Appendix 11
Cape Cod Coastal Drainage Area
Assessment and Listing Decision Summary

Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle

CN: 505.1

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2018/20 Cycle Impairment Changes

Waterbody	AU_ID	2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
Allens Harbor	MA96-95	5	5	Nitrogen, Total	65883	Added
Allens Harbor	MA96-95	5	5	Nutrient/Eutrophication Biological Indicators	65883	Added
Areys Pond	MA96-70	4a	5	Estuarine Bioassessments	33786	Removed
Areys Pond	MA96-70	4a	5	Nutrient/Eutrophication Biological Indicators		Added
Barnstable Harbor	MA96-01	5	4a	Estuarine Bioassessments		Removed
Bass River	MA96-118	--	4a	Nitrogen, Total	68003	Added
Bass River	MA96-118	--	4a	Nutrient/Eutrophication Biological Indicators	68003	Added
Bass River	MA96-12	5	4a	Estuarine Bioassessments	68003	Changed
Bass River	MA96-12	5	4a	Nitrogen, Total	68003	Added
Bassing Harbor	MA96-48	2	5	Estuarine Bioassessments		Added
Bearse Pond	MA96012	4a	4a	(Fanwort*)		Added
Bearse Pond	MA96012	4a	4a	(Non-Native Aquatic Plants*)		Removed
Black Pond	MA96017	--	4c	(Fish Passage Barrier*)		Added
Cedar Pond	MA96-88	5	5	(Fish Passage Barrier*)		Added
Centerville Harbor	MA96-03	2	5	Estuarine Bioassessments		Added
Chase Garden Creek	MA96-103	5	5	(Curly-leaf Pondweed*)		Added
Childs River	MA96-120	--	4a	Nitrogen, Total	R1_MA_2020_08	Added
Childs River	MA96-120	--	4a	Nutrient/Eutrophication Biological Indicators	R1_MA_2020_08	Added
Childs River	MA96-98	2	5	(Curly-leaf Pondweed*)		Added
Childs River	MA96-98	2	5	(Fish Passage Barrier*)		Added
Childs River	MA96-98	2	5	Lead		Added
Depot Pond	MA96061	3	4c	(Fish Passage Barrier*)		Added
Dinahs Pond	MA96-112	--	4a	Nitrogen, Total	68003	Added
Dinahs Pond	MA96-112	--	4a	Nutrient/Eutrophication Biological Indicators	68003	Added
Duck Creek	MA96-32	4a	5	Benthic Macroinvertebrates		Added
Duck Creek	MA96-32	4a	5	Dissolved Oxygen		Added
Duck Creek	MA96-32	4a	5	Nitrogen, Total		Added
Duck Creek	MA96-32	4a	5	Nutrient/Eutrophication Biological Indicators		Added
Eel Pond	MA96-121	--	4a	Estuarine Bioassessments	R1_MA_2020_08	Added
Eel Pond	MA96-121	--	4a	Nitrogen, Total	R1_MA_2020_08	Added
Eel Pond	MA96-121	--	4a	Nutrient/Eutrophication Biological Indicators	R1_MA_2020_08	Added

Waterbody	AU_ID	2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
Falmouth Inner Harbor	MA96-17	2	4a	Nitrogen, Total	R1_MA_2020_06	Added
Falmouth Inner Harbor	MA96-17	2	4a	Nutrient/Eutrophication Biological Indicators	R1_MA_2020_06	Added
Flax Pond	MA96091	--	5	Dissolved Oxygen		Added
Follins Pond	MA96-114	--	4a	Nitrogen, Total	68003	Added
Follins Pond	MA96-114	--	4a	Nutrient/Eutrophication Biological Indicators	68003	Added
Great Harbor	MA96-18	4a	5	Estuarine Bioassessments		Added
Hamblin Pond	MA96-58	4a	4a	Nutrient/Eutrophication Biological Indicators	R1_MA_2020_08	Added
Hamblins Brook	MA96-133	--	4c	(Fish Passage Barrier*)		Added
Hawes Run	MA96-101	4c	5	Trash		Changed
Herring River	MA96-22	4a	4a	Estuarine Bioassessments	65960	Added
Herring River	MA96-22	4a	4a	Nitrogen, Total	65960	Added
Herring River	MA96-22	4a	4a	Nutrient/Eutrophication Biological Indicators	65960	Added
Hinckleys Pond	MA96140	2	4c	(Curly-leaf Pondweed*)		Added
Hyannis Harbor	MA96-05	2	5	Estuarine Bioassessments		Added
Jehu Pond	MA96-59	4a	4a	Nutrient/Eutrophication Biological Indicators	R1_MA_2020_08	Added
Johns Pond	MA96157	4a	4a	(Fish Passage Barrier*)		Added
Kelleys Bay	MA96-113	--	4a	Nitrogen, Total	68003	Added
Kelleys Bay	MA96-113	--	4a	Nutrient/Eutrophication Biological Indicators	68003	Added
Lake Elizabeth	MA96080	3	4c	(Fish Passage Barrier*)		Added
Lewis Bay	MA96-36	4a	5	Nitrogen, Total		Added
Lewis Bay	MA96-36	4a	5	Nutrient/Eutrophication Biological Indicators		Added
Lewis Pond	MA96-109	--	4a	Nitrogen, Total	68369	Added
Lewis Pond	MA96-109	--	4a	Nutrient/Eutrophication Biological Indicators	68369	Added
Little River	MA96-99	5	5	(Fish Passage Barrier*)		Added
Loagy Bay	MA96-125	--	5	Chlorophyll-a		Added
Loagy Bay	MA96-125	--	5	Dissolved Oxygen		Added
Lovells Pond	MA96185	5	5	(Fish Passage Barrier*)		Added
Maraspin Creek	MA96-06	4a	5	Nutrient/Eutrophication Biological Indicators		Added
Mashpee Pond	MA96194	4a	5	Dissolved Oxygen		Added
Middle Pond	MA96198	5	5	(Curly-leaf Pondweed*)		Added
Mill Pond	MA96-117	--	4a	Nitrogen, Total	68003	Added

Waterbody	AU_ID	2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
Mill Pond	MA96-117	--	4a	Nutrient/Eutrophication Biological Indicators	68003	Added
Miss Thachers Pond	MA96258	3	4c	(Fish Passage Barrier*)		Added
Muddy Creek	MA96-51	4a	4a	(Fish Passage Barrier*)		Added
Nauset Harbor	MA96-28	2	5	Estuarine Bioassessments		Added
Parkers River	MA96-38	4a	4a	Nitrogen, Total	68361	Added
Parkers River	MA96-38	4a	4a	Nutrient/Eutrophication Biological Indicators	68361	Added
Pleasant Bay	MA96-77	4a	5	Estuarine Bioassessments		Added
Quashnet River	MA96-90	2	5	(Curly-leaf Pondweed*)		Added
Quashnet River	MA96-90	2	5	Temperature		Added
Quivett Creek	MA96-09	4a	5	(Curly-leaf Pondweed*)		Added
Quivett Creek	MA96-09	4a	5	Dissolved Oxygen		Added
Rock Harbor Creek	MA96-16	4a	4a	(Fish Passage Barrier*)		Added
Sagelot Pond	MA96-119	--	4a	Nutrient/Eutrophication Biological Indicators	R1_MA_2020_08	Added
Santuit Pond	MA96277	5	5	(Fish Passage Barrier*)		Added
Santuit River	MA96-91	2	5	(Fish Passage Barrier*)		Added
Santuit River	MA96-91	2	5	Temperature		Added
Saquatucket Harbor	MA96-23	4a	4a	Nitrogen, Total	65884	Added
Saquatucket Harbor	MA96-23	4a	4a	Nutrient/Eutrophication Biological Indicators	65884	Added
Seine Pond	MA96-110	--	4a	Nitrogen, Total	68362	Added
Seine Pond	MA96-110	--	4a	Nutrient/Eutrophication Biological Indicators	68362	Added
Sesuit Creek	MA96-130	--	4c	(Fish Passage Barrier*)		Added
Spectacle Pond	MA96307	4a	5	Dissolved Oxygen		Added
Stage Harbor	MA96-11	4a	5	Estuarine Bioassessments		Added
Stillwater Pond	MA96309	5	5	(Fish Passage Barrier*)		Added
Swan Pond	MA96-111	--	4a	Nitrogen, Total	68000	Added
Swan Pond	MA96-111	--	4a	Nutrient/Eutrophication Biological Indicators	68000	Added
Swan Pond River	MA96-14	5	4a	Estuarine Bioassessments	68001	Changed
Swan Pond River	MA96-14	5	4a	Nitrogen, Total	68001	Added
Swan Pond River	MA96-14	5	4a	Nutrient/Eutrophication Biological Indicators	68001	Added
The River	MA96-76	4a	4a	Estuarine Bioassessments	33787, 33788, 33790, 33789	Removed
Unnamed Tributary	MA96-128	--	4c	(Fish Passage Barrier*)		Added
Unnamed Tributary	MA96-129	--	4c	(Fish Passage Barrier*)		Added

Waterbody	AU_ID	2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
Unnamed Tributary	MA96-132	--	4c	(Fish Passage Barrier*)		Added
Walkers Pond	MA96331	5	5	Nutrient/Eutrophication Biological Indicators		Added
Waquoit Bay	MA96-21	5	4a	Dissolved Oxygen	R1_MA_2020_08	Changed
Waquoit Bay	MA96-21	5	4a	Estuarine Bioassessments	R1_MA_2020_08	Changed
Waquoit Bay	MA96-21	5	4a	Nitrogen, Total	R1_MA_2020_08	Added
Waquoit Bay	MA96-21	5	4a	Nutrient/Eutrophication Biological Indicators	R1_MA_2020_08	Added
Weir Creek	MA96-116	--	4a	Nitrogen, Total	68003	Added
Wellfleet Harbor	MA96-34	2	5	Nitrogen, Total		Added
Wellfleet Harbor	MA96-34	2	5	Nutrient/Eutrophication Biological Indicators		Added
Wequaquet Lake	MA96333	4a	4a	(Fanwort*)		Added
Wequaquet Lake	MA96333	4a	4a	(Fish Passage Barrier*)		Added
Wequaquet Lake	MA96333	4a	4a	(Non-Native Aquatic Plants*)		Removed
Wychmere Harbor	MA96-96	5	5	Nitrogen, Total	65882	Added
Wychmere Harbor	MA96-96	5	5	Nutrient/Eutrophication Biological Indicators	65882	Added

Allens Harbor (MA96-95)

Location:	south of Lower County Road, Harwich to Doanes Creek, Harwich.
AU Type:	ESTUARY
AU Size:	0.02 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	Nitrogen, Total	65883	Added
5	5	Nutrient/Eutrophication Biological Indicators	65883	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical report benthic sampling was conducted at seven stations in Allens Harbor in the summer and fall of 2004. The open water main basin of Allen Harbor was dominated by gammarid amphipods associated with intermediate stress associated with a shift from low to high enrichment (i.e. a transitional community) characterized by moderate numbers of species (15) and very high numbers of individuals (1518). The small tributary Allen Creek on the west side of the harbor was dominated by stress indicator species characterized by moderate species numbers (12) and high numbers of individuals (928); patches dominated by moderate organic enrichment indicators (gammarid amphipods) or high organic enrichment indicator sp. (*Capitella*). Sediments in both the basin and creek were noted to be sulfidic with a very thin oxidized layer or sulphur bacterial mat. It was concluded overall that the Allen Harbor basin had a "moderately to significantly impaired" benthic habitat, with the more significant impairment observed in the creek area. The creek area was found to have a high density of drift algae, *Ulva* and a red branched form while drift algae was sparse/absent with little surface microphyte mat in the main basin. No eelgrass bed habitat has been recorded. Chlorophyll a data were collected by SMAST at two mooring stations during the summer of 2004; in the main Basin concentrations were often ~4 to 15µg/L with frequent excursions over 15µg/L and the creek area was higher (~6 to 20µg/L, frequently >20µg/L) and DO mooring data in the main basin area was generally >4mg/L with periodic depletions 4-3mg/L and the creek area frequently depleted to <4mg/L, periodically to 3-2mg/L. Both the chlorophyll a and DO data in Allens Harbor were indicative of between "moderately" and "significantly impaired" conditions with a tendency towards more significantly impaired conditions in the Creek area. Yearly mean total nitrogen data collected by the Town of Harwich Water Quality Monitoring Program (WQMP) from 2001-2008 in the main basin of Allen Harbor ranged from 0.473 to 1.135mg/L and was higher in the creek area 0.482 to 1.415mg/L.

The Aquatic Life Use for Allens Harbor (MA96-95) will be assessed as Not Supporting based on the MEP analysis indicating the "Nutrient Related Habitat Health" was between Moderately and Significantly Impaired as evidenced by the degraded benthic habitat conditions, frequently elevated chlorophyll a, and low DO which is being added as the nutrient/eutrophication biological indicators impairment and total nitrogen. Aggregated estuary watershed nitrogen loads were partitioned by the major types of nitrogen sources in order to focus development of nitrogen management alternatives. According to the MEP report MEP-Linked Watershed Embayment Model to Determine Critical Nitrogen Loading Thresholds for the Allen, Wychmere, and Saquatucket Harbor Embayment Systems, Harwich, MA the major types (sources) of nitrogen loads in Allens Harbor area in descending order of percent contribution were wastewater (e.g. septic systems), residential lawn and golf fertilizer and impervious surfaces.

Areys Pond (MA96-70)

Location:	Orleans.
AU Type:	ESTUARY
AU Size:	0.02 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	5	Estuarine Bioassessments	33786	Removed
4a	5	Nutrient/Eutrophication Biological Indicators		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

No new data have been collected in Areys Pond. According to the Pleasant Bay MEP project technical report the benthic community in Areys Pond was significantly depleted, the pond exhibited frequent anoxia, and average chlorophyll a concentration was elevated (12.49µg/L).

The Aquatic Life Use of Areys Pond (MA96-70) will continue to be assessed as Not Supporting based on the overall MEP analysis. The estuarine bioassessment impairment is being delisted (see additional information in removal comment) since no eelgrass bed habitat has been found in Areys Pond between 1995 and present but nutrient/eutrophication biological indicators is being added as an impairment to address the biological evidence of degradation.

2018/20 Delisted Impairment	Delisting Reason	Delisting Comment
Estuarine Bioassessments	Applicable WQS attained; original basis for listing was incorrect	The 2012 CALM guidance manual utilized estimated eelgrass bed habitat data from the 1951 aerial photograph dataset which was only anecdotally validated. The 2018 CALM guidance manual describes the change in the eelgrass bed habitat evaluation which compares data collected as part of the Eelgrass Mapping Project utiling data collected with standardized eelgrass mapping protocols. Since no eelgrass bed habitat has been mapped in Areys Pond at any time during the Eelgrass Mapping Project, and the confidence in the 1951 data were described as low, the estuarine bioassessment impairment is being removed.

Supporting Information for Delisted Impairments

Estuarine Bioassessments

Eelgrass Bed Habitat Eelgrass surveys and analysis of historical data was conducted for Areys Pond by the MassDEP Wetlands Conservancy Program (WCP) as part of the Eelgrass Mapping Project. Surveys were conducted in 1995, 2001, and most recently in 2006 as part of this program (MassGIS 2008 and Costello 2008). Additional analysis of available aerial photos from 1951 was used to reconstruct the eelgrass distribution prior to any substantial development of the watershed. The 1951 data were only anecdotally validated, while the 1995, 2001, and 2006 maps were field validated (MassGIS 2008 and Costello 2008). There was an estimated 0.5 acres (~4.3% of the segment area) of eelgrass bed habitat present in 1951 however the confidence in the data were described as low. No eelgrass bed habitat has since been identified in this segment. The 2012 CALM guidance manual utilized estimated eelgrass bed habitat data from the 1951 aerial photograph dataset which was only anecdotally validated. The 2018 CALM guidance manual describes the change in the eelgrass bed habitat evaluation which compares data collected as part of the Eelgrass Mapping Project utilizing data collected with standardized eelgrass mapping protocols. Since no eelgrass bed habitat has been mapped in Areys Pond at any time during the Eelgrass Mapping Project, and the confidence in the 1951 data were described as low the estuarine bioassessment impairment is being removed.

Ashumet Pond (MA96004)

Location:	Mashpee/Falmouth.
AU Type:	FRESHWATER LAKE
AU Size:	203 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

According to the DCR database of non-native species, there was a 2007 report of an infestation of *Corbicula fluminea* (Asian Clam) in Ashumet Pond; however, confirmation of the presence of live organisms is needed.

The Superfund Otis Air National Guard Base/Camp Edwards site now known as "The Joint Base Cape Cod (JBCC)" (formerly known as the Massachusetts Military Reservation (MMR)), covers approximately 22,000 acres. A write up of the historical cleanup programs at this site is included in the MassDEPs last water quality assessment report for the Cape. Currently two environmental cleanup programs at the JBCC are addressing areas of groundwater contamination (plumes) and their sources: 1) the Air Force is addressing contamination found primarily on Otis Air National Guard Base (Otis ANGB) which is on the southern portion of the JBCC under the authority of Superfund 2) the Army, is addressing contamination from the northern portion of the base, Camp Edwards/Impact Area, under the authority of the Safe Drinking Water Act. Both of these program's efforts are being conducted with oversight from the EPA and MassDEP. Current site status: For Otis ANGB seven groundwater treatment systems are in operation on seven groundwater plumes; all treated groundwater is returned to the aquifer or discharged to surface water. Ongoing treatment systems will be operated and maintained until cleanup levels are met. In 2014 per- and polyfluoroalkyl substances (PFAS) was found in two existing groundwater plumes. Periodic private well sampling for PFAS continues to monitor for potential exposures in Falmouth and Mashpee. 1,4-Dioxane above the Massachusetts Method 1 GW-1 standard of 0.3 parts per billion was found in four existing groundwater plumes. Supplemental remedial investigations for these groundwater plumes are ongoing. For the Camp Edwards/Impact area currently, there are seven groundwater plumes undergoing extraction and treatment. The Army also manages a land use control program so that there are no public exposures to contaminated groundwater undergoing treatment. Long-term groundwater monitoring and operation and maintenance of treatment systems will continue until groundwater cleanup levels are met. MassDEP staff conducted a depth profile at the deep hole (W1306) of Ashumet Pond in August 2005; the DO profile indicated a sharp drop off between 5.7 and 6.7m showing severe oxygen depletion at depths less than 5.7m. The pH ranged from 5.9 to 7.0SU. The depth integrated chlorophyll a sample was low (3.3µg/L) and Secchi disk depth was good (3.5m). There was evidence of total phosphorus release from anoxic sediment (0.3mg/L).

The Aquatic Life Use of Ashumet Pond will be assessed as Not Supporting. The existing impairment listings for abnormal fish deformities, low DO and total phosphorus will remain based on the on-going "clean up status" at the JBCC site. An Alert is being added for the possible infestation of the non-native aquatic organism Asian clam (*Corbicula fluminea*).

Baker Pond (MA96008)

Location:	Orleans/Brewster.
AU Type:	FRESHWATER LAKE
AU Size:	26 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Baker Pond, so it is Not Assessed.

Barnstable Harbor (MA96-01)

Location:	From the mouths of Scorton and Spring creeks, Barnstable east to an imaginary line drawn from Beach Point to the western edge of the Mill Creek estuary, Barnstable.
AU Type:	ESTUARY
AU Size:	3.2 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	4a	Estuarine Bioassessments		Removed

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

According to the MEP project technical report benthic sampling was conducted at 20 locations in Barnstable Harbor in the fall of 2007. Benthic samples were characterized by high numbers of species (16) & individuals (>250) or moderate individuals (~150), dominated by polychaetes, mollusks and crustaceans with few stress indicator species present and the habitat was considered generally high-quality. Macroalgal accumulations were generally absent. No eelgrass bed habitat has been mapped in the harbor area between 1995 and 2017. Chlorophyll a data from the Town of Dennis Water Quality Monitoring Program (WQMP) collected from June through mid-September (2005-2007)) indicated low summer concentrations averaging 2.8-4.5µg/L. SMAST mooring data collected during the summer of 2007 indicated 5.2µg/L at mid basin mooring with a bloom to 20µg/L. but overall was considered healthy. DO data collected by the WQMP program was generally >6mg/L with infrequent depletions to 5-6mg/L (3-5% of samples). SMAST mooring data was collected during the summer of 2007 in the mid-basin at Blish Point was >6mg/L (82% of record), rarely 5mg/L (1% of record). Yearly means of total nitrogen collected at five monitoring stations throughout Barnstable Harbor in the summers of 2002 through 2014 ranged between 0.098 and 0.269mg/L.

The Aquatic Life Use is for Barnstable Harbor assessed as Fully Supporting based on the results of the MEP project studies which concluded Nutrient Related Habitat Health of the harbor was indicative of "Healthy Habitat Conditions". The estuarine bioassessment impairment is being delisted (See additional information in the removal comment).

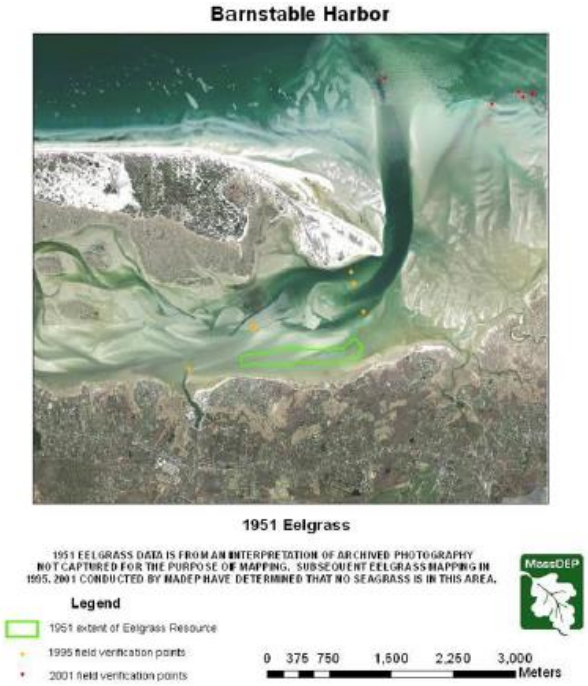
2018/20 Delisted Impairment	Delisting Reason	Delisting Comment
Estuarine Bioassessments	Applicable WQS attained; original basis for listing was incorrect	The estuarine bioassessment impairment was first listed for Barnstable Harbor during the 2012 reporting cycle. This impairment was based on eelgrass bed habitat estimates from the 1951 aerial photophraphy data which were only anecdotally validated according to the methods in the 2012 CALM guidance manual. The 2018 CALM guidance manual describes the change in the eelgrass bed habitat evaluation which compares data

2018/20 Delisted Impairment	Delisting Reason	Delisting Comment
		collected as part of the Eelgrass Mapping Project utiling data collected with standardized eelgrass mapping protocols. The comparisons were made based on the data collected as part of the project comparing areas mapped in 1995 with the most recent datalayer (2017). In Barnstable Harbor AU, no eelgrass has been documented in between 1995 and 2017. Furthermore, according to the MEP project the harbor experiences high tidal velocities, unstable sediments (shifting sands), and winter storm exposures less than ideal for eelgrass bed habitat growth. The overall MEP analysis for the Barnstable Harbor AU indicates healthy habitat conditions, so the estuarine bioassessment impairment is being delisted.

Supporting Information for Delisted Impairments

Estuarine Bioassessments

A historical analysis of possible eelgrass distribution (1951) was conducted within the estuary using aerial photos, which showed only a limited area supporting eelgrass. The photographic analysis indicated the possible presence of eelgrass in the open water portion of Barnstable Harbor close to the mouth and east of what is commonly referred to as the Millway. This is likely because many of the central basin areas have very dynamic sediments, with unstable sands that do not support eelgrass. The MEP Technical Team confirmed that eelgrass is not currently present in the tidal creeks to the Great Marshes portion of the system or Bass Hole while undertaking field surveys as part of the benthic regeneration and infauna studies and during the deployment and recovery of the instrument moorings (summer and fall 2007).The absence of any eelgrass, was consistent with a salt marsh dominated system that is also composed of a large open water area with a large tidal range, strong tidal currents and large areas of shifting sand flats and sand waves. As a result of the absence of eelgrass or documentation indicating eelgrass loss due to nitrogen enrichment, temporal changes in eelgrass distribution could not provide a basis for evaluating recent increases (nitrogen loading) in nutrient enrichment of Barnstable Harbor and Bass Hole. It should be noted that the historical eelgrass distribution is not confirmed or validated. None-the-less to the extent that it existed, the cause of its disappearance is consistent with a non-nitrogen factor, due to the low phytoplankton and macroalgal biomass, oxidized sediments, fully oxygenated water column (>6 mg/L in 98% of 133 sampling dates by Barnstable Water Quality Monitoring Program) and high light penetration in that region of the estuary. The most likely cause appears to be associated with high tidal velocities, unstable sediments and possibly winter storm exposure. Unstable sediments (shifting sands) have been



Narrative above Ibid, pp 164, map- pp 166 (Howes, Samimy, et al. 2017)

Figure VII-16. Eelgrass bed distribution offshore of the Barnstable Great Marsh estuary system (2010-2013). Beds were not identified in 1995 and 2001 (map from the MassDEP Eelgrass Mapping Program). MassDEP surveying did not extend into the salt marsh tidal creeks however, no eelgrass was observed in any of the component basins during SMAST-MEP surveying in 2007.

Ibid, map just above, pp 166. (Howes, Samimy, et al. 2017)

The 2012 CALM guidance manual utilized estimated eelgrass bed habitat data from the 1951 aerial photograph dataset which was only anecdotally validated. The 2018 CALM guidance manual describes the change in the eelgrass bed habitat evaluation which compares data collected as part of the Eelgrass Mapping Project utiling data collected with standardized eelgrass mapping protocols. The comparisons were made based on the data collected as part of the project comparing areas mapped in 1995 with the most recent datalayer (2017). In Barnstable Harbor AU, no eelgrass has been documented in between 1995 and 2017 (MassGIS 2018, MassDEP 2020). Furthermore, according to the MEP project the harbor experiences high tidal velocities, unstable sediments (shifting sands), and winter storm exposures less than ideal for eelgrass bed habitat growth (Howes, Samimy, et al. 2017). Since the overall evaluation of Barnstable Harbor was that of supporting healthy habitat conditions, the estuarine bioassessment impairment is being delisted.

Bass River (MA96-118)

Location:	"Grand Cove" portion of Bass River, north of Main Street (Route 28), Yarmouth.
AU Type:	ESTUARY
AU Size:	0.12 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
--	4a	Nitrogen, Total	68003	Added
--	4a	Nutrient/Eutrophication Biological Indicators	68003	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical report benthic sampling was conducted at two locations within this Bass River AU (referred to as "Grand Cove" in the MEP report), in the summer and fall of 2005. High numbers of individuals and a low number of species (7) were observed indicative of "significantly impaired" benthic habitat. MEP surveys in 2005 noted accumulations of macroalgae i.e. areas of moderate accumulations of *Ulva* with filamentous and branched forms indicative of "moderate impairment". No eelgrass bed habitat was mapped in this area between 1995 and 2017 although historically beds were present. Chlorophyll a data from the Town (Yarmouth and Dennis) Water Quality Monitoring Program (WQMP), collected at one location during the summer months (2003-2008) averaged 7.6µg/L. SMAST mooring data collected at one location during the summer of 2005 had an average of 7.7µg/L with concentrations >15µg/L ~7% of record. DO data from the (WQMP) was collected at one location during the summer months (2003-2008) with a minimum of 4.1mg/L and during the SMAST mooring summer of 2005 generally >4mg/L, infrequently below 4mg/L (6% of record), <5mg/L (18% of record) with minimum of 3mg/L indicative of "moderate to significant impairment". Yearly mean total nitrogen from 2003 through 2008 ranged between 0.403 and 0.763mg/L with an overall mean of 0.564mg/L.

The Aquatic Life Use of Grand Cove portion of the Bass River AU (MA96-118) is assessed as not supporting based on the overall MEP analysis indicating "Nutrient Related Habitat Health" was significantly impaire" as evidenced by degraded benthic habitat, periodically elevated chlorophyll a, low DO and large diel DO shifts which is being added as the nutrient/eutrophication biological indicators impairment and total nitrogen. According to the MEP report Linked Watershed- Embayment Model to Determine Critical Nutrient Loading Thresholds for the Bass River Embayment System, Towns of Yarmouth and Dennis, MA within the Grand Cove portion of the Bass River embayment system the major types (sources) of nitrogen loads in descending order of percent contribution were wastewater (e.g. septic systems), impervious surfaces, and fertilizers.

