Appendix C
SUPPORTING INFORMATION

CONTENTS

Appendix C-1. Air Quality Conformity Analysis

Calculation Procedures for Determining Air Emissions

In order to evaluate the applicability of this Clean Air Act statute, annual air emissions were calculated for each of the three mitigation tasks. Air emissions were estimated based on equipment types, engine sizes, and estimated hours of operation. The calculations made were of a "screening" nature using factors provided for diesel engines in the USEPA AP-42 Emission Factor document (EPA 1995). The emission factors used were expressed in lb/hp-hr. The factors utilized were as follows:

- 0.00668 lb CO/hp-hr
- 0.031 lb NOx/hp-hr
- 0.00072 lb PM10/hp-hr
- 0.00205 lb SO2/hp-hr

Emissions were calculated by simply multiplying the usage hours by the equipment horsepower and then by emission factor. To be complete, emissions were calculated for the four primary internal combustion engine related air pollutants. Total project emissions were calculated by adding the number of specific projects anticipated over a given 12-month period. In order to be conservative, all equipment was assumed to be at 100% load.

As mentioned in the air quality section of the report, the only regulatory program that would regulate such activities is a provision under the Clean Air Act referred to as General Conformity. General Conformity applies if the total of direct and indirect emissions from a proposed Federal Action in a nonattainment area (such as Barnstable County) exceed the thresholds specified in §93.153(b)(1). For this region, the only pollutant of concern would be NOx. The annual threshold established for emissions of NOx is 100 tpy.

Tables C-1 through C-3 present the emissions associated with each of the three task areas. Table C-4 provides the roll-up of annual emissions from all tasks and individual projects. NOx emissions were determined to be low. Assuming 4 stormwater projects, 4 salt marsh projects, and 3 fish passage project per year, the resulting NOx emissions would be approximately 9 tons/year. Obviously, at this level of activity, the General Conformity regulation would not apply to the Cape Cod project. In fact, the individual annual project activity could increase by 10-fold and still remain under the NOx significance threshold.

References

U.S. Environmental Protection Agency. 1995. *Compilation of Air Pollutant Emission Factors (AP-42).* Volume I, Fifth Edition. January.

Table C-1 - Stormwater Improvement Construction - Emissions Calculations

Equipment	Quantity	Use (hrs)	Horsepower	Emission Factor (lb/hp-hr) CO	NOX	PM10	SO2	Emissions (lbs) CO	NOX	PM10	SO2
Installing standard Catch basins or drywells - 1 day											
Loader	1	24	315	0.00668	0.031	0.0007	0.00205	50.5008	234.36	5.45076	15.498
Backhoe	1	40	110	0.00668	0.031	0.0007	0.00205	29.392	136.4	3.1724	9.02
10-wheel Dump Truck	1	32	350	0.00668	0.031	0.0007	0.00205	74.816	347.2	8.0752	22.96
Pickup Truck	2	8	150	0.00668	0.031	0.0007	0.00205	16.032	74.4	1.7304	4.92
Flat-bed Hauler	1	16	315	0.00668	0.031	0.0007	0.00205	33.6672	156.24	3.63384	10.332
Installing larger structures for sand filters, leaching galleys, oil-grit separators, or swirl concentrators - 3 days over a week + 1 day for piping											
Backhoe	1	56	110	0.00668	0.031	0.0007	0.00205	41.1488	190.96	4.44136	12.628
10-wheel Dump Truck	1	48	350	0.00668	0.031	0.0007	0.00205	112.224	520.8	12.1128	34.44
Loader	1	40	315	0.00668	0.031	0.0007	0.00205	84.168	390.6	9.0846	25.83
Pickup Trucks	2	16	150	0.00668	0.031	0.0007	0.00205	16.032	148.8	3.4608	9.84
								457.981	**2199.76**	**51.1622**	**145.468**

Table C-2 - Salt Marsh Construction - Emissions Calculations

Equipment	Quantity	Use (hrs)	Horsepower	Emission Factor (lb/hp-hr) CO	NOX	PM10	SO2	Emissions (lbs) CO	NOX	PM10	SO2
Excavator	1	40	268	0.00668	0.031	0.0007	0.00205	71.6096	332.32	7.72912	21.976
Loader	1	40	216	0.00668	0.031	0.0007	0.00205	57.7152	267.84	6.22944	17.712
Skidsteer	1	40	62	0.00668	0.031	0.0007	0.00205	16.5664	76.88	1.78808	5.084
15 yrd Dump	1	40	350	0.00668	0.031	0.0007	0.00205	93.52	434	10.094	28.7
3 Ton Pickup	1	40	250	0.00668	0.031	0.0007	0.00205	66.8	310	7.21	20.5
1/2 Ton Pickup	1	40	150	0.00668	0.031	0.0007	0.00205	40.08	186	4.326	12.3
								346.291	**1607.04**	**37.3766**	**106.272**

Table C-3 - Fish Passage Construction - Emissions Calculations

				Emission Factor (lb/hp-hr)				Emissions (lbs)			
Equipment	**Quantity**	**Use (hrs)**	**Horsepower**	**CO**	**NOX**	**PM10**	**SO2**	**CO**	**NOX**	**PM10**	**SO2**
Excavator (med-lg)	1	32	345	0.00668	0.031	0.0007	0.00205	73.7472	342.24	7.728	22.632
10-wheel truck	1	32	350	0.00668	0.031	0.0007	0.00205	74.816	347.2	7.84	22.96
Loader	1	32	315	0.00668	0.031	0.0007	0.00205	67.3344	312.48	7.056	20.664
Medium Capacity Pumps	2	32	30	0.00668	0.031	0.0007	0.00205	12.8256	59.52	0.672	1.968
Pickup Truck	1	32	150	0.00668	0.031	0.0007	0.00205	32.064	148.8	3.36	9.84
								260.787	**1210.24**	**26.656**	**78.064**

Table C-4 - Emissions Summary

Stormwater				
	Emissions Per Project (lbs)	**Projects Per Year**	**Emissions Per Year (lbs)**	**Emissions Per Year (tons)**
CO	458	4	1832	0.916
NOX	2200	4	8799	4.400
PM10	50	4	199	0.099
SO2	73	4	291	0.145
Salt Marsh				
	Emissions Per Project (lbs)	**Projects Per Year**	**Emissions Per Year (lbs)**	**Emissions Per Year (tons)**
CO	346	4	1385	0.693
NOX	1607	4	6428	3.214
PM10	36	4	145	0.073
SO2	106	4	425	0.213
Fish Passages				
	Emissions Per Project (lbs)	**Projects Per Year**	**Emissions Per Year (lbs)**	**Emissions Per Year (tons)**
CO	261	3	782	0.391
NOX	1210	3	3631	1.815
PM10	27	3	80	0.040
SO2	78	3	234	0.117
Total				
	Emissions Per Year (tons)		**Threshold Value (tons/year)***	
NOX	9.429		100	

* http://www.epa.gov/air/genconform/deminimis.htm

Appendix C-2. Massachusetts Category 5 Waters, "Waters Requiring a TMDL"

NAME	SEGMENT ID	DESCRIPTION	SIZE	POLLUTANT NEEDING TMDL [EPA APPROVAL DATE/DOCUMENT CONTROL NUMBER]
Cape Cod				
Ashumet Pond (96004)	MA96004_2004	Mashpee	203 acres	-Metals
Barnstable Harbor (96901)	MA96-01_2004	From the mouths of Scorton and Spring Creeks east to an imaginary line drawn from Beach Point to the western edge of the Mill Creek estuary, Barnstable.	3.3 sq mi	-Pathogens
Bass River (9662200)	MA96-12_2004	Route 6 to mouth at Nantucket Sound, Dennis/Yarmouth.	0.67 sq mi	-Pathogens
Boat Meadow River (9661450)	MA96-15_2004	Headwaters east of old railway grade to mouth at Cape Cod Bay, Eastham.	0.04 sq mi	-Pathogens
Bournes Pond (96925)	MA96-57_2004	west of Central Avenue, to Vineyard Sound, Falmouth.	0.24 sq mi	-Nutrients -Pathogens
Bucks Creek (9662025)	MA96-44_2004	Outlet from Harding Beach Pond (locally known as Sulfur Springs) to confluence with Cockle Cove, Chatham.	0.02 sq mi	-Pathogens
Bumps River (9662600)	MA96-02_2004	From outlet of pond at Bumps River Road through Scudder Bay to South Main Street bridge (confluence with Centerville River), Barnstable.	0.07 sq mi	-Pathogens
Centerville River (9662575)	MA96-04_2004	From headwaters in wetland west of Strawberry Hill Road to confluence with Centerville Harbor, including East Bay, Barnstable.	0.25 sq mi	-Pathogens
Chase Garden Creek (9661225)	MA96-35_2004	Source west of Route 6A, Dennis to mouth at Cape Cod Bay, Dennis/Yarmouth.	0.16 sq mi	-Pathogens
Cotuit Bay (96926)	MA96-63_2004	From North Bay at Point Isabella oceanward to a line extended along Oyster Harbors Beach, Barnstable.	0.85 sq mi	-Nutrients -Pathogens
Crows Pond (96049)	MA96-47_2004	To Bassing Harbor, Chatham.	0.19 sq mi	-Nutrients
Crystal Lake (96050)	MA96050_2004	Orleans	33.1 acres	-Organic enrichment/Low DO
Duck Creek (9661625)	MA96-32_2004	Source west of Route 6 to Wellfleet Harbor (at a line from Shirttail Point to Taylor Road), Wellfleet.	0.15 sq mi	-Pathogens
Falmouth Inner Harbor (96908)	MA96-17_2004	Waters included north of Inner Falmouth Harbor Light, Falmouth.	0.05 sq mi	-Pathogens
Frost Fish Creek (9661900)	MA96-49_2004	Outlet from cranberry bog northwest of Stony Hill Road to confluence with Ryder Cove, Chatham.	0.02 sq mi	-Nutrients -Pathogens
Great Harbor (96909)	MA96-18_2004	The waters north of an imaginary line drawn east from Penzance Point to Devils Foot Island and southeast from Devils Foot Island to Juniper Point (excludes Eel Pond), Falmouth.	0.31 sq mi	-Pathogens
Great Pond (96115)	MA96115_2004	Eastham	109 acres	-Nutrients -Organic enrichment/Low DO
Great Pond (96922)	MA96-54_2004	From inlet of Coonamessett River to Vineyard Sound (excluding Perch Pond), Falmouth	0.40 sq mi	-Nutrients -Pathogens
Great River (9662825)	MA96-60_2004	From inlet of Abigails Brook to Waquoit Bay (excluding Jehu Pond), Mashpee.	0.17 sq mi	-Nutrients
Green Pond (96923)	MA96-55_2004	east of Acapesket Road, outlet to Vineyard Sound, Falmouth.	0.21 sq mi	-Nutrients -Pathogens
Hamblin Pond (96126)	MA96126_2004	Barnstable	113 acres	-Metals
Hamblin Pond (96127)	MA96-58_2004	From inlet of Red Brook to outlet of Little River and inlet/outlet of Waquoit Bay west of Meadow Neck Road, Falmouth/Mashpee.	0.19 sq mi	-Nutrients -Pathogens

Appendix C-2. Massachusetts Category 5 Waters, "Waters Requiring a TMDL"

