

PRELIMINARY DATA ON THE IMPACTS OF THE 2005-2006 WATER
MANAGEMENT PROJECT AT WERTHEIM NATIONAL WILDLIFE REFUGE,
SHIRLEY, NY

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Abstract

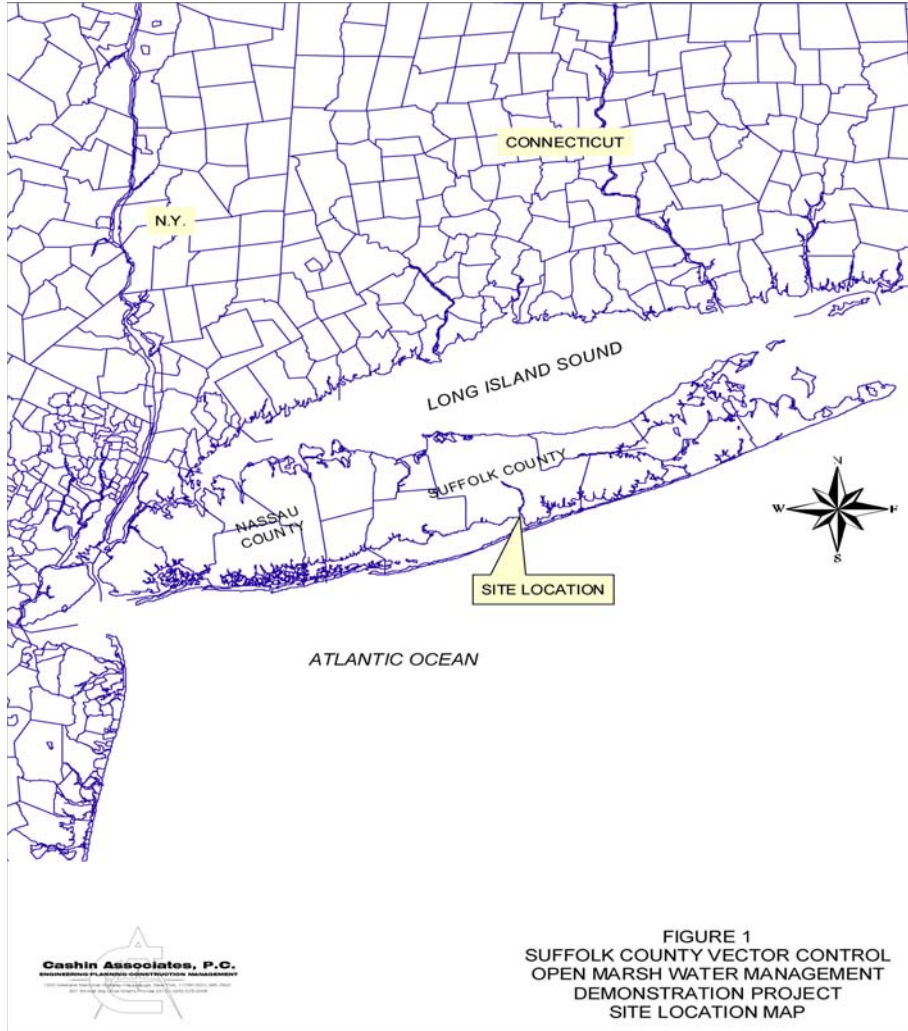
In 2005-2006, Suffolk County (NY) Vector Control implemented a water management project at Wertheim National Wildlife Refuge, Shirley, NY, a design that was the fruit of collaboration among Suffolk County and its consultants, the US Fish and Wildlife Service, and the New York State Department of Environmental Conservation. The project, although it had a determined focus on reductions in mosquito breeding and consequent pesticide applications to reduce adult mosquito emergences, intended to create measurable improvements in important salt marsh functions. These included increased fish and waterfowl use of the marsh, decreases in acreage of the marsh dominated by invasive *Phragmites australis*, and changes to the negative aesthetics associated with linear mosquito control ditches (constructed in the 1930s). A monitoring program was begun in 2003 and has continued through 2006. Data generated from post-project sampling clearly show the goals of the project are being attained.

Introduction

In 2002, the Suffolk County (NY) Legislature determined that a re-assessment of its mosquito control program was in order. As part of this project, Suffolk County decided to test water management techniques. At the same time, the US Fish and Wildlife Service (USFWS) was seeking to reduce the use of pesticides in its Long Island Complex refuges, and also to address other issues it felt were impacting the marshes within these refuges.