Bass River (MA96-12)

Location:	Headwaters outlet Kelley's Bay, Route 6, Dennis/Yarmouth to mouth at inlet Nantucket Sound, Yarmouth (excluding Grand Cove, Dennis).
AU Type:	ESTUARY
AU Size:	0.69 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	4a	Estuarine Bioassessments	68003	Changed
5	4a	Nitrogen, Total	68003	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical report benthic sampling was conducted at eight stations throughout this Bass River AU (MA96-12) in the summer and fall of 2005. This area had moderate to high numbers of individuals (356-1911) and large numbers of non-organic enrichment species (25-31) (some of the highest quality benthic animal habitat assessed by the MEP on Cape Cod) and consequently was considered "high quality benthic habitat". Drift macroalgae was generally absent/sparse. According to MassDEP eelgrass bed mapping data there was a complete loss of eelgrass bed habitat in this Bass River AU between 1995 and 2017 (although historically beds were present throughout the AU) . Chlorophyll a data from the Town (Yarmouth & Dennis) Water Quality Monitoring Program (WQMP) was collected at six stations during the summer months (2003-2008) average 5.8µg/L in the uppermost area, and 3.9µg/L in the lower area. In general low to moderate blooms were noted. SMAST mooring data collected was collected at one station (Salt Box Beach) during the summer of 2005 with an average ~10µg/L and >15µg/L (20% of record) which MEP indicated "moderate and significant impairment", with a trend to improved conditions is the lower area. DO data from the (WQMP) was collected at six stations during the summer months (2003-2008) with a minimum of 4.3mg/L in the mid reach and >6mg/L 41% of record in the lower area. SMAST mooring data near Salt Box Beach during the summer of 2005 was generally ~6mg/L and above 5mg/L (93% of record), rarely <4mg/L in the mid-reach and generally >5mg/L 98% of record (minimum 4.7mg/L in the lower reach). The (WQMP) conducted nutrient sampling at six monitoring stations between 2003 and 2008. Yearly mean total nitrogen in the upper area (stations BR6, 7 & 8) ranged between 0.346 and 0.864mg/L with overall means 0.485 to 0.796mg/L. In the lower half of the AU (stations BR10, 11, &13) were somewhat lower (0.310 to 0.694mg/L with overall means ranging from 0.367 to 0.479mg/L). The MEP report noted that there was a strong horizontal gradient in water quality results for this Bass River AU (MA96-12), mainly due to high nitrogen water entering from the upper estuary on the ebb tide and low nitrogen water entering from the Nantucket Sound on the flood tide.

The Aquatic Life Use of this Bass River AU (MA96-12) will continue to be assessed as "Not Supporting" based on the loss of eelgrass bed habitat so the estuarine bioassessment impairment will remain and based on the results of the MEP analysis total nitrogen is being added. According to the MEP report Linked Watershed- Embayment Model to Determine Critical Nutrient Loading Thresholds for the Bass River Embayment System, Towns of Yarmouth and Dennis, MA within the Bass River embayment system the major types (sources) of nitrogen loads in descending order of percent contribution were wastewater (e.g. septic systems), impervious surfaces and fertilizers.

2018/20 Delisted Impairment	Delisting Reason	Delisting Comment
Estuarine Bioassessments	TMDL approved or established by EPA (4a)	Impairment covered under TMDL: Bass River Estuarine System Total Maximum Daily Load For Total Nitrogen (Report CN 392.1, approved 6/26/2017, ATTAINS Action ID: 68003)

Bassing Harbor (MA96-48)

Location:	Excluding Crows Pond and Ryder Cove, Chatham.
AU Type:	ESTUARY
AU Size:	0.13 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
2	5	Estuarine Bioassessments		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting
The MassDEP Eelgrass mapping project data indicates a moderate decrease (24.43%) in beds between 1995 and 2017. The Aquatic Life Use of Bassing Harbor will be assessed as Not Supporting based on the loss of eelgrass bed habitat. According to the Pleasant Bay System Total Maximum Daily Loads for Total Nitrogen, impairment of this waterbody can best be mitigated by reducing excess nutrient loading, total nitrogen. The controllable local sources of total nitrogen identified in this TMDL included on-site subsurface wastewater disposal (septic) systems, stormwater runoff, and fertilizers.

Bearse Pond (MA96012)

Location:	Barnstable.
AU Type:	FRESHWATER LAKE
AU Size:	64 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	4a	(Fanwort*)		Added
4a	4a	(Non-Native Aquatic Plants*)		Removed

Fish, other Aquatic Life and Wildlife Use: Not Supporting
The Town of Barnstable Concervation Division reported an infestation of the non-native aquatic macrophyte, *Cabomba caroliniana*, in Bearse Pond in 2001. The Aquatic Life Use of Bearse Pond will continue to be assessed as Not Supporting because of the infestation of the non-native macrophyte fanwort (*Cabomba caroliniana*).

2018/20 Delisted Impairment	Delisting Reason	Delisting Comment
Non-Native Aquatic Plants	Clarification of listing cause	The generic "Non-Native Aquatic Plants" is not needed since the specific macrophyte Cabomba caroliniana (fanwort) has been utilized.

Supporting Information for Delisted Impairments

Non-Native Aquatic Plants

Original source of the information in the 1999 WQAR (CN 50.0) based on a personal communication:

> Gatewood, Rob. 2001. Personal Communication. *Presence of Cabomba caroliniana in Bearse Pond and Wequaquet Lake, Barnstable*. Town of Barnstable Conservation Division. Barnstable, MA.

There is an infestation of the non-native aquatic macrophyte, *Cabomba caroliniana*, in Bearse Pond (MassDEP Undated).

Black Pond (MA96017)

Location:	Brewster/Harwich.
AU Type:	FRESHWATER LAKE
AU Size:	9 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
--	4c	(Fish Passage Barrier*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to DMF biologists, a degraded wooden fishway ladder that connects Black Pond to Long Pond (MA96183) has a passage score of 5 (restricted passage) for river herring.

The Aquatic Life Use for Black Pond is assessed as Not Supporting because of the fish passage barrier that restricts passage of river herring.

Blackfish Creek (MA96-123)

Location:	Headwaters south of Lecount Hollow Road, Wellfleet to mouth at confluence with Wellfleet Harbor, Wellfleet (area within Cape Cod National Seashore designated ORW).
AU Type:	ESTUARY
AU Size:	0.01 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO ('ORW' applies only to portion in Cape Cod National Seashore)

Fish, other Aquatic Life and Wildlife Use: Not Assessed
The downstream end of Blackfish Creek is upstream of the MEP project station WHRB22. Since no data are available to assess the Aquatic Life Use of Blackfish Creek it is Not Assessed.

Boat Meadow River (MA96-15)

Location:	Headwaters east of old railway grade, Eastham to mouth at inlet Cape Cod Bay, Eastham.
AU Type:	ESTUARY
AU Size:	0.05 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
No new data are available so the Aquatic Life Use for Boat Meadow River will continue to be assessed as Not Supporting with the Estuarine Bioassessment impairment carried forward.

Bog Pond (MA96024)

Location:	Falmouth.
AU Type:	FRESHWATER LAKE
AU Size:	3 ACRES
Classification/Qualifier:	B: ORW, WWF (also tributary)

Fish, other Aquatic Life and Wildlife Use: Insufficient Information
According to DMF biologists there is a fish ladder at the outlet of Bog Pond at the "Bog Pond Dam". Notes indicate the ladder was constructed by DMF fishway crew in the fall of 2016 which has a passage score of 2 (minor obstruction) for river herring and American eel. Too limited data/information are available to assess the Aquatic Life Use of Bog Pond so it is assessed as having Insufficient Information.

Bourne Pond (MA96026)

Location:	Falmouth.
AU Type:	FRESHWATER LAKE
AU Size:	9 ACRES
Classification/Qualifier:	B: ORW, WWF (also tributary)

Fish, other Aquatic Life and Wildlife Use: Insufficient Information
According to DMF biologists there is a culvert at the outlet of Bourne Pond that has a passage score of 3 (minor obstruction) for the passage of river herring. No other recent data are available. Too limited data are available to assess the assess the Aquatic Life Use of Bourne Pond, so it is assessed as having Insufficient Information.

Bournes Pond (MA96-57)

Location:	west of Central Avenue, Falmouth outlet to Vineyard Sound, including Israel's Cove, Falmouth.
AU Type:	ESTUARY
AU Size:	0.24 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
The MassDEP eelgrass mapping project data indicates a large decrease (~53%) in beds between 1995 (0.0726mi^2) and 2017 (0.0339mi^2). No other more recent water data are available. The Aquatic Life Use of Bournes Pond will continue to be assessed as Not Supporting with the estuarine bioassessments and total nitrogen impairments being carried forward.

Bucks Creek (MA96-44)

Location:	Outlet Harding Beach Pond (locally known as Sulfur Springs), Chatham to mouth at inlet Cockle Cove, Nantucket Sound, Chatham.
AU Type:	ESTUARY
AU Size:	0.02 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
No new data are available for Bucks Creek. The Aquatic Life Use of Bucks Creek will continue to be assessed as Not Supporting with the total nitrogen impairment being carried forward. The 2008 Stage Harbor/Oyster Pond, Sulphur Springs/Bucks Creek, Taylors Pond/Mill Creek Total Maximum Daily Load TMDL for Total Nitrogen indicated that this waterbody can best be protected by reducing excess nutrient loading, total nitrogen.

Bumps River (MA96-02)

Location:	From pond outlet, Bumps River Road, Barnstable through Scudder Bay to mouth at Main Street/South Main Street bridge (confluence with Centerville River), Barnstable.
AU Type:	ESTUARY
AU Size:	0.07 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Insufficient Information

According to DMF biologists, two structures on along the Bumps River were noted to be of minimal impact to the passage of American eel. The most upstream barrier is the Bumps River Road Dam in Barnstable (NatID#MA02390) which has a passage score of 3 (minor obstruction) and the second is a culvert below the Bumps River Road Dam which also has a passage score of 3 (minor obstruction) however DMF biologists also assigned a population score of 0 for these structures. During the summer of 2009 MassDEP staff deployed one long term (104-day) temperature logger near the mouth of the Bumps River at Route 28 (W2073). The maximum temperature was 24.6 with a maximum daily mean of 23.0 °C (both well below recommended temperature criteria).

Too limited data are available to assess the Aquatic Life Use for the Bumps River so it will be assessed as having Insuffient Information.

Cedar Pond (MA96-88)

Location:	Orleans (in Inner Cape Cod Bay ACEC).
AU Type:	ESTUARY
AU Size:	0.03 SQUARE MILES
Classification/Qualifier:	SA: ORW (SWQS "shellfishing" NOT mentioned)

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	(Fish Passage Barrier*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

DMF biologists identified the Cedar Pond outlet control structure (just upstream of Rt.6 in Orleans) as a barrier to diadromous fish passage at with a passage score of 5 (restricted passage) for river herring and American eel.

The Aquatic Life Use for Cedar Pond is assessed as Not Supporting based on the barrier to diadromous fish passage. The former impairments indicative of enriched conditions (DO, DOsat and Chlorophyll a) are being carried forward.

Centerville Harbor (MA96-03)

Location:	From an imaginary line that extends from Dowses Beach, Barnstable to Hyannis Point, Barnstable including all waters north to the shore, Barnstable.
AU Type:	ESTUARY
AU Size:	1.46 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
2	5	Estuarine Bioassessments		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

The MassDEP Eelgrass mapping project indicates a large decrease (~100%) in beds between 1995 and 2017. The 42.1 acres noted in 2001 was completely gone by 2007 with a complete loss after 2007.

The Aquatic Life Use for Centerville Harbor is assessed as Not Supporting because of the loss of eelgrass bed habitat (estuarine bioassessment impairment).

Centerville River (MA96-04)

Location:	From approximately 300 feet west of Elliot Road, Barnstable to inlet Centerville Harbor, including East Bay, Barnstable.
AU Type:	ESTUARY
AU Size:	0.24 SQUARE MILES
Classification/Qualifier:	SA: SFO

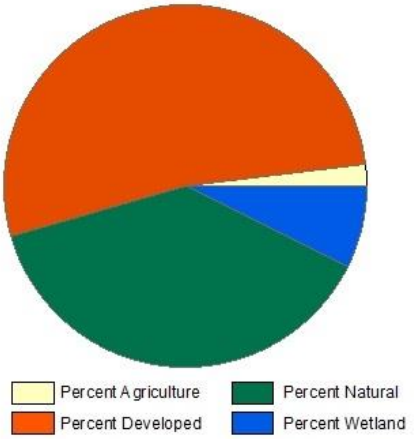
Fish, other Aquatic Life and Wildlife Use: Not Supporting
No new water quality data are available for Centerville River. The Aquatic Life Use of Centerville River will continue to be assessed as Not Supporting with the estuarine bioassessments and total nitrogen impairments being carried forward.

Chase Garden Creek (MA96-103)

Location:	Headwaters south of Roads End and west of Jericho Road, Dennis to New Boston Road, Dennis.
AU Type:	RIVER
AU Size:	1.2 MILES
Classification/Qualifier:	B

Chase Garden Creek - MA96-103

Watershed Area: 0.78 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.78	0.78	0.35	0.35
Agriculture	1.9%	1.9%	2.9%	2.9%
Developed	52.6%	52.6%	47.1%	47.1%
Natural	38.2%	38.2%	34.8%	34.8%
Wetland	7.3%	7.3%	15.1%	15.1%
Impervious Cover	16.7%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	(Curly-leaf Pondweed*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

The non-native aquatic macrophyte (Curly leaf pondweed), *Potamogeton crispus*, was identified during a 2009 MassDEP survey of this Chase Garden Creek AU (MA96-103).

The Aquatic Life Use of this Chase Garden Creek AU (MA96-103) will be assessed as Not Supporting due to the presence of the non-native aquatic macrophyte species curly-leaf pondweed (*Potamogeton crispus*).

Chase Garden Creek (MA96-35)

Location:	New Boston Road, Dennis to mouth at inlet Cape Cod Bay, Dennis/Yarmouth.
AU Type:	ESTUARY
AU Size:	0.13 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

According to the MEP project technical report benthic samples were collected at 5 stations in Chase Garden Creek in the fall of 2007. The benthic samples were characterized by high numbers of species (16) & individuals (>250) or moderate numbers of individuals (~150), dominated by polychaetes, mollusks and crustaceans with few stress indicator species present. Sediments were oxidized and consolidated with no observed anoxia but with periodic oxygen depletion typical of salt marshes. There was a near absence of macroalgal accumulations and no record of eelgrass bed habitat present. Chlorophyll a data from the Town of Dennis Water Quality Monitoring Program (WQMP) included samples collected from June through mid-September (2005-2007) were low <4µg/L in the lower creek and ~12µg/L in the upper creek. SMAST mooring data collected during the summer of 2007 was similar but there was a late bloom (up to 20µg/L) but with means of ~9µg/L in the upper and lower creek. DO data from (WQMP) and SMAST mooring was frequently to 3mg/L (5% of mooring record) and >4mg/L 98% of dates in the lower basin and frequently 3mg/L in upper small creeks but MEP concluded these data were considered healthy habitat conditions since natural oxygen depletions is typical of salt marsh creeks which can go anoxic at night due to natural high organic sediments and high oxygen. Yearly means of total nitrogen data collected at six monitoring stations throughout the Chase Garden Creek in the summers of 2002 through 2014 ranged from 0.098 to 0.269mg/L.

The Aquatic Life Use of this Chase Garden Creek AU (MA96-35) is assessed as Fully Supporting based on the overall MEP analysis that concluded that healthy infauna habitat typical of open salt marsh dominated basins or organic rich New England salt marsh tidal creeks were present.

Chatham Harbor (MA96-10)

Location:	Harbor, bounded on east by Cape Cod National Seashore (CCNS), with northern extent as an imaginary line drawn northeast from northern tip of Strong Island to a point on inner CCNS and western extent as an imaginary line drawn from southern tip of Strong Island south to Allen Point including waters south to an imaginary line along northern edge of South Beach Bar extending from Chatham Lighthouse to inlet created by 1987 storm, Chatham (area within CCNS designated as ORW).
AU Type:	ESTUARY
AU Size:	2.85 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO ('ORW' applies only to portion in Cape Cod National Seashore)

Fish, other Aquatic Life and Wildlife Use: Insufficient Information
The MassDEP Eelgrass mapping project data indicates a significant decrease (97.35%) in beds between 1995 and 2017. It should be noted that the eelgrass bed coverage appeared to hold steady up until 2007 but then suffered a drastic decline after that time which is consistent with the changes in circulation of the harbor as new cuts occurred in the Chatham Bar. Too limited data are available to assess the Aquatic Life Use of Chatham Harbor so it will be assessed as having Insufficient Information. While there has been significant loss of eelgrass bed habitat in Chatham Harbor since 2007, these changes are coincident with major circulation changes as a result of a large cut along Chatham Bar (the North Cut) and likely do not indicate a decline in water quality conditions.

Childs River (MA96-120)

Location:	From confluence with freshwater portion south of Barrows Road, Falmouth to mouth at confluence with Seapit River, Falmouth (area within Waquoit Bay ACEC designated as ORW).
AU Type:	ESTUARY
AU Size:	0.06 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO ('ORW' applies only to portion in Waquoit Bay ACEC)

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
--	4a	Nitrogen, Total	R1_MA_2020_08	Added
--	4a	Nutrient/Eutrophication Biological Indicators	R1_MA_2020_08	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical report benthic sampling was conducted at two stations in this Childs River AU (MA96-120) in the fall of 2006. Low to moderate numbers of species (8-11) and moderate numbers of individuals (~300) and a community dominated by organic enrichment species (Crustaceans) with some stress indicators (*Capitella*) = 29% of population) were found indicative of "significantly impaired" benthic animal habitat. Sediments were noted to be organic enriched soft muds. Frequent accumulations of drift macroalgae were noted; patches of dense *Ulva* and some accumulations of drift branched forms and algal mats. The MEP project notes that eelgrass bed habitat within the Childs River was lost (patterns of loss associated with nitrogen enrichment) supported by quantitative time-series analysis by Short & Burdick as beds first declined between 1951 and 1987 and were completely lost by 1995. Chlorophyll a data from the Town of Mashpee Water Quality Monitoring Program (MWQMP) was collected June-September (2000-2010) with very high concentrations in the upper and mid-reach (mean ~28µg/L of 34 dates). SMAST mooring data was collected close to the confluence with the Seapit River during the summer of 2007 where very high chlorophyll a concentrations were also found (mean 23.3µg/L, >20µg/L (53%) and frequently (37%) >25µg/L of 23 day record). DO data was collected by the MWQMP project between June and September (2000-2010) was frequently low (<5mg/L 51%, <4mg/L 30%, and <3mg/L 6% of 34 dates). SMAST compiled time series DO records obtained in summer 2005 and mooring data collected during the summer of 2007 with the following results: Mid-reach <5mg/L 38%, <4mg/L 24%, <3mg/L 11% of 23-day record. Overall, significant oxygen depletions (<4mg/l) were noted with periodic declines to <3mg/L. Yearly means of total nitrogen data collected near the top (CR01) and middle (CR02) in the summers of 2004 through 2010 ranged between 1.095 and 1.533mg/L with an overall mean 1.190mg/L and between 0.720 and 1.067mg/L with an overall mean 0.888mg/L, respectively.

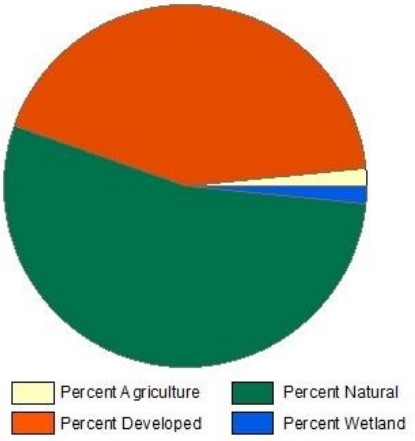
The Aquatic Life Use for this Childs River AU (MA96-120) is assessed as not supporting based on the overall MEP analysis indicating the "Nutrient Related Habitat Health" was significantly impaired as evidenced by the degraded benthic habitat conditions, loss of eelgrass bed habitat, elevated chlorophyll a, and low DO which is being added as the nutrient/eutrophication biological indicators impairment and total nitrogen. Aggregated estuary watershed nitrogen loads were partitioned by the major types of nitrogen sources in order to focus development of nitrogen management alternatives. According to the Linked Watershed Embayment Approach to Determine Critical Nitrogen Loading Thresholds for the Waqoit Bay and Eel Pond Embayment System, Towns of Falmouth and Mashpee, MA the major types (sources) of nitrogen loads in Childs River area in descending order of percent contribution were wastewater (e.g. septic systems), fertilizers and impervious surfaces.

Childs River (MA96-98)

Location:	Headwaters outlet Johns Pond, Mashpee to confluence with tidal portion south of Barrows Road, Falmouth.
AU Type:	RIVER
AU Size:	2.4 MILES
Classification/Qualifier:	B: ORW (also tributary)

Childs River - MA96-98

Watershed Area: 8.28 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	8.28	3.18	1.41	0.92
Agriculture	1.6%	2.8%	2.1%	3.3%
Developed	43%	34.8%	25.4%	25.9%
Natural	53.8%	59.4%	66.9%	65.4%
Wetland	1.5%	3%	5.6%	5.4%
Impervious Cover	15.8%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
2	5	(Curly-leaf Pondweed*)		Added
2	5	(Fish Passage Barrier*)		Added
2	5	Lead		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to DMF biologists, there are two structures on this Childs River AU (MA96-98) that can impact passage of river herring; from upstream to downstream these structures include the outlet structure at John's Pond with a passage score of 6 (restricted passage) and further downstream at the Carriage Shop Dam with a passage score of 3 (minor obstruction). DFG biologists conducted backpack shocking at two sites in the river in September 2006 between Barrows Street and Carriage Shop Road (SampleID 1622) and above Barrow Street (SampleID 1938). Only three individuals were recorded (Sample 1622) including two intolerant fluvial specialists, brown trout and brook trout but notes were made that American eels were numerous (just not collected). Many fish were collected in Sample 1938 (5 species, 193 individuals). The sample was comprised primarily by the moderately tolerant fourspine stickleback. MassDEP staff conducted nutrient and metals samples in the river at Carriage Shop Rd Falmouth (W1908) and physicochemical samples further downstream downstream at Barrow Road in Falmouth (W2071) during the summer of 2009 and at this time noted an

infestation of the non-native aquatic macrophyte, *Potamogeton crispus* (curly leaf pondweed). Between May and September (n=4) the seasonal average total phosphorus concentration was 0.015mg/L (maximum 0.019mg/L) and total nitrogen 1.5mg/L (maximum 1.8mg/L). There were no exceedances of any acute or chronic metals criteria (n=3 sampling events) except for three chronic lead criteria exceedances (TUs ranging from 5 to 22). Further downstream at Barrow Road in Falmouth (W2071) a long term (110-day) temperature logger recorded a maximum temperature of 17.1°C and a maximum 24-hour average of 15.9°C indicative of cold-water habitat. According to the MEP technical report, one water quality monitoring station was sampled right at bottom of the AU (site CRfw) in 2006-2007. Weekly water quality samples were collected at this site for 16 months starting in May 2006. The average total nitrogen concentration measured at this location was 0.258mg/L.

The Aquatic Life Use of the Childs River (MA96-98) will be assessed as "Not Supporting" due to the chronic lead criteria exceedances (all three samples with TUs between 5 and 22), the infestation of the non-native aquatic plant *Potamogeton crispus* (curly leaf pondweed) and the barrier to diadromous fish (river herring) passage at the John's Pond outlet.

Clapps Pond (MA96035)

Location:	Provincetown (area associated with Cape Cod National Seashore designated as ORW).
AU Type:	FRESHWATER LAKE
AU Size:	40 ACRES
Classification/Qualifier:	B: ORW ('ORW' applies only to portion in Cape Cod National Seashore)

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Clapps Pond, so it is Not Assessed.

Cliff Pond (MA96039)

Location:	Brewster.
AU Type:	FRESHWATER LAKE
AU Size:	190 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)
Prolonged algal blooms occurred in Cliff Pond in four years (2009 & 2012-2014). No other data are available. Too limited data are available to assess the Aquatic Life Use of Cliff Pond, so it is assessed as having Insufficient Information. An alert is being identified because of the harmful algal blooms.

Cockle Cove Creek (MA96-79)

Location:	Northeast of the bend in Cockle Drive, Chatham to mouth at confluence with Bucks Creek, Chatham (2005 orthophotos used to delineate segment).
AU Type:	ESTUARY
AU Size:	0.01 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No recent water data are available to assess the Aquatic Life Use of Cockle Cove Creek, so it is Not Assessed.

Coonamessett Pond (MA96043)

Location:	Falmouth.
AU Type:	FRESHWATER LAKE
AU Size:	159 ACRES
Classification/Qualifier:	B

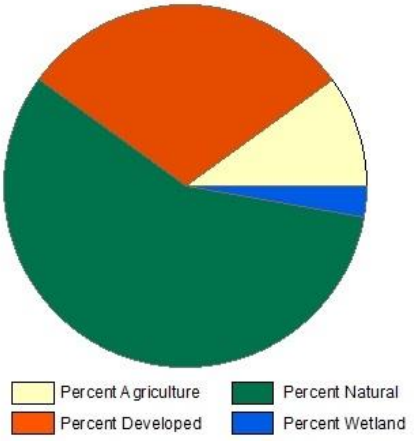
Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Coonamessett Pond, so it is Not Assessed.

Coonamessett River (MA96-69)

Location:	Headwaters, outlet Coonamessett Pond, Falmouth to mouth at inlet Great Pond, Falmouth.
AU Type:	RIVER
AU Size:	3.4 MILES
Classification/Qualifier:	B

Coonamessett River - MA96-69

Watershed Area: 5.58 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	5.58	3.52	1.39	1.29
Agriculture	9.9%	7.7%	10.6%	10.5%
Developed	30.1%	31.4%	26.9%	26.5%
Natural	57.3%	57.1%	55.9%	56.1%
Wetland	2.7%	3.8%	6.6%	6.9%
Impervious Cover	11%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

According to DMF biologists three structures allow adequate passage of river herring along the Coonamessett River from upstream to downstream as follows: the Coonamesset Pond Outlet passage score 0 (no obstruction), the Pond 14 dam passage score 0 (no obstruction), and the John Parker Road bridge which in early 2020 underwent removal of the fishway and rebuilding of the bridge which now has a passage score of 1 (minor obstruction). MassDEP biologists conducted backpack electrofishing in the Coonamessett River just upstream from the flow structure at the Sandwich Road crossing (SampleID 4541) in September 2009. Sampling efficiency was noted as poor although tessellated darter, a moderately tolerant fluvial specialist dominated the sample. Water quality monitoring data were also collected at Sandwich Road Falmouth (W1905) during the summer of 2009 and were indicative of good conditions. The minimum DO during the three five-day unattended probe deployments in June, July and August recorded was 5.3mg/L, the maximum diel DO shift was 2.8mg/L, the maximum saturation was 96.8%, and the maximum temperature was 21.8°C. The maximum temperate recorded during the long-term (104-day) thermistor deployment beginning 18 June was 21.7 °C (maximum 7 DADM 21°C, maximum 24-hour rolling average 19.8°C) well below acute and criterion for warm water. Attended probes data documented a minimum DO of 6.9mg/L, maximum saturation 86%, somewhat low pH but considered natural ranging from 6.0 to 6.3SU, maximum temperature 19.9°C. The seasonal average (May-September) total phosphorus concentration was 0.026mg/L (maximum 0.034mg/L). The seasonal average total

nitrogen concentration was 0.44mg/L. There were also no exceedances of acute or chronic metals criteria (n=3 sampling events).

DFG biologists conducted backpack electrofishing in the river downstream from John Parker Road in a section of a lower bog (SampleID 1424) in September 2005. The sample was comprised of nine species (103 individuals) primarily moderately tolerant/tolerant macrohabitat generalists and one fluvial specialist. American eel and tesselated darter dominated the sample. MassDEP staff also conducted water quality sampling in the river at Route 28 Falmouth (W1906) during the summer of 2009. The minimum DO during the three five-day unattended probe deployments in June, July and August was 5.7mg/L and the maximum temperature was 23.9^{o}C. There was some evidence of enrichment (maximum diel DO shift 3.77mg/L and above 3.0mg/L in both June and July) and the maximum saturation was 125.6%, but there were no observations of dense/very dense filamentous aglae noted. For attended probes data the minimum DO concentration was 8.5mg/L, the maximum saturation was 103%, pH ranged from 6.4 to 6.6SU (n=6), and the maximum temperature was 22^{o}C. The seasonal average total phosphorus concentration was low (0.032mg/L) with a maximum of 0.037mg/L. The seasonal average total nitrogen concentration was 0.6525mg/L. There were no exceedances of acute or chronic metals criteria (n=3 sampling events).

The Aquatic Life Use of the Coonamessett River is assessed as Fully Supporting based on the presence of moderately tolerant fluvial fish, adequate diadromous fish passage, and generally good water quality conditions. An alert is being identified based on some evidence of enrichment in the river (high diel DO shifts/saturation) at Route 38 (downstream of Coonamessett Bogs).

Cotuit Bay (MA96-63)

Location:	From North Bay at Point Isabella, Barnstable oceanward to a line extended along Oyster Harbors Beach, Barnstable.
AU Type:	ESTUARY
AU Size:	0.85 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
No new water quality data are available for Cotuit Bay. The Aquatic Life use of Cotuit Bay will continue to be assessed as Not Supporting with the total nitrogen impairment being carried forward.