NAME	SEGMENT ID	DESCRIPTION	SIZE	POLLUTANT NEEDING TMDL [EPA APPROVAL DATE/DOCUMENT CONTROL NUMBER]
Harding Beach Pond (96128)	MA96-43_2004	locally known as Sulfur Springs (northeast of Bucks Creek), Chatham.	0.07 sq mi	-Pathogens
Herring River (9661650)	MA96-33_2004	South of High Toss Road to Wellfleet Harbor (at an imaginary line drawn due north from the eastern tip of Great Island to the opposite shore), Wellfleet.	0.39 sq mi	-Pathogens
Herring River (9661650)	MA96-67_2004	From outlet of Herring Pond to south of High Toss Road, Wellfleet.	3.6 miles	-Metals -pH
Herring River (9662150)	MA96-22_2004	Outlet of Herring River Reservoir west of Bells Neck Road to mouth at Nantucket Sound, Harwich.	0.07 sq mi	-Pathogens
Hyannis Harbor (96903)	MA96-05_2004	The waters from the shoreline to an imaginary line drawn from the light at the end of Hyannis breakwater to the point west of Dunbar Point, Barnstable.	0.68 sq mi	-Pathogens
Jehu Pond (96153)	MA96-59_2004	Mashpee.	0.09 sq mi	-Nutrients
Johns Pond (96157)	MA96157_2004	Mashpee	317 acres	-Metals
Lewis Bay (96917)	MA96-36_2004	Includes portion of Pine Island Creek and Uncle Roberts Cove to confluence with Nantucket Sound, Barnstable/Yarmouth (excluding Hyannis Inner Harbor, Barnstable/Yarmouth and Mill Creek, Yarmouth).	1.8 sq mi	-Pathogens
Little Harbor (96910)	MA96-19_2004	The waters north of an imaginary line drawn from Juniper Point east to Nobska Beach, Falmouth.	0.07 sq mi	-Pathogens
Little Namskaket Creek (9661400)	MA96-26_2004	Source to mouth at Cape Cod Bay, Orleans.	0.01 sq mi	-Pathogens
Little Pond (96924)	MA96-56_2004	west of Vista Boulevard, outlet to Vineyard Sound, Falmouth.	0.07 sq mi	-Nutrients
Little River (9662875)	MA96-61_2004	From outlet of Hamblin Pond to the Great River, Mashpee.	0.03 sq mi	-Nutrients -Pathogens
Long Pond (96183)	MA96183_2004	Brewster/Harwich	715 acres	-Organic enrichment/Low DO
Lower Mill Pond (96188)	MA96188_2004	Brewster	44.2 acres	-Nutrients -Noxious aquatic plants -Turbidity
Maraspin Creek (9661100)	MA96-06_2004	From headwaters just south of Route 6A to confluence with Barnstable Harbor at Blish Point, Barnstable.	0.03 sq mi	-Pathogens
Mashpee Pond (96194)	MA96194_2004	Mashpee/Sandwich	375 acres	-Metals
Mashpee River (9662775)	MA96-24_2004	Quinaquisset Avenue to mouth at Shoestring Bay (formerly to mouth at Popponesset Bay), Mashpee.	0.09 sq mi	-Nutrients -Pathogens
Mill Creek (9661125)	MA96-37_2004	From Keveny Lane/Mill Lane north to confluence with Cape Cod Bay, Barnstable/Yarmouth.	0.05 sq mi	-Pathogens
Mill Creek (9662075)	MA96-41_2004	Outlet of Taylors Pond to confluence with Cockle Cove, Chatham.	0.03 sq mi	-Pathogens
Mill Pond (96203)	MA96-52_2004	including Little Mill Pond (PALIS # 96174), Chatham.	0.06 sq mi	-Nutrients
Muddy Creek (9661875)	MA96-51_2004	Outlet of small unnamed pond south of Countryside Drive and north-northeast of Old Queen Anne Road to mouth at Pleasant Bay, Chatham.	0.05 sq mi	-Pathogens
Namskaket Creek (9661375)	MA96-27_2004	From outlet of unnamed pond north of Route 6A in Orleans to mouth at Cape Cod Bay, Brewster/Orleans.	0.02 sq mi	-Pathogens

Appendix C-2. Massachusetts Category 5 Waters, "Waters Requiring a TMDL"

NAME	SEGMENT ID	DESCRIPTION	SIZE	POLLUTANT NEEDING TMDL [EPA APPROVAL DATE/DOCUMENT CONTROL NUMBER]
North Bay (96928)	MA96-66_2004	From Fox Island to just south of Bridge Street and separated from Cotuit Bay at a line from Point Isabella southward to the opposite shore (including Dam Pond), Barnstable.	0.47 sq mi	-Nutrients -Pathogens
Oyster Pond (96234)	MA96-45_2004	Including Stetson Cove, Chatham.	0.21 sq mi	-Nutrients -Pathogens
Oyster Pond (96235)	MA96-62_2004	east of Fells Road, Falmouth.	0.10 sq mi	-Pathogens
Oyster Pond River (9662000)	MA96-46_2004	Outlet of Oyster Pond to confluence with Stage Harbor, Chatham.	0.14 sq mi	-Nutrients -Pathogens
Pamet River (9661725)	MA96-31_2004	Route 6 to mouth at Cape Cod Bay (including Pamet Harbor), Truro.	0.14 sq mi	-Pathogens
Parkers River (9662325)	MA96-38_2004	Outlet Seine Pond to mouth at Nantucket Sound, Yarmouth.	0.04 sq mi	-Pathogens
Perch Pond (96921)	MA96-53_2004	Connects to northwest end of Great Pond, west of Keechipam Way, Falmouth.	0.03 sq mi	-Pathogens
Peters Pond (96244)	MA96244_2004	Sandwich	123 acres	-Metals
Popponesset Bay (96918)	MA96-40_2004	From line connecting Ryefield Point, Barnstable and Punkhorn Point, Mashpee to inlet of Nantucket Sound (including Ockway Bay and Pinquickset Cove), Mashpee/Barnstable.	0.67 sq mi	-Nutrients
Popponesset Creek (9662800)	MA96-39_2004	All waters west of Popponesset Island (from Popponesset Island Road bridge at the north to a line extended from the southeastern most point of the island southerly to Popponesset Beach), Mashpee.	0.04 sq mi	-Pathogens
Prince Cove (96904)	MA96-07_2004	Includes adjacent unnamed cove east of Prince Cove to North Bay at Fox Island, Barnstable.	0.14 sq mi	-Nutrients -Pathogens
Provincetown Harbor (96915)	MA96-29_2004	The waters northwest of an imaginary line drawn northeasterly from the tip of Long Point, Provincetown to Beach Point Beach, Truro.	4.3 sq mi	-Pathogens
Quashnet River (9662925)	MA96-20_2004	Just south of Route 28 to mouth at Waquoit Bay, Falmouth. Also known as Moonakis River.	0.07 sq mi	-Nutrients -Organic enrichment/Low DO -Pathogens
Quivett Creek (9661325)	MA96-09_2004	Outlet of unnamed pond just south of Route 6A to the mouth at Cape Cod Bay, Brewster/Dennis.	0.03 sq mi	-Pathogens
Red Lily Pond (96257)	MA96257_2004	Barnstable	3.8 acres	-Nutrients -Pathogens -Noxious aquatic plants
Rock Harbor Creek (9661425)	MA96-16_2004	Outlet Cedar Pond, Orleans to mouth at Cape Cod Bay, Eastham/Orleans.	0.02 sq mi	-Pathogens
Ryder Cove (96920)	MA96-50_2004	Chatham.	0.17 sq mi	-Nutrients -Pathogens
Ryder Pond (96268)	MA96268_2004	Truro	18.0 acres	-Nutrients -Organic enrichment/Low DO
Santuit Pond (96277)	MA96277_2004	Mashpee	164 acres	-Nutrients -Noxious aquatic plants
Saquatucket Harbor (96913)	MA96-23_2004	South of Route 28 to confluence with Nantucket Sound, Harwich.	0.02 sq mi	-Pathogens

Appendix C-2. Massachusetts Category 5 Waters, "Waters Requiring a TMDL"

NAME	SEGMENT ID	DESCRIPTION	SIZE	POLLUTANT NEEDING TMDL [EPA APPROVAL DATE/DOCUMENT CONTROL NUMBER]
Scorton Creek (9660800)	MA96-30_2004	Jones Lane to mouth at Cape Cod Bay, Sandwich (including several tributaries).	0.07 sq mi	-Pathogens
Seapuit River (9662650)	MA96-64_2004	south of Osterville Grand Island to Cotuit Bay and West Bay, Barnstable.	0.06 sq mi	-Pathogens
Sesuit Creek (9661300)	MA96-13_2004	From Route 6A to mouth at Cape Cod Bay, Dennis.	0.06 sq mi	-Pathogens
Sheep Pond (96289)	MA96289_2004	Brewster	138 acres	-Metals -Organic enrichment/Low DO
Shoestring Bay (96905)	MA96-08_2004	Quinaquisset Avenue to Popponesset Bay (line from Ryefield Point, Barnstable to Punkhorn Point, Mashpee, including Gooseberry Island), Barnstable/Mashpee.	0.31 sq mi	-Nutrients -Pathogens
Snake Pond (96302)	MA96302_2004	Sandwich	81.1 acres	-Metals
Stage Harbor (96907)	MA96-11_2004	From the outlet of Mill Pond (including Mitchell River) to the confluence with Nantucket Sound at a line from the southernmost point of Harding Beach southeast to the Harding Beach Point , Chatham.	0.58 sq mi	-Nutrients -Pathogens
Swan Pond River (9662175)	MA96-14_2004	Outlet of Swan Pond to confluence with Nantucket Sound, Dennis.	0.04 sq mi	-Pathogens
Taylors Pond (96311)	MA96-42_2004	Chatham.	0.02 sq mi	-Pathogens
Upper Mill Pond (96324)	MA96324_2004	Brewster	247 acres	-Nutrients -Organic enrichment/Low DO -Noxious aquatic plants -Turbidity
Wakeby Pond (96346)	MA96346_2004	Mashpee/Sandwich	353 acres	-Metals
Walkers Pond (96331)	MA96331_2004	Brewster	99.4 acres	-Nutrients -Noxious aquatic plants -Turbidity
Waquoit Bay (96912)	MA96-21_2004	From mouths of Seapit River, Quashnet River (also known as Moonakis River), and Great River to confluence with Vineyard Sound, Falmouth/Mashpee.	1.4 sq mi	-Nutrients -Organic enrichment/Low DO -Pathogens
Wellfleet Harbor (96916)	MA96-34_2004	The waters north of an imaginary line drawn east from the southern tip of Jeremy Point, Wellfleet to Sunken Meadow, Eastham excluding the estuaries of Herring River, Duck Creek, Blackfish Creek, and Fresh Brook, Wellfleet.	8.5 sq mi	-Pathogens
Wequaquet Lake (96333)	MA96333_2004	Barnstable	573 acres	-Metals -(Exotic species*)
West Bay (96927)	MA96-65_2004	south of the Bridge Street bridge to Nantucket Sound including Eel River, Barnstable.	0.52 sq mi	-Nutrients

Appendix C-3. Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species

Species	Life Stage	Geographic Area	Temp (C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
American plaice	Eggs	GOME, GB and estuaries from Passamaquoddy Bay to Saco Bay, ME and from Mass. Bay to Cape Cod Bay, MA	<12	-32	30 - 90	All year in GOME Dec - June on GB Peaks April & May both	Surface waters	
	Larvae	GOME, GB, Southern NE and estuaries from Passamaquoddy Bay to Saco Bay, ME and from Mass Bay to Cape Cod Bay, MA	<14	-32	30-130	Between January and August, with peaks in April and May	Surface Waters	
	Juveniles	GOME and estuaries from Passamaquoddy Bay to Saco Bay, ME and from Mass Bay to Cape Cod Bay, MA	<17	-32	45-150		Bottom habitats with fine-grained sediments or substrate of sand or gravel	(Strong concentrations inside and around 100m isobath in Western GOME; Major Prey: echinoderms, arthropods, annelids)
	Adults	GOME, GB and estuaries from Passamaquoddy Bay to Saco Bay, ME and from Mass Bay to Cape Cod Bay, MA	<17	(34-20)	45-175		Bottom habitats with fine-grained sediments or a substrate of sand or gravel	
	Spawning Adults	GOME, GB and estuaries from Passamaquoddy Bay to Saco Bay, ME and from Mass Bay to Cape Cod Bay, MA	<14	-32	<90	March through June	Bottom habitats of all substrate types	