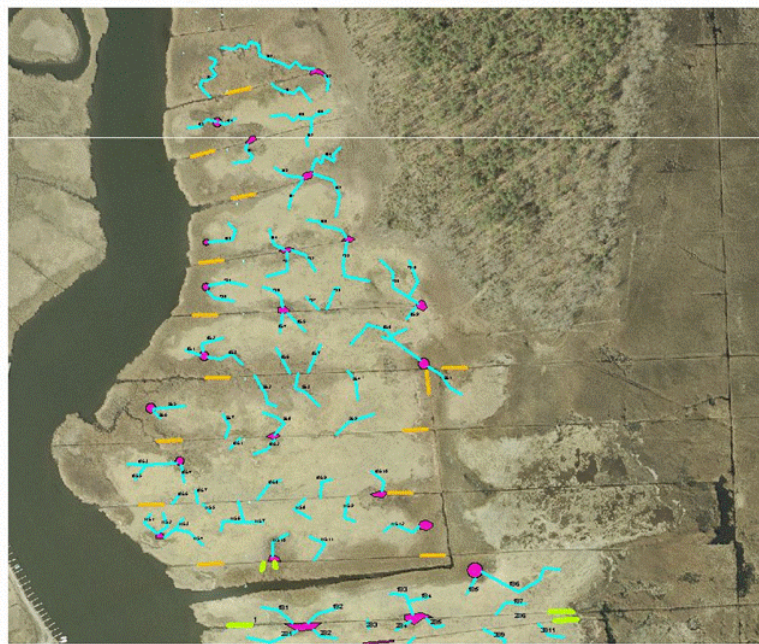
Therefore, the Wertheim National Wildlife Refuge (Shirley, NY), a 2,500 acre site along the south shore of Long Island at the mouth of the Carmans River, was selected as a site for a water management demonstration project (Figure 1). A design was made based on a series of techniques detailed by the County to address mosquito control needs, but also to meet important USFWS management goals, including enhancement of habitat for migratory water fowl, suppression of invasive *Phragmites*, and removal of the grid ditch






system installed in the 1930s. The New York State Department of Environmental Conservation (NYSDEC), as a requirement of permitting, made some further modifications to the design. These were primarily intended to ensure adequate water quality to support fish use of the expanded area of surface waters.

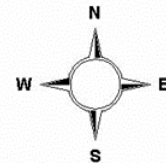


The basic project was to modify two 40 acre portions (Area 1 and Area 2) of the approximately 600 acres of tidal marsh in the refuge. Ponds of varying sizes were to be constructed, with the spoils from the ponds being used to fill the mosquito control ditches and to eliminate hummocky areas of the marsh that supported mosquito breeding. A channel was to be dug around the landward side of one marsh area to increase tidal flows to spots where *Phragmites* was prevalent. Several ditches that were not filled were to be “naturalized” by adding curvature to their previously linear layout. All ponds were to be connected to tidal waters to enhance water quality to support fish (Figure 2, Figure 3).

Wertheim NWR OMWM Demonstration Area 1

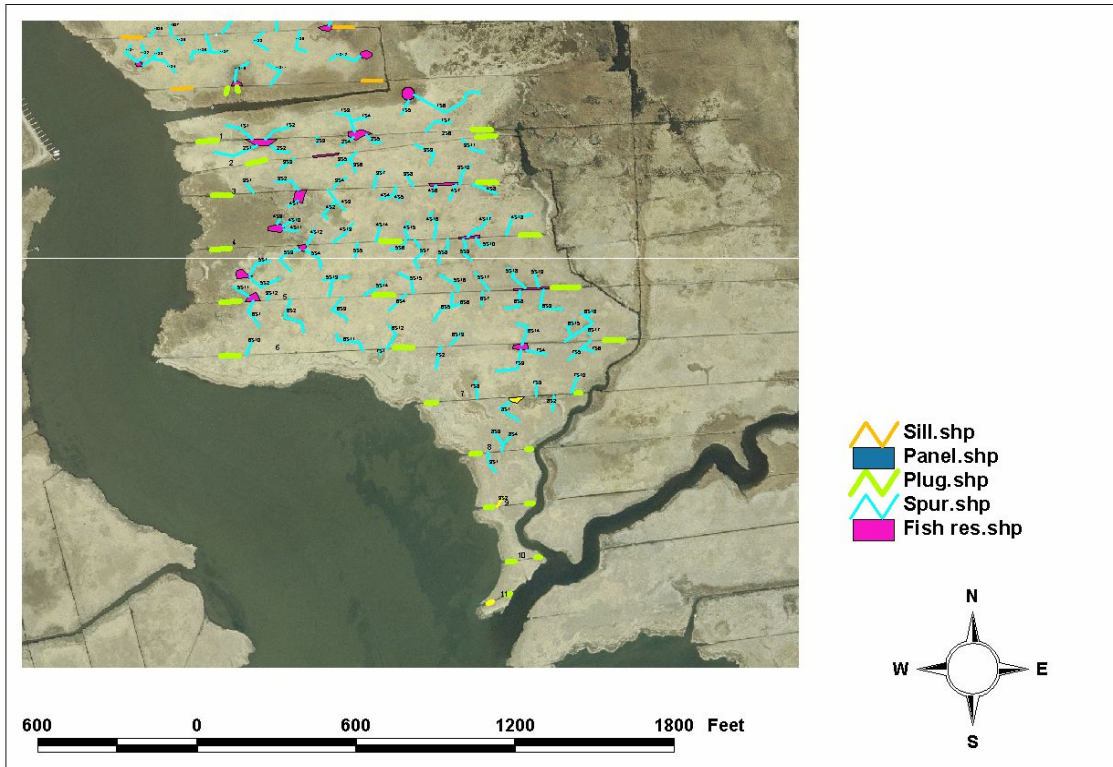


-  Sill.shp
-  Panel.shp
-  Plug.shp
-  Spur.shp
-  Fish res.shp



500 0 500 1000 1500 Feet

Wertheim NWR OMWM Demonstration Area 2



Two similar sized areas (Area 3 and Area 4) in close proximity to the sites to be altered were designated as control sites. Monitoring was begun in August 2003. The protocols used are described elsewhere (Somers et al., 2007) but were largely based on those used in an extensive assessment of similar kinds of projects being undertaken by researchers at USFWS sites across the Northeast (James-Pirri et al., 2001), although important modifications and extensions were made. Monitoring has continued through 2006. Area 1 has been monitored for two growing seasons after initial modifications in March 2005, and Area 2 was monitored for a season following construction activities in February-March, 2006.