Crows Pond (MA96-47)

Location:	To Bassing Harbor, Chatham.
AU Type:	ESTUARY
AU Size:	0.19 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO

Fish, other Aquatic Life and Wildlife Use: Fully Supporting
MassDEP eelgrass mapping project data indicates maintenance of the eelgrass beds in Crows Pond over the years, with a loss of only (0.39%) between 1995 and 2017. Some improvement/new growth has occurred since 2013. The Aquatic Life Use of Crows Pond will continue to be assessed as Fully Supporting based on the presence of stable eelgrass bed habitat, an indicator of good water quality conditions.

Crystal Lake (MA96050)

Location:	Orleans.
AU Type:	FRESHWATER LAKE
AU Size:	33 ACRES
Classification/Qualifier:	B: ORW, WWF

Fish, other Aquatic Life and Wildlife Use: Not Supporting
No new data are available so the Aquatic Life Use for Crystal Lake will continue to be assessed as Not Supporting with the DO impairment being carried forward.

Depot Pond (MA96061)

Location:	Eastham.
AU Type:	FRESHWATER LAKE
AU Size:	26 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
3	4c	(Fish Passage Barrier*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

According to DMF biologists the railroad culvert at the outlet of Depot Pond and at the boundary of an unnamed waterbody (locally known as Priscilla Pond), does not allow adequate passage of river herring (passage score of 7 – severe impediment). The Town of Eastham volunteers conducted water quality monitoring in Depot Pond between June and September 2001 to 2006. These data were summarized as follows: On average DO was >6 mg/L to a depth of 5m, but at depths greater than 6.5m the average DO was <5.0mg/L, while below 7m the average was <4 mg/L. Anoxic concentrations (<1mg/L) were regularly measured at 8 and 9m depth (15 of 33 readings at both depths). Secchi disk depths averaged 4.0m (n=25), and average total phosphorus (TP) concentrations 2002-2006 at three depths were low: 0.0106 mg/L at 0.5m (n=16), 0.008 mg/) at 3m (n=15), and 0.0108 mg/L at ~8.6m (n=15), generally meeting the EPA criterion for lakes (0.025 mg/L);

The Aquatic Life Use of Depot Pond is assessed as Not Supporting based on the limitations to diadromous fish passage at the Depot Pond railroad culvert. An Alert is also being identified due to the low DO at depth (bathymetry not available to calculate % of lake surface area with oxygen depletion) as measured by Town of Eastham volunteers during the summers 2001-2006.

Dinahs Pond (MA96-112)

Location:	Yarmouth.
AU Type:	ESTUARY
AU Size:	0.04 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
--	4a	Nitrogen, Total	68003	Added
--	4a	Nutrient/Eutrophication Biological Indicators	68003	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical report benthic sampling was conducted at two stations in Dinahs Pond in the summer and fall of 2005. Samples were found to have relatively low numbers of individuals (<75), low number of species (7) and >50% of community were the stress indicator species (*Capitella*). The MEP reports the benthic habitat was between "significantly impaired" and "severely degraded". Sparse amounts of drift algae, with some moderately dense patches were noted. There was dense coverage of an eelgrass bed in Dinah Pond in the summer of 2005 (found by MEP scientists, however, a heavy epiphyte growth was noted on the plants indicative of "moderate impairment". Chlorophyll a data from the Town (Yarmouth & Dennis) Water Quality Monitoring Program (WQMP) was collected at one location during the summer months (2003-2008) with an overall average 9.3µg/L. SMAST mooring data was collected at one location during the summer of 2005 averaged 5.2µg/L, only rarely >15µg/L. Overall the MEP technical report concluded that the Chlorophyll a data was indicative of "moderate impairment". There was periodic oxygen depletion to <1mg/L, <3mg/L during 13% of record, <5mg/L ~32% of record with frequent large daily excursions in DO which MEP concluded was indicative of "significant impairment". Between 2003 and 2008 WQMP yearly mean total nitrogen concentration ranged between 0.727-0.959mg/ with an overall mean of 0.843mg/L.

The Aquatic Life Use of Dinahs Pond is assessed as Not Supporting based on the overall MEP analysis indicating "Nutrient Related Habitat Health" was "Significantly Impaired" as evidenced by significantly impaired benthic habitat, the presence of eelgrass with heavy epiphyte growth, low DO and large diel DO shifts which is being added as the nutrient/eutrophication biological indicators impairment and total nitrogen. According to the MEP report Linked Watershed- Embayment Model to Determine Critical Nutrient Loading Thresholds for the Bass River Embayment System, Towns of Yarmouth and Dennis, MA within the Dinahs Pond embayment system the major types (sources) of nitrogen loads in descending order of percent contribution were wastewater (e.g. septic systems), impervious surfaces, and fertilizers.

Dock Creek (MA96-86)

Location:	From railroad crossing northeast of Route 6A, Sandwich to confluence with Old Harbor Creek, Sandwich.
AU Type:	ESTUARY
AU Size:	0.02 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Dock Creek, so it is Not Assessed.

Duck Creek (MA96-32)

Location:	Source west of Route 6, Wellfleet to mouth at inlet Wellfleet Harbor (at a line from Shirttail Point to Taylor Road), Wellfleet.
AU Type:	ESTUARY
AU Size:	0.15 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	5	Benthic Macroinvertebrates		Added
4a	5	Dissolved Oxygen		Added
4a	5	Nitrogen, Total		Added
4a	5	Nutrient/Eutrophication Biological Indicators		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP Technical Report for the Duck Creek area of the Wellfleet Harbor System, benthic infaunal communities sampling was conducted at two stations in the summer and fall of 2004. The basin was found to be supporting low numbers of species (5) and individuals (<100) and dominated by small polychaetes (*Streblospio*). It was concluded that these data were indicative of between "moderately and significantly impaired" benthic animal habitat. Moderate accumulations of drift macroalgae (Ulva), patchy with some coverages of 75% were noted. There was no evidence this AU ever supported eelgrass. Chlorophyll a data from the Town of Wellfleet Water Quality Monitoring Program (WQMP) was collected at two stations June-September (2005-2011). The reported overall average was 8µg/L and the SMAST mooring data at one station during the summer of 2004 averaged 9µg/L with periodic blooms to 14µg/L. The MEP technical report concluded that Chlorophyll a data in the Duck Creek AU was indicative of "moderately impaired conditions". DO data was collected by the WQMP at one station in June-September (2005-2011) with results <4 and <3mg/L (12% and 1% of samples, respectively). SMAST mooring data collected at one station during the summer of 2004 was <5mg/L 38% of record, frequently <4mg/L with periodic declines to <3mg/L. It was also noted that oxygen concentrations periodically dropped to hypoxic conditions. The MEP concluded that the DO data was indicative of "moderate to significant impairment".Total Nitrogen data was collected at one monitoring station in the Duck Creek AU in the summers between 2003 and 2011; the overall mean was 0.908mg/L. Aggregated estuary watershed nitrogen loads were partitioned by the major types of nitrogen sources in order to focus development of nitrogen management alternatives. Overall, within the Duck Creek sub-watershed the major types (sources) of nitrogen loads in descending order of percent contribution are; wastewater (e.g. septic systems), buildout, impervious surfaces and fertilizers. The MEP technical report concluded that overall "Nutrient Related Habitat Health" for the Duck Creek AU was categorized as between "moderately and significantly" impaired".

The Aquatic Life Use of Duck Creek is assessed as Not Supporting based on the evidence of impairments to the benthic community, biological indicators of nutrient enrichment, low DO, and total nitrogen based on the MEP and SMAST data collected between 2004 and 2011.

Duck Pond (MA96068)

Location:	Wellfleet.
AU Type:	FRESHWATER LAKE
AU Size:	11 ACRES
Classification/Qualifier:	B: ORW

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Duck Pond, so it is Not Assessed.

Dyer Pond (MA96070)

Location:	Wellfleet.
AU Type:	FRESHWATER LAKE
AU Size:	10 ACRES
Classification/Qualifier:	B: ORW

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Dyer Pond, so it is Not Assessed.

East Harbor (Pilgrim Lake) (MA96-83)

Location:	Truro/Provincetown.
AU Type:	ESTUARY
AU Size:	0.5 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO

Fish, other Aquatic Life and Wildlife Use: Insufficient Information
DMF biologists report that the culvert at Pilgrim Lake control (NatID# MA02479) is at the planning stages for a tidal improvement project. The culvert was noted to have a passage score of 1 indicating that this culvert is only a minor obstruction to American eel. Too limited data are available to assess the Aquatic Life Use of East Harbor (Pilgrim Lake) so it will be assessed as having Insufficient information.

Eel Pond (MA96-121)

Location:	Falmouth.
AU Type:	ESTUARY
AU Size:	0.32 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO (Tributary)

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
--	4a	Estuarine Bioassessments	R1_MA_2020_08	Added
--	4a	Nitrogen, Total	R1_MA_2020_08	Added
--	4a	Nutrient/Eutrophication Biological Indicators	R1_MA_2020_08	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical report benthic sampling was conducted at six stations in Eel Pond in the fall of 2006. The west branch area had low -moderate numbers of species (8), low numbers of stress indicator species, some areas with depauperate populations and was dominated by organic enrichment species. The east branch area had high numbers of individuals, moderate numbers of species (18) and low numbers of stress indicator species; but dominated by a transitional community of amphipod mats (organic enrichment species). It was concluded that these data were indicative of "significantly and moderately impaired" benthic habitat in the west and east branch areas, respectively. Sparse accumulations of branched macroalgae were noted in the east branch-upper reach with some attached *Codium* and patches of algal mats; in the west branch moderate to dense accumulations of branched forms (*Cladophora*) were observed with some open areas. No macroalgae were noted in the lower basin of either branch. Eelgrass loss according to the MEP conclusions were indicative of "significantly impaired conditions with the analysis of the patterns of loss associated with nitrogen enrichment. Eelgrass beds declined in the east branch between 1951 and 1987 and were completely lost by 1995. Chlorophyll a concentrations from the Town of Mashpee Water Quality Monitoring Program (MWQMP) collected between June and September (2000-2010) in the west branch upper and mid-reach areas had a mean of ~20µg/L and in the east branch upper area mean was 7.5µg/L and lower basin mean was 6.6µg/L. SMAST mooring data was collected during the summer of 2007 indicated high chlorophyll a in the upper west branch reach (mean 17.4µg/L, frequently (34%) >20µg/L of 72 day record) and slightly lower concentrations in the east branch area upper reach (moderate chlorophyll a, lower basin mean 6.2µg/L, generally <10µg/L (82%), rarely >15µg/L). DO from the (MWQMP) project in the west upper-reach was <3mg/L 7% of 34 dates; mid reach <4mg/L 12%, <3mg/L 2% of 34 dates. In the east branch lower-basin area DO was >5mg/L 91%, 4-5mg/L 9%. Time series DO records from summer 2005 and SMAST mooring data collected during the summer of 2007 in the west branch area upper-reach was <5mg/L 41%,<4mg/L 22% and <3mg/L 7% of record and in the east branch upper reach area was <5mg/L 26%, <4mg/L 10% and <3mg/L 2% of 34 dates; lower basin near inlet always >4mg/L, 4-5mg/L 6% of 85 day record. Overall, significant summer time oxygen depletion of bottom waters was noted in the upper reaches, but in in the lower basin was usually >5mg/L. Yearly mean total nitrogen data at two monitoring stations (CR03 and ER03) collected in the summers of 2005 through 2010 at ER03 ranged from 0.362 to 0.455mg/L (overall mean 0.404mg/L) and at CR03 ranged from 0.421 to 0.555mg/L (overall mean 0.474mg/L).

The Aquatic Life Use for Eel Pond is assessed as Not Supporting based on the MEP analysis indicating the "Nutrient Related Habitat Health" was between moderately and significantly impaired as evidenced by the degraded benthic habitat conditions, frequently elevated chlorophyll a, and low DO which is being added as the nutrient/eutrophication biological indicators impairment, eelgrass loss (estuarine bioassessment) and total nitrogen. Aggregated estuary watershed nitrogen loads were partitioned by the major types of nitrogen sources in order to focus development of nitrogen management alternatives. According to the MEP report MEP- Linked Watershed Embayment Approach to Determine Critical Nitrogen Loading Thresholds for the Waquoit Bay and Eel Pond Embayment System, Towns of Falmouth and Mashpee, MA the major types (sources) of nitrogen loads in Eel Pond area in descending order of percent contribution were wastewater (e.g. septic systems), fertilizers, impervious surfaces.

Elbow Pond (MA96077)

Location:	Brewster.
AU Type:	FRESHWATER LAKE
AU Size:	32 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)
An alert is being identified because of the algal bloom that occurred in Elbow Pond in 2013. No other data are available. Too limited data are available to assess the Aquatic Life Use of Elbow Pond, so it is assessed as having Insufficient Information.

Falmouth Inner Harbor (MA96-17)

Location:	Waters included north of Falmouth Inner Harbor Light, Falmouth.
AU Type:	ESTUARY
AU Size:	0.05 SQUARE MILES
Classification/Qualifier:	SB: SFR

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
2	4a	Nitrogen, Total	R1_MA_2020_06	Added
2	4a	Nutrient/Eutrophication Biological Indicators	R1_MA_2020_06	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical report benthic sampling in Falmouth Inner Harbor was conducted at nine sample stations in the fall of 2007. The outer and inner basins supported high numbers of individuals (482-931) and moderate numbers of species (15-19). The outer basin also supported stress and organic enrichment indicator species (capitellids, tubificids) accounting for 50% of the population with few mollusks or deep burrowers. The inner basin was generally dominated by intermediate organic enrichment species, amphipods (*Ampelisca, spionids*). It was concluded that the benthic habitat was between "high quality" and "moderately impaired". In the outer basin drift algae was generally absent, with some small patches of sparse *Gracillaria*. In the inner basin drift algae was not observed. Sediments were observed to be soft organic enriched muds, generally with an oxidized surface. No eelgrass was present. SMAST mooring chlorophyll a data collected during the summer of 2007 were indicative of moderate to high concentration in the outer harbor area (average 13.5µg/L, >10µg/L 65% of record; blooms >20-25µg/L) and in the inner basin concentrations were moderate to high (average 12.4µg/L, >10µg/L 57% of record and blooms >20-25µg/L). Chlorophyll a data collected was collected from June to September (2006-2009) as part of the MEP Town monitoring program had a long term average between 14 and 19µg/L in the outer basin and between 19 and 21µg/L in the inner basin. DO data collected by the MEP Town monitoring program June-September (2006-2009) in the outer basin were <5mg/L 22%, <4mg/L 2% and were slightly lower in the inner basin (<5mg/L 44%, <4mg/L 11%, periodically <3mg/L). SMAST DO mooring data collected July through September 2007 in the outer basin were <5mg/L 8%, <4mg/L 1% of time, generally 5-8mg/L, daily excursion ~2.5mg/L and in the inner basin <6mg/L 60%, <5mg/L 28% of time, periodically to <4mg/L (3%), daily excursion ~3mg/L. Yearly means total nitrogen concentration data collected at three monitoring stations in the summers 2006 through 2009) ranged from 0.496 to 0.588mg/L.

The Aquatic Life Use for Falmouth Inner Harbor is assessed as Not Supporting based on the overall MEP analysis indictating "Nutrient Related Habitat Health" was "moderately and significantly" impaired as evidenced by the degraded benthic habitat conditions, frequently elevated chlorophyll a, and low DO which is being added as the nutrient/eutrophication biological indicators impairment and total nitrogen. Aggregated estuary watershed nitrogen loads were partitioned by the major types of nitrogen sources in order to focus development of nitrogen management alternatives. According to the MEP report Linked Watershed Embayment Approach to Determine Critical Nitrogen Loading Thresholds for the Falmouth Inner Harbor Embayment System, Yarmouth, MA the major types (sources) of nitrogen loads in descending order of percent contribution were on-site wastewater (e.g. septic systems), impervious surfaces, non-golf fertilizers and WWTF.

Flax Pond (MA96090)

Location:	Dennis.
AU Type:	FRESHWATER LAKE
AU Size:	15 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data area available to assess the Aquatic Life Use of this Flax Pond AU (MA96090) so it is Not Assessed.

Flax Pond (MA96091)

Location:	Brewster
AU Type:	FRESHWATER LAKE
AU Size:	47 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
--	5	Dissolved Oxygen		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

A depth profile of DO, saturation, and pH was conducted by MassDEP staff at the deep hole in Flax Pond (W1307) on 1 September 2005. Oxygen depletion (i.e., <5.0mg/L) occurred at depths somewhere between 12.5m (41ft) where DO was 5.7mg/L and 13.6m (44.6ft) whre DO was 1.1mg/L. Considering the rapid decline occurred between these two depths, the point where there DO concentrations drop below 5.0mg/L was considered closer to the 40ft contour than the 45ft contour which represents ~19.1% of the pond surface area (45ft contour represents ~9.5%). The depth integrated (upper 14m) chlorophyll a concentration was low (1.5µg/L). The saturation near the surface was 99% but was as high as 122% at a depth of 7.5m. Secchi disk depth was 9m. pH near the surface was 6.5SU but was as low as 5.3SU (at 13.6m). Differences in pH levels between water strata are due to increased CO2 from respiration and decomposition below the thermocline. This significant drop in pH observed comes from the saturated CO2 that is stored up in the lower strata of the pond. Total phosphorus concentrations were elevated at depth (near bottom) (max 0.13mg/L) indicative of nutrient release from anoxic sediment, whereas the water column total phosphorus concentrations were much lower (~0.01mg/L).

The Aquatic Life Use for Flax Pond is assessed as Not Supporting because of the oxygen depletion at depth comprising ~19% of the pond surface area. Although there were no other specific indicators of nutrient enrichment (low chlorophyll a, good Secchi disk depth), there was evidence of total phosphorus release from anoxic sediment.

Flax Pond (MA96354)

Location:	Falmouth.
AU Type:	FRESHWATER LAKE
AU Size:	21 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Insufficient Information

According to DMF biologists there are two structures that could potentially have an impact on the passage of river herring and American eel up into Fax Pond. From upstream to downstream these include the Flax Pond Control Culvert that has a single stream baffle with flow and maintenance limitations that has a passage score of 3 (minor obstruction) and a little further downstream on the Unnamed Tributary AU (MA96-131) is the John Parker Road Culvert that has a nog flume which passes adequately at higher flows with a passage score of 3 (minor obstruction) for the passage of diadromous fish. No other water quality data are available.

Too limited data are available to assess the Aquatic Life Use of Flax Pond so it is assessed as having Insufficient Information.

Follins Pond (MA96-114)

Location:	Yarmouth/Dennis.
AU Type:	ESTUARY
AU Size:	0.32 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
--	4a	Nitrogen, Total	68003	Added
--	4a	Nutrient/Eutrophication Biological Indicators	68003	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical report benthic sampling was conducted at five sites in Follins Pond in in the summer and fall of 2005. This area was found to have moderate to high numbers of individuals but few species (7-9) and generally dominated by stress and organic enrichment indicators (e.g tubificids, *Capitella*, *Streblospio*). In addition, the lower reach of Follins Pond had amphipod mats, suggesting a transitional zone between the upper and lower reaches of the system. It was concluded that these data were indicative of "significantly impaired" benthic animal habitat. Dense drift macroalgae were noted by MEP project staff in some areas; a branched form possibly *Gracillaria*, with some *Ulva* indicative of "significantly impaired conditions". The MEP technical report also concluded that there was no evidence Follins Pond supported eelgrass bed habitat. Chlorophyll a data from the Town (Yarmouth & Dennis) Water Quality Monitoring Program (WQMP) was collected at two locations during the summer months (2003-2008) with an overall average of 11.5µg/L. SMAST mooring data was collected at two locations during the summer of 2005 with an average of ~10 and >15µg/L (16% of record). The MEP concluded that these data were indicative of between "moderate and significant impairment". DO data were also collected at two locations during the summer months (2003-2008) by the WQMP and SMAST mooring data was collected at two locations was during the summer of 2005, with the following results: Periodic depletions to <1mg/L, 3mg/L 10% of time, <5mg/L ~25% of record. Overall, large daily excursions in DO ranging from concentrations in excess of air equilibration (regularly exceeding 10mg/L and periodically exceeding 12mg/L) to below 4mg/L and 3mg/L and for short periods below 2mg/L were noted. The MEP technical report concluded that DO in the Follins Pond AU, was indicative of "significant impairment". Nutrient sampling at two monitoring stations within the Follins Pond as part of the WQPM between 2003 and 2008 documented total nitrogen (yearly means) in the "Upper Pond" between 0.569 and 1.084mg/L with an overall mean of 0.804mg/L and in the "Lower Pond" between 0.605 and 1.002mg/L with an overall mean of 0.807mg/L.

The Aquatic Life Use for Follins Pond is assessed as Not Supporting based on the findings of the MEP technical report concluded that overall "Nutrient Related Habitat Health" was "Significantly Impaired" as evidenced by degraded benthic communities, elevated chlorophyll a, accumutions of drift algae, low DO and large diel DO swings which are being added as the nutrient/eutrophication biological indicators impairment and total nitrogen. According to the MEP report Linked Watershed- Embayment Model to Determine Critical Nutrient Loading Thresholds for the Bass River Embayment System, Towns of Yarmouth and Dennis, MA within Follins Pond embayment system the major types (sources) of nitrogen loads in descending order of percent contribution were wastewater (e.g. septic systems), fertilizers, and impervious surfaces.

Fresh Brook (MA96-126)

Location:	Estuarine portion west of Route 6, Wellfleet to mouth at confluence with Wellfleet Harbor, Wellfleet.
AU Type:	ESTUARY
AU Size:	0.004 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Insufficient Information

MassDEP staff deployed a thermistor in Fresh Brook at Rt.6 in Wellfleet (W2076) during the summer of 2009. The temperature logger recorded a maximum 7 DADM of 26.1°C and a maximum daily mean of 24.2°C during the 103-day deployment. No exceedances of acute or chronic temperature criterion for a warm water fishery was documented at any time. Flow and nitrogen load measurements were by the MEP staff (September 2004- August 2005) at a gauge within the Fresh Brook AU. Total nitrogen concentrations were directly measured weekly at low tide at the "Fresh Brook outflow" (leaving the wooded areas up gradient of Rt.6) resulting in a calculated average of 0.561 mg/L. The MEP technical report did not make a final conclusion regarding overall "Nutrient Related Habitat Health" for this AU, due to lack of data. Aggregated estuary watershed nitrogen loads were partitioned by the major types of nitrogen sources in order to focus development of nitrogen management alternatives. Overall, within the Fresh Brook sub-watershed the major types (sources) of nitrogen loads in descending order of percent contribution are; wastewater (e.g. septic systems), farm animals, fertilizers and impervious surfaces.

Too limited data are available to assess the Aquatic Life of Fresh Brook, so this use is assessed as having Insufficient Information.

Frost Fish Creek (MA96-49)

Location:	Headwaters outlet cranberry bog northwest of Stony Hill Road, Chatham to mouth at inlet Ryder Cove, Chatham.
AU Type:	ESTUARY
AU Size:	0.01 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
According to DMF biologists, the Route 28 culvert on Frost Fish Creek has a passage score of 3 (minor obstruction) for river herring passage. No other new data are available so the Aquatic Life Use of Frost Fish Creek will continue to be assessed as Not Supporting with the total nitrogen impairment being carried forward.

Goose Pond (MA96106)

Location:	Chatham.
AU Type:	FRESHWATER LAKE
AU Size:	35 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available, so the Aquatic Life Use of Goose Pond is Not Assessed.

Great Harbor (MA96-18)

Location:	The waters north of an imaginary line drawn east from Penzance Point, Falmouth to Devils Foot Island, Falmouth and southeast from Devils Foot Island to Juniper Point (excludes Eel Pond), Falmouth.
AU Type:	ESTUARY
AU Size:	0.31 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	5	Estuarine Bioassessments		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

The MassDEP Eelgrass Mapping Project data indicates a loss of ~27% in eelgrass bed habitat in Great Harbor between 1995 and 2017. However, data mapping in 2007 indicated 100% loss of all the eelgrass beds and even though the beds appear to have reestablished somewhat, they are still diminished in comparison to the 1995 coverage.

The Aquatic Life Use of Great Harbor is assessed as Not Supporting based on the loss of eelgrass bed habitat (estuarine bioassessment).

Great Pond (MA96114)

Location:	Truro.
AU Type:	FRESHWATER LAKE
AU Size:	17 ACRES
Classification/Qualifier:	B: ORW

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of this Great Pond AU (MA96114), so it is Not Assessed.

Great Pond (MA96115)

Location:	Eastham.
AU Type:	FRESHWATER LAKE
AU Size:	109 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

DMF biologists noted three minor obstructions to the passage of diadromous fish (American eel and river herring) in an Unnamed Tributary (locally known as Herring Brook) at Great Pond in Eastham: at the "outlet control" (also known as the Herring Brook Pond dam NatID# MA03143) the passage score was 3, a street culvert which underwent a channel improvement project in 2011 (culvert was replaced and most of the stream baffles were removed) with a passage score of 1, and the third most downstream structure a channel weir with a passage score of 2. MassDEP staff conducted water quality monitoring in Great Pond in 2009. Three depth profiles were conducted at the deep hole site (W1234) in June, September and October. Oxygen depletion (i.e. <5.0mg/L) occurred at the following depths: between 7.2 and 7.9m in June, 5.5 and 6.5m in September, and 9.1 and 9.6m in October which at depth of 5.5m represents approximately 25% of the lake's surface area. These data are similar to conditions documented by MassDEP in August 2004. Total phosphorus concentrations were slightly elevated at depth (average of two samples near bottom 0.029mg/L) indicative of nutrient release from anoxic sediment, although the average of the three water column samples was much lower (0.012mg/L). Both Secchi disk depth and pH were good (2.8 to 3.8m and 6.2-7.5SU, respectively). Although the chlorophyll a concentration in the upper 7m of the pond was not elevated (13.2µg/L) in June, MassDEP staff did note a green algal bloom in May 2009 at the Eastern Beach site (W1927).

The Aquatic Life Use for this Great Pond AU (MA96115) will remain assessed as Not Supporting with the impairments for DO, Chlorophyll a and Total Phosphorus being carried forward. An Alert is being identified because of the green algal bloom observed at the eastern beach site in May 2009.

Great Pond (MA96117)

Location:	Wellfleet.
AU Type:	FRESHWATER LAKE
AU Size:	41 ACRES
Classification/Qualifier:	B: ORW

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of this Great Pond AU (MA96117), so it is Not Assessed.

Great Pond (MA96-54)

Location:	From inlet of Coonamessett River, Falmouth to Vineyard Sound (excluding Perch Pond), Falmouth.
AU Type:	ESTUARY
AU Size:	0.4 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
The MassDEP Eelgrass mapping project indicates a complete loss of eelgrass bed habitat in this Great Pond AU (MA96-54) after 1995. The Aquatic Life Use of this Great Pond AU (MA96-54) will continue to be assessed as Not Supporting with the estuarine bioassessments and total nitrogen impairments being carried forward.

Great River (MA96-60)

Location:	From inlet of Abigail's Brook, Mashpee to mouth at inlet Waquoit Bay (excluding Jehu Pond), Mashpee.
AU Type:	ESTUARY
AU Size:	0.16 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO (Tributary)

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical report benthic sampling was conducted at three sites in the Great River in the fall of 2006. Great River had roughly 9-10 species and >1000 individuals per sample at each station. It was concluded that these data were indicative of "moderately impaired" benthic habitat. Sparse to no accumulation of macroalgae was noted in the Great River during the MEP surveys. MassDEP eelgrass mapping project data indicates a complete loss of beds between 1995 and 2017. It was noted that it was during the 1980's when eelgrass coverage started to decline in this AU and was most likely to be correlated to an increase in nutrient enrichment. There was no MEP probe deployment station located in the Great River, although average concentrations of chlorophyll a were noted to be 5-6ug/L in the general area. Yearly mean total nitrogen concentrations at two monitoring stations in the summers of 2002 through 2010 ranged from 0.442 to 0.714mg/L (overall mean 0.585mg/L in the upper reach and 0.535mg/L in the lower reach.

The Aquatic Life Use for Great River will continue to be assessed as Not Supporting with the estuarine bioassessments and total nitrogen impairments being carried forward. The MEP technical report concluded that overall "Nutrient Related Habitat Health" was Moderately Impaired. Aggregated estuary watershed nitrogen loads were partitioned by the major types of nitrogen sources in order to focus development of nitrogen management alternatives. According to the MEP Linked Watershed Embayment Approach to Determine Critical Nitrogen Loading Thresholds for the Waquoit Bay and Eel Pond Embayment System, Towns of Falmouth and Mashpee, MA within the Great River sub-watershed the major types (sources) of nitrogen loads in descending order of percent contribution were wastewater, impervious surfaces, and fertilizers.

Green Pond (MA96-55)

Location:	east of Acapesket Road, Falmouth outlet to Vineyard Sound, Falmouth.
AU Type:	ESTUARY
AU Size:	0.21 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
No new water quality data are available for Green Pond. The Aquatic Life Use of Green Pond will continue to be assessed as Not Supporting with the estuarine bioassessments and total nitrogen impairments being carried forward. According to the Great, Green and Bournes Pond Embayment Systems Total Maximum Daily Loads For Total Nitrogen the local controllable sources of nitrogen include wastewater (septic systems), stormwater runoff, and fertilizers.

