoreline Segment Length (mi.)
PA-8	LIGHT	1B	3.01
		6B	1.83
	MEDIUM	1B	1.04
		6B	0.09
	VERY LIGHT	1B	0.59
		6B	0.26

Appendix H.5.

Report to the Pennsylvania Bureau of Forestry on a Visit to Inspect Oil Damage to Tidal Marshes of Little Tincum Island from the Athos I Oil Spill of November 26, 2004

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On December 16, 2004 I visited Little Tincum Island in the Delaware River in Delaware County, PA with Paul Jardel and Thomas L. Magge of the Pennsylvania Department of Environmental Protection. Our visit was timed to coincide with low tide. We walked the entire north side of Little Tincum Island inspecting the shoreline and the exposed tidal mud flats and lagoons.

Tidal Mud Flats

We saw very little oil on the surface of the tidal flats; however, anything that protruded from the surface had oil on it, including debris and plants.

Plants that were visible on the tidal flats included dormant leaves of spatterdock (*Nuphar advena*), sweetflag (*Acorus calamus*), arrowhead (*Sagittaria rigida*), arrow-arum (*Peltandra virginica*), and dwarf spike-rush (*Eleocharis parvula*). Black deposits of oil were visible on the leaves of many, but not all, of these plants. We did see a few small (6 inch diameter or less) patches of oil on the mud and an occasional area with oil sheen on the water; but for the most part the surface of the tidal flat appeared to be free of oil. There was no evidence that the oil had penetrated into the sediments on the mud flats.



Dormant leaves of spatterdock with black coating of oil visible



Arrowhead leaves with an oily coating 1

My assessment is that the oil-coated leaves will almost certainly die, but the rhizomes of the plants mentioned above, all of which are perennials, will be unaffected; and that normal

growth will resume in the spring. Other perennial species that were not visible at this time but are known to be present, including strap-leaf arrowhead (*Sagittaria subulata*), Smith's bulrush (*Scirpus smithii*), and mud-

plantain (*Heteranthera multiflora*) should also be unaffected. The seeds of tidal flat annuals, including long-lobed arrowhead (*Sagittaria calycina* var. *spongiosa*) and spike-rush (*Eleocharis obtusa* var. *peasii*), should also be unaffected.

ATVs and other vehicles and heavy foot traffic should not be allowed on the tidal flats, as the rhizomes of some of these plants are slender and fragile.

High Tide Line

Deposits of oil were present on vegetation, rocks, debris, and the sand along the high tide line; the intensity of the deposit varied depending on the exposure of each section of shoreline. Those areas most open to the east (upstream direction) were the most severely affected. Thick black oil coated the lower 1-3 feet of dead stems of common reed (*Phragmites australis*), purple loosestrife (*Lythrum salicaria*), swamp-mallow (*Hibiscus moschuetos*), and smartweed (*Polygonum* sp.). Stems and exposed roots of woody plants, including shrubs such as arrow-wood (*Viburnum dentatum*), groundsel-tree (*Baccharis halimifolia*), black elderberry (*Sambucus canadensis*), false indigo (*Amorpha fruticosa*), and trees also were coated to a height of about 12 inches at the base.

In a few areas near the east (upstream) end of the island, oil had soaked in to the sand and gravel surface just below the high tide line forming an asphalt-like crust.



Oil coating the lower portions of purple loosestrife and smartweed at the high tide line

I recommended that dead stems of the herbaceous species be cut as close to the base as possible and removed from the site to prevent the oil on them from being redistributed. Woody stems of shrubs may be girdled and killed by the oil, due to the toxicity of the oil to the cambium layer just below the bark; however, the bark of older stems may be thick enough to protect them. Whether the stems are cut or left in place, regrowth will likely occur from dormant buds at the base or from stolons. Similarly, exposed roots and lower stems of trees that are coated with oil may be girdled, or they may escape damage depending on the thickness of the bark. It is probably best to leave these roots and stems in place.