Means by which Project Goals were Assessed

The primary goals of the project were as follows:

Reduction in Mosquito Breeding

Monitoring data were collected at the 88 marsh stations using the techniques outlined in James-Pirri et al. (2001). In addition, intensive monitoring across the marshes to determine all (or nearly all) mosquito breeding locations were made throughout the breeding season on a bi-weekly basis (Somers et al., 2007). Data collected pre-project has been compared to data collected post-project.

Reduction in Larvicide Applications

The number of pesticide applications made by SCVC at the project site has been compared pre-project and post-project.

Increases in the Area of Surface Water

The project intended to increase the amount of surface water in the project areas. This has been quantified using analyses of aerial photographs.

Decreases in *Phragmites* Area

Maintenance of *Spartina* Area

General descriptions of vegetation type have been made across each area (Somers et al., 2007). This were compared to vegetation descriptions derived from quadrat sampling (James-Pirri et al., 2001) made at the 88 marsh stations, and were found to be in accord. The changes in general vegetation type has been determined pre-project and post-project.

Increased Waterfowl Usage of the Marsh

Bird surveys were made in 2004, 2005, and 2006 (Somers et al., 2007). Intended winter bird monitoring were not conducted sufficiently to allow for any analyses. However, pre-construction bird usage of the marsh in summer months has been compared to post-construction usage of the marsh.

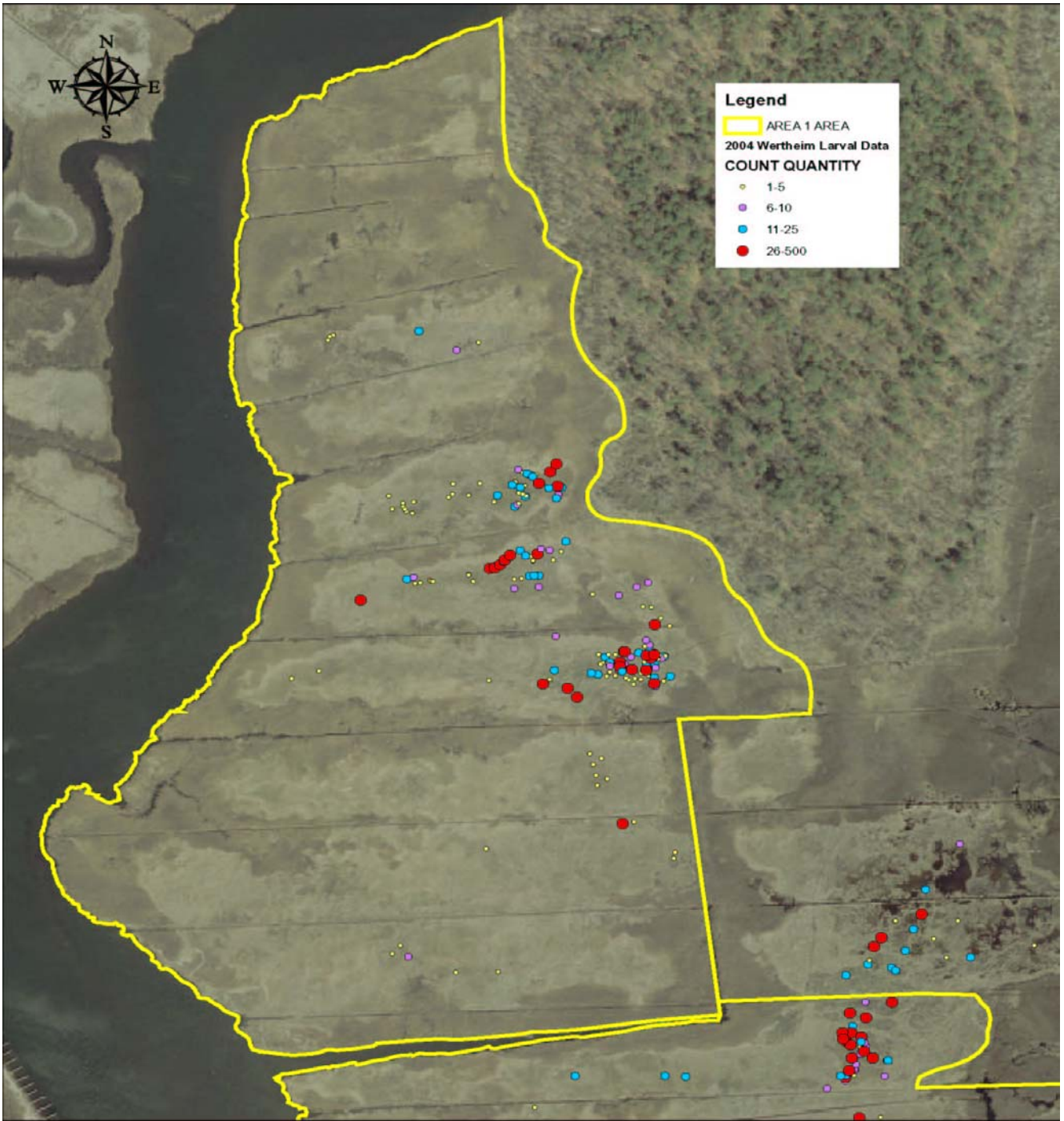
Increased Nekton Usage of the Marsh

Fish sampling (James-Pirri et al., 2001) was conducted three times each year following an initial sampling effort in 2003. The pre-construction data have been compared to post-construction data.