Appendix C-3. Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species

Species	Life Stage	Geographic Area	Temp (C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
Atlantic cod	Eggs	GOME, GB, eastern portion of continental shelf off southern NE and following estuaries: Englishman/ Machias Bay to Blue Hill Bay; Sheepscot R., Casco Bay, Saco Bay, Great Bay, Mass Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	<12	32 - 33 (10 - 35)	<110	Begins in fall, peaks in winter and spring	Surface Waters	
	Larvae	GOME, GB, eastern portion of continental shelf off southern NE and following estuaries: Passamaquoddy Bay to Penobscot Bay; Sheepscot R., Casco Bay, Saco Bay, Great Bay, Mass Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	<10	32 - 33	30-70	Spring	Pelagic waters	
	Juveniles	GOME, GB, eastern portion of continental shelf off southern NE and following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	<20	30 - 35	25 - 75		Bottom habitats with a substrate of cobble or gravel	HAPC - An area approximate of 300sq. nautical miles along the northern edge of GB and the Hague line containing gravel cobble substrate.
	Adults	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	<10	(29 - 34)	10-150		Bottom habitats with a substrate of rocks, pebbles, or gravel	(Major prey: fish crustaceans, decapods, amphipods)

Appendix C-3. Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species

Species	Life Stage	Geographic Area	Temp (C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Spawning Adults	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and following estuaries: Englishman/ Machias Bay to Blue Hill Bay; Sheepscot R., Mass Bay, Boston Harbor, Cape Cod Bay, MA	<10	(10 - 35)	10-150	spawn during fall, winter, and early spring	Bottom habitats with a substrate of smooth sand, rocks, pebbles, or gravel	
Atlantic halibut	Eggs	GOME, GB	7-Apr	<35	<700	Between late fall and early spring, peak Nov and Dec.	Pelagic waters to the sea floor	
	Larvae	GOME, GB		30 - 35			Surface waters	
	Juveniles	GOME, GB	>2		20 - 60		Bottom habitats with a substrate of sand, gravel, or clay	
	Adults	GOME, GB	<13.6	30.4-35.3	100-700		Bottom habitats with a substrate of sand, gravel, or clay	(Major prey: crustaceans, fish, cod, squid)
	Spawning Adults	GOME, GB	<7	<35	<700	Between late fall and early spring, peaks in Nov. and Dec.	Bottom habitats with a substrate of soft mud, clay, sand, or gravel; rough or rocky bottom locations along slopes of the outer banks	

Appendix C-3. Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species

Species	Life Stage	Geographic Area	Temp (C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
Atlantic herring	Eggs	GOME, GB and following estuaries: Englishman/ Machias Bay, Casco Bay,& Cape Cod Bay	<15	32 - 33	20 - 80	July through November	Bottom habitats with a substrate of gravel, sand, cobble, shell fragments & aquatic macrophytes. .	Eggs adhere to bottom forming extensive beds. Eggs most often found in areas of well-mixed water, with tidal currents between 1.5 and 3.0 knots (Egg beds can range from 4500 to 10,000 Km^2 on GB. Eggs susceptible to suffocation from high densities and siltation)
	Larvae	GOME, GB, Southern NE and following estuaries: Passamaquoddy Bay to Cape Cod Bay, Narragansett Bay, & Hudson R./ Raritan Bay	<16	32	50 - 90	Between August and April, peaks from Sept. - Nov.	Pelagic waters	
	Juveniles	GOME, GB, Southern NE and Middle Atlantic south to Cape Hatteras and following estuaries: Passamaquoddy Bay to Cape Cod Bay; Buzzards Bay to Long Island Sound; Gardiners Bay to Delaware Bay	<10	26 - 32	15-135		Pelagic waters and bottom habitats	
	Adults	GOME, GB, southern NE and middle Atlantic south to Cape Hatteras and following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Cape Cod Bay; Buzzards Bay to Long Island Sound; Gardiners Bay to Delaware Bay; & Chesapeake Bay	<10	>28	20-130		Pelagic waters and bottom habitats	(major prey: zooplankton)

Appendix C-3. Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species

Species	Life Stage	Geographic Area	Temp (C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Spawning Adults	GOME, GB, southern NE and middle Atlantic south to Delaware Bay and Englishman/ Machias Bay Estuary	<15	32 - 33	20 - 80	July through November	Bottom habitats with a substrate of gravel, sand, cobble and shell fragments, also on aquatic macrophytes	Herring eggs are spawned in areas of well-mixed water, with tidal currents between 1.5 and 3.0 knots
Atlantic salmon	Eggs	Rivers from CT to Maine: Connecticut, Pawcatuck, Merrimack, Cocheco, Saco, Androscoggin, Presumpscot, Kennebec,	<10	Fresh water	30-31 cm	Between October and April	Bottom habitats with a gravel or cobble riffle (redd) above or below a pool in rivers	need clean well-oxygenated freshwater
	Larvae	Sheepscot, Ducktrap, Union, Penobscot, Narraguagus, Machias, East Machias, Pleasant, St. Croix, Denny's, Passagassawaukeag Aroostook, Lamprey, Boyden, Orland Rivers, and the Turk, Hobart & Patten Streams; and the following estuaries for juveniles and adults: Passamaquoddy Bay to Muscongus Bay; Casco Bay to Wells Harbor; Mass Bay, Long Island Sound, Gardiners Bay to Great South Bay.	<10	Fresh water		Between March and June for alevins/fry	Bottom habitats with a gravel or cobble riffle (redd) above or below a pool in rivers	
	Juveniles	Sheepscot, Ducktrap, Union, Penobscot, Narraguagus, Machias, East Machias, Pleasant, St. Croix, Denny's, Passagassawaukeag Aroostook, Lamprey, Boyden, Orland Rivers, and the Turk, Hobart & Patten Streams; and the following estuaries for juveniles and adults: Passamaquoddy Bay to Muscongus Bay; Casco Bay to Wells Harbor; Mass Bay, Long Island Sound, Gardiners Bay to Great South Bay.	<25	Fresh water to Oceanic	10- 61 cm		Bottom habitats of shallow gravel/cobble riffles interspersed with deeper riffles and pools in rivers and estuaries Water velocities between 30 - 92cm/sec	As they grow, parr transform into smolts. Atlantic salmon smolts require access downstream to the ocean. Upon entering the ocean, post-smolts become pelagic and range from Long Island Sound north to the Labrador Sea.

Appendix C-3. Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species

Species	Life Stage	Geographic Area	Temp (C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Adults	All aquatic habitats in the watersheds of the above listed rivers, including all tributaries to the extent that they are currently or were historically accessible for salmon migration.	<22.8	Fresh water to Oceanic			Oceanic adult Atlantic salmon are primarily pelagic and range from waters of the continental shelf off southern NE north throughout the GOME Dissolved oxygen above 5ppm for migratory pathway.	HAPC - Eleven rivers in Maine includes: St. Croix, Denny's, East Machias, Machias, Pleasant, Turk stream, Narraguagus, Penobscot, Ducktrap, Sheepscot, and Kennebec River.
	Spawning Adults		<10	Fresh water	30- 61 cm	October and November	Bottom habitats with a gravel or cobble riffle (redd) above or below a pool in rivers	Water velocity around 61cm per second
Atlantic sea scallop	Eggs	GOME, GB, southern NE and middle Atlantic south to Virginia-North Carolina border and following estuaries: Passamaquoddy Bay to Sheepscot R.; Casco Bay, Mass Bay, and Cape Cod Bay	<17			May through October Peaks in May and June in middle Atlantic area, and in Sept. and Oct. on GB and GOME	Bottom habitats	Eggs remain on sea floor until they develop into the first free-swimming larval stage.
	Larvae	GOME, GB, southern NE and middle Atlantic south to Virginia-North Carolina border and following estuaries: Passamaquoddy Bay to Sheepscot R.; Casco Bay, Mass Bay, and Cape Cod Bay	<18	16.9 - 30			Pelagic waters and bottom habitats with a substrate of gravelly sand, shell fragments, pebbles, or on various red algae, hydroids, amphipod tubes and bryozoans	

Appendix C-3. Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species

Species	Life Stage	Geographic Area	Temp (C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Juveniles	GOME, GB, southern NE and middle Atlantic south to Virginia-North Carolina border and following estuaries: Passamaquoddy Bay to Sheepscot R.; Casco Bay, Great Bay, Mass Bay, and Cape Cod Bay	<15		18-110		Bottom habitats with a substrate of cobble, shells, and silt	(prey: filter feeders on phytoplankton; preferred substrates are associated with low concentrations of inorganics for optimal feeding)
	Adults	GOME, GB, southern NE and middle Atlantic south to Virginia-North Carolina border and following estuaries: Passamaquoddy Bay to Sheepscot R.; Casco Bay, Great Bay, Mass Bay, and Cape Cod Bay	<21	>16.5	18-110		Bottom habitats with a substrate of cobble, shells, coarse/gravelly sand, and sand	
	Spawning Adults	GOME, GB, southern NE and middle Atlantic south to Virginia-North Carolina border and following estuaries: Passamaquoddy Bay to Sheepscot R.; Casco Bay, Mass Bay, and Cape Cod Bay	<16	>16.5	18-110	May through October, peaks in May and June in middle Atlantic area, and in Sept. and Oct. on GB and in GOME	Bottom habitats with a substrate of cobble, shells, coarse/gravelly sand, and sand	
Haddock	Eggs	GB southwest to Nantucket Shoals and coastal areas of GOME and the following estuaries: Great Bay, Mass Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	<10	34 - 36	50 - 90	March to May, peak in April	Surface waters	
	Larvae	GB southwest to the middle Atlantic south to Delaware Bay and the following estuaries: Great Bay, Mass Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay, and Narragansett Bay	<14	34 - 36	30 - 90	January to July, peak in April and May	Surface waters	

Appendix C-3. Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species

Species	Life Stage	Geographic Area	Temp (C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Juveniles	GB, GOME, middle Atlantic south to Delaware Bay	<11	31.5 - 34	35-100		Bottom habitats with a substrate of pebble gravel	
	Adults	GB and eastern side of Nantucket Shoals, throughout GOME, *additional area of Nantucket Shoals, and Great South Channel	<7	31.5 - 35	40-150		Bottom habitats with a substrate of broken ground, pebbles, smooth hard sand, and smooth areas between rocky patches	*additional area more accurately reflects historic patterns of distribution and abundance
	Spawning Adults	GB, Nantucket Shoals, Great South Channel, throughout GOME	<6	31.5 - 34	40-150	January to June	Bottom habitats with a substrate of pebble gravel or gravelly sand	
Monkfish (Goosefish)	Eggs	GOME, GB, southern NE, middle Atlantic south to Cape Hatteras, North Carolina	<18		15- 1000	March to September	Surface waters	(eggs contained in long mucus veils that float near or at the surface)
	Larvae	GOME, GB, southern NE, middle Atlantic south to Cape Hatteras, North Carolina	15		25-1000	March to September	Pelagic waters	
	Juveniles	Outer continental shelf in the middle Atlantic, mid-shelf off southern NE, all areas of GOME	<13	29.9-36.7	25-200		Bottom habitats with substrates of a sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud	

Appendix C-3. Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species

Species	Life Stage	Geographic Area	Temp (C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Adults	Outer continental shelf in the middle Atlantic, mid-shelf off southern NE, outer perimeter of GB, all areas of GOME	<15	29.9-36.7	25-200		Bottom habitats with substrates of a sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud	(Major prey: fish, shrimp, squid, crustaceans, mollusks)
	Spawning Adults	Outer continental shelf in the middle Atlantic, mid-shelf off southern NE, outer perimeter of GB, all areas of GOME	<13	29.9-36.7	25-200	February to August	Bottom habitats with substrates of a sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud	
Ocean pout	Eggs	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay and Cape Cod Bay	<10	32-34	<50	Late fall and winter	Bottom habitats, generally hard bottom sheltered nests, holes, or crevices where they are guarded by parents	(eggs are laid in gelatinous masses and take 2-3 months to develop
	Larvae	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay and Cape Cod Bay	<10	>25	<50	Late fall to spring	Bottom habitats in close proximity to hard bottom nesting areas	
	Juveniles	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay, Boston Harbor and Cape Cod Bay	<14	>25	<80		Bottom habitats, often smooth bottom near rocks or algae	