Gull Pond (MA96123)

Location:	Wellfleet.
AU Type:	FRESHWATER LAKE
AU Size:	104 ACRES
Classification/Qualifier:	B: ORW

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Gull Pond, so it is Not Assessed.

Halls Creek (MA96-93)

Location:	Estuarine portion, from Marchant Mill Way, Barnstable to mouth at inlet Centerville Harbor, Barnstable.
AU Type:	ESTUARY
AU Size:	0.07 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Fully Supporting (Alert)
According to DMF biologists the road culvert at Marchants Mill Road/Marston Lane, at the upstream end of Halls Creek has a passage score of 8 (severe impediment) to diadromous fish passage, however they noted that there is insufficient habitat for river herring to justify the construction of a fishway at this location and have not observed/sampled any diadromous fish in Halls Creek. Consequently, the presence of this structure will not be used as reason to impair Halls Creek, but an Alert will be identified to bring attention to the passage issues. No other recent data are available. The MEP project data considered the "Nutrient Related Habitat Health" as "Healthy Habitat Conditions". The Aquatic Life Use of Halls Creek will continue to be assessed as "Fully Supporting" based on the MEP project data indicating healthy habitat conditions but an Alert will be identified for the fish passage barrier at the culvert at Marchants Mill Road/Marston Lane for diadromous fish.

Hamblin Pond (MA96126)

Location:	Barnstable.
AU Type:	FRESHWATER LAKE
AU Size:	114 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

There is a 2016 report of the non-native Asian clam (*Corbicula fluminea*) in Hamblin Pond, but confirmation of the presence of live organisms is needed. One prolonged algal bloom occurred in Hamblin Pond in 2014 (22 days). MassDEP conducted water quality monitoring at the deep hole in Hamblin Pond (W1984) in September 2009. Like conditions found during the summer of 2004, DO was depleted at depths greater than 11m (anoxic conditions). The maximum saturation was 109%. The pH was good near the surface (6.8 to 7.2SU) but more acidic at depth (minimum 5.7SU). Total phosphorus concentrations measured high at depth (near bottom) were high (0.41 and 0.56mg/L) indicative of nutrient release from anoxic sediment whereas the water column total phosphorus concentrations were much lower (0.008 and 0.007mg/L). The integrated Chlorophyll a concentration in the upper 7m of the pond was low ranging from 1.9 to 2.5µg/L and the Secchi disk depth was also good (7 to 8m).

The Aquatic Life Use for Hamblin Pond will continue to be assessed as Not Supporting with the low DO impairment being carried forward. An Alert is being identified because of the potential presence of the non-native aquatic species Asian clam (*Corbicula fluminea*).

Hamblin Pond (MA96-58)

Location:	From inlet of Red Brook, Falmouth/Mashpee to outlet of Little River, Mashpee and inlet/outlet of Waquoit Bay west of Meadow Neck Road, Falmouth/Mashpee.
AU Type:	ESTUARY
AU Size:	0.19 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO (also tributary)

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	4a	Nutrient/Eutrophication Biological Indicators	R1_MA_2020_08	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical benthic sampling was conducted at three stations in Hamblin Pond in the fall of 2006. There were 10-18 species and 496-793 individuals per sample in the upper and lower sections of the AU but markedly less within the mid basin (only four species, 26 individuals). It was concluded that overall, these data were indicative of "moderately impaired" benthic animal habitat. There were sparse to no accumulation of macroalgae but there has been a complete loss of eelgrass bed habitat (0.0386mi^2 in 1995 and none after 2007) according to MassDEP Eelgrass Mapping Project data. MEP SMAST reported a geometric mean chlorophyll a of 7.4µg/L from their mooring site in Hamblin Pond between June and September 2001-2003. SMAST DO data mooring data in the summer of 2002 had over 29 days when DO was <6mg/L (31% of the time), <5mg/l (11%), <4mg/L (1%). Yearly mean total nitrogen in the summers of 2002-2010 ranged from 0.451 to 0.583mg/L (overall mean of 0.517mg/L). Total nitrogen data were also collected at a "drain location" same time period, where Hamblin Pond flow discharged directly to Waquoit Bay. Yearly mean total nitrogen concentration ranged between 0.43 and 0.747mg/L (overall mean 0.590mg/L).

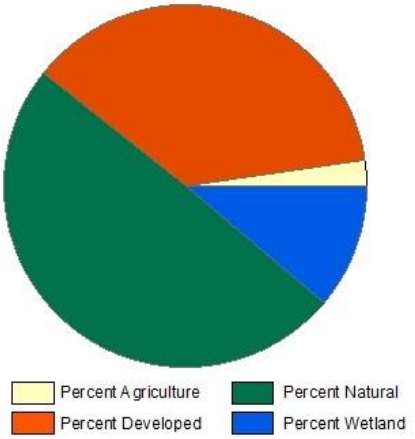
The Aquatic Life Use of this Hamblin Pond AU (MA96-58) will continue to be assessed as Not Supporting with the total nitrogen and estuarine bioassessment (eelgrass loss) impairments being carried forward. The MEP analysis also indicated degraded benthic habitat, elevated chlorophyll a, and low DO conditions which is being added as the nutrient/eutrophication biological indicators impairment. Aggregated estuary watershed nitrogen loads were partitioned by the major types of nitrogen sources in order to focus development of nitrogen management alternatives. According to the MEP Linked Watershed Embayment Approach to Determine Critical Nitrogen Loading Thresholds for the Waquoit Bay and Eel Pond Embayment System, Towns of Falmouth and Mashpee, MA Overall within the Hamblin Pond sub-watershed the major types (sources) of nitrogen loads in descending order of percent contribution were wastewater, impervious surfaces, and fertilizers.

Hamblins Brook (MA96-133)

Location:	Headwaters, outlet Miss Thatcher's Pond, Yarmouth to mouth at inlet Mill Pond, Yarmouth.
AU Type:	RIVER
AU Size:	0.6 MILES
Classification/Qualifier:	B

Hamblins Brook - MA96-133

Watershed Area: 0.96 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.96	0.96	0.42	0.42
Agriculture	2.3%	2.3%	3%	3%
Developed	37%	37%	34.1%	34.1%
Natural	49.6%	49.6%	40%	40%
Wetland	11.1%	11.1%	22.8%	22.8%
Impervious Cover	15.1%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
--	4c	(Fish Passage Barrier*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)
According to DMF biologists there are two barriers to diadromous fish passage along Hamblins Brook. From upstream to downstream these include the outlet at Miss Thatchers pond where the stream channel (downstream of the fish ladder) used to be choked with weeds but underwent significant channel maintenance in 2017-2018 now has a passage score of 3 (minor obstruction) to river herring. Further downstream, the Hamblin Brook Culverts were collectively assigned a passage score of 5 (restricted passage) for river herring and American eel. Flow and nitrogen load measurements were also recorded by the MEP staff (September 2005-August 2006) at a gauge towards the mouth Hamblin Brook. Total nitrogen concentrations were directly measured weekly at low tide resulting in a calculated average of 1.181mg/L. The Aquatic Life Use of Hamblins Brook will be assessed as Not Supporting due to the presence of a fish passage barrier at the Hamblins Brook culverts that restrict passage for river herring and American eel. Considering Hamblins Brook discharges directly into a saltwater AU (Mill Pond MA96-117) with nitrogen loading concerns, an alert is being identified for elevated total nitrogen.

Harding Beach Pond (MA96-43)

Location:	locally known as Sulfur Springs (northeast of Bucks Creek), Chatham.
AU Type:	ESTUARY
AU Size:	0.07 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting

No new data are available for Harding Beach Pond.

The Aquatic Life use of Harding Beach Pond will continue to be assessed as Not Supporting with the total nitrogen impairment being carried forward. The 2008 Stage Harbor/Oyster Pond, Sulphur Springs/Bucks Creek, Taylors Pond/Mill Creek Total Maximum Daily Load TMDL for Total Nitrogen indicated that this waterbody can best be protected by reducing excess nutrient loading, total nitrogen. The controllable local sources of total nitrogen identified in the TMDL included yard maintenance, discharges from municipal separate storm sewer systems (MS4), agriculture, stormwater, and on-site subsurface wastewater disposal (septic) systems.

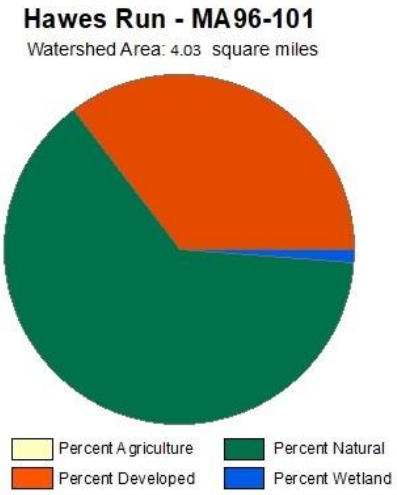
Hatches Creek (MA96-124)

Location:	Estuarine portion west of West Street, at the Wellfleet/Eastham border to mouth at confluence with Wellfleet Harbor, Wellfleet.
AU Type:	ESTUARY
AU Size:	0.02 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Insufficient Information
Flow and nitrogen load measurements were made by MEP staff (September 2004-August 2005) at a gauge within this Hatches Creek AU. Total nitrogen concentrations were measured weekly at low tide (at the Massasoit Road/West Road crossing), resulting in a calculated average of 2.613 mg/L. The MEP technical report did not make a final conclusion regarding overall "Nutrient Related Habitat Health" for this AU. Too limited data are available to assess the Aquatic Life Use for Hatches Creek, so it is assessed as having Insufficient Information.

Hawes Run (MA96-101)

Location:	Headwaters outlet small unnamed pond west of Higgins Crowell Road, Yarmouth to mouth at inlet Mill Pond, Yarmouth.
AU Type:	RIVER
AU Size:	1.7 MILES
Classification/Qualifier:	B



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	4.03	4.03	0.94	0.94
Agriculture	0%	0%	0%	0%
Developed	35.3%	35.3%	16.7%	16.7%
Natural	63.5%	63.5%	79.4%	79.4%
Wetland	1.2%	1.2%	3.9%	3.9%
Impervious Cover	18.2%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4c	5	Trash		Changed

Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)

Two backpack electroshing surveys were conducted along Hawes Run up and downstream from Buck Island Rd in Yarmouth (SampleID 928) in July 2003 sampled by DFG biologists and 200m downstream of Buck Island Rd/end of Pondview Ave (SampleID 4538) sampled by DEP biologists in September 2009. Both samples had few individuals (5-10) and species (2) (American eel and pumpkinseed). MassDEP staff also conducted nutrient water quality monitoring ~900' downstream of Buck Island Rd (W1925) during the summer of 2009. The seasonal average and maximum total phosphorus concentrations (n=4) were low (0.007 and 0.008mg/L, respectively) and no filamentous algae was noted either. The entire watershed, however, lies within Zone II Wellhead Protection Areas associated with numerous community wells so low flow issues may be problematic. Too limited data are available to assess the Aquatic Life Use of Hawes Run so it will be assessed as having Insufficient Information. Although pumpkinseed (a macrohabitat generalist species modereatly tolerant to pollution) were present in this low gradient stream, only a few of these fish were present in the samples. Low flow issues (dams/impoundments and well withdrawals) may be problematic so is being identified as an Alert issue.

Herring Pond (MA96133)

Location:	Eastham.
AU Type:	FRESHWATER LAKE
AU Size:	42 ACRES
Classification/Qualifier:	B: ORW, WWF

Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)

DMF biologists identified a minor obstruction to the passage of river herring at the outflow of Herring Pond. The existing fishway at this location needed improvement due to an issue with sediment and was given a passage score of 2 (minor obstruction) to diadromous fish (river herring). Town of Eastham volunteers conducted water quality monitoring in Herring Pond between 2001 and 2006 and these data were summarized by SMAST. The SMAST summaries indicate the Secchi disk depth and DO were generally indicative of healthy conditions: Secchi averaged 3.4 m between June and September 2001-2006 (n=38). DO was <6mg/L at depths >8 m the majority of the time between June and September which was calculated to equate to roughly 8% of the pond volume. Average total phosphorus concentrations between June and September 2002-2006 at "four depth stations" were 0.0148mg/L at 0.5m (n=21), 0.0129mg/L at 3m (n=18), 0.0326mg/L at 9m (n=15), and 0.0564mg/L at ~10m (n=18). These data indicate release of phosphorus from sediment under anoxic conditios.

Too limited data are available to assess the Aquatic Life Use of this Herring Pond AU (MA96133) so it is will be assessed as having Insufficient Information. Alerts are being identified because of evidence of phosphorus release from anoxic sediments and low DO at depth (bathymetry not available to calculate % of lake surface area with oxygen depletion) as measured by Town of Eastham volunteers during the summers 2001-2006.

Herring Pond (MA96134)

Location:	Wellfleet.
AU Type:	FRESHWATER LAKE
AU Size:	18 ACRES
Classification/Qualifier:	B: ORW

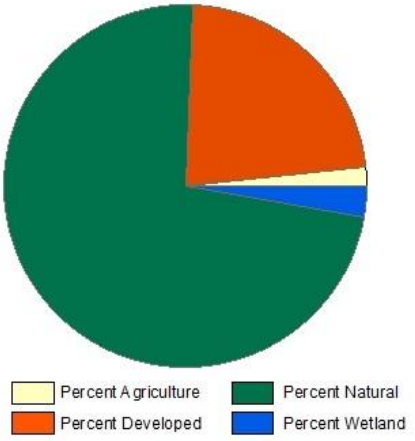
Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of this Herring Pond AU (MA961434), so it is Not Assessed.

Herring River (MA96-106)

Location:	Headwaters, outlet Hinckleys Pond, Harwich to mouth at inlet Herring River Reservoir, Harwich.
AU Type:	RIVER
AU Size:	2.5 MILES
Classification/Qualifier:	B

Herring River - MA96-106

Watershed Area: 10.35 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	10.35	3.41	2.80	1.43
Agriculture	1.7%	3.8%	4.9%	7.8%
Developed	22.6%	18.5%	18.8%	14.6%
Natural	72.9%	72.9%	67.1%	66.6%
Wetland	2.8%	4.8%	9.1%	10.9%
Impervious Cover	9.8%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting (Alert)

According to DMF biologists the Hinckleys Pond Dam has adequate passageway (passage score 0) so is not an obstruction to the passage of river herring. DFG biologists conducted backpack electrofishing along this Herring River AU (MA96-106) in July 2007 and September 2009, with the following results: at the end of Bog Lane (SampleID 2352) 56 individuals, 6 species were collected. This sample was characterized by tolerant/moderately tolerant macrohabitat generalists (including a number of Alewife) as well as of note a fluvial specialist species (Tesselated darter). Just upstream of Main Street (SampleID 4544) 110 individuals, 9 species were collected. Similarly, this sample was characterized by tolerant/moderately tolerant macrohabitat generalists (this time including a number of largemouth bass) and again a large number of tesselated darter.

MassDEP staff conducted water quality monitoring at two locations along Herring River during the summer of 2009: At Rt. 6 in Harwich (W2080) one long term (103-day) temperature logger recorded a maximum 7 DADM of 25.2^{o}C and a maximum 24-hour rolling average of 24.7^{o}C, therefore not exceeding the chronic or acute criterion for a warm water fishery at any time. Similarly, for attended probes data: the maximum temperature recorded was only 18.3^{o}C. The seasonal average (May-September) total phosphorus concentration was 0.035mg/L with a maximum of 0.043mg/L. At Main Street in North Harwich (W1920) during the summer of 2009 unattended continuous probe deployments for DO in June (3 days), July (4 days) and August (2 days) recorded a minimum DO concentration of 4.98mg/L (in July), a maximum saturation of 92.2%, a maximum diel shift of 1.13mg/L, and a maximum temperature of 24.2^{o}C. For attended probes data the minimum DO concentration was 7.8mg/L, the maximum saturation was 94%, pH ranged from 6.2 to 6.4SU, and the maximum temperature was 23.3^{o}C. The

incidence of low DO at Main Street in July was an isolated incident but is noted as a concern (the graph during that deploy appeared to be trending downward just at the time of retrieval). There are two working cranberry bogs and a farm just upstream of Main Street, so an alert is being identified.
The Aquatic Life use of this Herring River AU (MA96-106) is assessed as Fully Supporting based on the presence of fluvial specialist and dependant fish species and adequate diadromous fish passage as well as the generally good water quality data. An an Alert is being identified however for the slightly low DO at Main Street in July since it appeared to be trending downward just at the time of probe retrieval.

Herring River (MA96-22)

Location:	From outlet Herring River Reservoir (at North Harwich Reservoir Dam NATID: MA02423) west of Bells Neck Road, Harwich to mouth at inlet Nantucket Sound, Harwich.
AU Type:	ESTUARY
AU Size:	0.07 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	4a	Estuarine Bioassessments	65960	Added
4a	4a	Nitrogen, Total	65960	Added
4a	4a	Nutrient/Eutrophication Biological Indicators	65960	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to DMF biologists, the West Reservoir Dam (also known as the North Harwich Dam) (NatID# MA02423) at the uppermost end of this Herring River AU (MA96-22) is equipped with an aging weir and pool ladder that has a passage score of 2 (minor obstruction) for river herring. According to the MEP project technical report benthic sampling was conducted at eleven stations along the Herring River in the summer and fall of 2004 and the data were indicative of "healthy benthic habitat conditions". Based on surveys (2004 & 2010) the MEP noted the following: in the upper estuary drift algae was sparse or absent with no evidence of surface microphyte mat; in the lower estuary very sparse patches of drift algae (*Ulva*) with small areas of attached *Codium*. Eelgrass was present in the lower estuary area but according to MassDEP mapping it has been lost between 1995 and 2017. Chlorophyll a data from the Town (Harwich) Water Quality Monitoring Program (HWQMP) was collected at four locations during the summer months (2002-2008) with the highest concentrations in the uppermost area average 18µg/L (represents discharge from West Reservoir) but rarely >10µg/L further downstream. Similar conditions were found by SMAST mooring data collected during the summer of 2004 with the average in the upper main estuary area 10.3µg/L, with maxima generally <15µg/L but periodic blooms to 25µg/L and in the lower estuary average 4.7µg/L rarely >10µg/L indicative of "healthy habitat conditions" except for a tendency towards "moderately impaired conditions" in the upper estuary-west area. DO data from HWQMP in the upper estuary had frequent depletion to ≤4mg/L, periodically to <3mg/L and in the lower estuary periodically <4mg/L and flooding tide >6mg/L. SMAST mooring data reflected the lower estuary DO was influenced by ebbing low oxygen waters from upper wetland basin, minimum ~4mg/L. Upper estuary typical of healthy wetland systems that are naturally organic matter rich. The MEP concluded that the DO data was indicative of "healthy habitat conditions" in the upper estuary but "moderately impaired conditions" in the lower estuary. Yearly mean total nitrogen data collected by the (HWQMP) at four monitoring stations between 2001 and 2011 ranged from 0.475 to 0.968mg/L with overall means at each location rangingfrom 0.628 to 0.810mg/L.

The Aquatic Life Use for this Herring River AU (MA96-22) is assessed as Not Supporting based on the MEP analysis which concluded that overall "Nutrient Related Habitat Health" was "healthy habitat" in the upper estuary but "significantly impaired" in the lower estuary/tidal river based on the loss of eelgrass bed habitat between 1995 and 2017 (estuarine biosassessment impairment), elevated chlorophyll a (contributed from West

Reservoir) and low DO were also identified so will be added as the nutrient/eutrophication biological indicators impairment along with total nitrogen. According to the Total Nitrogen Embayment Study for Harwich MEP technical report, overall within the Herring River Embayment System the major types (sources) of nitrogen loads in descending order of percent contribution are; wastewater (e.g. septic systems), impervious surfaces, cranberry, fertilizers, and farm animal loads.

Herring River (MA96-33)

Location:	South of High Toss Road, Wellfleet to mouth at inlet Wellfleet Harbor (at an imaginary line drawn due north from the eastern tip of Great Island to the opposite shore), Wellfleet.
AU Type:	ESTUARY
AU Size:	0.4 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO

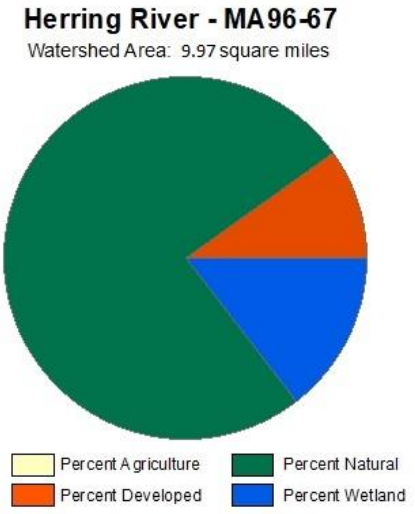
Fish, other Aquatic Life and Wildlife Use: Not Supporting

DMF biologists note that the tide gate at the culvert under Chequessett Neck Rd, is an obstruction that restricts passage of river herring (passage score 4). The potential removal of this tide gate was noted by DMF biologists as a long-term, large scale project which would benefit aquatic resources. The tide gate structure impacts the river herring population in a number of ways: i.e., limited passage through the tide gate dependent on the tidal cycle; frequent loss of juvenile herring to low oxygen levels caused by the lack of flushing action in the stream; low water levels at the pond outlets means the connecting ditches often become dry and require dredging to insure movement of the juveniles out of the system. Considering the tide gate has not yet been removed, the impairments for fish passage barrier and flow regime modifications will be carried forward. According to the MEP technical report the benthic infaunal samples collected at two stations in the summer and fall of 2004 were indicative of high-moderate benthic habitat conditions. Chlorophyll a data were collected near the mouth (below the dike) where conditions were similar to the adjacent open waters of Wellfleet Harbor. Town of Wellfleet Water Quality Monitoring Program (WQMP) collected chlorophyll a samples at two stations June-September (2005-2011) with averages of 6-8µg/L. SMAST mooring data was collected at one station during the summer of 2004. Chlorophyll a averaged 12µg/L with blooms ~15-20ug/L. DO data collected by WQMP at two stations between June-September (2005-2011) were summarized as follows: 34% of samples <5mg/L with 10% <4mg/L with notes made that this may result of receiving outflow from a large wetland. SMAST mooring data was collected at one station during the summer of 2004 with DO frequently low with 35% of record <5mg/L and 12% <4mg/L. Total nitrogen data were collected at two monitoring stations in the summers between 2003 and 2011; the overall mean ranged from 0.722-0.741mg/L. MassDEP eelgrass mapping project data indicates a complete loss of eelgrass bed habitat (100% loss) between 1995 and 2017 however the areas were originally very small.

The Aquatic Life Use for Herring River will continue to be assessed as Not Supporting with the existing impairments carried forward. Since the overall MEP analysis indicated high-moderate benthic habitat conditions, the low DO, occasionally elevated clorophyll a and slightly elevetated total nitrogen concentrations are being identified as Alert issues. The major sources of nitrogen loads in descending order of percent contribution in this Herring River system were septic systems, impervious surfaces, and fertilizers.

Herring River (MA96-67)

Location:	Headwaters outlet Herring Pond, Wellfleet to south of High Toss Road, Wellfleet.
AU Type:	RIVER
AU Size:	3.6 MILES
Classification/Qualifier:	B: ORW



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	9.97	9.07	3.98	3.76
Agriculture	0%	0%	0%	0%
Developed	9.8%	10.3%	9%	9.3%
Natural	75.7%	74.2%	57%	55.3%
Wetland	14.5%	15.6%	34%	35.4%
Impervious Cover	5.3%			

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

DFG biologists conducted two fish surveys on the Herring River in September 2008 using backpack electrofishers: at the upstream site above Old Kings Highway (east) (SampleID 2785) 15 individuals, 3 species were collected. This sample was dominated by tolerant and moderately tolerant macrohabitat generalist species, the most numerous being American eel. Below Old Kings Highway, south of Black Pond Rd (SampleID 2795) just 10 American eels were collected. DMF biologists note that the tide gate at the culvert under Chequessett Neck Rd (on the Herring River AU MA96-33), is a minor obstruction (passage score 3) to the passage of river herring. The potential removal of this tide gate was noted by DMF biologists as a long-term, large scale project which would benefit aquatic resources. This structure impacts the river herring population in the Herring River AU upstream of High Toss Rd in a number of ways: i.e. limited passage through the tide gate dependent on the tidal cycle; frequent loss of juvenile herring to low oxygen levels caused by the lack of flushing action in the stream; low water levels at the pond outlets means the connecting ditches often become dry and require dredging to insure movement of the juveniles out of the system. Considering the tide gate has not yet been removed, the fish passage barrier and flow regime modifications impairments will be carried forwards for this AU. Further downstream, MassDEP staff conducted water quality monitoring at two locations in 2009 at Rt 6 (W1915) and at Bound Brook Island Rd (W1916) five-day unattended continuous probe deployments for DO in June, July and August, plus a four-day deployment in September recorded mean minimum DO below 5.0mg/L during each survey (minimum daily mean 3.56mg/L). The maximum DO saturation was 109.6% and the maximum temperature was 25.8^{o}C were recorded at these stations. Of note at Rt.6 (W1915) there was a maximum diel shift of 4.8mg/L (always >3mg/L), and at (W1916) the maximum diel shift was 5.03mg/L, but the rest of the time was <3mg/L. Attended probes data at Rt 6 (W1915) in 2009 noted a minimum DO of 5.7mg/L,

the maximum saturation was 89%, pH ranged from 5.6 to 6.3SU (once in July falling well below the criterion of 6.0SU), and the maximum temperature was 22.4^{o}C. The seasonal average total phosphorus was 0.041mg/L (maximum 0.046mg/L) and the seasonal average total nitrogen was 0.31mg/L. There were no exceedances of acute or chronic metals criteria (n=3 sampling events). Further downstream in the Herring River at Bound Brook Island Rd (W1916) the seasonal average total phosphorus was elevated at 0.148mg/L (maximum 0.18mg/L) and the seasonal average total nitrogen at (W1916) was 0.925mg/L. Except for copper which exceeded the acute and chronic criteria during one of the three sampling events, no other metals exceeded any of their criteria. It is possible that the proximity of the Bound Brook Island Rd sample location to a series of mosquito ditches just downstream exacerbates the lack of flushing in this location and results in a greater build up of nutrients such as total phosphorus.

The Aquatic Life Use of this Herring River AU (MA96-67) will continue to be assessed as Not Supporting a result of the diking and altered hydrology caused by the tide gate at the culvert under Chequessett Neck Rd. The existing impairments will be carried forwards and the use will be identified with an Alert for elevated total phosphorus.

Hinckleys Pond (MA96140)

Location:	Harwich.
AU Type:	FRESHWATER LAKE
AU Size:	164 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
2	4c	(Curly-leaf Pondweed*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

According to DMF biologists, there is adequate passage at Hinckleys Pond Dam (passage score 0) so it is not an obstruction to the passage of river herring. MassDEP staff conducted water quality monitoring at the deep hole of Hinckleys Pond (W1237) during the summer of 2009. Depth profiles were measured in June, September, and October. DO concentrations were all good (6.1 to 9.8mg/L) except at depths greater than 5.5m (18ft) in September (2.6mg/L at 6.5m and <0.2 at 6.8m). The maximum saturation was 103%, pH ranged from 6.7 to 7.1SU at the surface and 6.1 to 7.0SU at depth, the maximum temperature was 23°C in early September. The depth integrated chlorophyll a concentration was low in June (3.7µg/L) and higher in September (15.1µg/L) but still meeting the CALM guideline of 16 µg/L for lakes. Secchi disk depth was good all three months ranging from 2.2 to 2.7m. The seasonal average total phosphorus concentration was 0.027mg/L at the surface (a little higher than the EPA Gold Book criterion of 0.025mg/L) and was 0.042mg/L at depth (near bottom) which is indicative of nutrient release from anoxic sediment. The non-native aquatic macrophyte, *Potamogeton crispus* (curly-leaf pondweed), was identified during a 2010 survey of Hinkleys Pond conducted by MassDEP staff.
The Aquatic Life Use of Hinckleys Pond is assessed as "Not Supporting" based on the presence of the non-native aquatic macrophyte curly-leaf pondweed (*Potamogeton crispus*). This use was identified with an alert status based on the indicators of productivity measured during the 2004 MassDEP survey (i.e. supersaturation, high pH, and slightly elevated chlorophyll a, as well as the presence of a blue-green algal bloom in 2009). There have been no further reports of algal blooms post-2009. These alert issues will be carried forward however as well as a new alert for slightly elevated total phosphorus concentrations.

Horseleach Pond (MA96144)

Location:	Truro.
AU Type:	FRESHWATER LAKE
AU Size:	23 ACRES
Classification/Qualifier:	B: ORW

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Horseleach Pond, so it is Not Assessed.

Hoxie Pond (MA96146)

Location:	Sandwich.
AU Type:	FRESHWATER LAKE
AU Size:	8 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Hoxie Pond, so it is Not Assessed.