Preliminary Results of the Wertheim Monitoring Effort

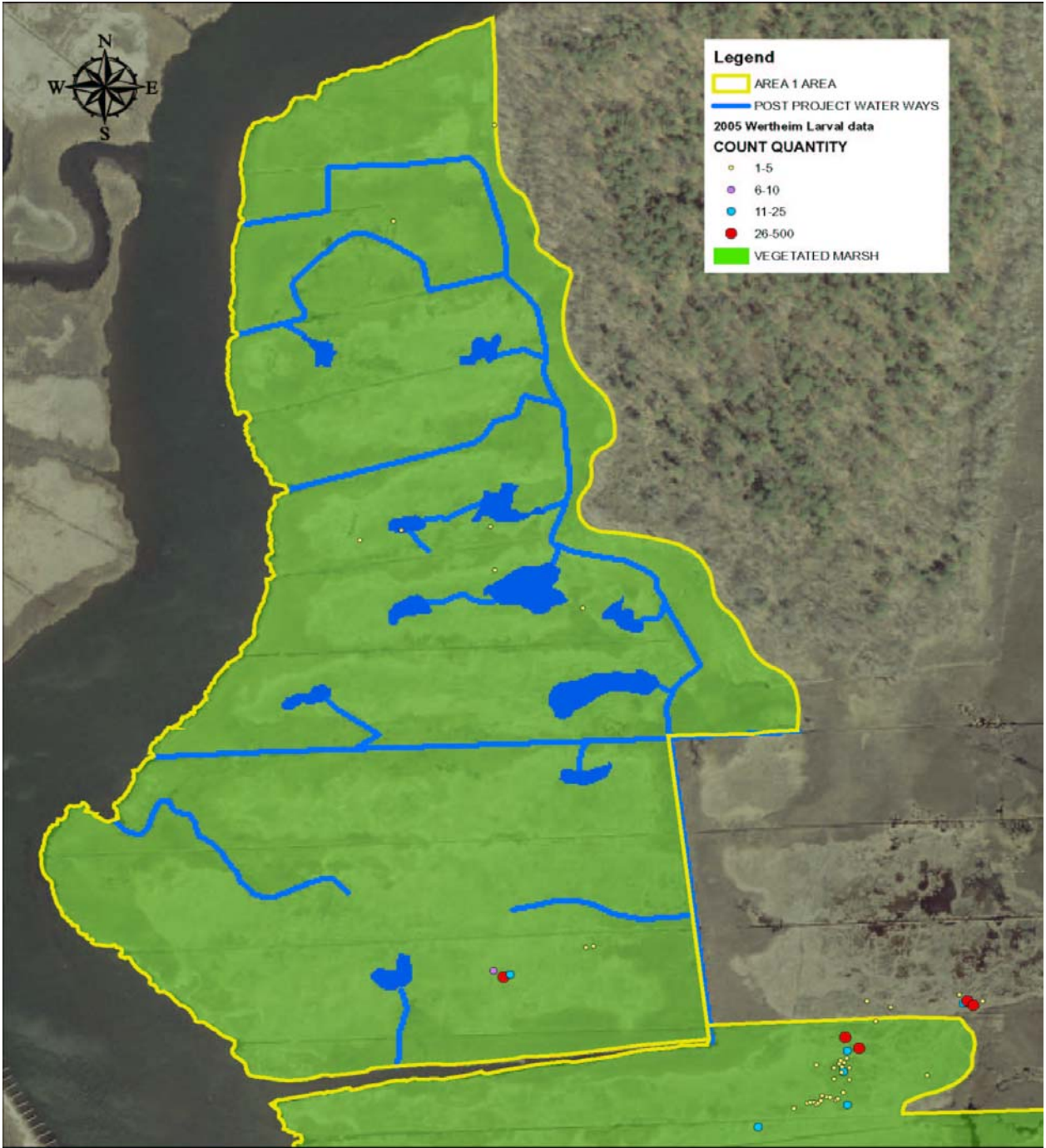
Mosquito Breeding

Larval mosquitoes were statistically significantly reduced across Areas 1 and 2 post construction. The number of breeding locations decreased markedly in Area 1 (Figures 4-6, 2004-2006). The decline was less so in Area 2 (Figures 7-8), although a statistical analysis conducted by SCVC (data not shown) found the difference between expected breeding and actual breeding to be statistically significant (based on comparisons to control areas).