Appendix C-3. Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species

Species	Life Stage	Geographic Area	Temp (C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Adults	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay, Boston Harbor and Cape Cod Bay	<15	32 - 34	<110		Bottom habitats. (Dig depressions in soft sediments which are then used by other species)	(major prey: mollusks, crustaceans, echinoderms, sand dollars)
	Spawning Adults	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay, and Cape Cod Bay	<10	32 - 34	<50	Late summer to early winter, peaks in Sept. and October	Bottom habitats with a hard bottom substrate, including artificial reefs and shipwrecks	(internal fertilization)
Offshore hake	Eggs	Outer continental shelf of GB and southern NE south to Cape Hatteras, North Carolina	<20		<1250	Observed all year and primarily collected at depths from 110 - 270m	Pelagic waters	
	Larvae	Outer continental shelf of GB and southern NE south to Chesapeake Bay	<19		<1250	Observed all year and primarily collected at depths from 70 - 130m	Pelagic waters	
	Juveniles	Outer continental shelf of GB and southern NE south to Cape Hatteras, NC	<12		170- 350		Bottom habitats	
	Adults	Outer continental shelf of GB and southern NE south to Cape Hatteras, NC	<12		150 - 380		Bottom habitats	(major prey: fish - cannibalistic, shrimp, other crustaceans)
	Spawning Adults	Outer continental shelf of GB and southern NE south to the Middle Atlantic Bight	<12		330 - 550	Spawn all throughout the year	Bottom habitats	
Pollock	Eggs	GOME, GB and the following estuaries: Great Bay to Boston Harbor	<17	32 - 32.8	30-270	October to June, peaks in November to February	Pelagic waters	

Appendix C-3. Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species

Species	Life Stage	Geographic Area	Temp (C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Larvae	GOME, GB and the following estuaries: Passamaquoddy Bay, Sheepscot R., Great Bay to Cape Cod Bay	<17		10-250	September to July, peaks from Dec. to February	Pelagic waters	(migrate inshore as they grow)
	Juveniles	GOME, GB and the following estuaries: Passamaquoddy Bay to Saco Bay; Great Bay to Waquoit Bay; Long Island Sound, Great South Bay	<18	29 - 32	0 - 250		Bottom habitats with aquatic vegetation or a substrate of sand, mud or rocks	(Intertidal zone may be important nursery area. Juveniles present in shallow intertidal zone at all tide stages throughout summer. Subtidal marsh creeks such as Little Egg Harbor, NJ are also seasonally important as nursery)
	Adults	GOME, GB, southern NE, and middle Atlantic south to New Jersey and the following estuaries: Passamaquoddy Bay, Damariscotta R., Mass Bay, Cape Cod Bay, Long Island Sound	<14	31 - 34	15-365		Hard bottom habitats including artificial reefs	(major prey: crustaceans, fish, mollusks)
	Spawning Adults	GOME, southern NE, and middle Atlantic south to New Jersey includes Mass Bay	<8	32 - 32.8	15-365	September to April, peaks December to February	Bottom habitats with a substrate of hard, stony, or rocky bottom includes artificial reefs	
Red hake	Eggs	GOME, GB, continental shelf off southern NE, and middle Atlantic south to Cape Hatteras	<10	< 25		May to November, peaks in June and July	Surface waters of inner continental shelf	

Appendix C-3. Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species

Species	Life Stage	Geographic Area	Temp (C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Larvae	GOME, GB, continental shelf off southern NE, and middle Atlantic south to Cape Hatteras and following estuaries: Sheepscot R., Mass Bay to Cape Cod Bay; Buzzards Bay, Narragansett Bay & Hudson R./ Raritan Bay	<19	>0.5	<200	May to December, peaks in Sept. and October	Surface waters	(newly settled larvae need shelter, including live sea scallps, also use floating or mid-water objects for shelter)
	Juveniles	GOME, GB, continental shelf off southern NE, and middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Saco Bay; Great Bay, Mass Bay to Cape Cod Bay; Buzzards Bay to Conn. R.; Hudson R./ Raritan Bay, & Chesapeake Bay	<16	31 - 33	<100		Bottom habitats with substrate of shell fragments, including areas with an abundance of live scallops	
	Adults	GOME, GB, continental shelf off southern NE, and middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Saco Bay; Great Bay, Mass Bay to Cape Cod Bay; Buzzards Bay to Conn. R.; Hudson R./ Raritan, Delaware Bay, & Chesapeake Bay	<12	33 - 34	10-130		Bottom habitats in depressions with a substrate of sand and mud	(major prey: fish and crustaceans)
	Spawning Adults	GOME, southern edge of GB, continental shelf off southern NE, and middle Atlantic south to Cape Hatteras and following estuaries: Sheepscott R., Mass Bay, Cape Cod Bay, Buzzards Bay, & Narragansett Bay	<10	>25	<100	May to November, peaks in June and July	Bottom habitats in depressions with a substrate of sand and mud	

Appendix C-3. Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species

Species	Life Stage	Geographic Area	Temp (C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
Redfish	Eggs	No EFH identification or description for this life history stage						Redfish are ovoviviparous (live bearers)
	Larvae	GOME, southern GB	<15		50-270	March to October, peak in August	Pelagic waters	
	Juveniles	GOME, southern edge of GB	<13	31 - 34	25-400		Bottom habitats with a substrate of silt, mud, or hard bottom	
	Adults	GOME, southern edge of GB	<13	31 - 34	50-350		Bottom habitats with a substrate of silt, mud, or hard bottom	
	Spawning Adults	GOME, southern edge of GB	<13	31 - 34	5 -350	April to August	Bottom habitats with a substrate of silt, mud, or hard bottom	copulation occurs between Oct-Jan. Fertilization is delayed until Feb-Apr
White hake	Eggs	GOME, GB, southern NE and the following estuaries: Great Bay to Cape Cod Bay				August to September	Surface waters	
	Larvae	GOME, southern edge of GB, southern NE to middle Atlantic and the following estuaries: Mass Bay, to Cape Cod Bay				May -mid-Atlantic area Aug. & Sept. - GOME, GB area	Pelagic waters	
	Juveniles	GOME, southern edge of GB, southern NE to middle Atlantic and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Cape Cod Bay	<19		5 - 225	May-Sep - pelagic	Pelagic stage - pelagic waters; Dermersal stage - Bottom habitat with seagrass beds or substrate of mud or fine-grained sand	

Appendix C-3. Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species

Species	Life Stage	Geographic Area	Temp (C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Adults	GOME, southern edge of GB, southern NE to middle Atlantic and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Cape Cod Bay	<14		5 - 325		Bottom habitats with substrate of mud or fine-grained sand	(major prey: small fish, shrimp and other crustaceans)
	Spawning Adults	GOME, southern edge of GB, southern NE to middle Atlantic	<14		5 - 325	April to May - southern part of range; August - Sept.-northern part of range	Bottom habitats with substrate of mud or fine-grained sand in deep water.	
Whiting (Silver hake)	Eggs	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Merrimack R. to Cape Cod Bay	<20		50-150	All year, peaks June to October	Surface waters	
	Larvae	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Mass Bay to Cape Cod Bay	<20		50-130	All year, peaks July to September	Surface waters	
	Juveniles	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Casco Bay, Mass Bay to Cape Cod Bay	<21	>20	20-270		Bottom habitats of all substrate types	
	Adults	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Casco Bay, Mass Bay to Cape Cod Bay	<22		30-325		Bottom habitats of all substrate types	

Appendix C-3. Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species

Species	Life Stage	Geographic Area	Temp (C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Spawning Adults	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Mass Bay and Cape Cod Bay	<13		30-325		Bottom habitats of all substrate types	
Windowpane flounder	Eggs	GOME, GB, southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Delaware Inland Bays	<20		<70	February to November, peaks May and October in middle Atlantic July - August on GB	Surface waters	
	Larvae	GOME, GB, southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Delaware Inland Bays	<20		<70	February to November, peaks May and October in middle Atlantic July - August on GB	Pelagic waters	
	Juveniles	GOME, GB, southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Chesapeake Bay	<25	5.5 - 36	1 - 100		Bottom habitats with substrate of mud or fine grained sand	
	Adults	GOME, GB, southern NE, middle Atlantic south to Virginia - NC border and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Chesapeake Bay	<26.8	5.5 - 36	<70		Bottom habitats with substrate of mud or fine grained sand	(major prey: polychaetes, small crustaceans, mysids, small fish)

Appendix C-3. Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species

Species	Life Stage	Geographic Area	Temp (C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Spawning Adults	GOME, GB, southern NE, middle Atlantic south to Virginia -NC border and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Delaware Inland Bays	<21	5.5 - 36	<70	February - December, peak in May in middle Atlantic	Bottom habitats with substrate of mud or fine grained sand	
Winter flounder	Eggs	GB, inshore areas of GOME, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Delaware Inland Bays	<10	30-Oct	<5	February to June, peak in April on GB	Bottom habitats with a substrate of sand, muddy sand, mud, and gravel	* On GB, eggs are generally found in water temp < 8EC, and < 90m deep.
	Larvae	GB, inshore areas of GOME, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Delaware Inland Bays	<15	30-Apr	<6	March to July, peaks in April and May on GB	Pelagic and bottom waters	* On GB, larvae are generally found in water temp < 8EC, and < 90m deep.
	Juveniles (age 1+)	GB, inshore areas of GOME, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Chincoteague Bay	<25	30-Oct	Jan-50		Bottom habitats with a substrate of mud or fine grained sand	* Young-of-year exist where water temp <28, depths 0.1 - 10m, salinities 5 - 33 (major prey: amphipods, copepods, polychaetes, bivalve siphons)
	Adults	GB, inshore areas of GOME, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Chincoteague Bay	<25	15 - 33	1 - 100		Bottom habitats including estuaries with substrate of mud, sand, gravel	(major prey: amphipods, polychaetes, bivalve siphons, crustaceans)

Appendix C-3. Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species

Species	Life Stage	Geographic Area	Temp (C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Spawning Adults	GB, inshore areas of GOME, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Delaware Inland Bays	<15	5.5 - 36	<6*	February to June	Bottom habitats including estuaries with substrate of mud, sand, gravel	*except on GB where they spawn as deep as 80m
Witch flounder	Eggs	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras	<13	High	Deep	March to October	Surface waters	
	Larvae	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras	<13	High	Deep	March to November, peaks in May - July	Surface waters to 250m	
	Juveniles	GOME, outer continental shelf from GB south to Cape Hatteras	<13	34 - 36	50-450 to 1500m		Bottom habitats with fine-grained substrate	(the upper slope is nursery area; major prey: crustaceans, polychaetes, mollusks)
	Adults	GOME, outer continental shelf from GB south to Chesapeake Bay	<13	32 - 36	25-300		Bottom habitats with fine-grained substrate	(major prey: polychaetes, echinoderms, crustaceans, mollusks, squid)
	Spawning Adults	GOME, outer continental shelf from GB south to Chesapeake Bay	<15	32 - 36	25-360	March to November, peaks in May-August	Bottom habitats with fine-grained substrate	
Yellowtail flounder	Eggs	GB, Mass Bay, Cape Cod Bay, southern NE continental shelf south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Saco Bay; Great Bay to Cape Cod Bay	<15	32.4 -33.5	30 - 90	Mid-March to July, peaks in April to June in southern NE	Surface waters	

Appendix C-3. Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species

Species	Life Stage	Geographic Area	Temp (C)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Larvae	GB, Mass Bay, Cape Cod Bay, southern NE continental shelf, middle Atlantic south to Chesapeake Bay and the following estuaries: Passamaquoddy Bay to Cape Cod Bay	<17	32.4 -33.5	Oct-90	March to April in New York bight; May to July in south NE and southeastern GB	Surface waters	(largely an oceanic nursery)
	Juveniles	GB, GOME, southern NE continental shelf south to Delaware Bay and the following estuaries: Sheepscot R., Casco Bay, Mass Bay to Cape Cod Bay	<15	32.4 -33.5	20 - 50		Bottom habitats with substrate of sand or sand and mud	
	Adults	GB, GOME, southern NE continental shelf south to Delaware Bay and the following estuaries: Sheepscot R., Casco Bay, Mass Bay to Cape Cod Bay	<15	32.4 -33.5	20 - 50		Bottom habitats with substrate of sand or sand and mud	(major prey: annelids, arthropods, mollusks)
	Spawning Adults	GB, GOME, southern NE continental shelf south to Delaware Bay and the following estuaries: Mass Bay to Cape Cod Bay	<17	32.4 -33.5	10-125		Bottom habitats with substrate of sand or sand and mud	

Source: NOAA 2006

APPENDIX C-4. ESSENTIAL FISH HABITAT IMPACT ASSESSMENT

Essential Fish Habitat Programmatic Consultation between the National Marine Fisheries Service, Northeast Regional Office (New England/Mid-Atlantic) and Natural Resources Conservation Service, Cape Cod Water Resource Restoration Project

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) strengthened the ability of the National Marine Fisheries Service (NMFS) and the Councils to protect and conserve the habitat of marine, estuarine, and anadromous fish, mollusks, and crustaceans. This habitat is termed essential fish habitat (EFH). EFH is defined to include "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity" (NOAA 2006). The Magnuson-Stevens Act requires Councils to describe and identify the essential habitat for managed species, minimize adverse effects on EFH caused by fishing, and identify other actions to encourage the conservation and enhancement of EFH.