Hyannis Harbor (MA96-05)

Location:	The waters from the shoreline to an imaginary line drawn from the light at the end of Hyannis breakwater, Barnstable to the point west of Dunbar Point, Barnstable.
AU Type:	ESTUARY
AU Size:	0.68 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
2	5	Estuarine Bioassessments		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting
MassDEP eelgrass mapping project data indicates a decrease in eelgrass bed coverage between 1995 (0.25 acres) and 2017 (0.09 acres) in Hyannis Harbor (~64% loss). The Aquatic Life Use for Hyannis Harbor is assessed as Not Supporting based on the loss of eelgrass bed habitat (estuarine bioassessment) between 1995 and 2017.

Hyannis Inner Harbor (MA96-82)

Location:	Waters landward of an imaginary line drawn from Harbor Bluff, Barnstable to Hyannis Park, Yarmouth.
AU Type:	ESTUARY
AU Size:	0.13 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
No new data are available for this reporting cycle so the total nitrogen impairment for Hyannis Inner Harbor is being carried forward.

Jehu Pond (MA96-59)

Location:	Mashpee.
AU Type:	ESTUARY
AU Size:	0.09 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO (also tributary)

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	4a	Nutrient/Eutrophication Biological Indicators	R1_MA_2020_08	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical report benthic sampling was conducted at three stations in the fall of 2006. There were a low number of species (4-6) and total individuals <150 at two of the three stations. It was concluded that overall these data were indicative of "significantly impaired" benthic animal habitat. Sparse to no accumulation of macroalgae were noted. Based on historical data the MEP concluded that the eelgrass coverage was indicative of "moderately impaired conditions". It was noted that it was during the 1980's when eelgrass coverage started to decline in this AU and was most likely to be correlated to an increase in nutrient enrichment. MassDEP eelgrass mapping project data over the years (1995-2013) indicated a large decrease (~30-57-%) there has been some regrowth since 2013 indicating a total loss 1995-2017 of only 10.98%. However, this is still enough loss to be considered impaired. SMAST collected mooring data from one station in Jehu Pond between June and September 2001-2003 with a geometric mean of the chlorophyll a data 11.9µg/L. The MEP technical report compiled a composite of SMAST and Town Water Quality Monitoring data (1994-2003); over 43 sample days DO concentrations were <6mg/L on 81% of days, <5mg/L 65%, <4mg/L 37% and <3mg/L 14%. It was noted that Jehu Pond showed a high level of oxygen depletion at a level that will impair habitat quality, with DO concentrations periodically approaching anoxia. Yearly mean total nitrogen data collected at one monitoring station (summers 2002 through 2010) ranged from 0.481 to 0.671mg/L (overall mean 0.581mg/L).

The Aquatic Life Use of Jehu Pond will continue to be assessed as Not Supporting with the estuarine bioassessment and total nitrogen impairments being carried forward. The MEP technical report concluded that overall "Nutrient Related Habitat Health" for Jehu pond was Significantly Impaired so based on the evidence of degraded benthic habita, elevated chlorophyll a, and low DO, the nutrient/eutrophication biological indicators impairment is being added. Aggregated estuary watershed nitrogen loads were partitioned by the major types of nitrogen sources in order to focus development of nitrogen management alternatives. According to the Linked Watershed Embayment Approach to Determine Critical Nitrogen Loading Thresholds for the Waquoit Bay and Eel Pond Embayment System, Towns of Falmouth and Mashpee, MA overall within the Jehu Pond sub-watershed the major types (sources) of nitrogen loads in descending order of percent contribution were wastewater (septic systems), fertilizers, and impervious surfaces.

Johns Pond (MA96157)

Location:	Mashpee.
AU Type:	FRESHWATER LAKE
AU Size:	316 ACRES
Classification/Qualifier:	B: ORW (Tributary)

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	4a	(Fish Passage Barrier*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting
According to DMF biologists there are two structures (one at each of two outlets of Johns Pond) that may potentially affect fish passage. One outlet structure channels discharge to the Quashnet River AU (MA96-90). DMF biologists noted that "sedimentation" was the issue at this outlet and sediment/erosion control was needed, however a sand retention structure was not favored by the Town. This barrier has a passage score of 2 (minor obstruction) for river herring. The other outlet structure discharges to the Childs River AU (MA96-98) and was identified as "limiting to fish passage". It was noted that the recommended installation of an "outlet screen" for juvenile herring, was not favored by the Town in 2011 and this barrier has a passage score of 6 (restricted passage) for river herring. The Aquatic Life Use for Johns Pond is assessed as Not Supporting based on the barrier to diadromous fish passage (river herring) at the Childs River outlet structure. The former alert for fish passage barrier is being removed but the alert associated with tumors on brown bullhead is being retained.

Kelleys Bay (MA96-113)

Location:	Dennis/Yarmouth.
AU Type:	ESTUARY
AU Size:	0.1 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
--	4a	Nitrogen, Total	68003	Added
--	4a	Nutrient/Eutrophication Biological Indicators	68003	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical report benthic sampling was conducted at two locations in Kelleys Bay in the summer and fall of 2005. The samples had relatively low numbers of individuals (<75), low number of species (7) and >50% of community were stress indicator species (*Capitella*). The MEP reports overall that nitrogen enrichment (through inputs and flushing) has resulted in virtual loss of benthic communities. It was concluded that Kelleys Bay supported between "significantly impaired" and "severely degraded" benthic habitat. Sparse amounts of drift algae, with some moderately dense patches overall conclusion "moderately impaired conditions". There was no evidence that this basin supported eelgrass bed habitat. Chlorophyll a data from the Town (Yarmouth & Dennis) Water Quality Monitoring Program (WQMP) was collected at one location during the summer months (2003-2008) with an overall average of 8.4µg/L. SMAST mooring data was collected at one location during the summer of 2005 with an average 10µg/L and >15µg/L for 11% of the record. Overall, the MEP concluded that these data were indicative of between "moderate and significant impairment". DO data from the (WQMP) collected at one location during the summer months (2003-2008) and SMAST mooring data at one location during the summer of 2005 generally documented DO >4mg/L (and infrequently below 4mg/L (5% of record), <5mg/L 23% of record with an overall MEP analysis of between"moderate and significant impairment". The (WQMP) total nitrogen data ranged between 0.663-0.900mg/L (yearly means) and with an overall mean of 0.790mg/L.

The Aquatic Life Use of Kelleys Bay is assessed as Not Supporting based on the overall MEP analysis indicating "Nutrient Related Habitat Health" was "Significantly Impaired" as evidenced by degraded benthic communities, occasionally elevated chlorophyll a and low DO which are being added as the nutrient/eutrophication biological indicators impairment and total nitrogen. According to the MEP report Linked Watershed- Embayment Model to Determine Critical Nutrient Loading Thresholds for the Bass River Embayment System, Towns of Yarmouth and Dennis, MA within Mill Pond embayment system the major types (sources) of nitrogen loads in descending order of percent contribution were wastewater (e.g. septic systems), impervious surfaces and fertilizers.

Kinnacum Pond (MA96163)

Location:	Wellfleet.
AU Type:	FRESHWATER LAKE
AU Size:	2 ACRES
Classification/Qualifier:	B: ORW

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life use of Kinnacum Pond, so it is Not Assessed.

Lake Elizabeth (MA96080)

Location:	Barnstable.
AU Type:	FRESHWATER LAKE
AU Size:	6 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
3	4c	(Fish Passage Barrier*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to DMF biologists two structures potentially impact the passage of river herring in and out of Lake Elizabeth. The upstream structure is the culvert from Red Lily Pond to Lake Elizabeth which becomes "perched" at lower flows. This structure has passage score of 3 (minor obstruction). The second structure is the Lake Elizabeth Dam (off Lake Elizabeth Drive in Barnstable) which has an "unorthodox" fish ladder that was installed in 2007 with a passage score of 8 (severe impediment) to diadromous fish passage. Further downstream in the Unnamed Tributary AU (MA96-132) at Lake Elizabeth Drive, there is an undersized culvert and the channel is choked with phragmites which has a passage score of 5 (restricted passage) for diadromous fish.

The Aquatic Life Use of Lake Elizabeth is assessed as "Not Supporting" due to the limitations to diadromous fish passage at the Lake Elizabeth Dam and the culvert at Lake Elizabeth Drive. The former alert regarding inefficient passage for diadromous fish (river herring) is being removed since an impairment has been identified based on the newer data provided by DMF biologists.

Lawrence Pond (MA96165)

Location:	Sandwich.
AU Type:	FRESHWATER LAKE
AU Size:	138 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Lawrence Pond, so it is Not Assessed.

Lewis Bay (MA96-36)

Location:	Includes portion of Pine Island Creek and Uncle Roberts Cove, Yarmouth to confluence with Nantucket Sound, Barnstable/Yarmouth (excluding Hyannis Inner Harbor, Barnstable/Yarmouth and Mill Creek, Yarmouth).
AU Type:	ESTUARY
AU Size:	1.79 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	5	Nitrogen, Total		Added
4a	5	Nutrient/Eutrophication Biological Indicators		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical report benthic sampling was conducted at ten locations in the summer/fall of 2004. The outer/inner bay area was characterized by high- moderate numbers of individuals and diversity with polychaetes, crustaceans and mollusks while the inner cove areas were characterized by low numbers of species and individuals with organic enrichment indicators. Overall a gradient in nutrient related habitat degradation was noted with "healthy conditions" in the Outer Bay; "healthy -moderate impairment" in the Inner Bay and "significantly impaired" in Uncle Roberts Cove. Macroalgae surveys indicated extensive attached dense beds of *Codium* throughout the basin (serving as SAV) and moderate amounts of filamentous drift algae in Uncle Roberts Cove. MassDEP eelgrass mapping project data indicates the loss of the small eelgrass bed habitat between 1995 and 2017. Chlorophyll a data were collected at three SMAST mooring stations in the summer of 2003 with the following findings: low- moderate concentrations 3 to 6µg/L in the outer bay (<5µg/L 73% of the time); moderate concentrations ~3 to 10µg/L (generally >5µg/L, frequently >10µg/L) in the inner bay and highest concentration in Uncle Roberts Cove (generally 5 to 15µg/L, frequently >13µg/L). DO data were collected at two SMAST mooring stations in the summer of 2003 with outer bay generally >6mg/L (periodic depletions 6-5mg/L) and in the inner bay depletions periodically 4-3mg/L, generally >5mg/L while in Uncle Roberts Cove depletions periodically to 4 to 4.5mg/L with infrequent declines to 3.7mg/L. Total nitrogen data were collected at six monitoring stations in the summers of 2001-2006 with yearly means ranging between 0.298 and 0.496mg/L and overall means between 0.373 and 0.430mg/L.

The Aquatic Life Usefor Lewis Bay will continue to be assessed as Not Supporting based on the loss of eelgrass bed habitat and the overall MEP analysis indicating "Nutrient Related Habitat Health" for Lewis Bay was "Significantly Impaired" as evidenced by the gradient in degraded benthic habitat conditions, frequently eleveated chlorophyll a, and low DO conditions in the inner cove areas (being added as nutrient/eutrophication biological indicators impairment and total nitrogen) to much better conditions in the outer bay area. According to the MEP Project and TMDL, the major types (sources) of nitrogen loads overall within the Lewis Bay watershed in descending order of percent contribution were wastewater (e.g. septic systems), WWTF, impervious surfaces, and fertilizers.

Lewis Pond (MA96-109)

Location:	north of Seagull Road, Yarmouth (segment includes tidal channel to Parkers River).
AU Type:	ESTUARY
AU Size:	0.07 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
--	4a	Nitrogen, Total	68369	Added
--	4a	Nutrient/Eutrophication Biological Indicators	68369	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical report benthic sampling was conducted at two locations in the summer and fall of 2004 in Lewis Pond. Moderate numbers of individuals (313), high/moderate numbers of species (25); some organic enrichment indicators typical of salt marsh ponds and some deep burrowers but dominated by opportunistic species indicative of organic matter overloading (tubificids). It was concluded that benthic habitat was between "healthy" and "moderately impaired". Drift algae was sparse or absent. Small patches of SAV (*Ruppia*) were noted (common to salt marsh ponds). There was no evidence of eelgrass bed habitat. Chlorophyll a data from by the Town of Yarmouth Water Quality Monitoring Program (YWQMP) program collected during the summer months (2002-2008) had an overall average of 9µg/L. DO data from the SMAST mooring survey (summer/fall 2004), in Lewis Pond was had frequent oxygen depletion to ≤4mg/L (5% of deployment), but it was noted that this was a shallow salt marsh pond with natural organic enrichment. The mean total nitrogen concentration based on the YWQMP summer 2002 through 2008 data was 0.868mg/L.

The Aquatic Life Use of Lewis Pond will be assessed as Not Supporting based on the MEP technical report which concluded that overall "Nutrient Related Habitat Health" was "Moderately Impaired" as evidenced by between healthy to moderately impaired benthic quality habitat with dominance by tubificids and moderately elevated chlorophyll a which is being added as the nutrient/eutrophication biological indicators impairment and total nitrogen. Aggregated estuary watershed nitrogen loads were partitioned by the major types of nitrogen sources in order to focus development of nitrogen management alternatives. Overall, within Lewis Pond embayment system the major types (sources) of nitrogen loads in descending order of percent contribution were wastewater (e.g. septic systems), fertilizers, impervious surfaces and the municipal wastewater treatment plant discharge (WWTF).

Little Harbor (MA96-19)

Location:	The waters north of an imaginary line drawn from Juniper Point, Falmouth east to Nobska Beach, Falmouth.
AU Type:	ESTUARY
AU Size:	0.07 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Fully Supporting
The MassDEP Eelgrass Mapping Project data indicates a slight loss (~4%) of eelgrass bed habitat in Little Harbor between 1995 (19.8 acres) and 2017 (18.6 acres). The Aquatic Life Use for Little Harbor is assessed as Fully Supporting for Little Harbor based on the stable presence of eelgrass bed habitat, an indicator of good water quality conditions.

Little Namskaket Creek (MA96-26)

Location:	Source west of Route 6, Orleans to mouth at inlet Cape Cod Bay, Orleans.
AU Type:	ESTUARY
AU Size:	0.01 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Little Namskaket Creek, so it is Not Assessed.

Little Pleasant Bay (MA96-78)

Location:	Waters north and east of imaginary lines drawn from the northeasterly edge of Orleans (near The Horseshoe), southeasterly around the northeastern tip of Sipson Island, and Sipson Meadow, Orleans then south to the northern tip of Strong Island, Chatham then east to a point on the inner Cape Cod National Seashore (CCNS)(including SARIS named Hog Island and Broad creeks) (excluding the delineated segments; The River, Pochet Neck, and Paw Wah Pond) (areas within CCNS designated as ORW).
AU Type:	ESTUARY
AU Size:	3.27 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO ('ORW' applies only to portion in Cape Cod National Seashore)

Fish, other Aquatic Life and Wildlife Use: Not Supporting
MassDEP eelgrass mapping project data indicates an increase in eelgrass bed coverage between 1995 (902 acres) and 2017 (953 acres) in Little Pleasant Bay (~5.6% increase) with gains noted since 2007. While this is an indication of improved conditions additional benthic, DO and nutrient sampling data should be collected prior to removal of the total nitrogen impairment which is being carried forward. The Aquatic Life Use for Little Pleasant Bay will continue to be assessed as Not Supporting based primarily on the MEP analysis described in the Pleasant Bay MEP technical report with the total nitrogen impairment being carried forward. According to the MEP project technical report the benthic community in Little Pleasant Bay was "indicative of moderate levels of stress from organic matter loading and oxygen depletion…the pattern was for a decrease in habitat quality moving from the marginal to depths…pattern is typical of a system near, but beyond its nitrogen loading limit…" DO concentrations in Little Pleasant Bay were generally good although there were infrequent low oxygen events in upper Llittle Pleasant Bay at Namequoit Point. The average chlorophyll a concentration reported for Namequoit Point was 1.97 µg/L and near Strong Island was 4.77 µg/L. There are indications of improvement however with increases in eelgrass bed habitat between 1995 and 2017 with gains noted since 2007.

Little Pond (MA96-56)

Location:	west of Vista Boulevard, Falmouth outlet to Vineyard Sound, Falmouth.
AU Type:	ESTUARY
AU Size:	0.07 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
The MassDEP Eelgrass mapping project data indicates a large decrease (~39%) in eelgrass bed habitat in Little Pond between 1995 and 2017 (~0.023mi^2 in 1995 and ~0.014mi^2 in 2017) with reestablishment noted since 2013. The Aquatic Life Use of Little Pond will continue to be assessed as Not Supporting with the estuarine bioassessments impairment being carried forward. It should be noted however that beds appear to be returning as of 2013 indicative of improving conditions.

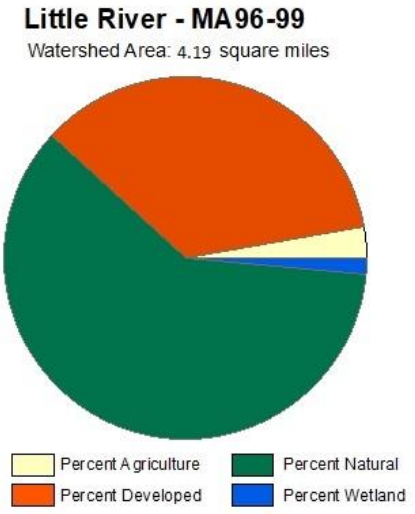
Little River (MA96-61)

Location:	Headwaters outlet Hamblin Pond, Mashpee to mouth at confluence with Great River, Mashpee.
AU Type:	ESTUARY
AU Size:	0.03 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO (Tributary)

Fish, other Aquatic Life and Wildlife Use: Not Supporting
According to the MEP project technical report benthic sampling was conducted at one site in this Little River AU (MA96-61) in the fall of 2006. The sample containd 19 species and 3170 individuals considered to be indicative of relatively healthy benthic habitat conditions. Sparse to no accumulation of macroalgae was noted. Eelgrass loss during the 1980's was associated with nutrient enrichment. The Aquatic Life Use for this Little River AU (MA96-61) will continue to be assessed as not supporting with the impairments estuarine bioassessments and total nitrogen being carried forward.

Little River (MA96-99)

Location:	Headwaters outlet Lovells Pond, Barnstable to confluence with tidal portion south of Old Post Road, Barnstable.
AU Type:	RIVER
AU Size:	1.8 MILES
Classification/Qualifier:	B



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	4.19	2.61	0.79	0.74
Agriculture	2.7%	4%	8%	8.5%
Developed	35.5%	27%	19%	18.5%
Natural	60.4%	67.2%	67%	67.3%
Wetland	1.4%	1.7%	5.9%	5.7%
Impervious Cover	11.8%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	(Fish Passage Barrier*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

According to DMF biologists there are three structures that may potentially affect the passage river herring and American eel along this Little River AU (MA96-99). From upstream to downstream these include the outlet pipe from Lovell's Pond to the Little River which is crushed and has a passage score of 10 (no possible passage), the Putnam Ave series of culverts and homeowner pond weirs that need attention have a passage score of 7 (severe impediment), and the Old Post Road culvert which is raised with a passage score of 10 (no possible passage) for diadromous fish. MassDEP staff collected water quality samples at Old Post Rd in Barnstable on four occasions (May-September) during the 2009 sampling season; the seasonal average total phosphorus concentration was low (0.022mg/L with a maximum 0.034mg/L) and the the seasonal average total nitrogen concentration was 0.83mg/L (maximum 0.94mg/L). There were no observations of dense/very dense filamentous algae noted. The Aquatic Life Use of this Little River AU (MA96-99) will be assessed as Not Supporting due to the limitations to diadromous fish passage at the Lovells Pond outlet, the Putnam Ave culverts, and the Old Post Road culvert. An alert is being identified because of elevated total nitrogen since this river flows into Cotuit Bay which is impaired for total nitrogen.

Loagy Bay (MA96-125)

Location:	Wellfleet.
AU Type:	ESTUARY
AU Size:	0.2 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
--	5	Chlorophyll-a		Added
--	5	Dissolved Oxygen		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the Wellfleet Harbor Embayment System MEP project technical report while no benthic sampling stations were located directly in this Loagy Bay AU this area was similar to the nearby Drummer Cove area which was found to have moderately impaired conditions for infaunal animals. Drift algae were sparse or absent with little surface microphyte mat and no visible accumulations during the 2004 surveys. There was no evidence Loagy Bay ever supported eelgrass. Chlorophyll a data from the Town of Wellfleet Water Quality Monitoring Program (WQMP) collected June-September (2005-2011) and SMAST mooring data collected during the summer of 2004 documented moderate chlorophyll a concentrations (average 10µg/L with blooms up to 18µg/L). Also based on mooring data collected in Wellfleet Harbor in the summer of 2004 it was concluded that DO levels were indicative of "moderately impaired conditions" with oxygen >4mg/L 16% (inner) and 5% (outer) of WQMP samples, <6mg/L only 47% and 53% of outer and inner samples, with <5mg/L frequent in inner basin (37% of samples).

The Aquatic Life Use of Loagy Bay is assessed as Not Supporting based on the overall MEP analysis concluding that there was evidence of nutrient related habitat health impairment (low DO, elevated chlorophyll a). In the aggregated estuary watershed model nitrogen loads were partitioned by the major types of nitrogen sources in order to focus development of nitrogen management alternatives. Overall, within the Wellfleet Harbor watershed the major types (sources) of nitrogen loads in descending order of percent contribution were wastewater (e.g. septic systems), fertilizers, and impervious surfaces.

Long Pond (MA96179)

Location:	Wellfleet.
AU Type:	FRESHWATER LAKE
AU Size:	35 ACRES
Classification/Qualifier:	B: ORW

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of this Long Pond AU (MA96179), so it is Not Assessed.

Long Pond (MA96180)

Location:	Yarmouth.
AU Type:	FRESHWATER LAKE
AU Size:	54 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Insufficient Information
According to DMF biologists there is a potential impediment to diadromous fish passage at the Long Pond Control structure (also known as the Long Pond dam-NatID# MA02494). The fishway at the dam is not operating at optimal capability so has a passage score of 1 (minor obstruction) for river herring and American eel. There are three other minor obstructions to fish passage downstream from Long Pond including a fishway and culvert at Clear Brook Road (which was replaced in 2009), the fishway and culvert at Forest Road (fishway replaced with board slots in flume in 2017), and the fishway at the Seine Pond Inlet which all have passage scores of 2. Too limited data are available to assess the Aquatic Life Use for this Long Pond AU (MA96180) so it is assessed as having Insufficient information.

Long Pond (MA96183)

Location:	Brewster/Harwich.
AU Type:	FRESHWATER LAKE
AU Size:	715 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Supporting
According to DMF biologists a flume was installed by DMF in 2016 at the pond's outflow which has a passage score of 2 (minor obstruction) to the passage of diadromous fish. The targeted species are river herring and white perch. No other new data are available. The Aquatic Life Use of Long Pond will continue to be assessed as Not Supporting with the DO impairment being carried forward. Severe oxygen depletion was documented at depths greater than 11m during a survey by MassDEP in September 2004.

Long Pond (MA96184)

Location:	Barnstable.
AU Type:	FRESHWATER LAKE
AU Size:	48 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Supporting
MassDEP staff identified the non-native aquatic macrophyte, *Hydrilla verticillata*, in Long Pond (MA96184) in 2001 and according to the DEP Herbicide Database, the Barnstable Conservation Commission or the Town applied for permits to have the pond treated for *Hydrilla* sp. every year from 2003 to 2016. The Aquatic Life Use for this Long Pond AU (MA96184) will continue to be assessed as Not Supporting due to the infestation of the non-native aquatic macrophyte *Hydrilla verticillate*.

Lovells Pond (MA96185)

Location:	Barnstable.
AU Type:	FRESHWATER LAKE
AU Size:	54 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	(Fish Passage Barrier*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to DMF biologists the outlet pipe at Lovells Pond to Little River is crushed so has a passage score of 10 (no possible passage) for river herring and American eel. Lovells Pond experienced five years with prolonged algal blooms during 2009-2013 (>20 days in 4 of 6 years) which were consistent with observations made by DWM personnel in 2004. MassDEP staff also conducted water quality surveys at the deep hole in Lovells Pond (W1214) once in July and twice in September 2009. These profiles generally indicated DO meeting criteria (>5mg/L) at all depths except at depths of 8.5-10m in early September. Although this appears to be an improvement compared to conditions in 2004 (i.e. severe oxygen depletion below 4.5m representing >50% pond surface area), the early September 2009 profile did have DO depletion at >10% of the pond surface area. DO saturation was high only once near the surface in July (120%) but was <100% the rest of the time. The integrated depth Chlorophyll a concentration in the upper 7m of the pond was 13.5µg/L in July (below the guideline of 16µg/L) but was higher in September (21.5µg/L) indicative of nutrient enrichment. The Secchi disk depths were all good (2.0 to 2.4m). Total phosphorus concentrations averaged 0.037mg/L at the surface and 0.09mg/L near the bottom (maximum at bottom 0.21mg/L in July). Except for one high pH (8.7SU on 29 July when saturation was 120%) all other measurements ranged from 6.0 to 7.6SU with a tendancy for more acidic conditions at depth.

The Aquatic Life Use for Lovells Pond will continue to be assessed as Not Supporting with the existing impairments for DO, Total Phosphorus and Chlorophyll a being carried forward. New impairments are being added for harmful algal blooms based on DPH postings data and the fish passage barrier due to the crushed outlet pipe at Lovells Pond.

Lovers Lake (MA96186)

Location:	Chatham.
AU Type:	FRESHWATER LAKE
AU Size:	37 ACRES
Classification/Qualifier:	B: ORW, WWF

Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)
According to DMF biologists, there is diadromous fish passage into Lovers Lake by means of two separate structures; a 60 foot length notched weir-pool fishway that allows fish to enter the culvert below the lake (passage score of 3) and a wooden vertical slot fishway that enables fish to overcome the outlet control structure (passage score of 1). The target species at these structures are river herring and American eel. There is no other recent data available to assess the Aquatic Life Use of Lovers Lake. The exisiting Alert for low dissolved oxygen in the hypolimnion will be carried forward.

Lower Mill Pond (MA96188)

Location:	Brewster.
AU Type:	FRESHWATER LAKE
AU Size:	44 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Supporting
According to DMF biologists, there are three structures that are minor obstructions to diadromous fish passage at the downstream boundary of Lower Mill Pond and along Stony Brook. The targeted species are river herring and American eel. Note that Stony Brook is "unassessed" (has never been defined as an AU). From upstream to downstream the minor obstructions include: Mill Pond Dam (improvement project completed in 2012 now passage score of 2, the existing notched weir-pool fishway that runs from the dam to downstream of Stoney Brook Road is passable despite the very steep weirs has a passage score of 2, and the channel itself (just downstream of Stony Brook Road) is an area identified by DMF biologists as having a "channel limitation" which has a passage score of 3. A site visit in 2020 determined that bank stabilization was not really needed, but annual maintenance should be conducted along this channel. MassDEP staff conducted water quality monitoring at the deep hole in Lower Mill Pond (W0748) during the summer of 2009. Three depth profiles were measured in June, September, and October. The oxygen concentrations were good at all depths (DO minimum 6.7 mg/L), the maximum saturation was 116%, pH ranged from 7.1 to 8.5SU at the surface and was slightly lower at depth (6.2-7.9SU). Secchi disk depth was good all three months ranging from 2.2 to 2.4m. The seasonal average total phosphorus concentration was 0.028mg/L at the surface (a little higher than the EPA Gold Book criterion of 0.025mg/L) and was 0.044mg/L at depth (near bottom). The integrated depth (upper 3m) chlorophyll a concentration was elevated above the guidance threshold for lakes in June (27.1µg/L) but was lower in September (11.5µg/L). The Aquatic Life Use of Lower Mill Pond will continue to be assessed as Not Supporting with the algae, Chlorophyll a, Total Phosphorus, and turbidity impairments be carried forward.

Maraspin Creek (MA96-06)

Location:	From Commerce Road, Barnstable to mouth at inlet Barnstable Harbor at Blish Point, Barnstable.
AU Type:	ESTUARY
AU Size:	0.03 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	5	Nutrient/Eutrophication Biological Indicators		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical report benthic sampling was conducted at one station (identified in the report as Millway/Barnstable Harbor) at the bottom of the Maraspin Creek AU, in the fall of 2007. A severely depleted benthic community was observed; samples were characterized by only one species and nine individuals consistent with the observed soft "fluid" sulfidic sediments. It was concluded that these data were indicative of "severely degraded" benthic habitat conditions. Drift algae were sparse or absent at the bottom of Maraspin Creek. There were no records of eelgrass bed habitat. SMAST mooring data were collected in the "Millway marina" (i.e,. at the bottom of the Maraspin Creek) during the summer of 2007. Chlorophyll a average of 9.3µg/L with a bloom to >15µg/L. Oxygen depletion was noted with >5mg/L 87% of mooring record but periodic events to <4mg/L (5% of record). It was concluded that chlorophyll a and DO were indicative of between "moderately" and "significantly impaired" habitat conditions. Total Nitrogen data was not collected directly from the Maraspin Creek AU, however the MEP technical report noted that the "Millway" receives ebbing water from Maraspin Creek and functions as an open water basin and thus is much more sensitive to nitrogen enrichment than the nearby salt marsh areas. It was also proposed that the dredging of the Millway (for navigation and to support marina activities) has created an enhanced depositional environment, where sediment processes may be facilitating oxygen demand/depletion.