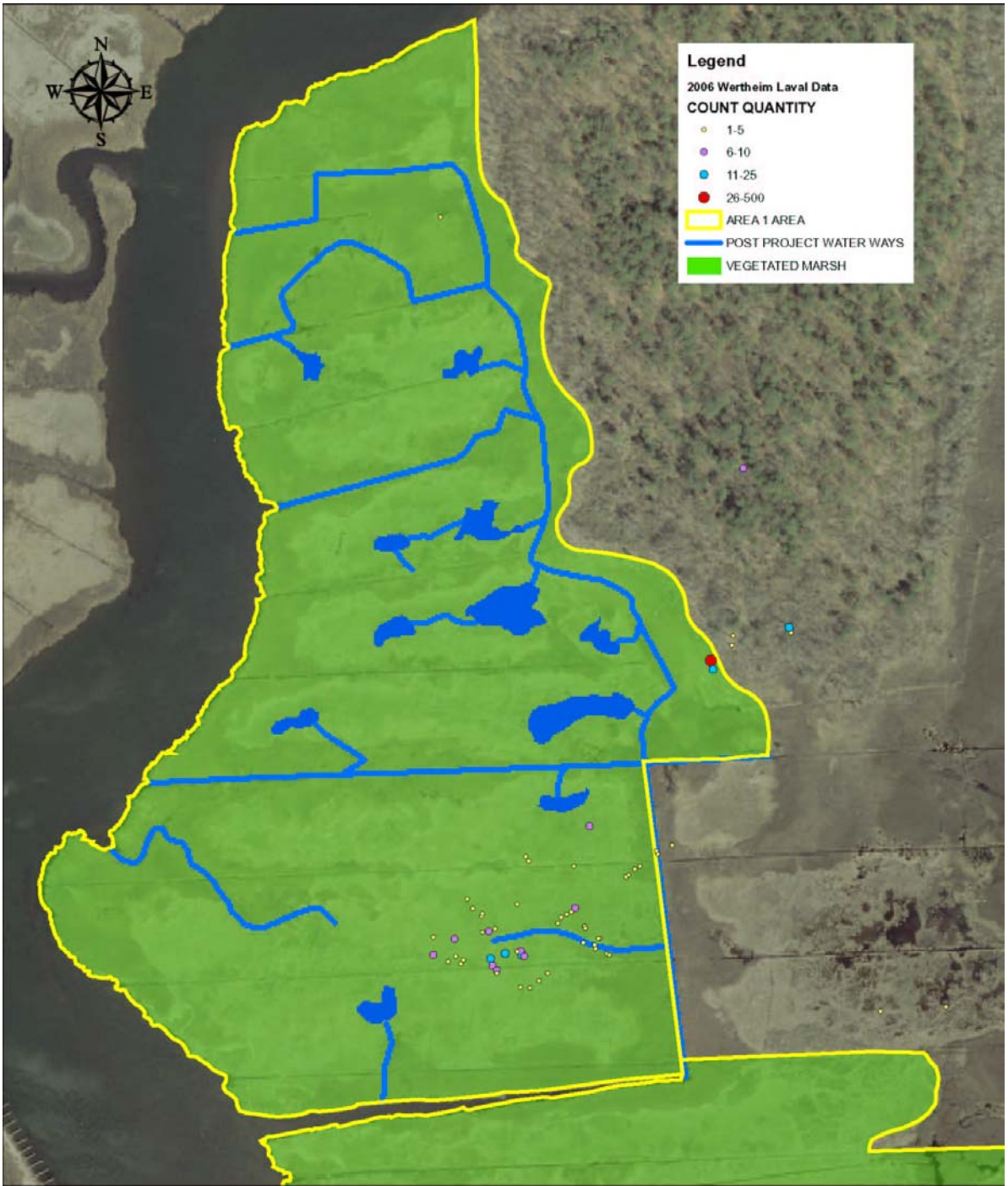
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SUFFOLK COUNTY VECTOR CONTROL
 OPEN MARSH WATER MANAGEMENT
 DEMONSTRATION PROJECT
 AREA 1 POST PROJECT
 2004 LARVAL DATA
 FEBRUARY 2007