Purpose

Under Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), Federal agencies are required to consult with the Secretary of Commerce on any action that may adversely affect EFH. Consultation can be addressed programmatically to broadly consider as many adverse effects as possible through programmatic EFH conservation recommendations.

The programmatic consultation applies to the Natural Resources Conservation Service (NRCS) watershed plan for Cape Cod to restore salt marshes, restore fish passage on anadromous fish runs, and restore and protect water quality at shellfish beds by treating stormwater runoff.

Project Description

NRCS developed the Cape Cod Water Resources Restoration Project (CCWRRP) in coordination with local sponsors. The CCWRRP Project Area is located within Barnstable County, Massachusetts, and includes all of Cape Cod except the Massachusetts Military Reservation. The project area includes all or parts of the 15 communities on Cape Cod (Figure 1). The CCWRRP includes individual projects for:

- Altering stream crossings to improve tidal flushing at locations where a road has reduced the size of the tidal channel and affected upstream salt marsh hydrology;
- Repairing and upgrading fish passages to restore herring runs; and
- Treating the first flush of stormwater runoff to improve water quality in shellfish areas.

NRCS worked with Massachusetts Division of Marine Fisheries (DMF), Massachusetts Office of Coastal Zone Management (CZM) and town officials to identify sites with

restricted tidal marshes, poorly functioning fish passages, or stormwater discharges into shellfish beds. NRCS then worked with DMF, CZM, and the towns to screen those sites to a list of preferred sites for each category. NRCS and DMF also identified measures that could be implemented to restore habitat or improve water quality for each type of project, they estimated the costs to implement specific projects, and they estimated the ecological value to be achieved from each project.

This Project is needed because human activity on Cape Cod has degraded its natural resources, including salt marshes, anadromous fish runs, and water quality over shellfish beds. The development of Cape Cod has required the construction of extensive road and railroad networks. Along the coast, culverts or bridges were needed for these networks to cross tidal marshes, and many of the openings through these structures are not large enough to allow adequate tidal flushing. When the culverts or bridges constrict flow, the tidal regime changes, which results in vegetation changes over time, and what was once a thriving salt marsh can become a brackish or fresh water wetland dominated by invasive species. Together with funding from the Massachusetts Office of Coastal Zone Management (CZM), the Cape Cod Commission and the Buzzards Bay Project National Estuary Program identified over 182 sites where salt marshes have been altered by human activity; through this program we expect to improve tidal flushing at 26 sites (Figure 2). Current design guidelines prevent or minimize road or railroad construction from causing the same hydrological restrictions that occurred in the past.

Human activity on Cape Cod has also resulted in damming or diverting streams, causing anadromous fish to lose access to spawning grounds. In addition, water flow may have been altered by cranberry growers and other farmers. Fish ladders and other fish passage facilities have been built to help ensure that fish get access to spawning areas, but these structures deteriorate over time (end of design life), or they may be of obsolete design and need replacement to function properly. The Massachusetts Division of Marine Fisheries (DMF) identified 93 fish passage obstructions on Cape Cod; through this program we expect to restore 24 fish passages on Cape Cod to full function (Figure 3).

Cape Cod's economy depends on good water quality. Shellfishing, a multi-million dollar industry on the Cape, is only allowed in areas with excellent water quality. As land is developed, and more areas are paved, stormwater runoff may become contaminated with nutrients, metals, fertilizers, bacteria, etc. This runoff may carry enough fecal coliform bacteria to affect water quality in shellfishing areas, thus leading to closure of shellfishing areas, or restrictions on the periods when the beds can remain open. DMF and town officials identified over 160 stormwater discharge points into shellfishing areas. By controlling sources of runoff, separating clean water from contamination sources, and capturing and treating the most heavily contaminated runoff through a variety of measures (e.g., infiltration, constructed wetlands), this Project will help to maintain or improve water quality in up to 26 shellfish areas affecting 7,300 acres of shellfish beds (Figure 4). Current laws and regulations require stormwater management for all new developments, which prevents or minimizes new development from causing the same water quality impairments that occurred in the past.

The plan was prepared under the authority of the Watershed Protection and Flood Prevention Act, Public Law 83-566, as amended (16U.S.C 1001-1008) and in accordance with Section 102 (2)(c) of the National Environmental Policy Act of 1969 (NEPA), Public Law 9-190, as amended (42 U.S.C 4321 et. seq.). Responsibility for compliance with NEPA rests with NRCS as the implementing federal agency.

The CCWRRP is in the planning stage. Through the process described in this Plan-EIS, and with considerable support from local and state agencies, NRCS has developed a list of 76 projects that will meet the sponsors' objectives. All of these projects have received a planning-level analysis to ensure that they appear feasible and capable of providing the habitat benefits sought through this areawide Project. When the Project is authorized and funded, the sponsors will propose specific projects to NRCS. NRCS will review each project in more detail to determine the best practice for that site and to verify that the habitat objectives will be achieved.

The Magnuson-Stevens Fishery Conservation and Management Act

Section 303(a)(7) of the Magnuson-Stevens Act (16 U.S.C 1801 et. seq.), requires that Fishery Management Councils include provisions in their fishery management plans that identify and describe EFH, including adverse impacts and conservation and enhancement measures. These provisions are addressed in one generic amendment to Fishery Management Plans (FMPs) in New England.

New England EFH Amendment to Fishery Management Plans (FMP)

The EFH amendments (NEFMC, 1998) represent the New England Fishery Management Council's (New England Council) response to those requirements stated in Section 303(a)(7) of the Magnuson-Stevens Act (16 U.S.C. et. seq.) by serving as a generic amendment to the following FMPS:

- Fishery Management Plan for the Multispecies (groundfish) Fishery in New England
- Fishery Management Plan for the Atlantic Salmon Fishery in New England
- Fishery Management Plan for the Monkfish Fishery in New England/Mid Atlantic
- Fishery Management Plan for the Sea Scallop Fishery in New England
- Fishery Management Plan for the Atlantic Herring Fishery in New England
- Fishery Management Plan for the Small Mesh Multispecies Fishery in New England
- Fishery Management Plan for the Dogfish Fishery in New England/Mid/Atlantic
- Fishery Management Plan for the Red Crab Fishery in New England
- Fishery Management Plan for the Skate Fishery in New England

The generic EFH document amends eight existing and one proposed FMP of the New England Council. EFH is identified and described based on areas where the various life stages of 28 managed species occur. A summary of the EFH for the managed species that may be encountered during the CCWRRP is located in Table 1.

Fishery Management Plans of the Mid-Atlantic Region

Seven FMPs exist in the Mid-Atlantic region. The EFH sections within each amendment are summarized in the EFH Summary which serves as a guide and a cross-reference to facilitate EFH consultations with State and Federal agencies, NMFS and the Council. The EFH Summary reviews the Mid-Atlantic Fishery Management Council's (Mid-Atlantic Council) amendments to the following FMPs:

- Fishery Management Plan for Atlantic Mackerel, Squid & Butterfish Fishery in the Mid-Atlantic
- Fishery Management Plan for the Bluefish Fishery in the Mid-Atlantic
- Fishery Management Plan for the Spiny Dogfish Fishery in the Mid-Atlantic and New England
- Fishery Management Plan for Surf Clam & Ocean Quahog Fishery in the Mid-Atlantic
- Fishery Management Plan for Summer Flounder, Scup & Black Sea Bass Fishery in the Mid-Atlantic
- Fishery Management Plan for Tilefish Fishery in the Mid-Atlantic
- Fishery Management Plan for Monkfish Fishery in the Mid-Atlantic and New England

EFH is identified and described based on areas where various life stages of 13 managed species commonly occur. A summary of the EFH for managed species that may be encountered during the CCWRRP is located in Table 1.

Secretarial FMPs

Under the Magnuson-Stevens Act, the Secretary is empowered to prepare FMPs in the Atlantic and Gulf of Mexico for highly migratory species. FMPs were prepared for the Atlantic swordfish, Atlantic sharks, Atlantic billfish, and the Atlantic bluefin tuna fishery. Under the Magnuson-Stevens Act, federal jurisdiction of EFH for Highly Migratory Species and Atlantic Billfish spans the area between the Canadian border in the north and the Dry Torugas in the south as well as the Gulf of Mexico and the U.S. Caribbean (NMFS 2006).

The following sections address EFH for managed species that may be encountered during the restoration projects of the CCWRRP. Table 1 list the FMPs and species that have EFH designations and are likely to be encountered in the CCWRRP and Table 2 list the FMPs and species that will not likely to be encountered in the CCWRRP.

Table 1. Fishery Management Plans (FMPs) in New England and the Mid-Atlantic, species managed under each FMP and the reasons for *inclusion* under the CCWRRP EIS

Fishery Management Plan	Species	Life Stages					Reason for Inclusion
		Eggs	Larvae	Juveniles	Adults	Spawning Adults	
New England FMP for Multispecies	Pollock (*Pollachius virens*)		S	M,S	S		Found in bays, estuaries, and some rivers
	Red hake (*Urophycis chuss*)		S	M,S	S	S	
	Whiting (*Merluccius bilinearis*)			M,S	S	S	
	Windowpane flounder (*Scopthalmus aquosus*)	M,S	M,S	M,S	M,S	M,S	
	Winter flounder (*Pleuronectes americanus*)	M,S	M,S	M,S	M,S	M,S	
	Yellowtail flounder (*Pleuronectes ferruginea*)	S	S	S	S	S	
New England FMP for Atlantic Herring	Atlantic herring (*Clupea harengus*)	S	S	M,S	M,S		Found in bays, estuaries, and nearshore waters
New England and Mid-Atlantic FMP for Monkfish	Monkfish (*Lophius americanus*)						Nearshore waters, bays, and estuaries
New England FMP for Skate	Winter skate (*Leucoraja ocellata*)		n/a	M,S	M,S		Distributed along coast near tideline to depths exceeding 700m.
	Thorny skate (*Amblyraja radiate*)		n/a	M,S	M,S		
	Little skate (*Leucoraja erinacea*)		n/a	M,S	M,S		

Table 1. Fishery Management Plans (FMPs) in New England and the Mid-Atlantic, species managed under each FMP, and the reasons for *inclusion* under the CCWRRP EIS (Continued)

Fishery Management Plan	Species	Life Stages					Reason for Inclusion
		Eggs	Larvae	Juveniles	Adults	Spawning Adults	
Mid Atlantic FMP for Summer Flounder, Scup, Black Sea Bass	Summer flounder (*Paralicthys dentatus*)						Found in nearshore waters, shellfish and seagrass beds, sandy/shelly areas, and rough areas
	Scup (*Stenotomus chrysops*)			M,S	S		
	Black sea bass (*Centropristus striata*)						
Mid Atlantic FMP for Surf Clam and Ocean Quahog	Surf clam (*Spisula solidissima*)	n/a	n/a				Found from the beach out to approximately 65m deep, vertically in substrate to 1m depth
	Ocean quahog (*Artica islandica*)	n/a	n/a				
Mid-Atlantic FMP for Atlantic Mackerel, Squid and Butterfish	Atlantic mackerel (*Scomber scombrus*)	M,S	M,S	M,S	M,S		Demersal eggs found attached to aquatic vegetation or rocks in shallower water
	Long finned squid (*Loligo pealei*)	n/a	n/a				
	Short finned squid (*Illex illecebrosus*)	n/a	n/a				
	Atlantic butterfish (*Peprilus triacanthus*)	S		M,S	M,S		
Mid-Atlantic FMP for Bluefish	Bluefish (*Pomatomus saltatrix*)			M,S	M,S		Juveniles and adults found in estuarine and nearshore waters

Source: NOAA 2006

Notes:

S=The EFH designation for this species includes the seawater salinity zone (salinity>or = 25%)

M=The EFH designation for this species includes the mixing water/brackish salinity zone (0.5% < salinity < 25%)

n/a=The species does not have this lifestage in its life history, or has no EFH designation for this lifestage.