Several rare tidal marsh plants typically grow at or near the high tide line, wild rice (*Zizania aquatica*), waterhemp ragweed (*Amaranthus cannabinus*), Walter’s barnyard grass (*Echinochloa walteri*), swamp-beggar-ticks (*Bidens bidentoides*), and marsh fleabane (*Pluchea odorata*), are all annuals and not visible at this time. Because they over-winter as seeds, they will likely escape direct impact from the oil.

Water-horehound (*Lycopus rubellus*), an herbaceous perennial that often grows right at the high tide line, may be vulnerable to damage from the oil. It frequently grows in crevices among the roots of trees right at the uppermost reach of the tide. Its over-wintering structures are stolons and tubers.

Interior Areas

In order to move people and materials from one side of the island to the other clean-up contractors have blazed several ATV trails through the island interior. These disturbances should not cause any permanent harm.

List of PNHP-classified plants known to occur at Little Tinicum Island

Common name	Scientific name	Growth cycle	Status
waterhemp ragweed	<i>Amaranthus cannabinus</i>	annual	PR
swamp beggar-ticks	<i>Bidens bidentoides</i>	annual	PT/PE
Walter’s barnyard grass	<i>Echinochloa walteri</i>	annual	PE
spike-rush	<i>Eleocharis obtusa var. peasii</i>	annual	PE
dwarf spike-rush	<i>Eleocharis parvula</i>	perennial	PE
mud-plantain	<i>Heteranthera multiflora</i>	perennial	PE
water-horehound	<i>Lycopus rubellus</i>	perennial	
marsh fleabane	<i>Pluchea odorata</i>	annual	TU/PE
long-lobed arrowhead	<i>Sagittaria calycina var. spongiosa</i>	annual	PE
strap-leaf arrowhead	<i>Sagittaria subulata</i>	perennial	PR
Smith’s bulrush	<i>Scirpus smithii</i>	perennial	PE
wild-rice	<i>Zizania aquatica</i>	annual	PR

APPENDIX I

Bird and Wildlife Survey Data

- I.1. Summary results of 3,428 ground surveys conducted between November 30, 2004 and January 10, 2005.
- I.2. Ratio of total birds observed during ground surveys/number of site visits by date.
- I.3. Summary of aerial survey data

Appendix I.1. Summary results of 3,428 ground surveys conducted between November 30, 2004 and January 10, 2005.

Guild	Common name	Total count	Most Observed in One Day	Most Observed Oiled in One Day	No oiling	Trace	Light	Moderate	Heavy	Total oiled	Proportion of Observed Species Oiled	Proportion of Total Birds Oiled
Dabbling ducks	Wood duck	2	1	0	2	0	0	0	0	0	0.00	0.00
	Northern pintail	4938	3010	10	4915	3	19	0	1	23	0.00	0.00
	American wigeon	83	31	0	83	0	0	0	0	0	0.00	0.00
	Northern shoveler	389	176	2	386	3	0	0	0	3	0.01	0.00
	Green-winged teal	1116	463	0	1116	0	0	0	0	0	0.00	0.00
	Blue-winged teal	5	4	0	5	0	0	0	0	0	0.00	0.00
	Mallard	7671	802	45	7224	164	159	73	51	447	0.06	0.03
	American black duck	922	217	10	881	26	11	1	3	41	0.04	0.00
	Black mallard hybrid	5	2	0	5	0	0	0	0	0	0.00	0.00
	Gadwall	524	111	1	521	2	0	0	1	3	0.01	0.00
	Muscovy duck	74	18	7	58	2	14	0	0	16	0.22	0.00
	Duck sp.	240	90	7	214	1	5	4	16	26	0.11	0.00
Diving birds	Unknown shoveler	7	6	0	7	0	0	0	0	0	0.00	0.00
	Red-throated loon	4	1	0	4	0	0	0	0	0	0.00	0.00
	Double-crested cormorant	257	57	14	174	6	39	29	9	83	0.32	0.01
	Great cormorant	1	1	0	1	0	0	0	0	0	0.00	0.00
	Cormorant	26	10	1	24	1	0	0	1	2	0.08	0.00
	Horned grebe	4	3	1	1	1	1	1	0	3	0.75	0.00
	Pied-billed grebe	112	68	2	105	3	2	2	0	7	0.06	0.00