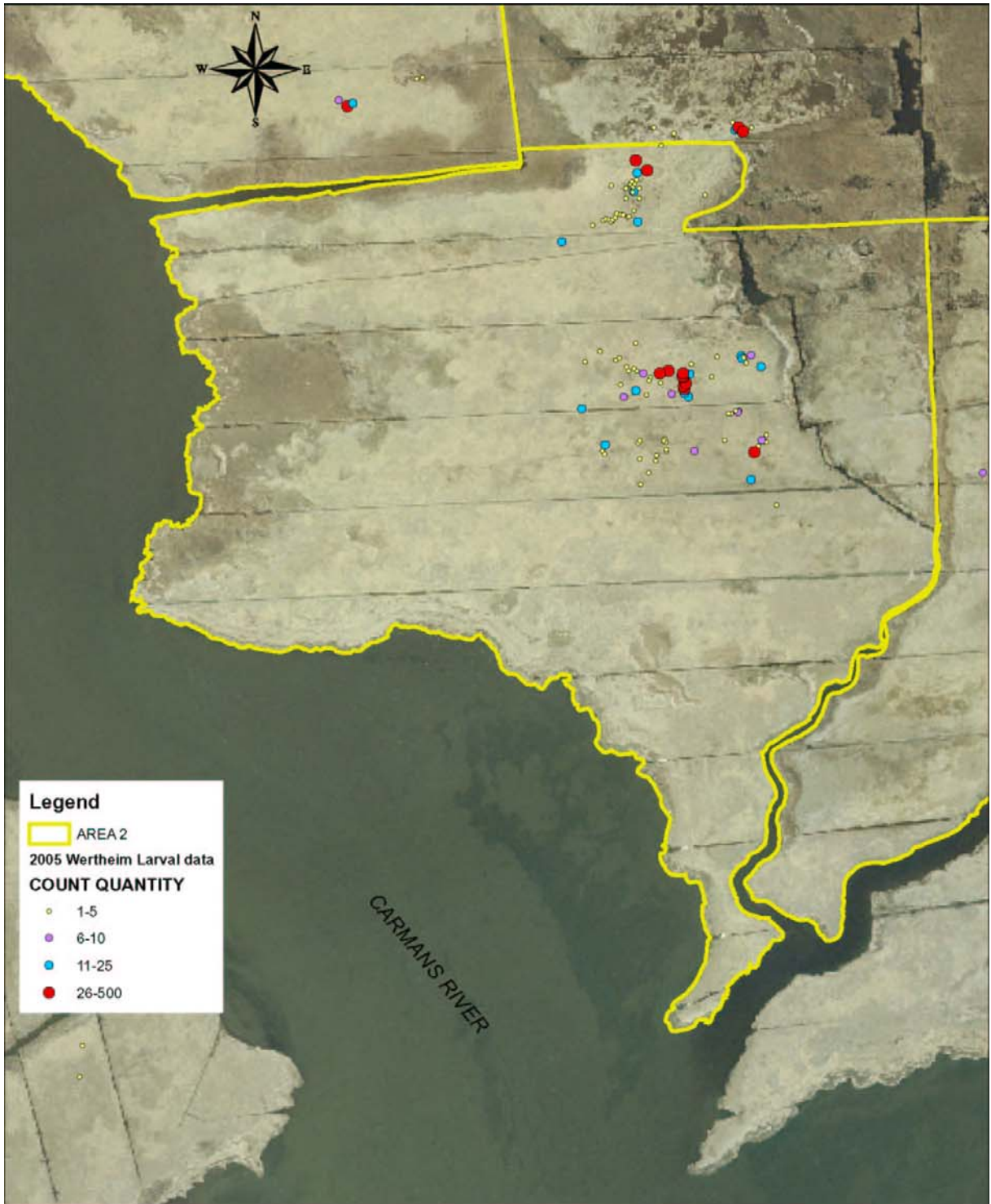
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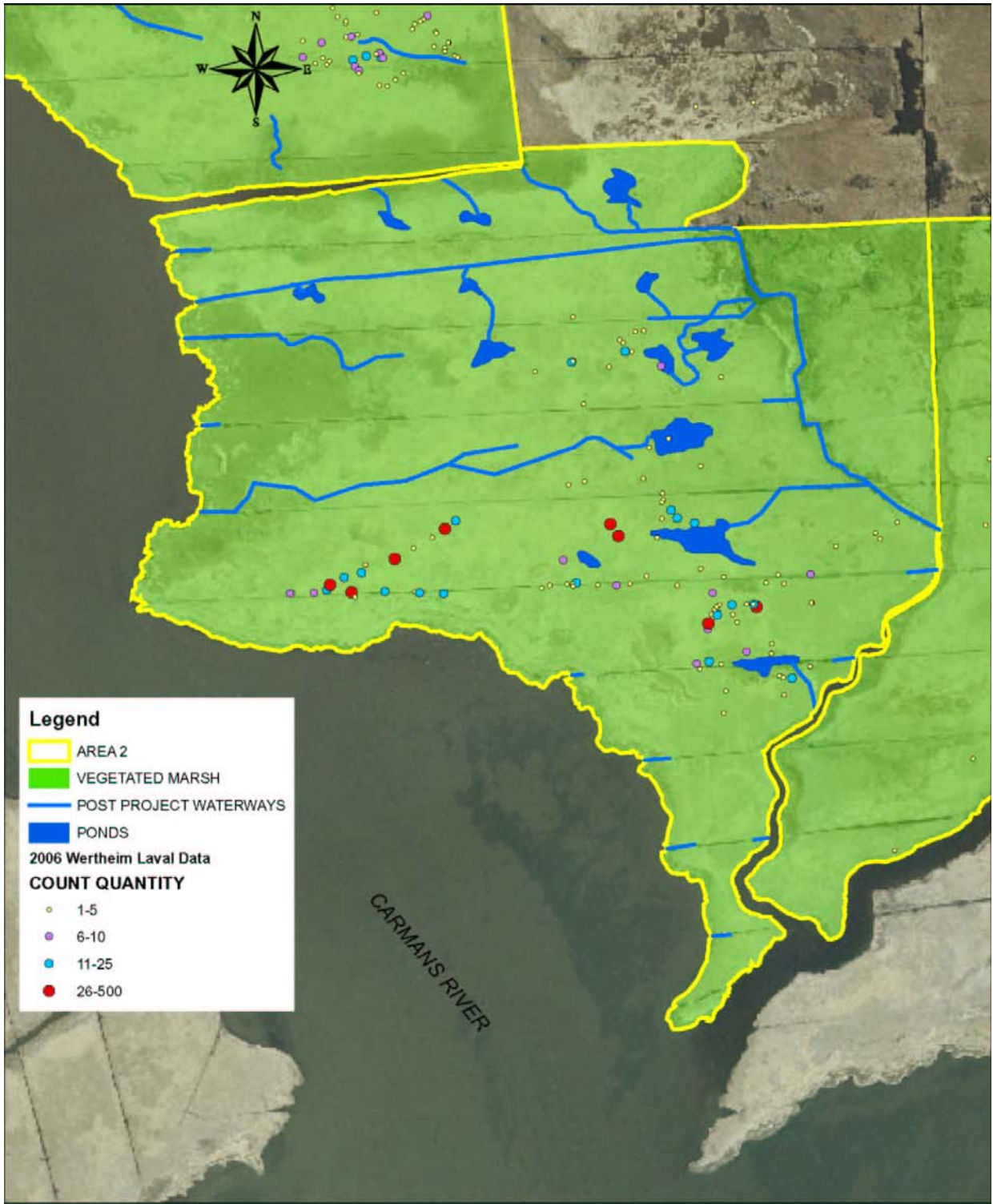
SUFFOLK COUNTY VECTOR CONTROL
 OPEN MARSH WATER MANAGEMENT
 DEMONSTRATION PROJECT
 AREA 1
 2005 LARVAL DATA
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SUFFOLK COUNTY VECTOR CONTROL
 OPEN MARSH WATER MANAGEMENT
 DEMONSTRATION PROJECT
 AREA 1
 2006 LARVAL DATA
 FEBRUARY 2007