Table 2. Fishery Management Plans (FMPs) in New England, species managed under each FMP and the reasons for *exclusion* under the CCWRRP EIS

Fishery Management Plan	Species	Life Stages					Reason for Exclusion
		Eggs	Larvae	Juveniles	Adults	Spawning Adults	
New England FMP for Multispecies	Atlantic cod (*Gadus morhua*)	S	S	S	S	S	Found in bays and estuaries at depths greater than 5m
	Haddock (*Melanogrammus aeglefinus*)	S	S				
	Ocean pout (*Macrozoarces americanus*)	S	S	S	S	S	
	American plaice (*Hippoglossoides platessoides*)	S	S	S	S	S	
	White hake (*Urophycis tenuis*)	S	S	M,S	M,S		
	Redfish (*Sebastes fasciatus*)	n/a					
New England FMP for Atlantic Salmon	Atlantic salmon (*Salmo salar*)						Cape Cod is not within the geographic area for Atlantic salmon. There are no major river systems located within Cape Cod that support spawning
New England FMP for Sea Scallops	Atlantic sea scallop (*Placopecten magellanicus*)	S	S	S	S	S	Mainly found north of Cape Cod in nearshore bays and estuaries. Restricted to deeper cooler water in south.

Table 2. Fishery Management Plans (FMPs) in New England, species managed under each FMP, and the reasons for *exclusion* under the CCWRRP EIS (Continued)

Fishery Management Plan	Species	Life Stages					Reason for Exclusion
		Eggs	Larvae	Juveniles	Adults	Spawning Adults	
New England FMP for Skate	Barndoor skate (*Dipturis laevis*)		n/a		S	S	Found at depts. From 18m to 874m. Most abundant between 110-457m
	Smooth skate (*Malacoraja senta*)		n/a		S	S	
	Clearnose skate (*Raja eglanteria*)		n/a		S	S	
	Rosette skate (*Leucoaja garmani*)		n/a		S	S	
New England and Mid-Atlantic FMP for Spiny Dogfish	Spiny dogfish (*Squalus acanthias*)	n/a	n/a				Found in warm waters over the continental shelf, depths greater than 5m
Mid-Atlantic FMP for Tilefish	Tilefish (*Lopholatilus chamaeleonticeps*)						Found on the outer continental shelf

Source: NOAA 2006

Notes:

S=The EFH designation for this species includes the seawater salinity zone (salinity>or = 25%)

M=The EFH designation for this species includes the mixing water/brackish salinity zone (0.5% < salinity < 25%)

n/a=The species does not have this lifestage in its life history, or has no EFH designation for this lifestage.

New England Council Policies

The New England Fishery Management Council's jurisdiction extends from Maine to southern New England, although some NEFMC-managed species range to the mid-Atlantic. Information presented in the EFH generic amendment (NEFMC, 1998) is consistent with and supports the Gulf Council's long-standing habitat policy. The policy, as set forth in the Council's Habitat Policy and Management Objectives, states:

> *Recognizing that all species are dependent on the quantity and quality of their habitat, it is the policy of the New England Fishery Management Council to promote and encourage the conservation, restoration and enhancement of the habitat upon which living marine resources depend.*

This policy shall be supported by four policy objectives which are to:

(1) Maintain and rehabilitate the current quantity and quality of habitats supporting harvested species, including their prey base.

(2) Restore and rehabilitate fish habitats which have already been degraded.

(3) Create and develop fish habitats where increased availability of fishery resources will benefit society.

(4) Modify fishing methods and create incentives to reduce the impacts on habitat associated with fishing.

These objectives are based on ensuring the sustainability of harvested species and optimizing the societal benefits of our marine resources.

The Council shall assume an active role in the protection and enhancement of habitats important to marine and anadromous fish. In support of the Council's habitat policy, the management objectives for the EFH amendment (NEFMC, 1998) are:

(a) To the maximum extent possible, to identify and describe all essential fish habitat for those species of finfish and mollusks managed by the Council;

(b) To identify all major threats to the essential fish habitat of those species managed by the Council; and

(c) To identify existing and potential mechanisms to protect, conserve, and enhance the essential fish habitat of those species managed by the Council, to the extent practicable.

Mid-Atlantic Council Policies

The Mid-Atlantic Council has jurisdiction over fisheries in federal waters which occur predominantly off the Mid-Atlantic coast. The Mid-Atlantic jurisdiction includes waters

off the coasts of New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina.

Types of EFH Affected by the CCWRRP and Assessment of Effects on EFH

EFH is described and identified as habitat that is important to the managed species. In New England, the EFH determination is based on source document reports from NMFS for each species managed by the Councils (NEFMC, 1998). The reports consist of a description of the habitat associations and requirements for species across all life stages, including summary descriptions of relevant survey data that indicate the relative abundance of and range for each species. This information is used by the Council to develop appropriate EFH designations for all species that identify preferred geographic areas, substrate, and ideal ranges for water temperature, depth, and salinity. The text descriptions of EFH set the environmental parameters within which the map designations are considered. Text descriptions, map designations, and tables identifying bays and estuaries included in the EFH designations for the existing FMPs for each life stage are available in Section 3.4 of the New England EFH amendment or viewed on the internet site of the National Marine Fisheries Service, <http://www.nero.noaa.gov/hcd/index2a.htm>.

Because of the large variability in the types of species comprising living marine resources, a wide range of coastal regions and riparian systems along streams and rivers that support fish must be considered as EFH for marine species. Most of the restoration activities associated with the CCWRRP would not impact large areas of habitat as commercial fishing operations would. The purpose of the CCWRRP is watershed protection. The objectives are to (1) improve water quality for shellfish beds, (2) restore degraded salt marshes, and (3) restore anadromous fish passages. The restoration activities are aimed to restore 1,500 acres of degraded salt marsh, restore/improve access to 4,200 acres of spawning habitat for anadromous fish, and improve 7,300 acres of water quality for shellfish beds. Construction of each project could cause short-term, minor adverse impacts to air, noise, vegetation, water quality and soils at the construction site. Construction periods would be short, generally a few weeks to a few months. Long-term beneficial impacts of the projects include improved water quality, improved anadromous fish runs, and increased recreational and commercial shellfish harvesting.

Description of Habitat (EFH) Affected:

Essential fish habitat descriptions provided by the New England Council do not include detailed descriptions of riverine or riparian systems and their distribution within each of the management areas. Potential impacts to managed species from CCWRRP would be limited to species within estuarine habitats and along stream channels such as marsh edges.

For estuarine environments, EFH is described and identified as all estuarine waters and substrates (i.e., mud, sand, shell, rock, and biological communities), including the sub-tidal vegetation (i.e., submerged aquatic vegetation and algae) and adjacent inter-tidal

vegetation (i.e., marshes). These areas provide essential nursery habitat for the development of many anadromous fish, estuarine fish, marine fish, and invertebrates.

Marsh habitats vary with coastal geographic locations. Salt marshes exist on the transition zone between the land and the sea in protected low-energy areas, such as estuaries, lagoons, bays, and river mouths (Copeland 1998). Marsh ecosystems are a function of hydrology, soil, and vegetation. Tidal cycles allow salty and brackish water to inundate and drain the salt marsh, circulating organic and inorganic nutrients throughout the marsh. Marshes are influenced by tidal flushing and stream flow. The importance of marshes include (1) export vital nutrients to adjacent waters; (2) improve water quality; (3) absorb wave energy; and (4) serve an important role in nitrogen and sulfur cycling.

Potential impacts from restoration activities:

Salt Marsh

Tidal wetlands create the foundation of a coastal food web that supports a large variety of coastal fish and bird species. Coastal wetlands serve as important nursery and spawning grounds from many commercially and recreationally important fish and shellfish species. They play a critical role in maintaining water quality. Additional, tidal wetlands provide irreplaceable protection from the flooding associated with storm surges and other serious weather events.

The salt marsh projects are associated with transportation infrastructure (i.e., roads, bridges, culvers, and railroads) on Cape Cod. The proposed salt marsh projects include replacement if inadequately sized or failed culverts with larger culverts or bridges. Construction of the proposed salt marsh would temporarily disrupt aquatic life in the vicinity of the projects due to turbidity and physical activity in the water. The duration of in-stream impacts would be short, typically one or two days to one or two weeks. The salt marsh projects would have a long-term, major beneficial effect on aquatic organisms in the restored tidal marshes. The increased sizes of the marsh inlets would physically allow more movement in an out of the marshes by fish and some invertebrates. The increased volume of water and improved water quality in the marshes would increase the availability and quality of habitat for all trophic levels of aquatic organisms. These improvements would benefit fish that spend all or most of their life in salt marshes and use the marshes for primary spawning and nursery areas. Larger numbers of smaller, resident foraging fish in the marshes would provide an increased food source for larger predatory fish that would move more easily into and out of the marshes. Fish that prefer the existing fresh or low-salinity fringe marshes would lose habitat as salinity increases after the restriction is removed. Some of this displaced habitat may move upstream as the salt water floods a larger area.

The salt marsh restoration project could have an effect on EFH that would be present in the area during construction, although these effects would be negligible because the projects are small in size, limited in duration, and widely separated in time and location.

Improvements to tidal salt marshes would result in increased marsh habitat, increased populations of prey species, and increased production of organic materials entering the food web.

Fish Passage

Anadromous fish live in the sea but must enter freshwater rivers and streams to spawn. Massachusetts coastal systems support 16 species of anadromous fish. These species play an important role in recreational and commercial fisheries.

The proposed fish passage projects would have long-term, major benefits toward reversing the general decline of anadromous fish on Cape Cod over the last century. The restoration of full function to fish passage structures would allow river herring, in particular, to access new and former spawning and nursery habitats. In many cases, a partially functioning fishway now supports a small population of river herring in a stream. Improving access upstream would allow more fish to return to the spawning grounds each spring and promote growth of that stream's natural population. Large predator fish in the downstream bays and estuaries would benefit from this project. The increased number of eggs and juvenile fish in the spawning and nursery areas would also serve as increased food supply for locally resident fish, birds, mammals, and other predators.

The fish passage projects would not directly affect designated EFH. Improvements to fish passages would make more spawning and nursery habitat available to anadromous fish that are food sources for some of the fish covered by the FMPs, and therefore, indirectly contribute to improved populations of those fish.

Stormwater

Construction of the proposed Stormwater projects would have only minor effects on aquatic organisms. The construction would not directly affect receiving water biota in the short-term because the projects occur back off the shoreline, and runoff of sediment from the disturbed areas is minimized by erosion and sediment controls. In the long-term, the primary benefit of the Stormwater projects – removing fecal coliform bacteria – would provide better water quality within the nearby waters, improving the surrounding shellfish habitat, improving forage.