Guild	Common name	Total count	Most Observed in One Day	Most Observed Oiled in One Day	No oiling	Trace	Light	Moderate	Heavy	Total oiled	Proportion of Observed Species Oiled	Proportion of Total Birds Oiled
Diving ducks	Lesser scaup	45	21	7	33	1	2	7	2	12	0.27	0.00
	Ring-necked duck	565	199	5	546	15	1	3	0	19	0.03	0.00
	Greater scaup	114	100	0	114	0	0	0	0	0	0.00	0.00
	Canvasback	59	28	4	46	1	7	5	0	13	0.22	0.00
	Bufflehead	856	520	15	747	35	51	23	0	109	0.13	0.01
	Goldeneye	66	59	0	66	0	0	0	0	0	0.00	0.00
	American coot	442	105	5	437	0	4	0	1	5	0.01	0.00
	Hooded merganser	36	17	0	36	0	0	0	0	0	0.00	0.00
	Black scoter	2	1	1	1	0	1	0	0	1	0.50	0.00
	Common merganser	249	47	7	232	12	4	0	1	17	0.07	0.00
	Red-breasted merganser	3	3	0	3	0	0	0	0	0	0.00	0.00
Ruddy duck	440	170	2	437	3	0	0	0	3	0.01	0.00	
Gulls	Herring gull	13451	6294	88	12536	551	242	96	26	915	0.07	0.06
	Laughing gull	118	95	21	94	2	2	20	0	24	0.20	0.00
	Yellow-legged gull	7	7	0	7	0	0	0	0	0	0.00	0.00
	Ring-billed gull	27367	3282	832	21945	2165	2183	902	172	5422	0.20	0.33
	Lesser black-backed gull	18	3	1	17	1	0	0	0	1	0.06	0.00
	Iceland gull	6	4	1	3	3	0	0	0	3	0.50	0.00
	Glaucous gull	3	1	0	3	0	0	0	0	0	0.00	0.00
	Great black-headed gull	5	3	0	5	0	0	0	0	0	0.00	0.00
	Great black-backed gull	4256	2144	56	3787	336	92	35	6	469	0.11	0.03
	Bonaparte's gull	15	5	0	15	0	0	0	0	0	0.00	0.00
Gull sp.	5822	1422		5557	48	115	86	16	265	0.05	0.02	

Guild	Common name	Total count	Most Observed in One Day	Most Observed Oiled in One Day	No oiling	Trace	Light	Moderate	Heavy	Total oiled	Proportion of Observed Species Oiled	Proportion of Total Birds Oiled
Kingfisher, Shorebirds	Belted kingfisher	118	21	3	111	3	4	0	0	7	0.06	0.00
	Ruddy turnstone	11	11	0	11	0	0	0	0	0	0.00	0.00
	Sanderling	55	34	8	47	0	8	0	0	8	0.15	0.00
	Dunlin	1353	781	0	1353	0	0	0	0	0	0.00	0.00
	Purple sandpiper	102	70	0	102	0	0	0	0	0	0.00	0.00
	Western sandpiper	200	200	0	200	0	0	0	0	0	0.00	0.00
	Killdeer	287	146	25	262	0	0	0	25	25	0.09	0.00
	Black-bellied plover	5	5	0	5	0	0	0	0	0	0.00	0.00
Greater yellowlegs	7	7	0	7	0	0	0	0	0	0.00	0.00	
Swans / geese	Greater white-fronted goose	357	80	0	26	1	72	243	15	331	0.93	0.02
	Canada goose	59724	9432	1243	51683	1948	3459	1500	1136	8041	0.13	0.49
	Snow goose	22094	20330	2	22090	3	0	1	0	4	0.00	0.00
	Tundra swan	595	172	14	512	1	26	24	32	83	0.14	0.01
	Mute swan	1773	558	15	1735	24	13	1	0	38	0.02	0.00
	Unknown swan	53	50	0	53	0	0	0	0	0	0.00	0.00
Wading birds	Great egret	60	11	2	55	0	5	0	0	5	0.08	0.00
	Great blue heron	367	38	12	309	12	40	3	3	58	0.16	0.00
	Snowy egret	4	3	0	4	0	0	0	0	0	0.00	0.00
	Glossy ibis	1	1	0	1	0	0	0	0	0	0.00	0.00
Total Birds		157491	51551	2469	140959	5377	6581	3059	1517	16532		

Appendix I.2. Ratio of total birds observed during ground surveys/number of site visits by date.