Breeding at the marsh stations in Area 1 pre-project was quantified as 3.0 larvae per dip (2003-2004). Area 3 and Area 4 averaged 1.6 larvae per dip (2003-2004). Area 1 averaged 0.4 larvae per dip post project (2005-2006), and across Areas 3 and 4 the average was 2.2 larvae per dip (2005-2006). In Area 2, breeding at the marsh stations pre-project was 2.4 larvae per dip (2003-2005). In Areas 3 and 4 the breeding was 1.3 larvae per dip (2003-2005). Post project, breeding across the marsh stations in Area 2 was 1.2 larvae per dip (2006), and in Areas 3 and 4 it was 2.9 larvae per dip (2006). Therefore, in absolute and relative terms, breeding decreased at the marsh stations post-project.

Larvicide Applications

There were 64 larvicide applications across Area 1 in the six years (1999-2004) immediately preceding the alterations (mean = 10.7). There was one made in 2005, and two made in 2006, approximately an order of magnitude decrease. There were 69 larvicide applications made across Area 2 in the seven years pre-construction (1999-2005) (mean = 9.9). There were four applications made in 2006, approximately 50% less than the long-term average. However, only five larvicide applications were made in Area 2 in 2005, suggesting conditions were not especially different from 2005 to 2006. In comparison, 69 applications were made in Area 3 from 1999 to 2006, an average of 9.9 per year. 14 applications were made in 2006, approximately 50% greater than the long-term average, and three times the number made in 2005 (five applications). In Area 4, 74 applications were made from 1999-2005 (mean = 10.6). 12 applications were made in 2006, above the long-term mean, and twice as many as occurred in 2005 (seven applications). Therefore, absolute and relative decreases in larvicide applications occurred post-project.

Area of Surface Water

The area of surface water in Area 1 increased by 21,350 square feet. This is net of the filling of the mosquito ditches. The area of surface water in Area 2 increased by 17,000 square feet, net of the filling of mosquito ditches. This increases surface water area across these areas to 4.4% of the total area (counting the tidal creek that lies between the two areas. This can be compared to a northeastern US average for unditched marshes of ~10% (Adamowicz and Roman, 2005).

Vegetation Area

Table 1 quantifies the changes in vegetation across Area 1 and Area 2 post-construction. *Phragmites* extent in Area 1 decreased by seven acres (approximately 30% of its original extent) and the area of marsh dominated by *Spartina patens* decreased slightly. However, because of expansion of *Scirpus spp.*, the area of high marsh plants actually increased post-project. Areas quantified as mud flats are not entirely bare earth (see Figure 9).