Mitigation

Best management practices will be employed at all construction sites to minimize impacts to water resources and aquatic organisms (e.g., erosion and sediment controls, turbidity curtains). Consultations will be conducted with U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration, and Massachusetts Division of Fish and Wildlife to ensure that habitat of sensitive plants and animals is avoided. Consultation with Massachusetts State Historic Preservation Office and the Wampanoag Tribe of Gay

Head (Aquinnah) Historic Preservation Office will be conducted to ensure historic and archaeological resources are not affected.

Conclusion

The potential adverse impacts from the CCWRRP would be associated with construction activities and would be short-term in duration and minor in magnitude. The construction of any single project would only take a few weeks up to a few months, and actual in-stream work would only take one or two weeks. Each project would disturb only a small area in the immediate vicinity of the project. The total number of projects is expected to be five to ten per year (salt marsh, fish passage, stormwater), and they would be widely scattered around Cape Cod. These projects, therefore, would make negligible adverse impacts on estuarine and aquatic resources on the Cape. There would be no long-term adverse impacts from the projects after construction is completed.

Restoration activities implemented under the CCWRRP will provide beneficial habitat to living marine resources in the long-term. The long-term positive benefits of the CCWRRP-improved salt marsh flushing and ecology, improved fish passage and herring runs, improved water quality and shellfishing-would mitigate historical adverse effects on the resources from human activity and development on Cape Cod. The projects would complement other marsh, fish passage, and water quality restoration and remediation projects that are being undertaken or planned by the towns and state and federal agencies.

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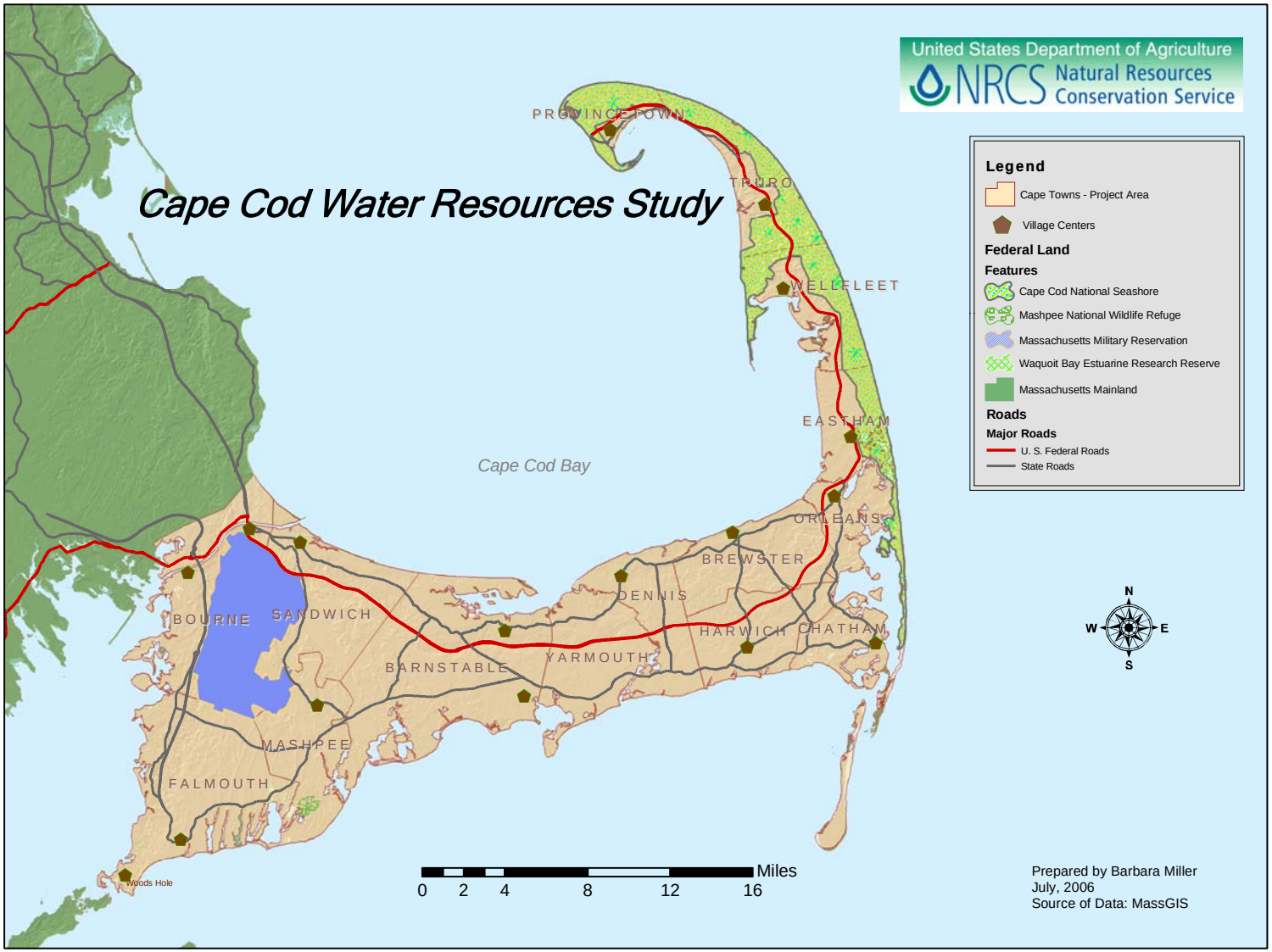