Guild	Common name	11/30/04	12/1/04	12/2/04	12/3/04	12/4/04	12/5/04	12/6/04	12/7/04	12/8/04	12/9/04	12/10/04	12/11/04	12/12/04	12/13/04
# DAILY SITE VISITS		29	17	198	161	232	237	162	181	276	177	91	235	258	43
Dabbling ducks	Wood duck			0.01				0.01							
	Northern pintail		0.12	0.49	0.52	1.22	0.35	1.29	0.14	2.18	1.19	0.02	12.81	0.31	1.21
	American wigeon				0.04	0.09	0.03	0.19		0.02	0.01			0.01	
	Northern shoveler			0.22		0.22	0.11	0.02		0.10		0.02	0.75	0.02	
	Green-winged teal			0.01				0.02	1.17	1.68	0.05		1.18	0.00	1.40
	Blue-winged teal	0.03													
	Mallard	2.41	6.00	2.04	3.32	2.59	2.17	2.78	3.07	2.91	1.35	1.84	2.34	1.17	1.33
	American black duck	0.55	0.06	0.18	0.18	0.49	0.06	0.36	0.07	0.13	0.26	0.15	0.92	0.10	
	Black mallard hybrid									0.01			0.01		
	Gadwall			0.02	0.35		0.17	0.12	0.04	0.40	0.63	0.22	0.09	0.34	
	Muscovy duck			0.01		0.02			0.07	0.05	0.03	0.07	0.00		
	Duck sp.			0.16	0.56	0.03		0.06	0.24	0.01	0.01	0.08			0.12
Unknown shoveler								0.01							
Diving birds	Red-throated loon							0.01	0.01	0.00				0.00	
	Double-crested cormorant		0.12	0.16	0.19	0.25	0.11	0.12	0.07	0.06	0.03	0.05	0.02	0.05	
	Great cormorant														
	Cormorant		0.12	0.01	0.02	0.00	0.02			0.01			0.00		
	Horned grebe				0.02										
	Pied-billed grebe		0.12	0.01	0.03	0.04	0.01	0.02	0.01	0.03	0.01			0.02	

Guild	Common name	11/30/04	12/1/04	12/2/04	12/3/04	12/4/04	12/5/04	12/6/04	12/7/04	12/8/04	12/9/04	12/10/04	12/11/04	12/12/04	12/13/04
Diving ducks	Lesser scaup			0.02			0.01			0.03	0.01		0.03		
	Ring-necked duck			0.01	0.19	0.08	0.22	0.15	0.15	0.72	0.34		0.20	0.21	0.02
	Greater scaup					0.03	0.03								
	Canvasback				0.02	0.01	0.12			0.03	0.03				
	Bufflehead	0.21	0.18	0.14	0.17	0.32	0.22	0.09	0.13	0.05	0.06	0.04	0.06	0.05	0.02
	Goldeneye						0.01		0.02						
	American coot			0.32	0.47	0.45	0.05	0.41	0.07	0.21	0.06		0.01	0.01	0.12
	Hooded merganser		0.06			0.07	0.00	0.01		0.01	0.01	0.07		0.01	
	Black scoter										0.01			0.00	
	Common merganser			0.06	0.01		0.08	0.02		0.05					0.09
	Red-breasted merganser														
Ruddy duck		0.06	0.02	0.48	0.08	0.53	0.02	0.02	0.01	0.05	0.01	0.03	0.03	0.05	
Gulls	Herring gull		6.06	31.79	0.68	1.47	2.16	1.63	0.15	1.25	0.70	0.12	2.09	0.17	2.60
	Laughing gull			0.48			0.05	0.01		0.00			0.03	0.00	
	Yellow-legged gull									0.03					
	Ring-billed gull	1.97	36.24	12.60	8.30	13.93	10.68	11.06	4.72	11.89	4.58	1.01	2.56	3.79	1.91
	Lesser black-backed gull														
	Iceland gull														
	Glaucous gull												0.00		
	Great black-headed gull									0.01					
	Great black-backed gull		0.41	10.83	0.30	0.19	0.65	1.04	0.06	0.62	0.07	0.05	0.74	0.40	0.28
	Bonaparte's gull			0.03					0.03					0.02	
Gull sp.	7.69	7.24	7.18	5.53	2.74	1.67	0.02	0.22			0.09	0.09	0.43		