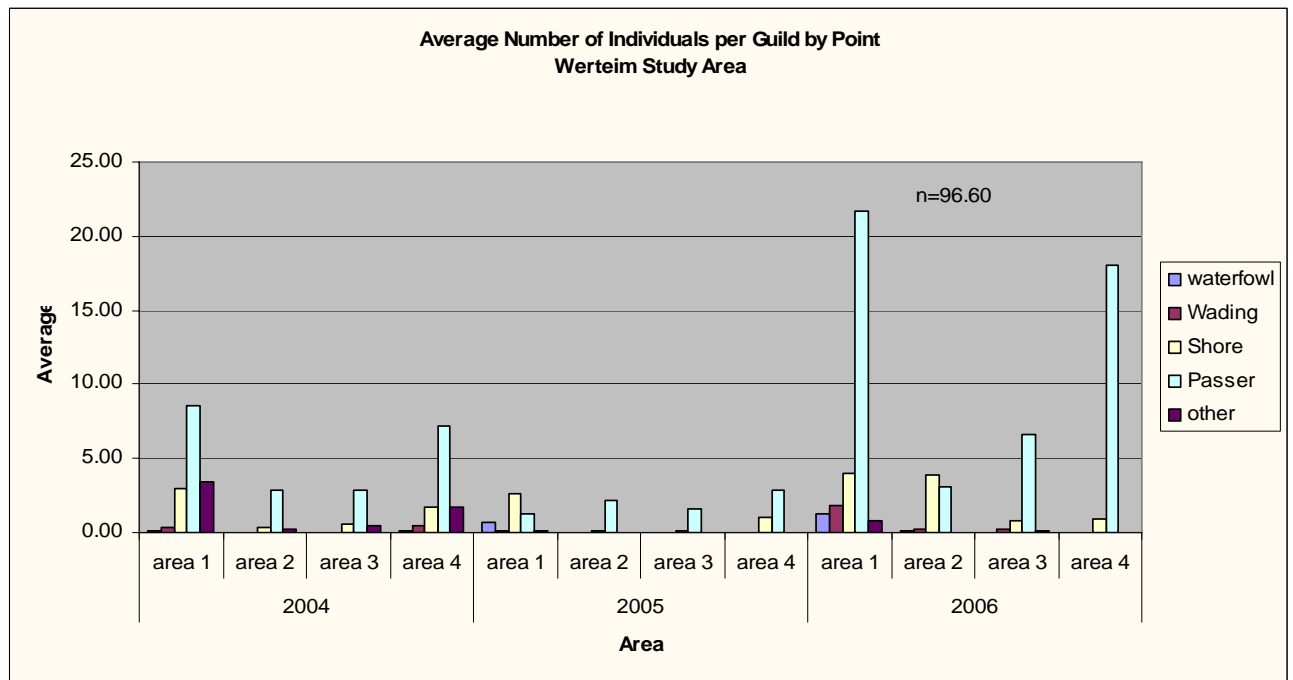
Figure 9



Bird Monitoring

Waterfowl presence in Area 1 and Area 2 increased post construction (Figure 10). Shore bird use of the sites increased in the first year of the post-project eras increased, but then decreased in Area 1 in 2006. This seems likely to accord with the decreased area of mudflats (prime shore bird foraging habitat). Passerine presence appeared to be unaffected by the project. It was thought that the creation of ponds would increase wading bird foraging. This was an anecdotal observation, but is not confirmed in the monitoring data.

Figure 10



Nekton Sampling

The number and diversity of nekton found at marsh sampling stations increased markedly following construction. 2006 diversity in Area 1 was much greater than that for 2005, and so fish use of Area 2 is expected to change over time, too (Table 2).

Table 2. Total Nekton Abundance 2003-2006

Year	Area	<i>Apeites quadracus</i>	<i>Cyprinodon variegatus</i>	<i>Fundulus diaphanus</i>	<i>Fundulus heteroclitus</i>	<i>Lucania luciae</i>	<i>Menidia parva</i>	Juv. <i>Unkown</i>	<i>Pungitius pungitius</i>	<i>Uca</i>	<i>Palaemonetes spp.</i>	<i>Anguilla rostrata</i>	TOTAL NEKTON		
2003	1	-	-	-	6	-	43	-	-	-	2	-	51		
	2	-	2	-	75	1	18	-	-	-	69	-	165		
	3	-	-	-	45	-	30	-	-	-	69	-	144		
	4	-	-	-	19	-	6	-	1	-	89	-	115		
2004	1	-	-	-	5	-	20	-	-	-	-	-	25		
	2	-	-	-	201	-	123	-	7	-	2	111	444		
	3	-	-	-	89	-	39	-	-	-	54	-	182		
	4	-	-	16	109	1	11	1	1	1	192	-	332		
2005	1	1	50	-	132	-	35	30	-	-	1	-	98	3	350
	2	-	-	1	81	2	28	-	1	-	-	-	146	-	259
	3	-	4	-	189	13	55	2	5	-	-	-	112	-	380
	4	-	5	-	86	2	20	1	4	-	-	-	33	-	151
2006	1	2	238	-	335	-	14	1	5	-	3	-	145	2	745
	2	-	48	-	409	-	6	46	-	-	5	-	177	-	691
	3	-	11	-	23	-	24	-	4	-	4	-	89	-	155
	4	1	2	-	10	-	34	-	-	-	-	-	11	-	58

Conclusions

Initial analyses of the sampling data indicate that project goals are generally being met. The increase in mosquito breeding and greater need to larvicide in 2006 compared to 2005 is thought to reflect generally increased mosquito breeding across southern Suffolk County in 2006, but will be closely watched in ensuing years. The natural resource goals of the project have been very successful to date. The main cause of concern, increases in mud areas, appears to be diminishing with time. The mud flat areas in Area 1 were at least partially vegetated in general (see Figure 9). The analysis of the data sets through 2006 is not complete at this time, and more complete results will be made available at later dates. In addition, the need to continue monitoring the site is clear, and Suffolk County and USFWS are intending to continue these efforts for the foreseeable future.

References

Adamowicz, S.C., and Roman C.T., 2005, New England salt marsh pools: a quantitative analysis of geomorphic and geographic features, *Wetlands* 25(2):279-288.

James-Pirri, M-J., Roman, C.T., and Erwin, R.M., 2001, *Field Methods Manual: US Fish and Wildlife Service (Region 5) Salt Marsh Study*, University of Rhode Island, Narragansett, R.I., 62 pp.

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