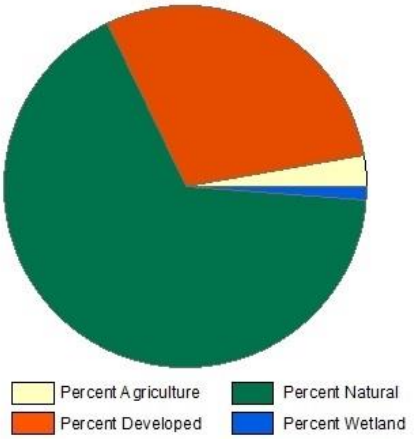
The Aquatic Life Use for Maraspin Creek is assessed as Not Supporting based on the MEP conclusion that Nutrient Related Habitat Health in the Millway area of the creek was severely degraded as evidenced by degraded benthic habitat conditions, frequently elevated chlorophyll a, and low DO which is being added as the nutrient/eutrophication biological indicators impairment. Aggregated estuary watershed nitrogen loads were partitioned by the major types of nitrogen sources in order to focus development of nitrogen management alternatives. According to the MEP report Linked Watershed Embayment Approach to Determine Critical Nitrogen Loading Thresholds for the Barnstable Great Marshes- Bass Hole Estuarine System, Town of Barnstable and Dennis MA within the Millway/Maraspin Creek sub-watershed the major types (sources) of nitrogen loads in descending order of percent contribution were wastewater (e.g. septic systems), farm animals, impervious surfaces, and residential fertilizers.

Marstons Mills River (MA96-127)

Location:	Headwaters outlet Middle Pond, Barnstable to saltwater portion approximately 1000 feet south of Route 28 (Falmouth Road), Barnstable.
AU Type:	RIVER
AU Size:	2 MILES
Classification/Qualifier:	B

Marstons Mill River - MA96-127

Watershed Area: 13.00 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	13.00	5.79	2.28	1.69
Agriculture	2.8%	6%	8.5%	11.2%
Developed	29.3%	30.6%	22.5%	21.2%
Natural	66.6%	60.9%	63.8%	60.9%
Wetland	1.2%	2.5%	5.2%	6.6%
Impervious Cover	10.1%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting (Alert)

According to DMF biologists, there are five barriers along the Marston Mills River that have minimal impact on the passage of river herring and American eel from upstream to downstream including the Middle Pond dam (NatID#MA02056) control structure (passage score 2) and fish ladder (passage score 3), the old bog sluice (passage score 1), a deteriorating fish ladder and culvert located at the first spillway of the Mill Pond dam (passage score 3), a fish ladder located at the second spillway of the Mill Pond Dam (passage score 1 since this is a new custom fishway that was installed by DMF in 2017), and stream baffles below Route 28 located downstream of the first spillway of the Mill Pond dam (passage score 1).

DFG biologists conducted backpack electrofishing in the Marstons Mills River upstream of Lovell's Lane/River Ridge Rd (SampleID 3568) (around the middle of the AU) in August 2010. The sample was comprised of four species (12 individuals) including a moderately tolerant macrohabitat generalist (yellow perch) and two fluvial species (one brook trout). During the summer of 2009 MassDEP staff deployed a long term (104-day) temperature logger downsteam from the Mill Pond dam (near bottom of the AU) at Route 28 in Falmouth (W2074). The maximum temperature was 25.4°C (maximum 7 DADM 25°C, maximum 24-hour rolling average 22.7°C) both meeting acute and chronic cold-water temperature criteria for a warm water fishery. A 2015 model (designed to simulate response of stream flow to pumping and wastewater returns) indicates spots of up to -50% flow (a marked decrease in flow) in the river from predevelopment conditions, with more pronounced decrease noted in the Cranberry Bog areas. Water withdrawal associated with Cranberry Bogs (located close to the headwaters/Middle Pond) is likely to have an impact on this watershed. The flow of the Marstons Mills River is also predicted to be disrupted by the numerous dams, spillways and bog sluices positioned along its length.

The Aquatic Life Use of Marstons Mill River is assessed as Fully Supporting based on the fish sample containing a moderately tolerant macrohabitat generalist and two fluvial fishes, good instream temperature, and the reasonable anadromous fish passage. An Alert is being identified because of numerous stresses to flow (pumping, cranberry bogs, dams/spillways).

Mashpee Pond (MA96194)

Location:	Mashpee/Sandwich.
AU Type:	FRESHWATER LAKE
AU Size:	377 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	5	Dissolved Oxygen		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

According to DMF biologists, there is an existing fishway at the Mashpee pond outlet/dam (NatID# MA01039) to the Mashpee River. The structure has a passage score of 1 (minor obstruction) to the movement of river herring and American eel up into the pond. According to the DCR database of non-native species, there is a 2007 report of an infestation of *Corbicula fluminea* in Mashpee Pond but confirmation of the presence of live organisms is needed. MassDEP staff conducted water quality monitoring at the deep hole in Mashpee Pond (W1308) in August 2005. Oxygen depletion (i.e. <5.0mg/L) was recorded at depths below 7.7m (25ft) representing 66% of the pond surface area. The maximum temperature was 24.5°C and pH ranged from 6.0 to7.2SU. The integrated depth chlorophyll a (upper 7m) was low (3.1µg/L), and secchi disk depth was good (5.5m) indicative of good conditions. The total phosphorus concentration near the surface was low (0.013mg/L) but was elevated near the bottom (0.29mg/L) indicative of nutrient release from anoxic sediment.

The Aquatic Life Use for Mashpee Pond is assessed as Not Supporting because of low DO at depth comprising ~66% of the pond's surface area which exceeds the 2018 CALM guidance of 10%. The former alert issue identified because of uncontrolled regulation of flow at the outlet control structure (vandalism) is being removed based on the updated information from DFG biologists. An Alert is being identified because of the potential infestation of the non-native aquatic species *C. fluminea* (Asian clam) but this needs confirmation.

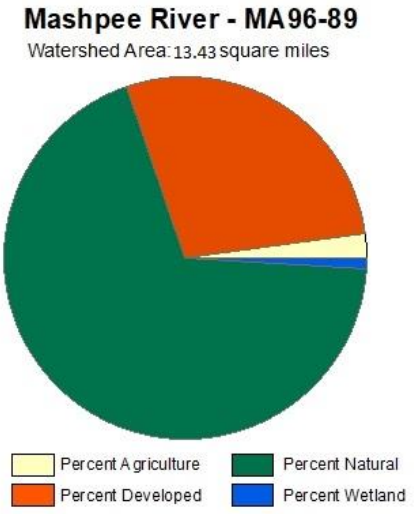
Mashpee River (MA96-24)

Location:	Quinaquisset Avenue, Mashpee to mouth at inlet Shoestring Bay (formerly to mouth at Popponesset Bay), Mashpee.
AU Type:	ESTUARY
AU Size:	0.08 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
DFG biologists conducted backpack electrofishing downstream of Quinaquisset Ave and the Route 28 crossing (SampleID 4539) in the Mashpee River in September 2009. A total of 7 species (48 individuals) were collected including American Brook Lamprey, fourspine stickleback, two age classes of brook trout (though not young of year), and white sucker. MassDEP staff also conducted water quality monitoring at one location downstream of Quinaquisset Avenue and Route 28 at old bridge crossing, Mashpee (W1911) during the summer of 2009. These data were indicative of excellent water quality conditions as follows: the mimimum DO during the five-day unattended continuous probe deployments was 7.28mg/L, the maximum saturation was 89.4%, the maximum diel DO shift was 0.9mg/L, the maximum temperature was 19.7^{o}C. The maximum temperature during the one long term (104-day) thermistor deployment was 20.0°C with a maximum7DADM of 19.5^{o}C and a maximum 24-hour average of 18.9^{o}C (all meeting acute and chronic Tier 1 cold water criteria). Attended data were as follows: minimum DO was 7.9mg/L, maximum saturation was 89%, pH ranged from 6.2 to 6.5SU, and the maximum temperature was 19.0^{o}C. The seasonal average total phosphorus concentration (n=4) was 0.028mg/L (maximum 0.033mg/L) and the seasonal average total nitrogen concentration was 0.50mg/L (maximum 0.54mg/L). There was no observation of any dense/very dense filamentous algae either. The Aquatic Life Use for this Mashpee River AU (MA96-24) will continue to be assessed as Not Supporting with the estuarine bioassessment impairment being carried forward.

Mashpee River (MA96-89)

Location:	Headwaters, outlet Mashpee Pond, Mashpee to Quinaquisset Avenue, Mashpee.
AU Type:	RIVER
AU Size:	2.7 MILES
Classification/Qualifier:	B



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	13.43	3.51	1.61	0.66
Agriculture	2.1%	0.2%	0.8%	0.3%
Developed	28.2%	20.9%	22.5%	16.8%
Natural	68.7%	76.7%	69.6%	72.4%
Wetland	1%	2.3%	7.1%	10.5%
Impervious Cover	9.5%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting

According to DMF biologists none of the five structures along the Mashpee River impair the passage of river herring and American eel. From upstream to downstream these structures include the fishway at the Mashpee pond outlet/dam (NatID# MA01039) that has a passage score of 2 (minor obstruction), the Route 130 dam has passage score of 0 (no obstruction), the bog sluice above Washburn Pond has a passage score of 0 (no obstruction), the Washburn Pond control structure has a passage score of 2 (minor obstruction), and the bog sluice downstream of Washburn Pond has a passage score of 0 (no obstruction). DFG biologists conducted backpack electrofishing in the Mashpee River at Ashers Path, east of Great Neck Road North (SampleID 1624) in September 2006. The sample was dominated by multiple age classes of brook trout and had two other fluvial specialist/dependant species.

The Aquatic Life Use of this Mashpee River AU (MA96-89) is assessed as Fully Supporting based on the presence of multiple age classes of brook trout and the reasonable fish passage for diadromous fish (particularly river herring and American eel). The former Alert associated with concerns for fish passage is being removed.

Middle Pond (MA96198)

Location:	Barnstable.
AU Type:	FRESHWATER LAKE
AU Size:	104 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	(Curly-leaf Pondweed*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

The non-native aquatic macrophyte, *Potamogeton crispus (*curly-leaf pondweed), was identified by MassDEP staff during a 2010 survey of Middle Pond. There is also a report of an infestation of Asian clam (*Corbicula fluminea*), in the USGS Non-Indigenous Aquatic Species database which informs the DEP Freshwater Aquatic Invasive Species database; however, confirmation of the presence of live specimens is still needed. Middle Pond experienced two years of MADPH algal bloom advisories in 2009 (14 days) and 2010 (28 days). According to DMF biologists, there is a fish ladder and control structure at the outlet of Middle Pond Dam (NatID#MA02056), which has a passage score of 3 to the ladder and 2 to the control structure (minor obstructions) to the passage of river herring and American eel up into the pond.

The Aquatic Life Use of Middle Pond will continue to be assessed as Not Supporting based on the presence of the non-native aquatic macrophyte *Potamogeton crispus* (curly-leaf pondweed) and low DO. Alerts are being added for the potential infestation of Asian clam and for harmful algal blooms.

Mill Creek (MA96-37)

Location:	Headwaters outlet Hallets Millpond, Barnstable/Yarmouth to mouth at inlet Cape Cod Bay, Barnstable/Yarmouth.
AU Type:	ESTUARY
AU Size:	0.03 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Fully Supporting
According to the MEP project technical report benthic samples were collected at one station (identified in the report as Wharf Creek) near the mouth of this Mill Creek AU (MA96-37) in the fall of 2007. The sample was characterized by a high number of species (17) & individuals (300) dominated by polychaetes, mollusks and crustaceans with few stress indicator species present. These data were considered indicative of "healthy habitat conditions". While no other water quality data were collected directly in Mill Creek although data collected nearby within the Barnstable Great Marshes embayment were also found to be indicative of healthy salt marsh habitat (i.e., naturally organic/nutrient enriched, with moderate DO and chlorophyll a concentrations). The Aquatic Life Use of this Mill Creek AU (MA96-37) will be assessed as Fully Supporting based on the healthy habitat conditions documented by the MEP project (Linked Watershed Embayment Approach to Determine Critical Nitrogen Loading Thresholds for the Barnstable Great Marshes- Bass Hole Estuarine System, Town of Barnstable and Dennis MA.)

Mill Creek (MA96-41)

Location:	Headwaters outlet Taylors Pond, Chatham to mouth at inlet Cockle Cove, Chatham.
AU Type:	ESTUARY
AU Size:	0.03 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Assessed
There are no data available to assess the Aquatic Life Use of this Mill Creek Creek AU (MA96-41) so it is Not Assessed.

Mill Creek (MA96-80)

Location:	Headwaters, outlet Mill Pond, Yarmouth to mouth at inlet Lewis Bay, Yarmouth.
AU Type:	ESTUARY
AU Size:	0.07 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
DMF biologists report that construction/rehabilitation of the Baxter Grist Mill dam (NatID# MA01079) and fish ladder for herring, alewives and American eels at the upper end of Mill Creek up into Mill Pond began in 2014 and was comleted by March 2020. This barrier now has a passage score of 2 (minor obstruction) for the passage of diadromous fish. No other recent water quality data for Mill Creek are available. The Aquatic Life Use for this Mill Creek AU (MA96-80) will continue to be assessed as Not Supporting with the total nitrogen impairment being carried forward based on MEP project results although diadromous fish passage should now be sufficient.

Mill Creek (MA96-85)

Location:	Headwaters, outlet Shawme Lake Lower, Sandwich to mouth at confluence with Old Harbor Creek, Sandwich.
AU Type:	ESTUARY
AU Size:	0.02 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Assessed
According to DMF biologists there is one fish passage structure at the upstream end of Mill Creek (associated with the Grist Mill dam) that acts as a minor obstruction to the passage of river herring and American eel. DMF assisted the Town with baffle repairs in 2015 and the mill/dam itself was restored between 2013 and 2016. This dam now has a passage score of 1 (minor obstruction) for passage of diadromous fish. There are no other data available to assess the Aquatic Life Use of this Mill Creek AU (MA96-85) so it is Not Assessed.

Mill Pond (MA96-117)

Location:	Yarmouth.
AU Type:	ESTUARY
AU Size:	0.09 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
--	4a	Nitrogen, Total	68003	Added
--	4a	Nutrient/Eutrophication Biological Indicators	68003	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical report benthic sampling was conducted at two locations in this Mill Pond AU (MA96-117) in the summer and fall of 2005. Samples had high numbers of individuals and low diversity, dominated by single organic enrichment species (*Streblospio*). Mill Pond had patchy surface mats of macroalgae, epiphytes on *Ruppia*, and a brackish rooted submerged aquatic vegetation (SAV) indicative of between "healthy habitat" and "moderately impaired" conditions. It was also concluded that there was no evidence that this area supported eelgrass bed habitat. Chlorophyll a data from the Town (Yarmouth & Dennis) Water Quality Monitoring Program (WQMP) collected during the summer months (2003-2008) had overall average of 24.7µg/L and DO data were reported as generally >5mg/L. 2005 SMAST mooring surveys indicated blooms. Overall it was concluded that the Chlorophyll a data was indicative of "significant impairment" and DO was indicative of "moderate impairment". Total nitrogen data were collected at one monitoring station between 2003 and 2005 with yearly means ranging from 0.909 to 1.129mg/L with an overall mean of 1.032mg/L.

The Aquatic Life Use of this Mill Pond AU (MA96-117) is assessed as not supporting based on the overall MEP analysis indicating "Nutrient Related Habitat Health" was significantly impaired as evidenced by elevated chlorophyll a and degraded benthic communities which is being added as the nutrient/eutrophication biological indicators impairment and total nitrogen. According to the MEP report Linked Watershed- Embayment Model to Determine Critical Nutrient Loading Thresholds for the Bass River Embayment System, Towns of Yarmouth and Dennis, MA within Mill Pond embayment system the major types (sources) of nitrogen loads in descending order of percent contribution were wastewater (e.g. septic systems), landfill, fertilizers, and impervious surfaces.

Mill Pond (MA96206)

Location:	Yarmouth.
AU Type:	FRESHWATER LAKE
AU Size:	6 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Insufficient Information
According to DMF biologists there are two structures (one at each end of the pond) that may potentially affect the passage of river herring and American eel. The fishway at the "culvert above Mill Pond" has a passage score of 0 (no obstruction) so passage is adequate. Construction/rehabilitation of the Baxter Grist Mill dam (NatID# MA01079) and fish ladder for herring, alewives and American eels at the outlet of Mill Pond began in 2014 and was comleted by March 2020. This barrier now has a passage score of 2 (minor obstruction) for the passage of diadromous fish. Too limited data are available to assess the Aquatic Life Use of this Mill Pond AU (MA96206) so it is assessed as having Insufficient Information although diadromous fish passage should now be sufficient.

Mill Pond (MA96356)

Location:	Harwich/Brewster.
AU Type:	FRESHWATER LAKE
AU Size:	12 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of this Mill Pond AU (MA96356), so it is Not Assessed.

Mill Pond (MA96-52)

Location:	including Little Mill Pond (PALIS # 96174), Chatham.
AU Type:	ESTUARY
AU Size:	0.06 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
MassDEP eelgrass mapping project data indicates a complete loss (100%) of eelgrass bed habitat in this Mill Pond AU (MA96-52) after 1995. The Aquatic Life Use of this Mill Pond AU (MA96-52) will continue to be assessed as Not Supporting with the existing impairment for estuarine bioassessments (eelgrass bed habitat loss) and total nitrogen being carried forward. The Stage Harbor/Oyster Pond, Sulphur Springs/Bucks Creek, Taylors Pond/Mill Creek Total Maximum Daily Load TMDL for Total Nitrogen contains information on sources.

Miss Thachers Pond (MA96258)

Location:	Yarmouth.
AU Type:	FRESHWATER LAKE
AU Size:	6 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
3	4c	(Fish Passage Barrier*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to DMF biologists there are two impediments to diadromous fish passage up into Miss Thachers Pond. From upstream to downstream these obstructions include the outlet at Miss Thachers pond where the stream channel (downstream of the fish ladder) used to be choked with weeds but underwent significant channel maintenance in 2017-2018 and now has a passage score of 3 (minor obstruction) to river herring. Further downstream, the Hamblin Brook Culverts were collectively assigned a passage score of 5 (restricted passage) for river herring and American eel.

The Aquatic Life Use of Miss Thachers Pond will be assessed as Not Supporting due to the presence of a fish passage barrier at the Hamblins Brook culverts that restrict passage for river herring and American eel.

Moll Pond (MA96355)

Location:	Eastham.
AU Type:	FRESHWATER LAKE
AU Size:	3 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)
One prolonged algal bloom occurred in Moll Pond in 2012. No other data are available. Too limited data are available to assess the Aquatic Life Use for Moll Pond, so it is assessed as having Insufficient Information. An Alert will be identified because of the prolonged algal bloom that occurred in 2012.

Muddy Creek (MA96-115)

Location:	Headwaters, outlet North Dennis Road Pond, Yarmouth to mouth at inlet Follins Pond, Yarmouth.
AU Type:	ESTUARY
AU Size:	0.004 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)
No specific data were collected in Muddy Creek as part of the MEP project to develop the Linked Watershed-Embayment Model to Determine Critical Nutrient Loading Thresholds for the Bass River Embayment System, Towns of Yarmouth and Dennis, MA, the MEP project technical report and TMDL indicated that the creek was impaired (extrapolation of conditions in the downstream AU Follins Pond (MA96-114) as a result of nitrogen impairment. There are too limited data available to assess the Aquatic Life Use for this Muddy Creek AU (MA96-115) so it is assessed as having Insufficient Information. An alert is being identified for elevated total nitrogen based on the results of the MEP project identifying total nitrogen impairment in the adjacent downstream waterbody.

Muddy Creek (MA96-51)

Location:	Source south of Countryside Drive and north-northeast of Old Queen Anne Road, Chatham to mouth at inlet Pleasant Bay, Harwich/Chatham, including Upper and Lower reaches.
AU Type:	ESTUARY
AU Size:	0.05 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	4a	(Fish Passage Barrier*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to DMF biologists there are three fish passage structures that affect the passage of American eel and river herring along this Muddy Creek AU (MA96-51). From upstream to downstream they are: The Queen Ann Road Culvert with a passage score of 8 (severe impediment), an eel pass was installed Upper Muddy Creek in 2009 to allow all-tide access which has a passage score of 5 (restricted passage), and the Route 28 culvert (replaced in 2016) now has a passage score of 2 (minor obstruction) to diadromous fish passage.

The Aquatic Life Use of this Muddle Creek AU (MA96-51) will continue to be assessed as Not Supporting. An impairment for fish passage barrier is being added because of the severe impediment at the Queen Ann Road culvert and the restricted passage in Upper Muddy Creek for river herring and American eel. The total nitrogen impairment is being carried forward. According to the Pleasant Bay System Total Maximum Daily Loads for Total Nitrogen, impairment of this waterbody can best be mitigated by reducing excess nutrient loading, total nitrogen. The controllable local sources of total nitrogen identified in this TMDL included waste from pets, waterfowl, discharges from Municipal Separate Storm Sewer Systems (MS4), and on-site subsurface wastewater disposal (septic) systems.

Mystic Lake (MA96218)

Location:	Barnstable.
AU Type:	FRESHWATER LAKE
AU Size:	146 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)
The Indian Pond Association reported an infestation of the non-native aquatic macrophyte, *Hydrilla verticillata*, in Mystic Lake in 2010. The Town of Barnstable has applied for permits to treat the lake with herbicides for this infestation each year from 2013-2016. Mystic Lake experienced algal bloom advisories in 2009 (14 days) and 2010 (15 days). No other new water quality data are available. The Aquatic Life Use for Mystic Lake will continue to be assessed as Not Supporting because of the non-native aquatic macrophyte *Hydrilla verticillata* infestation and low DO. An alert is being identified because of the algal blooms.

Namequoit River (MA96-71)

Location:	Headwaters, outlet Areys Pond, Orleans to mouth at confluence with The River, Orleans.
AU Type:	ESTUARY
AU Size:	0.06 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
MassDEP eelgrass mapping project data indicates a complete loss (100%) of eelgrass habitat between 1995 and 2017 in Namequoit River. The Aquatic Life Use of Namequoit River will continue to be assessed as Not Supporting as evidenced by the complete loss of eelgrass beds. The Total Nitrogen impairment is being carried forward as an impairment as documented in the Pleasant Bay System Total Maximum Daily Load for Total Nitrogen.

Namskaket Creek (MA96-27)

Location:	Source west of Route 6, Orleans/Brewster to mouth at inlet Cape Cod Bay, Brewster/Orleans.
AU Type:	ESTUARY
AU Size:	0.03 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO

Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)
USGS staff conducted water quality sampling at late ebb tide within the Inner Nemskaket Marsh and Nemskaket Creek downstream of the Cape Cod Rail Trail in 2010 and 2011 as part of an ongoing study to evaluate potential impacts from the Tri-Town Septage Treatment Facility. The seasonal average (May-September) Total Dissolved Nitrogen in the Creek in 2010 was 0.76mg/L and in 2011 was 0.78mg/L. In both cases these concentrations are higher than the MEP critical indicator threshold of >0.5mg/L. According to MEP studies, elevated concentrations of total nitrogen are often typically associated with systems experiencing degraded overall health. It should be noted however that USGS concluded that these samples, collected approximately eight years after the shallow effluent plume segments was first detected beneath the marsh, do not show evidence of elevated nitrate or total dissolved nitrogen concentrations attributable to discharge of the plume segments. Too limited data are available to assess the Aquatic Life Use of Namskaket Creek so it will be assessed as having Insufficient Information. An Alert is being identified for the elevated total nitrogen however.

Nauset Harbor (MA96-28)

Location:	The waters south of an imaginary line drawn east from Woods Cove, Orleans around the southern point of Stony Island, around the southern end of the unnamed island in the harbor, to Cape Cod National Seashore (CCNS), excluding Mill Pond, Orleans (area within CCNS designated as ORW).
AU Type:	ESTUARY
AU Size:	0.41 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO ('ORW' applies only to portion in Cape Cod National Seashore)

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
2	5	Estuarine Bioassessments		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting
There has been a complete loss of eelgrass bed habitat in Nauset Harbor (0.00173mi^2 in 2001 noted as real) and none since (note estimated eelgrass bed habitat present in 1951 was 0.0089mi^2). The Aquatic Life Use of Nauset Harbor is assessed as Not Supporting based on the loss of eelgrass bed habitat (estuarine bioassessment). The alert for eelgrass bed habtitat loss is no being removed (no longer needed).

North Bay (MA96-66)

Location:	From Prince Cove outlet at Fox Island to just south of Bridge Street (including Dam Pond) and separated from Cotuit Bay at a line from Point Isabella, Barnstable southward to the opposite shore, Barnstable.
AU Type:	ESTUARY
AU Size:	0.47 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
MassDEP eelgrass mapping project data indicates complete loss of eelgrass bed habitat since 1995 (0.00684mi^2). The Aquatic Life Use of North Bay will continue to be assessed as Not Supporting with the estuarine bioassessment impairment being carried forward.

North Pond (MA96225)

Location:	Barnstable.
AU Type:	FRESHWATER LAKE
AU Size:	4 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed
One short term (<20 days) algal bloom occurred in North Pond in 2011 but none since. No other recent water quality data are available. The Aquatic Life Use for North Pond is Not Assessed.

Nye Pond (MA96228)

Location:	Sandwich.
AU Type:	FRESHWATER LAKE
AU Size:	6 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Nye Pond, so it is Not Assessed.

Old Harbor Creek (MA96-84)

Location:	From Foster Road, Sandwich to mouth at inlet Sandwich Harbor, Sandwich.
AU Type:	ESTUARY
AU Size:	0.06 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Old Harbor Creek, so it is Not Assessed.

Oyster Pond (MA96-45)

Location:	Including Stetson Cove, Chatham.
AU Type:	ESTUARY
AU Size:	0.21 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
MassDEP eelgrass mapping project data indicates a complete loss of of eelgrass bed habitat in this Oyster Pond AU (MA96-45) since 1995. The Aquatic Life Use of this Oyster Pond AU (MA96-45) will continue to be assessed as Not Supporting with the estuarine bioassessment (eelgrass bed habitat loss) and total nitrogen impairments being carried forward. The Stage Harbor/Oyster Pond, Sulphur Springs/Bucks Creek, Taylors Pond/Mill Creek Total Maximum Daily Load TMDL for Total Nitrogen has information on sources.

Oyster Pond (MA96-62)

Location:	east of Fells Road, Falmouth.
AU Type:	ESTUARY
AU Size:	0.1 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
According to DMF biologists the fishway at the control structure of Oyster Pond has a passage score of 0 (no obstruction) and allows passage of diadromous fish (river herring and American eel). No other water quality data are available. The Aquatic Life Use of this Oyster Pond AU (MA96-62) will continue to be assessed as Not Supporting with the dissolved oxygen and estuarine bioassessment impairments being carried forward based on the results of the MEP project analysis for the Oyster Pond Embayment System Total Maximum Daily Loads For Total Nitrogen.

Oyster Pond River (MA96-46)

Location:	Headwaters outlet Oyster Pond, Chatham to mouth at inlet Stage Harbor, Chatham.
AU Type:	ESTUARY
AU Size:	0.14 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
MassDEP eelgrass mapping project data indicates a large decrease (99.95%) in eelgrass bed habitat in the Oyster Pond River between 1995 and 2017. The Aquatic Life Use of Oyster Pond River will continue to be assessed as Not Supporting for estuarine bioassessment (eelgrass bed habitat loss) and the total nitrogen will also be carried forward. The Stage Harbor/Oyster Pond, Sulphur Springs/Bucks Creek, Taylors Pond/Mill Creek Total Maximum Daily Load TMDL for Total Nitrogen has information on sources.

Pamet River (MA96-31)

Location:	From tidegate at Route 6A, Truro to mouth at inlet Cape Cod Bay (including Pamet Harbor), Truro.
AU Type:	ESTUARY
AU Size:	0.14 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Insufficient Information
According to DMF biologists, there used to be a tidegate in the upper reaches of the Pamet River at Truro Center Road in Truro. In 2019 the tidegate was removed and once the work was complete DMF assigned a passage score of 2 to the remaining culvert structure, which indicates it is no longer an obstruction to the passage of diadromous fish. This AU was previously identified with an Alert Status due to concern for fish passage when the tidegate was still in place. Since the tidegate structure has been removed and the remaining culvert is only a “minor obstruction” to fish passage, the former Alert status for this AU will be removed. Too limited data are available to assess the Aquatic Life Use of the Pamet River so it is will be assessed as having Insufficient Information.