Guild	Common name	12/14/04	12/15/04	12/16/04	12/17/04	12/19/04	12/21/04	12/22/04	12/23/04	12/28/04	12/30/04	1/4/05	1/5/05	1/6/05	1/10/05
	# DAILY SITE VISITS	202	122	97	205	2	114	84	29	96	58	48	6	49	19
Dabbling ducks	Wood duck														
	Northern pintail	0.20	0.25	0.02	0.58		0.02				0.02	0.06		0.02	
	American wigeon		0.04									0.04		0.02	
	Northern shoveler		0.43												
	Green-winged teal	0.36	0.13		0.00										
	Blue-winged teal		0.03												
	Mallard	1.76	2.48	4.72	1.97		1.64	1.36	1.90	0.86	2.41	0.63	12.17	1.06	2.74
	American black duck	0.49	0.37	0.52	0.20		0.26			0.30	0.09	0.04			
	Black mallard hybrid				0.00										
	Gadwall	0.08	0.06		0.09						0.07				
	Muscovy duck		0.15		0.05										
Duck sp.	0.03		0.05	0.07		0.12				0.09					
Unknown shoveler										0.10					
Diving birds	Red-throated loon														
	Double-crested cormorant	0.10			0.00		0.10								
	Great cormorant									0.01					
	Cormorant		0.08	0.01											
	Horned grebe							0.01							
Pied-billed grebe		0.56		0.00			0.02		0.01						

Guild	Common name	12/14/04	12/15/04	12/16/04	12/17/04	12/19/04	12/21/04	12/22/04	12/23/04	12/28/04	12/30/04	1/4/05	1/5/05	1/6/05	1/10/05
Diving ducks	Lesser scaup				0.01						0.36				
	Ring-necked duck	0.12	0.01		0.11			0.01							
	Greater scaup			1.03											
	Canvasback	0.01	0.04		0.01					0.02					
	Bufflehead	0.03	0.02	5.36	0.13		0.03	0.11		0.04	0.02				
	Goldeneye			0.61	0.00										
	American coot	0.00	0.02	0.03			0.16	0.01		0.01	0.02	0.04			
	Hooded merganser			0.02	0.00										
	Black scoter														
	Common merganser	0.01	0.02	0.26	0.04		0.23	0.46		0.49	0.10	0.40		0.39	
	Red-breasted merganser			0.03											
Ruddy duck	0.01	0.03	1.75												
Gulls	Herring gull	0.88	4.26	1.20	0.58		0.54	8.74	0.03	9.04	0.93	22.75		0.20	48.58
	Laughing gull		0.01												
	Yellow-legged gull														
	Ring-billed gull	4.66	12.85	12.14	4.89	46.50	7.49	5.98	0.38	7.32	5.02	3.54	17.50	11.24	33.53
	Lesser black-backed gull		0.02					0.02				0.06			0.58
	Iceland gull							0.01				0.08			0.05
	Glaucous gull							0.01							0.05
	Great black-headed gull	0.01													
	Great black-backed gull	0.16	1.70	0.73	0.28	1.00	0.82	2.98	0.24	0.66	0.50	4.06		0.63	8.58
	Bonaparte's gull				0.00										
Gull sp.	3.12	2.59	0.02	3.06		0.78		9.86							

Appendix I.3. Summary of aerial survey data. “P” indicates that not all survey segments in an area (e.g., “New Jersey-North”) were flown; “F” indicates that all shoreline survey segments in an area were flown.