Figure 1. Project Location Map

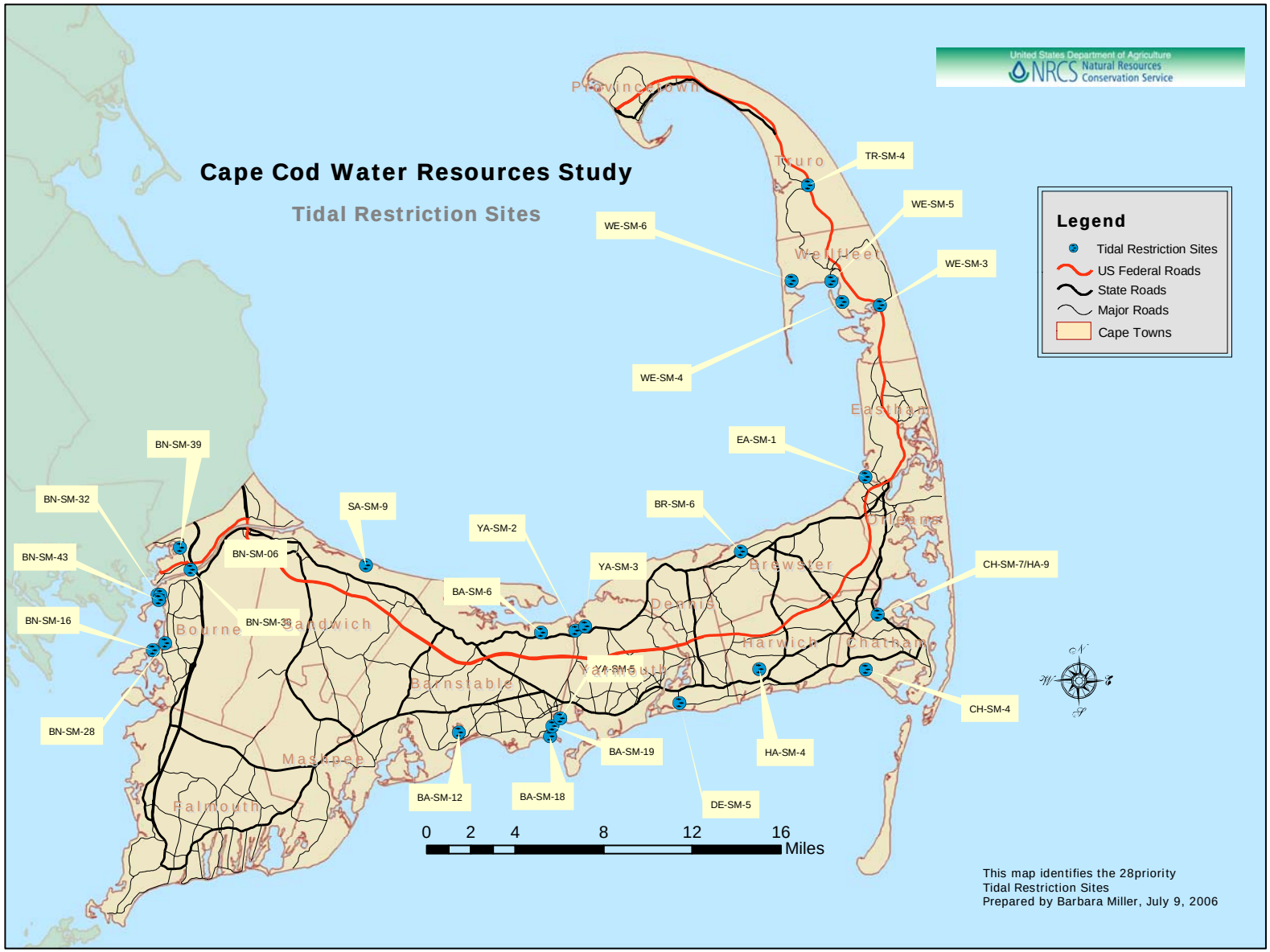

Figure 2. Priority Salt Marsh Sites

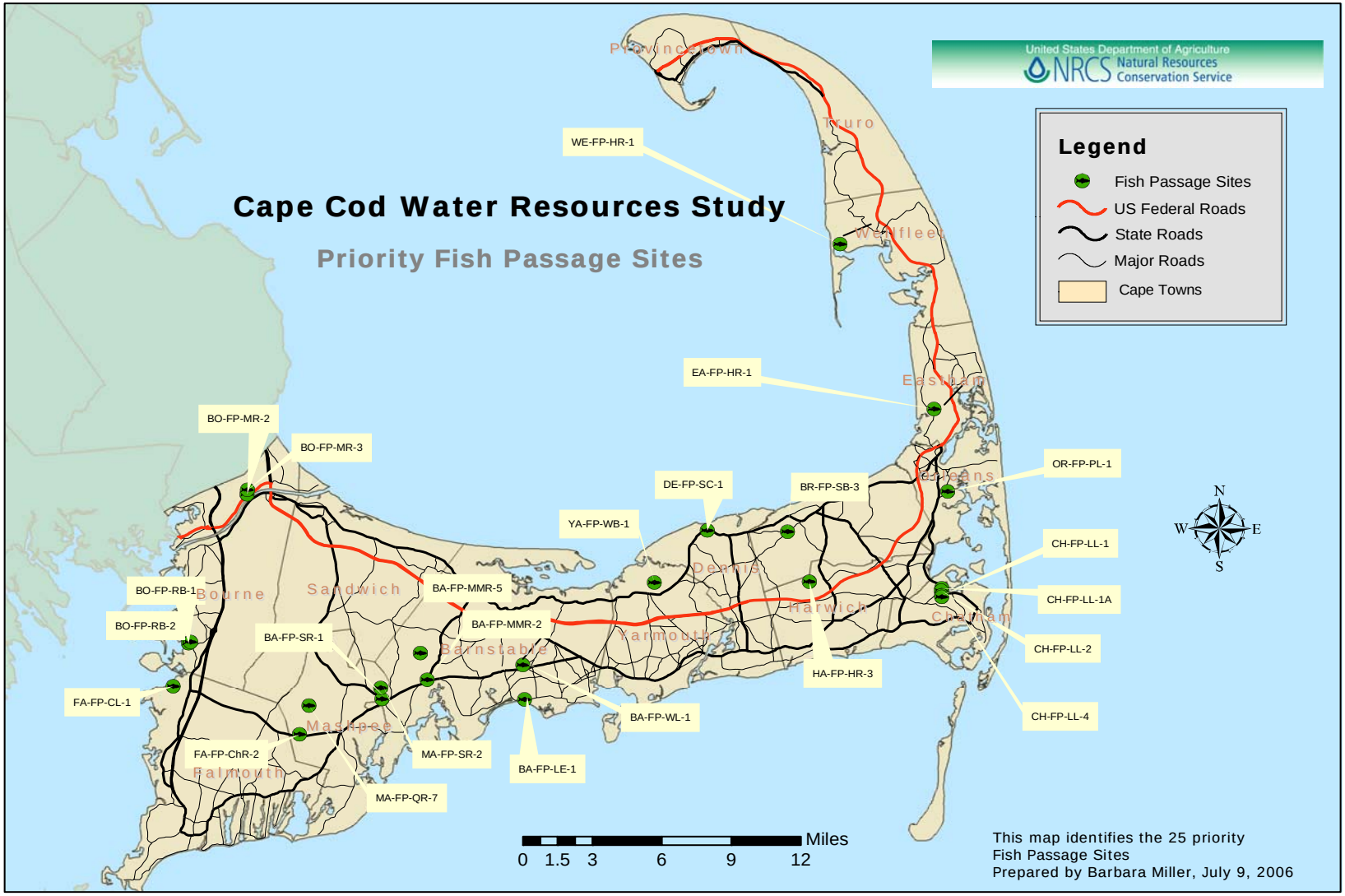

Figure 3. Priority Fish Passage Sites

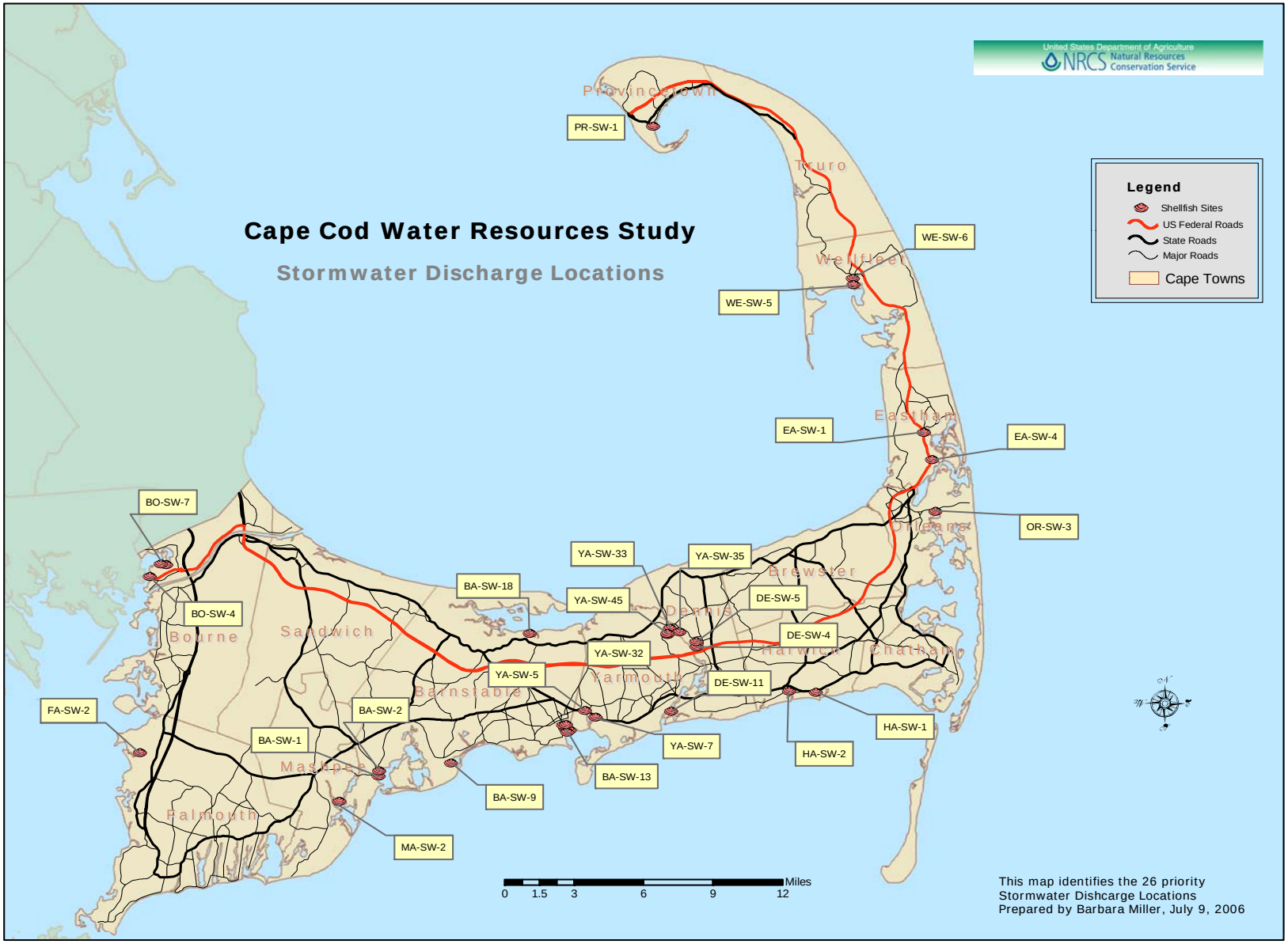

Figure 4. Priority Stormwater Sites

Appendix C-5. Federal and State Listed Threatened and Endangered Species within Barnstable County or Adjacent Massachusetts Coastal Waters.

Scientific Name	Common Name	State Rank	Federal Rank	Most Recent Observation
Fish				
Acipenser brevirostrum	Shortnose sturgeon	E	LE	1871
Acipenser oxyrinchus	Atlantic sturgeon	E	LT, C	UNK
Lampetra appendix	American brook lamprey	T	---	1989
Amphibian				
Ambystoma opacum	Marbled salamander	T	---	1936
Scaphiopus holbrookii	Eastern spadefoot	T	---	1999
Reptile				
Malaclemys terrapin	Diamondback terrapin	T	---	2000
Lepidochelys kempi	Kemp's ridley turtle [1/]		LE	
Dermochelys coriacea	Leatherback turtle [1/]		LE	
Caretta caretta	Loggerhead turtle [1/]		LT	
Chelonia mydas	Green turtle [1/]		LT	
Bird				
Ammodramus savannarum	Grasshopper sparrow	T	---	2001
Asio flammeus	Short-eared owl	E	---	1985
Bartramia longicauda	Upland sandpiper	E	---	2001
Botaurus lentiginosus	American bittern	E	---	1965
Charadrius melodus	Piping plover	T	LE,LT	1997
Circus cyaneus	Northern harrier	T	---	2000
Haliaeetus leucocephalus	Bald eagle	E	LT, PDL	1905
Ixobrychus exilis	Least bittern	E	---	1993
Parula americana	Northern parula	T	---	1989
Podilymbus podiceps	Pied-billed grebe	E	---	1987
Pooecetes gramineus	Vesper sparrow	T	---	1996
Rallus elegans	King rail	T	---	1974
Sterna antillarum	Least tern	SC	LE	1998
Sterna dougallii	Roseate tern	E	LE, LT	1998
Mammal				
Eubalaena glacialis	Northern right whale	E	LE	1986
Megaptera novaeangliae	Humpback whale [1/]		LE	
Balaenoptera physalus	Fin whale [1/]		LT	
Balaenoptera borealis	Sei whale [1/]		LT	
Physter macrocephalus	Sperm whale [1/]		LT	
Dragonfly/Damselfly				
Aeshna mutata	Spatterdock darner	E	---	1999
Enallagma recuratum	Pine barrens bluet	T	---	1999
Gomphus abbreviatus	Spine-crowned clubtail	E	---	1878
Gomphus fraternus	Midland clubtail	E	---	1977
Butterfly/Moth				
Acronicta albarufa	Barrens daggermoth	T	---	1999
Cicinnu melsheimeri	Melsheimer's sack bearer	T	---	1998
Cycnia inopinatus	Unexpected cycnia	T	---	1998

Appendix C-5. Federal and State Listed Threatened and Endangered Species within Barnstable County or Adjacent Massachusetts Coastal Waters.

Scientific Name	Common Name	State Rank	Federal Rank	Most Recent Observation
Erynnis persius persius	Persius duskywing	E	---	1952
Faronta rubripennis	The pink streak	T	---	2001
Papaipema stenocelis	Chain fern borer moth	T	---	1981
Papaipema sulphurata	Water-willow stem borer	T	---	1996
Pieris oleracea	Eastern veined white	T	---	1949
Vascular Plant				
Aristida purpurascens	Purple needlegrass	T	---	1986
Asclepias purpurascens	Purple milkweed	T	---	2000
Asclepias verticillata	Linear-leaved milkweed	T	---	1915
Carex mesochorea	Midland sedge	E	---	1988
Carex oligosperma	Few-fruited sedge	E	---	1987
Carex striata var brevis	Walters sedge	E	---	1990
Claytonia virginica	Narrow-leaved spring beauty	E	---	1933
Crataegus bicknellii	Bicknell's hawthorn	E	---	1994
Dichanthelium mattamuskeetense	Mattamuskeet panic-grass	E	---	1989
Dichanthelium scabriusculum	Woolly rosette grass	T	---	1989
Eleocharis obtusa var ovata	Ovate spike-sedge	E	---	1994
Eupatorium aromaticum	Lesser snakeroot	E	---	1916
Eupatorium leucolepis var novae-angliae	New England boneset	E	---	1994
Gamochaeta purpurea	Purple cudweed	E	---	1924
Hydrocotyle verticillata	Saltpond pennywort	T	---	1980
Hypericum adpressum	Creeping St. John's-wort	T	---	1994
Isoetes acadiensis	Acadian quillwort	E	---	1989
Juncus debilis	Weak rush	E	---	1993
Leptochloa fascicularis var maritima	Saltpond grass	T	---	1985
Leymus mollis ssp mollis	Sea lyme-grass	E	---	1913
Linum medium var texanum	Rigid flax	T	---	1983
Lipocarpha micrantha	Smallflower halfchaff sedge	E	---	1999
Listera cordata	Heartleaf twayblade	E	---	1999
Malaxis bayardii	Bayard's green adder's-mouth	E	---	1997
Mertensia maritima	Oysterleaf	E	---	2001
Ophioglossum pusillum	Adder's-tongue fern	T	---	1999
Opuntia humifusa	Prickly pear	E	---	1999
Platanthera dilatata	Leafy white orchis	T	---	1988
Polygonum setaceum var interjectum	Strigose knotweed	T	---	1985
Prenanthes serpentaria	Lion's foot	E	---	1918
Rhexia mariana	Maryland meadow beauty	E	---	1995
Rynchospora inundata	Inundated horned-sedge	T	---	1988
Rhynchospora nitens	Short-beaked bald-sedge	T	---	1985
Rhynchospora torreyana	Torrey's beak-sedge	E	---	2000
Rumex pallidus	Seabeach dock	T	---	1994
Sabatia campanulata	Slender marsh pink	E	---	2001
Scleria pauciflora var caroliniana	Papillose nut-sedge	E	---	2001

Appendix C-5. Federal and State Listed Threatened and Endangered Species within Barnstable County or Adjacent Massachusetts Coastal Waters.

Scientific Name	Common Name	State Rank	Federal Rank	Most Recent Observation
Spartina cynosuroides	Salt reedgrass	T	---	1993
Sphenopholis pensylvanica	Swamp oats	T	---	2001
Spiranthes vernalis	Grass-leaved Ladies'-tresses	T	---	1989
Tipularia discolor	Cranefly orchid	E	---	1983
Triosteum perfoliatum	Broad tinker's-weed	E	---	2000
Utricularia striata	Fibrous bladderwort	T	---	1995

Source: Massachusetts DFW (2003) unless otherwise noted.

Key to Abbreviations used on Natural Heritage Resource Lists:

UNK=Unknown

State Rank: E=Endangered, T=Threatened, SC=Special Concern

Federal Status: LE=Listed Endangered, LT=Listed Threatened, C=Candidate, PE=Proposed Endangered, PT=Proposed Threatened, PS=Partial Status, PDL=Proposed for Delisting.

Combination values = Taxon has one status currently, but a more recent proposal has been made to change that status with no final action yet published.

[1/] Identified by the National Oceanic and Atmospheric Administration as known seasonally in coastal waters off Massachusetts (letter from M.A. Colligan, April 20, 2006).

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