Parkers River (MA96-38)

Location:	Headwaters outlet Seine Pond, Yarmouth to mouth at inlet Nantucket Sound, Yarmouth (excluding Lewis Pond, Yarmouth).
AU Type:	ESTUARY
AU Size:	0.04 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	4a	Nitrogen, Total	68361	Added
4a	4a	Nutrient/Eutrophication Biological Indicators	68361	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical report benthic sampling was conducted at two locations (Upper and Lower Parkers River) in the summer and fall of 2004. The Upper River was noted to be dominated by Seine Pond outflow and samples showed low total numbers of species and individuals. The Lower River showed high numbers of species (27) and individuals (2433), with dense amphipod mats indicative of disturbance and/or moderate levels of organic enrichment. It was concluded that this data is indicative of "moderately impaired" and "significantly impaired" benthic habitat conditions", with a tendency towards more impaired conditions in the upper part of the AU. In the upper reach of the river drift algae was sparse or absent with little surface microphyte mat while in the lower reach there wer patches of drift algae (Ulva), with some filamentous species and some algal mat. No eelgrass bed habitat was mapped between 1995 and 2017 although some was mapped in this area with low confidence in 1951. Chlorophyll a data from the Town of Yarmouth Water Quality Monitoring Program (YWQMP) during the summer months (2002-2008) averaged 8µg/L in the upper reach and 4µg/L in the lower reach. DO data reported by the YWQMP project (2002-2008) was dominated by ebbing Seine Pond waters) minimum 3.6mg/L in the upper reach and was periodically depleted (minimum 4.4mg/L) in the lower reach. The overall mean total nitrogen concentration in the upper reach summers 2002 through 2008 was 0.776mg/L and in the lower reach was 0.663mg/L.

The Aquatic Life Use for the Parkers River is assessed as Not Supporting based on the MEP analysis which concluded that overall the "Nutrient Related Habitat Health" for the Parkers River AU was between "Moderately" and "Significantly" Impaired as evidenced by moderately to significantly impaired benthic habitat, moderate chlorophyll a levels, and periodically depleted oxygen levels which is being added as the nutrient/eutrophication biological indicators impairment and total nitrogen. Aggregated estuary watershed nitrogen loads were partitioned by the major types of nitrogen sources in order to focus development of nitrogen management alternatives. According to the MEP report Linked Watershed Embayment Approach to Determine Critical Nitrogen Loading Thresholds for the Parkers River Embayment System, Yarmouth, MA Overall within Parkers River embayment system the major types (sources) of nitrogen loads in descending order of percent contribution are; wastewater (e.g. septic systems), fertilizers, impervious surfaces and WWTFanalysis.

Paw Wah Pond (MA96-72)

Location:	Orleans.
AU Type:	ESTUARY
AU Size:	0.01 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
MassDEP eelgrass mapping project data indicates a complete loss (100%) of eelgrass habitat between 1995 and 2017 in Paw Wah Pond. The Aquatic Life Use of Paw Wah Pond will continue to be assessed as Not Supporting as evidenced by the complete loss of eelgrass beds. The Total Nitrogen impairment is being carried forward as an impairment as documented in the Pleasant Bay System Total Maximum Daily Load for Total Nitrogen.

Perch Pond (MA96-53)

Location:	Connects to northwest end of Great Pond, west of Keechipam Way, Falmouth.
AU Type:	ESTUARY
AU Size:	0.03 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
No new water quality data are available for Perch Pond. The Aquatic Life Use for Perch Pond will continue to be assessed as Not Supporting with the total nitrogen impairment being carried forward based the information in the Great, Green and Bournes Pond Embayment Systems Total Maximum Daily Loads For Total Nitrogen.

Peters Pond (MA96244)

Location:	Sandwich/Mashpee.
AU Type:	FRESHWATER LAKE
AU Size:	123 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)
According to the DCR database of non-native aquatic species, there was a 2007 report of an infestation of *Corbicula fluminea* (Asian Clam) in Peters Pond; however, confirmation of the presence of live organisms is needed prior to making an impairment decision. Too limited data are available to assess the Aquatic Life Use of Peters Pond so it is assessed as having Insufficient Information. An alert is being identified for the potential presence of the non-native aquatic organism Asian clam.

Pilgrim Lake (MA96246)

Location:	Orleans.
AU Type:	FRESHWATER LAKE
AU Size:	38 ACRES
Classification/Qualifier:	B: ORW, WWF

Fish, other Aquatic Life and Wildlife Use: Not Assessed
According to DMF biologists there were two barriers to diadromous fish passage up to Pilgrim Lake. Recent improvement work was completed in 2018 at the notched weir -pool fishway at the Pilgrim Lake control structure which now has a Passage score of 3 (minor obstruction). Further downstream improvement projects were completed between 2010 and 2015 so the concrete notched weir-pool fish ladder running along the unassessed stream between Pilgrim Lake and "The River" AU (MA96-76) now has a Passage score of 1 (minor obstruction). No other data are available to assess the Aquatic Life Use of Pilgrim Lake, so it is Not Assessed. Since improvements have been made for diadromous fish passage (river herring and American eel) and now only minor obstructions exist, the former alert for the deteriorating fishway is being removed.

Pleasant Bay (MA96-77)

Location:	The waters between the mouth of Muddy Creek, Harwich and imaginary lines drawn from the northeastern edge of Orleans (near The Horseshoe and The Narrows), southeasterly around the northeastern tip of Sipson Island, and Sipson Meadow, Orleans then south to the northern tip of Strong Island, Chatham and from the southeastern tip of Strong Island to Allen Point, Chatham (excluding the delineated segments; Bassing Harbor, Round Cove and Quanset Pond).
AU Type:	ESTUARY
AU Size:	2.88 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	5	Estuarine Bioassessments		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

MassDEP eelgrass mapping project data in the Pleasant Bay AU area indicates a large decrease (47.9%) in eelgrass bed habitat between 1995 and 2017.

The Aquatic Life Use of Pleasant Bay (MA96-77) will continue to be assessed as Not Supporting with the existing total nitrogen impairment being carried forward. This impairment was based on the 2006 Pleasant Bay MEP technical report which concluded overall "Nutrient Related Habitat Health" was moderately impaired as evidenced by infrequent low DO events, eelgrass loss and infaunal animals data and these impairments could best be mitigated by reducing excess nutrient loading, total nitrogen. The estuarine bioassessments impairment is being added because of the eelgrass bed habitat loss between 1995 and 2017.

Pochet Neck (MA96-73)

Location:	outlet to Little Pleasant Bay, Orleans (areas within Cape Cod National Seashore designated as ORW).
AU Type:	ESTUARY
AU Size:	0.24 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO ('ORW' applies only to portion in Cape Cod National Seashore)

Fish, other Aquatic Life and Wildlife Use: Not Supporting
MassDEP eelgrass mapping project data indicates a complete loss (100%) of eelgrass habitat between 1995 and 2017 in Pochet Neck. The Aquatic Life Use of Pochet Neck will continue to be assessed as Not Supporting as evidenced by the complete loss of eelgrass beds. The Total Nitrogen impairment is being carried forward as an impairment as documented in the Pleasant Bay System Total Maximum Daily Load for Total Nitrogen.

Popponesset Bay (MA96-40)

Location:	The waters seaward of an imaginary line connecting Ryefield Point, Barnstable and Punkhorn Point, Mashpee to inlet of Nantucket Sound (including Ockway Bay, Mashpee and Pinquickset Cove, Barnstable) (excludes Popponesset Creek, Mashpee).
AU Type:	ESTUARY
AU Size:	0.68 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
No new data are available to assess the Aquatic Life Use for Popponesset Bay. The Aquatic Life Use of Popponesset Bay will continue to be assessed as Not Supporting with the estuarine bioassessment impairment being carried forward.

Popponesset Creek (MA96-39)

Location:	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.
AU Type:	ESTUARY
AU Size:	0.05 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
No new data are available to assess the Aquatic Life Use for Popponsesset Creek. The Aquatic Life Use of Popponesset Creek will continue to be assessed as Not Supporting with the estuarine bioassessment impairment being carried forward.

Prince Cove (MA96-07)

Location:	Includes areas east of Prince Cove (which are locally known as "Warren Cove" and "Prince Cove Channel") to confluence with North Bay, Barnstable.
AU Type:	ESTUARY
AU Size:	0.14 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
MassDEP eelgrass mapping project data indicates a complete loss of eelgrass bed habitat after 1995 (0.00238mi^2). The Aquatic Life Use of Prince Cove will continue to be assessed as Not Supporting with the estuarine bioassessment impairment being carried forward.

Provincetown Harbor (MA96-29)

Location:	The waters northwest of an imaginary line drawn northeasterly from the tip of Long Point, Provincetown to Pilgrim Beach (in vicinity of Sandbars Inn), Truro (area within Cape Cod National Seashore designated as ORW).
AU Type:	ESTUARY
AU Size:	4.33 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO ('ORW' applies only to portion in Cape Cod National Seashore)

Fish, other Aquatic Life and Wildlife Use: Fully Supporting
MassDEP eelgrass mapping project data indicates an increase in eelgrass bed coverage between 1995 (1.11 square miles) and 2017 (1.18 square miles). The Aquatic Life Use of Provincetown Harbor is assessed as Fully Supporting based on the evident increasing eelgrass bed habitat.

Quanset Pond (MA96-74)

Location:	Orleans.
AU Type:	ESTUARY
AU Size:	0.02 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO (also tributary)

Fish, other Aquatic Life and Wildlife Use: Not Supporting
No new data are available to assess the Aquatic Life Use for Quanset Pond. Total nitrogen is being carried forward as an impairment based on the MEP analysis documented in the Pleasant Bay System Total Maximum Daily Load for Total Nitrogen.

Quashnet River (MA96-20)

Location:	From just south of Route 28, Falmouth to mouth at inlet Waquoit Bay, Falmouth. Also known as Moonakis River.
AU Type:	ESTUARY
AU Size:	0.07 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO

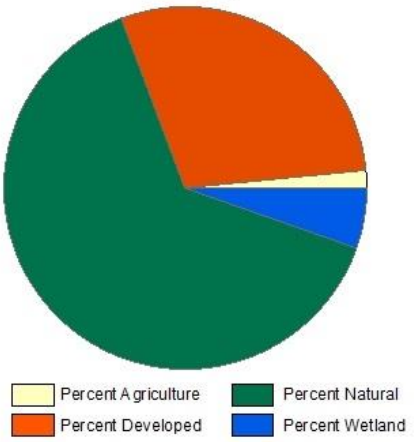
Fish, other Aquatic Life and Wildlife Use: Not Supporting
No more recent data are available for this Quashnet River AU (MA96-20). The Aquatic Life Use of this Quashnet River AU (MA92-20) will continue to be assessed as Not Supporting with the dissolved oxygen and total nitrogen impairments being carried forward. Aggregated estuary watershed nitrogen loads were partitioned by the major types of nitrogen sources in order to focus development of nitrogen management alternatives. According to the MEP Linked Watershed Embayment Approach to Determine Critical Nitrogen Loading Thresholds for the Waquoit Bay and Eel Pond Embayment System, Towns of Falmouth and Mashpee, MA Overall within the Quashnet River sub-watershed the major types (sources) of nitrogen loads in descending order of percent contribution were Wastewater (septic systems), impervious surfaces, and fertilizers.

Quashnet River (MA96-90)

Location:	Headwaters, outlet Johns Pond, Mashpee to just south of Route 28, Falmouth (area within Waquoit Bay ACEC designated as ORW).
AU Type:	RIVER
AU Size:	4.1 MILES
Classification/Qualifier:	B: ORW ('ORW' applies only to portion in Waquoit Bay ACEC)

Quashnet River - MA96-90

Watershed Area: 3.79 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	3.79	2.12	0.89	0.73
Agriculture	1.5%	0.4%	4.7%	0.7%
Developed	29.3%	16.2%	10.7%	13.2%
Natural	63.9%	74.8%	65.5%	65.7%
Wetland	5.4%	8.5%	19.1%	20.5%
Impervious Cover	10.3%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
2	5	(Curly-leaf Pondweed*)		Added
2	5	Temperature		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)
According to DMF biologists, six structures along this Quashent River AU (MA96-90) have minimal impact on the passage of diadromus fish (river herring and American eel) from upstream to downstream as follows: Johns Pond outlet sedimentation issue so sediment/erosion control was needed, however a sand retention structure was not favored by the Town but passage score 2 (minor obstruction), Third/Second bog sluices passage score 2 (minor obstruction), First bog sluice passage score 3 (minor obstruction) (note all sluices are passable if properly adjusted), Golf Course Bridge passage score 0 (no obstruction), unnamed dam at DFW property (NatID# MA02443) has an existing fishway passage score 1 (minor obstruction). MassDEP biologists conducted backpack electrofishing in the Quashnet River in September 2009 just upstream of Route 151 in Mashpee (SampleID 4540). A total of 7 species (53 individuals) were collected including multiple age classes of Eastern brook trout. The sample was well represented by fluvial specialist/dependant species both intolerant and moderately tolerant of pollution. DFG biologists conducted backpack electrofishing in the river further downstream near Martin Rd in Mashpee (SampleID 1400) in August 2005. Six species (235 individuals) were collected and the sample was dominated by brook trout (no length data were recorded). It should be noted that the Quashnet River is on the MDFG Cold Water Fishery Resource List and will be assessed as an Existing Tier 1 cold water based on the presence of multiple age classes of brook trout. An infestation of the non-native aquatic macrophyte, *Potamogeton crispus* (curly leaf pondweed) was identified in the river during the 2009 surveys. MassDEP staff conducted water quality monitoring in the river at Rt 151

(W1910) in 2009. During the three five-day unattended continuous probe deployments for DO in June, July and August the minimum DO was 4.1mg/L and the mean daily minimum DOs were 6.99, 5.81 and 5.21mg/L respectively, violating the cold water criterion of 6.0mg/L during both the July and August deployments. The maximum DO saturation was 103.9%, with a maximum diel DO shift of 2.98mg/L. During the July deploy temperature was elevated – maximum temp 23.8^{o}C, 4-DADM 23.0°C (exceeding the chronic temperature criteria of 20°C) although the maximum 24-hour rolling average was only 21.1°C. The pH ranged from 6.0 to 6.4SU (n=6, a little low but considered natural). The seasonal average total phosphorus (n=5) was low (0.032mg/L, maximum 0.043mg/L) as was ammonia ($\leq$0.05mg/L). Seasonal average total nitrogen was 0.52mg/L. There were also no exceedances of acute or chronic metals criteria (n=3 sampling events). Further downstream at Martin Rd (W1909) the long term (104-day) temperature logger recorded a maximum temperature of 20.1°C, 7-DADM 19.6^{o}C, and a maximum daily mean 19^{o}C not exceeding acute or chronic Tier 1 cold water criteria. The seasonal average total phosphorus concentration was 0.043mg/L (maximum 0.054mg/L) and the seasonal average total nitrogen was 0.42mg/L. The MEP technical report summarized total nitrogen data collected right at the bottom of the river (WB06 at Rt.28), in the summers of 2002 and 2004 through 2010 with yearly means between 0.424 and 0.597mg/L (overall mean 0.516mg/L).
The Aquatic Life Use of this Quashnet River AU (MA96-90) is assessed as Not Supporting due to elevated temperature in the river at Rt 151 in July 2009 exceeding chronic temperature criteria for a Tier 1 cold water as a result of dams and impoundments upstream and the presence of non-native aquatic macrophyte curly-leaf pondweed. Since this river supports muliptle age classes of brook trout no impairment will be made for low DO although it will be identified as an Alert as will total nitrogen (because of issues downstream and Waquoit Bay). The former alert for concerns related to fish passage is being removed based on the updated survey/project information from DMF biologists.

Quivett Creek (MA96-09)

Location:	Outlet of unnamed pond just south of Route 6A, Brewster/Dennis to mouth at inlet Cape Cod Bay, Brewster/Dennis.
AU Type:	ESTUARY
AU Size:	0.04 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	5	(Curly-leaf Pondweed*)		Added
4a	5	Dissolved Oxygen		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to DMF biologists there is a fish passage structure at the outlet of a small unnamed pond in the headwaters of Quivett Creek. Passage at this structure was good (passage score 0) allowing passage of river herring and American eel between the pond and Quivett Creek. MassDEP staff conducted water quality monitoring of Quivett Creek t a walking path crossing, south off Sea Street, Dennis (W1922) during the summer of 2009. During these surveys the presence of the non-native aquatic macrophyte, *Potamogeton crispus* (curly-leaf pondweed), was identified. It should be noted that all deployed probe data were qualified because of tidal and unstable conditions however the minimum DO concentration during the five-day unattended continuous probe deployments in June, July and August were all very low (2.5, 0.8 and 0.8mg/L, respectively). The maximum diel DO shifts were also very large 4.9, 7.7 and 6.0mg/L). The maximum saturation was 115%. Temperature met Class SA standards (maximum 28.3°C, 24-hour rolling maximum 24.7°C).
The Aquatic Life Use of Quivett Creek is assessed as "Not Supporting" based on the presence of the non-native aquatic macrophyte curly leaf pondweed (*Potamogeton crispus*) and low DO.

Red Brook (MA96-25)

Location:	From dam (NATID: MA01037) at Red Brook Road, Falmouth/Mashpee to mouth at inlet Hamblin Pond, Falmouth/Mashpee.
AU Type:	ESTUARY
AU Size:	0.01 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO

Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)
MassDEP staff deployed a thermistor in Red Brook ~225 feet downstream of Red Brook Road, Mashpee/Falmouth (W2075) in 18 June 2009. The maximum temperature recorded during the long-term (104-day) deployement was 28.2°C with a maximum daily average of 25.2 °C meeting both acute and chronic temperature criteria for an estuarine AU. No eelgrass bed habitat has been mapped in Red Brook. Yearly mean total nitrogen data collected at (WB05 Red Brook Road) in the summers of 2002 and 2004 through 2010 ranged from 0.461 to 0.643mg/L (overall mean 0.561mg/L). The MEP technical report did not make a conclusion regarding overall "Nutrient Related Habitat Health" for this AU, due to lack of data. Too limited data are available to assess the Aquatic Life Use of Red Brook, so it is assessed as having Insufficient Information. Since the average total nitrogen concentration was above 0.5mg/L, an alert for total nitrogen is being identified.

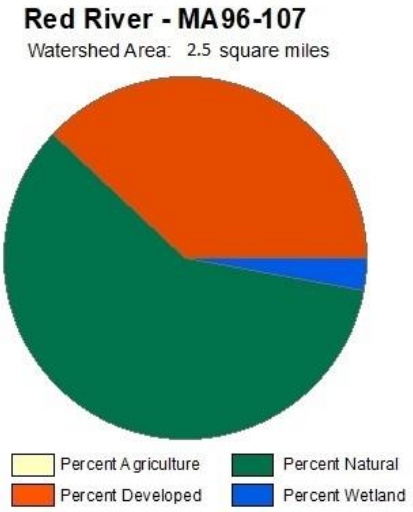
Red Lily Pond (MA96257)

Location:	Barnstable.
AU Type:	FRESHWATER LAKE
AU Size:	4 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Supporting
According to DMF biologists there is a culvert structure at the Red Lily Pond outlet to Lake Elizabeth, that may potentially affect the passage of river herring because it becomes "perched" at lower flows. This culvert has a fish passage score of 3 (minor obstruction) to the passage of diadromous fish (river herring). No other recent data are available. The Aquatic Life Use of Red Lily Pond will continue to be assessed as "Not Supporting" with the Nutrient/Eutrophication Biological Indicators impairment being carried forward.

Red River (MA96-107)

Location:	Headwaters west of Mayflower Drive, Chatham to south Chatham Road, Chatham.
AU Type:	RIVER
AU Size:	0.9 MILES
Classification/Qualifier:	B



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	2.50	2.50	0.59	0.59
Agriculture	0.8%	0.8%	2.6%	2.6%
Developed	37.7%	37.7%	35%	35%
Natural	58.7%	58.7%	53.7%	53.7%
Wetland	2.8%	2.8%	8.6%	8.6%
Impervious Cover	16.7%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting (Alert)

MassDEP biologists conducted backpack electrofishing in the Red River at the end of the Shirley Drive cul-de-sac Chatham/Harwich (SampleID 4542) in September 2009. The sample was comprised of four species (80 individuals) and was dominated by the moderately tolerant fourspine stickleback with banded killifish and American eel also well represented. It was noted that this sampling run was a slow moving, murky lowland stream and was described as great eel habitat. MassDEP staff also collected nutrient samples at this location (W1918) during the summer of 2009. The seasonal average total phosphorus concentration was elevated (0.12mg/L, maximum 0.18mg/L), ammonia nitrogen concentrations were all low ($\leq$0.05mg/L), and total nitrogen concentrations averaged 1.15mg/L. There were no observations of dense/very dense filamentous algae noted during any of the surveys (n=6).

The Aquatic Life Use of Red River is assessed as Fully Supporting based on the fish sample which was dominated by moderately tolerant species. Alerts are being identified for elevated total phosphorous and nitrogen concentrations.

Rock Harbor Creek (MA96-16)

Location:	Headwaters outlet Cedar Pond, Orleans to mouth at inlet Cape Cod Bay, Eastham/Orleans.
AU Type:	ESTUARY
AU Size:	0.03 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	4a	(Fish Passage Barrier*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting
DMF biologists identified two barriers to diadromous fish passage (target species river herring and American eel) along Rock Harbor Creek. From upstream to downstream, the Cedar Pond outlet control structure (just upstream of Rt.6 in Orleans) passage score was 5 (restricted passage) and the Rock Harbor Road culvert had a sediment/depth problem with a passage score of 2 (a minor obstruction). The Aquatic Life Use of Rock Harbor Creek will be assessed as Not Supporting based on the limitations to diadromous fish passage at the Cedar Pond Control Structure. The former Alert identified for the fish passage is being removed (updated CALM assessment guidance using fish passage scoring criteria provided by DMF biologists).

Round Cove (MA96-75)

Location:	east of Route 28, Harwich outlet to Pleasant Bay, Harwich.
AU Type:	ESTUARY
AU Size:	0.02 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO (also tributary)

Fish, other Aquatic Life and Wildlife Use: Not Supporting
No new data area available to assess the Aquatic Life Use for Round Cove. The Aquatic Life Use for Round Cove will continue to be assessed as Not Supporting with the total nitrogen impairment being carried forward based on the MEP analysis documented in the Pleasant Bay System Total Maximum Daily Loads for Total Nitrogen.

Round Pond (East) (MA96260)

Location:	Truro.
AU Type:	FRESHWATER LAKE
AU Size:	6 ACRES
Classification/Qualifier:	B: ORW

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Round Pond (East) so it is Not Assessed.

Round Pond (west) (MA96261)

Location:	Truro.
AU Type:	FRESHWATER LAKE
AU Size:	2 ACRES
Classification/Qualifier:	B: ORW

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Round Pond (West) so it is Not Assessed.

Run Pond (MA96265)

Location:	Dennis.
AU Type:	FRESHWATER LAKE
AU Size:	7 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed (Alert)
No data are available to assess the Aquatic Life Use of Run Pond, so it is Not Assessed. An Alert is being identified because the MEP technical report identified this pond as a contributor of Nitrogen to the Bass River embayment system.

Rushy Marsh Pond (MA96266)

Location:	Barnstable.
AU Type:	FRESHWATER LAKE
AU Size:	14 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Insufficient Information
According to DMF biologists, there is a culvert at the outlet of Rushy Marsh Pond that is an impediment to the passage of river herring and white perch up into the pond with a passage score of 8 (severe impediment). There is a passage improvement project in place for this location, though its expected time of completion is currently unknown. DMF biologist also note that it is uncertain how feasible the habitat is for the support of diadromous fish (the existing populations score was recorded as 0). Too limited data are available to assess the Aquatic Life Use for Rushy Marsh Pond, so it is assessed as having Insufficient Information. Since the population score is 0 an impairment is not being made for the severe impediment for diadromous fish passage.

Ryder Cove (MA96-50)

Location:	Chatham.
AU Type:	ESTUARY
AU Size:	0.19 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
MassDEP eelgrass mapping project data indicates a large decrease (72.25%) in eelgrass beds in Ryder Cove between 1995 and 2017. The Aquatic Life Use of Ryder Cove will continue to be assessed as Not Supporting based on the continuing loss of eelgrass bed habitat. The total nitrogen impairment is also being carried forward (information available in Pleasant Bay System Total Maximum Daily Load for Total Nitrogen).

Ryder Pond (MA96268)

Location:	Truro.
AU Type:	FRESHWATER LAKE
AU Size:	18 ACRES
Classification/Qualifier:	B: ORW

Fish, other Aquatic Life and Wildlife Use: Not Supporting
No recent data are available to assess the Aquatic Life Use of Ryder Pond, so it will continue to be assessed as Not Supporting with the DO and total phosphorus impairments carried forward.

Sagelot Pond (MA96-119)

Location:	west of Great Oak Road, Mashpee (segment includes tidal channels to Waquoit Bay).
AU Type:	ESTUARY
AU Size:	0.06 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO (also tributary)

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
--	4a	Nutrient/Eutrophication Biological Indicators	R1_MA_2020_08	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical report benthic samples were collected at two stations in Sagelot Pond in the fall of 2006. It was noted that the basin was a naturally nutrient and organic matter enriched salt marsh showing "stress" with high numbers of individuals and low numbers of species (10), mainly macroalgal associated crustaceans (which is atypical for salt marsh basins) with some stress indictors (*Capitella* 39% of population). It was concluded that these data were indicative of between "moderately impaired" and "significantly impaired" conditions. Frequent accumulations of drift macroalgae were noted, with moderate to high coverage accumulations of red branched macroalgae. A small moderate density bed of eelgrass was noted during benthic surveys in 2006, with a moderate-heavy epiphyte growth over the plants. Based on MassDEP eelgrass mapping program data (1995 & 2001) the MEP technical report concluded that the eelgrass coverage was indicative of "moderately impaired conditions". DO data were collected by Waquoit National Estuarine Research Reserve (WBNERR) SWMP mooring from 2002-2006 were periodically to 2-3mg/L ~5%, frequently <4mg/L 11% of record, rarely to 1mg/L, although oxygen depletions were noted to be *typical* of salt marsh basins and creeks.

The Aquatic Life Use for Sagelot Pond is assessed as Not Supporting based on the overall MEP analysis concluded that overall "Nutrient Related Habitat Health" for the Sagelot Pond AU was categorized as "Moderately Impaired" as evidence by degraded benthic habitat, loss of eelgrass, algal accumulation, and periodic low DO which is being added as the nutrient/eutrophication biological indicators impairment. Aggregated estuary watershed nitrogen loads were partitioned by the major types of nitrogen sources in order to focus development of nitrogen management alternatives. According to the MEP report MEP- Linked Watershed Embayment Approach to Determine Critical Nitrogen Loading Thresholds for the Waquoit Bay and Eel Pond Embayment System, Towns of Falmouth and Mashpee, MA the major types (sources) of nitrogen loads in descending order of percent contribution were wastewater (e.g. septic systems), fertilizers, and impervious surfaces.

Santuit Pond (MA96277)

Location:	Mashpee.
AU Type:	FRESHWATER LAKE
AU Size:	164 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	(Fish Passage Barrier*)		Added

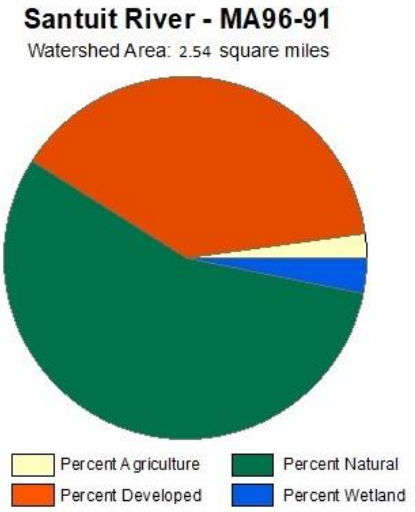
Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to DMF, the Santuit Pond Dam (located at the boundary of Santuit Pond and the Santuit River (MA96-91)) has a fishway that has recently been repaired with a passage score of 4 (restricted passage). Santuit Pond experienced five years with prolonged algal blooms during 2009-2013 (>20 days in 5 of 6 years). MassDEP staff conducted water quality monitoring at the deep hole of Santuit Pond (W0739) once in July and twice in September 2009. While DO was all above 5.0mg/L except for the single measurement of <0.2mg/L at 2.1m depth on 29 July. All othe data were indicative of nutrient enrichment as follows: DO saturation often high reaching 124% at near surface in early September, pH >8.8SU 7 of 11 measurements, depth integrated Chlorophyll a concentration in the upper 1.2 and 2.4m of the pond was very high at 50µg/L in July and September, Secchi disk depth was consistently poor (range 0.4 to 0.8m), and total phosphorus concentrations were elevated (range 0.083 to 0.13mg/L with a seasonal average of 0.10mg/L).

The Aquatic Life Use for Santuit Pond will continue to be assessed as Not Supporting. The existing impairments for Abnormal Fish Deformities, Erosions, Lesions, Tumors (DELTS), chloropyll a, harmful algal blooms, nutrient/eutrophication biological indicators, high pH, and total phosphorus will all be carried forward. A fish passage barrier impairment is being added because of the restriced passage at the Santuit Pond dam for diadromous fish.