Guild	Common name	11/28/2004	11/29/2004	11/30/2004	12/2/2004	12/3/2004	12/5/2004	12/9/2004	12/13/2004	12/15/2004	12/16/2004	12/21/2004
NUM. SEGMENTS FLOWN (of 23 total)		4	3	8	19	5	23	10	12	11	4	12
COVERAGE BY AREA	Delaware				F		F			F	P	
	New Jersey - North	P	P	P	F		F	P	F			F
	New Jersey - South			P	F		F			F	P	
	Pennsylvania			P		F	F	P	F			F
Dabbling ducks	American black duck	261	109	135	8147	70	3656	1199	1252	3519	4710	2895
	American wigeon	0	0	0	0	0	61	0	0	45	0	0
	Blue-winged teal	0	0	0	0	0	0	0	0	1	0	0
	Gadwall	35	0	20	15	0	423	35	0	0	4	10
	Green-winged teal	15	25	30	595	0	895	195	540	998	390	0
	Mallard	413	86	130	2262	257	3375	2191	2169	967	4442	3490
	Northern pintail	10	0	0	20	0	1075	1455	2320	38	1246	115
	Northern shoveler	0	0	0	0	0	0	0	0	0	40	0
Unknown dabbling duck	0	0	0	5	0	333	0	0	140	0	0	
Diving birds	Common loon	0	0	0	0	0	3	0	0	0	0	0
	Cormorant sp.	2	5	4	30	21	46	40	54	0	0	65
	Double-crested cormorant	0	0	0	9	0	1	0	0	47	1	0
	Red-throated loon	0	0	0	0	0	5	0	0	0	0	0
	American coot	70	0	70	50	0	90	0	50	0	0	30

Guild	Common name	11/28/2004	11/29/2004	11/30/2004	12/2/2004	12/3/2004	12/5/2004	12/9/2004	12/13/2004	12/15/2004	12/16/2004	12/21/2004
NUM. SEGMENTS FLOWN (of 23 total)		4	3	8	19	5	23	10	12	11	4	12
Diving ducks	Black scoter	0	0	0	2	0	0	0	0	0	0	0
	Bufflehead	100	0	70	63	5	110	15	62	14	10	25
	Canvasback	0	0	5	5	0	45	5	35	16	0	155
	Common merganser	0	0	0	14	0	6	0	0	0	0	135
	Greater scaup	0	0	0	9	0	0	0	0	0	0	0
	Hooded merganser	0	0	0	10	0	7	5	0	0	4	60
	Long-tailed duck	0	0	0	1	0	0	0	0	13	0	0
	Red-breasted merganser	27	2	5	5	0	10	0	5	1	0	17
	Ring-necked duck	5	0	0	0	0	0	95	90	0	0	50
	Ruddy duck	90	0	100	213	0	218	130	0	48	0	25
	Lesser scaup	75	0	50	83	0	265	95	10	12	0	10
	Scoter sp.	0	0	0	5	0	0	0	0	0	0	0
	Surf scoter	0	0	0	0	0	3	0	0	0	0	0
Unkown diving duck	0	0	0	1	0	2	0	0	9	0	0	
Gulls	Great black-backed gull	0	0	0	108	0	238	0	0	18	3	0
	Gull sp.	1015	235	1980	3295	1155	7662	1897	4899	1160	200	4140
	Herring gull	0	0	0	57	0	1157	0	0	88	26	0
	Northern gannet	0	0	0	10	0	102	0	0	0	0	0
	Ring-billed gull	0	0	0	1114	0	1149	0	0	844	0	0
Shorebirds	Unknown shorebird	0	0	0	1448	0	355	0	0	297	0	5
Swans / geese	Canada goose	1271	277	2422	6911	1068	12373	5313	6308	4468	3915	8250
	Goose sp.	0	0	0	0	0	0	0	0	20	0	0
	Mute swan	1	0	0	35	1	45	9	8	133	35	4
	Greater white-fronted goose	0	0	0	0	0	0	0	0	0	0	0
	Snow goose	0	0	0	3438 0	0	64260	0	0	57220	36002	0
	Swan sp.	0	0	0	0	0	152	0	0	89	0	0
	Tundra swan	0	11	9	178	0	90	29	20	0	64	30
Wading birds	Great blue heron	2	1	0	29	0	32	8	2	4	3	5
	Great egret	0	4	0	14	0	1	0	1	0	1	