Santuit River (MA96-91)

Location:	Headwaters, outlet Santuit Pond, Mashpee to confluence with tidal portion south of Old Mill Road/Old Kings Road, Mashpee/Barnstable.
AU Type:	RIVER
AU Size:	1.6 MILES
Classification/Qualifier:	B



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	2.54	2.53	0.88	0.88
Agriculture	2.1%	2.2%	5.6%	5.6%
Developed	38.9%	38.9%	23.7%	23.7%
Natural	55.8%	55.8%	62.9%	62.9%
Wetland	3.1%	3.1%	7.8%	7.8%
Impervious Cover	13.3%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
2	5	(Fish Passage Barrier*)		Added
2	5	Temperature		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting (Alert)

According to DMF biologists there are two structures that may affect passage of river herring and American eel from upstream to downstream including the Santuit Pond dam which has recently undergone dam repair and fishway installation projects that has a passage score of 4 (restricted passage) and a bog control sluice about a third of the way down the river that has undergone construction/improvement projects at with a passage score of 3 (minor obstruction). Since multiple age classes of brook trout were collected from the river in September 2003 this brook will be assessed as having an Existing Use of Tier 1 cold water. MassDEP staff conducted water quality monitoring at Old Mill Rd/Old Kings Rd (W1912) in 2009. The mimum DO during five-day unattended probes deploys in June, July and August was 6.77 mg/L, the maximum DO saturation was 87.4%, the maximum diel DO shift was 1.38mg/L, and the maximum temperature was 21.4°C. During the long term (104-day) thermistor deployment, the maximum temperature was 21.9°C. The 7 DADM exceeded 20°C 29 times (maximum was 21°C) and the maximum 24-hour average was 20.4°C (below the acute criterion of 23.5°C). The temperature violations were not considered natural based on three factors: 1) The proximity of the Santuit Pond dam, 2) The percentage of natural land in both the complete and proximal watershed were much less than 80% (55.8%) and the percentage of impervious cover is much more than 4% (at 13.3%), and 3) a 2015 model

designed to simulate response of stream flow to pumping and wastewater returns indicates spots of up to -50% flow (a marked decrease in flow) from predevelopment conditions, with more pronounced decrease noted in the Cranberry Bog areas (although those were downstream from the W1912 sampling location. The attended probe data minimum DO was 7.2mg/L, the maximum saturation was 84%, pH ranged from 6.0 to 6.3SU, and the maximum temperature was 20.3°C (one slight exceedance, all others <20°C). The seasonal average total phosphorus concentration (n=4) was 0.065mg/L (maximum 0.099mg/L). Total nitrogen was elevated, with a seasonal average concentration of 1.3mg/L (n=4).

The Aquatic Life Use of this Santuit River AU (MA96-91) is assessed as Not Supporting due to elevated temperature of this Tier 1 cold water and the obstruction to diadromous fish passage at the Santuit Pond dam. The former alert for diadromous fish passage concerns is being removed. While total nitrogen is not considered in the assessment of a freshwater AU, considering this flows eventually into an estuarine segment (Shoestring Bay MA96-08) that is impaired for eelgrass bed habitat loss as a result of excess nutrient loading, an Alert is being added for total nitrogen.

Santuit River (MA96-92)

Location:	From confluence with fresh water portion south of Old Mill Road, Mashpee to mouth at inlet Shoestring Bay, Mashpee/Barnstable.
AU Type:	ESTUARY
AU Size:	0.01 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of this Santuit River AU (MA96-92) so it is Not Assessed.

Saquatucket Harbor (MA96-23)

Location:	South of Route 28, Harwich outlet to Nantucket Sound, Harwich.
AU Type:	ESTUARY
AU Size:	0.02 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	4a	Nitrogen, Total	65884	Added
4a	4a	Nutrient/Eutrophication Biological Indicators	65884	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical repor benthic sampling was conducted at six locations in Saquatucket Harbor by SMAST in the summer and fall of 2004. The samples were characterized by moderate numbers of species (9-14) and very high numbers of individuals (944-1920), dominated by moderate organic enrichment indicator species (gammarid amphipods). It was concluded that Saquatucket Harbor had "moderately to significantly impaired" benthic animal habitat. Drift algae were sparse or absent and no eelgrass was found in this area. Chlorophyll a data collected by SMAST at one mooring station during the summer of 2004 were moderately high (generally 6 to 20µg/L) but frequently >20µg/L, and indicator of "significant impairment". DO data was collected by SMAST at one mooring station during the summer of 2004 were generally >4mg/L with frequent depletions to 4-3mg/L. Annual mean total nitrogen data collected by the Town of Harwich Water Quality Monitoring Program from 2001-2008 at one sample station in the Saquatucket Harbor ranged from 0.546 to 0.819mg/L with an overall mean of 0.658mg/L.

The Aquatic Life Use of Saquatucket Harbor will be assessed as Not Supporting based on the MEP analysis indicating the "Nutrient Related Habitat Health" was between Moderately and Significantly Impaired as evidenced by the degraded benthic habitat conditions, frequently elevated chlorophyll a, and low DO which is being added as the nutrient/eutrophication biological indicators impairment and total nitrogen. Aggregated estuary watershed nitrogen loads were partitioned by the major types of nitrogen sources in order to focus development of nitrogen management alternatives. According to the MEP report MEP-Linked Watershed Embayment Model to Determine Critical Nitrogen Loading Thresholds for the Allen, Wychmere, and Saquatucket Harbor Embayment Systems, Harwich, MA the major types (sources) of nitrogen loads in Saquatucket Harbor area in descending order of percent contribution were wastewater (e.g. septic systems), impervious surfaces, residential lawn and golf fertilizer and cranberry fertilizer.

Scargo Lake (MA96279)

Location:	Dennis.
AU Type:	FRESHWATER LAKE
AU Size:	54 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Insufficient Information
According to DMF biologists, despite recent culvert fixes, operation and maintenance at the outlet of Scargo Lake is still necessary due to sedimentation and a “shoaling fix” is recommended. This barrier between the lake and Sesuit Creek (MA96-130) has a passage score of 3 (minor obstruction) for river herring and American eel (Sesuit Creek). No other new data are available. Too limited data are available to assess the Aquatic Life Use of Scargo Lake to it will be assessed as having Insufficient information.

Schoolhouse Pond (MA96281)

Location:	Chatham.
AU Type:	FRESHWATER LAKE
AU Size:	20 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Schoolhouse Pond, so it is Not Assessed.

Scorton Creek (MA96-30)

Location:	Jones Lane, Sandwich to mouth at inlet Cape Cod Bay, Sandwich (includes Scorton Harbor).
AU Type:	ESTUARY
AU Size:	0.03 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Scorton Creek, so it is Not Assessed.

Seapit River (MA96-122)

Location:	From confluence of Childs River and Eel Pond, Falmouth to inlet Waquoit Bay, Falmouth.
AU Type:	ESTUARY
AU Size:	0.05 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO (Tributary)

Fish, other Aquatic Life and Wildlife Use: Fully Supporting
According to the MEP project technical report benthic sampling was conducted at one station near upper end of the Seapit River in the fall of 2006. This sampled was described as having the highest quality benthic habitat of those observed within the western sub-embayments of the Waquoit Bay system; supporting a productive community with high numbers of individuals (>1000) and species (33) with good diversity and evenness comprised of crustaceans, mollusks, and polycheates with some deep burrowers. The MEP technical report summarized total nitrogen data collected at one monitoring station (located in the middle of the AU) in the summers of 2002 through 2010 with an overall yearly mean of 0.528mg/L (range 0.460 to 0.617mg/L). The Aquatic Life Use of the Seapit River is assessed as fully supporting based on high quality benthic habitat conditions documented during the fall of 2006.

Seapuit River (MA96-64)

Location:	south of Osterville Grand Island, Barnstable to Cotuit Bay and West Bay, Barnstable.
AU Type:	ESTUARY
AU Size:	0.06 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Seapuit River, so it is Not Assessed.

Seine Pond (MA96-110)

Location:	east of Winslow Gray Road, Yarmouth.
AU Type:	ESTUARY
AU Size:	0.13 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
--	4a	Nitrogen, Total	68362	Added
--	4a	Nutrient/Eutrophication Biological Indicators	68362	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical report benthic sampling was conducted at six locations in the summer and fall of 2004 in Seine Pond. The samples had low numbers of individuals (48), low numbers of species (6); dominated by organic enrichment and stress tolerant opportunistic species indicative of "significantly impaired" and "severely degraded" benthic habitat conditions". The MEP 2004 surveys noted dense patches of drift algae (*Ulva*) with some filamentous species mostly in the lower half of the basin. There was no evidence of eelgrass bed habitat being present. Chlorophyll a data from the Town of Yarmouth Water Quality Monitoring Program (YWQMP) was collected during the summer months (2002-2008) with average ranges between 12 and 15µg/L, with frequent blooms to >40µg/L. The SMAST mooring survey (summer/fall 2004) chlorophyll a average was 26µg/L. DO data was collected as part of the YWQMP project at two sites (2003-2008) minimum of 1.9mg/L at the deep site. DO at the SMAST mooring site in the summer/fall 2004 was frequently <6mg/L (19% of deployment), infrequently ≤4mg/L 1% of deployment, with a minimum of 3.4mg/L. The YWQMP nitrogen sampling in the summers of 2002 through 2008 had overall mean in the upper and lower areas of 0.994 and 0.948mg/L. According to DMF biologists the Seine Pond Inlet (immediately upstream of the Pond), may potentially impede the passage of river herring and American eel in and out of the pond. It was noted there is a fish ladder at this site which has a passage score of 2 (minor obstruction) with notes that and sediment/tidal interactions limiting the fishway entrance.

The Aquatic Life Use of Seine Pond will be assessed as Not Supporting based on the MEP analysis indicating the "Nutrient Related Habitat Health" was significantly impaired as evidenced by the degraded benthic habitat conditions, frequently elevated chlorophyll a, and low DO which is being added as the nutrient/eutrophication biological indicators impairment and total nitrogen. Aggregated estuary watershed nitrogen loads were partitioned by the major types of nitrogen sources in order to focus development of nitrogen management alternatives. According to the MEP report Linked Watershed Embayment Approach to Determine Critical Nitrogen Loading Thresholds for the Parkers River Embayment System, Yarmouth, MA the major types (sources) of nitrogen in the Seine Pond watershed (in descending order of percent contribution) were wastewater (e.g. septic systems), fertilizers, impervious surfaces and the municipal point source discharge (WWTF).

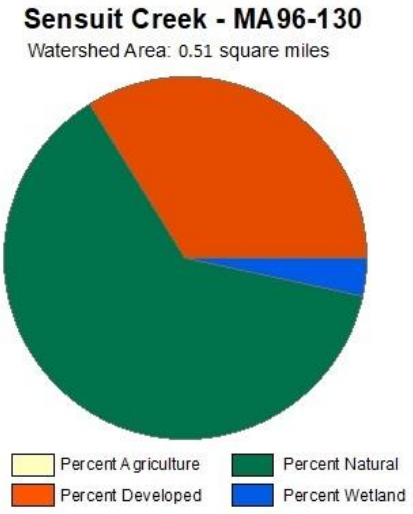
Sesuit Creek (MA96-13)

Location:	Approximately 650 feet downstream from Route 6A, Dennis to mouth at inlet Sesuit Harbor, Cape Cod Bay, Dennis.
AU Type:	ESTUARY
AU Size:	0.01 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No new data are available to assess the Aquatic Life Use of this Sesuit Creek AU (MA96-13) so it is Not Assessed.

Sesuit Creek (MA96-130)

Location:	Headwaters outlet Scargo Lake, Dennis to salt water portion approximately 650 feet downstream from Route 6A, Dennis.
AU Type:	RIVER
AU Size:	0.6 MILES
Classification/Qualifier:	B



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.51	0.51	0.18	0.18
Agriculture	0%	0%	0%	0%
Developed	33.8%	33.8%	39.8%	39.8%
Natural	62.8%	62.8%	51%	51%
Wetland	3.4%	3.4%	9.2%	9.2%
Impervious Cover	11.2%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
--	4c	(Fish Passage Barrier*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to DMF biologists, three structures along this Sesuit Creek AU (MA96-130) may interfere with diadromous fish passage of river herring and American eel. From upstream to downstream these structures are: Scargo Lake Outlet has sedimentation issues so a passage score of 3 (minor obstruction), the Paddocks Path culvert has a passage score of 1 (minor obstruction), and the Route 6A culverts (two of them) that cross under Rt. 6A are undersized and prone to clogging so has a passage score of 5 (restricted passage).

The Aquatic Life Use for this Sesuit Creek AU (MA96-130) is assessed as Not Supporting due to the fish passage barrier at the Rte. 6A culverts.

Shallow Pond (MA96285)

Location:	Barnstable.
AU Type:	FRESHWATER LAKE
AU Size:	76 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available, so the Aquatic Life Use of Shallow Pond is Not Assessed.

Shawme Lake Lower (MA96288)

Location:	Sandwich.
AU Type:	FRESHWATER LAKE
AU Size:	25 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed
According to DMF biologists, there are two structures that bracket Shawme Lake Lower that act as minor obstructions to the passage of river herring and American eel. From upstream to downstream these include the Upper Shawme Dam (NatID#MA02214) and the Grist Mill Dam. The Town repaired the Upper Shawme Dam dam and fishway at this location back in 2008/early 2009, replacing the previous earthen dam with a concrete structure and spillway. The new dam was also equipped with an aluminum fish ladder and this now has a passage score of 3 (minor obstruction) for diadromous fish. DMF staff assisted the Town with baffle repairs at the Grist Mill Dam in 2015 and the mill/dam itself was restored between 2013 and 2016. This barrier now has a passage score of 1 (minor obstruction). No other recent data available are available to assess the Aquatic Life Use of Lower Shawme Lake so it is Not Assessed.

Sheep Pond (MA96289)

Location:	Brewster.
AU Type:	FRESHWATER LAKE
AU Size:	139 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed
Since no data are available to assess the Aquatic Life Use of Sheep Pond it is Not Assessed.

Shoestring Bay (MA96-08)

Location:	Quinaquisset Avenue, Mashpee/Barnstable to Popponesset Bay (line from Ryefield Point, Barnstable to Punkhorn Point, Mashpee, including Gooseberry Island), Barnstable/Mashpee.
AU Type:	ESTUARY
AU Size:	0.31 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
No new data are available for Shoestring Bay so the Aquatic Life Use of Shoestring Bay will continue to be assessed as Not Supporting with estuarine bioassessment impairment being carried forward.

Shubael Pond (MA96293)

Location:	Barnstable.
AU Type:	FRESHWATER LAKE
AU Size:	55 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Shubael Pond, so it is Not Assessed.

Slough Pond (MA96298)

Location:	Truro.
AU Type:	FRESHWATER LAKE
AU Size:	29 ACRES
Classification/Qualifier:	B: ORW

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Slough Pond, so it is Not Assessed.

Smith Pond (MA96301)

Location:	Brewster.
AU Type:	FRESHWATER LAKE
AU Size:	11 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)
An algal bloom occurred in Smith Pond in 2010. No other data are available. Too limited data are available to assess the Aquatic Life Use of Smith Pond, so it is assessed as having Insufficient Information. An Alert is being identified because of the algal bloom in 2010.

Snake Pond (MA96302)

Location:	Sandwich.
AU Type:	FRESHWATER LAKE
AU Size:	81 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Snake Pond, so it is Not Assessed.

Snow Pond (MA96303)

Location:	Truro.
AU Type:	FRESHWATER LAKE
AU Size:	7 ACRES
Classification/Qualifier:	B: ORW

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Snow Pond, so it is Not Assessed.

Snows Creek (MA96-81)

Location:	East of Old Colony Road, Barnstable to mouth at inlet Lewis Bay, Barnstable.
AU Type:	ESTUARY
AU Size:	0.02 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No new data are available for Snows Creek, so it is Not Assessed.

Spectacle Pond (MA96306)

Location:	Wellfleet.
AU Type:	FRESHWATER LAKE
AU Size:	2 ACRES
Classification/Qualifier:	B: ORW

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of this Spectacle Pond AU (MA96306), so it is Not Assessed.

Spectacle Pond (MA96307)

Location:	Sandwich.
AU Type:	FRESHWATER LAKE
AU Size:	93 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	5	Dissolved Oxygen		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting
Water quality monitoring was conducted by MassDEP staff at the deep hole of this Spectacle Pond AU (MA96307) in Sandwich (W1310) on 30 August 2005. Oxygen depletion (i.e., <5.0mg/L) occurred at depths somewhere between 9.5 (~31') and 10.1m (~33') representing roughly 11% of the lake surface area. The other water quality data were indicative of generally good conditions (maximum temperature 25.6°C, maximum saturation 102%, pH ranged from 5.6 to 6.7SU (more acidic at depth), Sechhi disk depth 6.8m, the integrated depth chlorophyll a concentration was low (2.4µg/L), and total phosphorus 0.008 mg/L at surface and 0.013mg/L at depth). The Aquatic Life Use for this Spectacle Pond AU (MA96307) is assessed as Not Supporting because of the oxygen depletion at depth comprising just slightly more (11%) than 10% of the lake surface area.

Springhill Creek (MA96-87)

Location:	From railroad crossing northeast of Route 6A, Sandwich to mouth at confluence with Old Harbor Creek, Sandwich.
AU Type:	ESTUARY
AU Size:	0.01 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Insufficient Information
MassDEP staff conducted some minimal water quality monitoring at the railroad crossing between Great Island and Spring Hill roads, Sandwich (W2082) in Springhill Creek (MA96-87) during the summer of 2009. The maximum termperature during the long term (104-day) thermistor deployment initiated on 18 June was 25.5°C with a maximum 7-DADM of 24.3°C and 24-hour rolling maximum of 23.2°C. These data do not exceed acute or chronic temperature criteria. Too limited data are available to assess the Aquatic Life of Springhill Creek, so it is assessed as having Insufficient Information.

Stage Harbor (MA96-11)

Location:	From outlet Mill Pond, Chatham (includes Mitchell River SARIS# 9661975) to inlet of Nantucket Sound at a line from the southernmost point of Harding Beach southeast to Harding Beach Point, Chatham.
AU Type:	ESTUARY
AU Size:	0.56 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	5	Estuarine Bioassessments		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

MassDEP eelgrass mapping project data indicates a large decrease (49.33%) in eelgrass bed habitat in Stage Harbor between 1995 and 2017.

The Aquatic Life Use of Stage Harbor will be assessed as Not Supporting based on the loss of eelgrass bed habitat (estuarine bioassessment). The 2008 Stage Harbor/Oyster Pond, Sulphur Springs/Bucks Creek, Taylors Pond/Mill Creek Total Maximum Daily Load TMDL for Total Nitrogen indicated that this waterbody can best be protected by reducing excess nutrient loading, total nitrogen. The controllable local sources of total nitrogen identified in the TMDL included on-site subsurface wastewater disposal (septic) systems, and fertilizers.

Stewarts Creek (MA96-94)

Location:	Estuarine portion west of Stetson Street, Barnstable to mouth at inlet Hyannis Harbor, Barnstable.
AU Type:	ESTUARY
AU Size:	0.01 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Assessed (Alert)
No new data are available for Stewarts Creek, so the Aquatic Life Use is Not Assesssed. An Alert is being identified based on elevated total nitrogen (yearly means between 1.016 and 1.606mg/L (overall mean 1.245mg/L) compiled from the Town of Barnstable/Yarmouth Water Quality Monitoring Program (WQMP) at one monitoring station at the very bottom of the Stewarts Creek.

Stillwater Pond (MA96309)

Location:	Chatham.
AU Type:	FRESHWATER LAKE
AU Size:	18 ACRES
Classification/Qualifier:	B: ORW, WWF

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	(Fish Passage Barrier*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to DMF biologists, there are three structures that concern fish passage for this AU. Two of the structures are on the downstream Unnamed Tributary AU (MA96-129) -- this stretch of stream is very short and impacts the passage of fish from Ryder Cove up into Stillwater Pond. The target species for these structures are river herring and American eel. From upstream to downstream these structures are: the "Stillwater Pond control structure" and associated "vertical slot" fishway (project completed in 2010 and has a final operation/maintenance plan in place) has passage score of 1 (minor obstruction), "Stillwater Pond elevation change" located immediately downstream of Stillwater Pond on the Unnamed Tributary AU (MA91-129) has an unusual notched weir-pool pipe ladder and vertical slot ladder with passage score of 3 (minor obstruction) and the "Ryders Cove Culvert" at Rt. 28 has a passage score of 5 (restricted passage). DMF biologists note the culvert is undersized and will be a difficult replacement.

The Aquatic Life Use of Stillwater Pond is assessed as Not Supporting due to the diadromous fish passage barrier that restricts passage of river herring and American eel at the Rt. 28 culvert connection to Ryder Cove.

Swan Pond (MA96-111)

Location:	Dennis.
AU Type:	ESTUARY
AU Size:	0.22 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
--	4a	Nitrogen, Total	68000	Added
--	4a	Nutrient/Eutrophication Biological Indicators	68000	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical report benthic sampling was conducted at four locations in Swan Pond in the summer and fall of 2005. The samples were found to have high numbers of individuals (1333), low number of species (8) and were dominated by the stress indicator species (*Capitella*) (~50% of population). There were large blooms and accumulations of macroalgae and periodic hypoxic/anoxic levels of oxygen depletion of bottom waters. The MEP surveys conducted in summer/fall 2005 dense patches of drift algae, *Ulva*, with some filamentous species were also observed with small patches of SAV and *Ruppia* (which is common in salt marsh ponds). There was no evidence of eelgrass bed habitat. Chlorophyll a data from the Town of Dennis Water Quality Monitoring Program (DWQMP) was collected at four locations during the summer months (2005-2010) with an overall average of 29µg/L. SMAST mooring data was collected at one location during the summer of 2005 had an average of 15.3µg/L, with a bloom>100µg/L. DO data from the (DWQMP), was collected at four locations during the summer months (2005-2010) with anoxic conditions at the bottom at all sites (<0.2mg/L), and frequently low DO (central basin <2mg/L 7% of record, <4mg/L 20%). SMAST mooring data during the summer of 2005 also indicative of very low oxygen conditions (oxygen depletions frequent <4mg/L 18% of record, <3mg/L 11%, periodically <1mg/L). The (DWQMP) conducted nutrient sampling at four monitoring stations within the Swan Pond AU between 2005 and 2010. Total Yearly means of total nitrogen data collected by DWQMP ranged between 0.879 and 1.547mg/L overall means ranging from 1.036 to 1.197mg/L.

The Aquatic Life Use for Swan Pond is assessed as Not Supporting based on the overall MEP technical report which concluded that "Nutrient Related Habitat Health" for the Swan Pond AU was "Significantly impaired" and "Severely degraded" as evidenced by the degraded benthic habitat conditions, frequently elevated chlorophyll a, and low DO which is being added as the nutrient/eutrophication biological indicators impairment and total nitrogen. Aggregated estuary watershed nitrogen loads were partitioned by the major types of nitrogen sources in order to focus development of nitrogen management alternatives. Overall, within the Swan Pond watershed the major types (sources) of nitrogen loads in descending order of percent contribution were wastewater (e.g. septic systems), impervious surfaces, landfill/solid waste, and fertilizers.

Swan Pond River (MA96-14)

Location:	Headwaters, outlet Swan Pond, Dennis to mouth at inlet Nantucket Sound, Dennis.
AU Type:	ESTUARY
AU Size:	0.04 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	4a	Estuarine Bioassessments	68001	Changed
5	4a	Nitrogen, Total	68001	Added
5	4a	Nutrient/Eutrophication Biological Indicators	68001	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

DMF biologists report a potential channel limitation in the form of a "tidal mouth" at Upper County Road near the upstream end of the Swan Pond River although there is adequate river herring and American eel fish passage (passage score 0). According to the MEP project technical report benthic sampling was conducted at four locations in the summer and fall 2005. The Upper River (USPR) was found to have high numbers of individuals (729), low-moderate numbers of species (12), low numbers of stress indicator species and dominated by organic enrichment species. The Lower River (LSPR) was found to have moderate-high numbers of individuals (346) and species (25) with stress indicator species ~20% of population, community of polychaetes, crustaceans and mollusks and some deep burrowers. It was concluded that the SWPR is supporting between "moderately impaired" and "significantly impaired" benthic habitat, with a tendency towards more significant impairment in the Upper River area. Sparse amounts of macroalgae but with patches of drift algae, *Ulva*, with some filamentous species were observed. No eelgrass was documented (eelgrass bed habitat was estimated near mouth in 1951). Chlorophyll a and DO data from the Town of Dennis Water Quality Monitoring Program (DWQMP) were collected at four locations during summer months with the following results: Upper River (2002-2008) very high chlorophyll a concentrations (average 20µg/L) and lower river (2005-2010) slightly lower (average 10-15µg/L) and DO in the upper area with the extensive salt marsh was low primarily related to low oxygen ebb waters from Swan Pond (minimum <0.2mg/L, <2mg/L 4% of record, <4mg/L ~15% of record) while in the lower Swan Pond River area with fringing salt marsh, slightly better (<4mg/L 11% of record, <5mg/L 40% of record). DWQMP nutrient samples were collected at three stations between 2005 and 2010 with yearly mean total nitrogen concentration between 0.540 and 1.015mg/L with overall means from 0.556 to 0.862mg/L. The MEP technical report concluded that "Nutrient Related Habitat Health" for the SWPR was categorized as between "moderately" and "significantly impaired" with a tendency towards more significant impairment in the upper river area.

The Aquatic Life Use for the Swan Pond River is assessed as Not Supporting based on the overall MEP analysis indicating the "Nutrient Related Habitat Health" was between moderately and significantly Impaired as evidenced by the degraded benthic habitat conditions, frequently elevated chlorophyll a, and low DO which is being added as the nutrient/eutrophication biological indicators impairment and total nitrogen. The Estuarine Bioassessment impairment will be carried forward since the TMDL target is for its habitat restoration.

Aggregated estuary watershed nitrogen loads were partitioned by the major types of nitrogen sources in order to focus development of nitrogen management alternatives. According to the MEP Report Linked Watershed Embayment Approach to Determine Critical Nitrogen Loading Thresholds for the Swan River Embayment System, Town of Dennis, MA the major types (sources) of nitrogen loads in the Swan Pond River in descending order of percent contribution were wastewater (e.g. septic systems), impervious surfaces, and fertilizers.

2018/20 Delisted Impairment	Delisting Reason	Delisting Comment
Estuarine Bioassessments	TMDL approved or established by EPA (4a)	Impairment covered under TMDL: Swan Pond River Estuarine System Total Maximum Daily Load For Total Nitrogen (Report CN 393.1, approved 6/26/2017, ATTAINS Action ID: 68001)

Taylors Pond (MA96-42)

Location:	Chatham.
AU Type:	ESTUARY
AU Size:	0.02 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
No new data are available for Taylors Pond so the Aquatic Life Use of Taylors Pond (MA96-42) will continue to be assessed as Not Supporting with the total nitrogen impairment being carried forward. The 2008 Stage Harbor/Oyster Pond, Sulphur Springs/Bucks Creek, Taylors Pond/Mill Creek Total Maximum Daily Load TMDL for Total Nitrogen indicated that this waterbody can best be protected by reducing excess nutrient loading, total nitrogen. The controllable local sources of total nitrogen identified in the TMDL included discharges from municipal separate storm sewer systems (MS4), on-site subsurface wastewater disposal (septic) systems, agriculture, and stormwater.

The River (MA96-76)

Location:	The water landward of an imaginary line drawn between Old Field Point and Namequoit Point including Meetinghouse Pond, and Kescayo Gansett Pond (locally known as "Lonnies Pond"), Orleans (excluding the delineated segments; Namequoit River and Areys Pond).
AU Type:	ESTUARY
AU Size:	0.41 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	4a	Estuarine Bioassessments	33787, 33788, 33790, 33789	Removed

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the last Cape Cod 2004 – 2008 water quality assessment report there was a significant decrease in eelgrass bed habitat between 1951 and 2006 (based on eelgrass mapping project data) in The River so it was assessed as impaired based on this loss. The 1951 eelgrass mapping data are no longer used in the evaluation as described in the 2018 CALM. The most recent MassDEP eelgrass mapping project data indicates an increase in eelgrass bed coverage between 1995 (35.2 acres) and 2017 (37.1 acres) in The River AU. The 2006 Pleasant Bay MEP technical report concluded that overall "Nutrient Related Habitat Health" for the AU was "Moderately Impaired", based primarily on the sporadic low DO events (periodically 4-5mg/L), moderately impaired macroalgae/chlorophyll a and data indicative of significantly impaired infaunal animal habitat. These impairments of this waterbody can best be mitigated by reducing excess nutrient loading, total nitrogen.
The Aquatic Life Use of The River (MA96-76) will continue to be assessed as Not Supporting based on the overall MEP analysis conclusions and the Nitrogen impairment will be carried forward. The Estuarine Bioassessment is being delisted (see additional information in removal comment). Controllable local sources of total nitrogen according to the Pleasant Bay System Total Maximum Daily Loads for Total Nitrogen includedon-site subsurface wastewater disposal (septic) systems, stormwater runoff, and fertilizers.

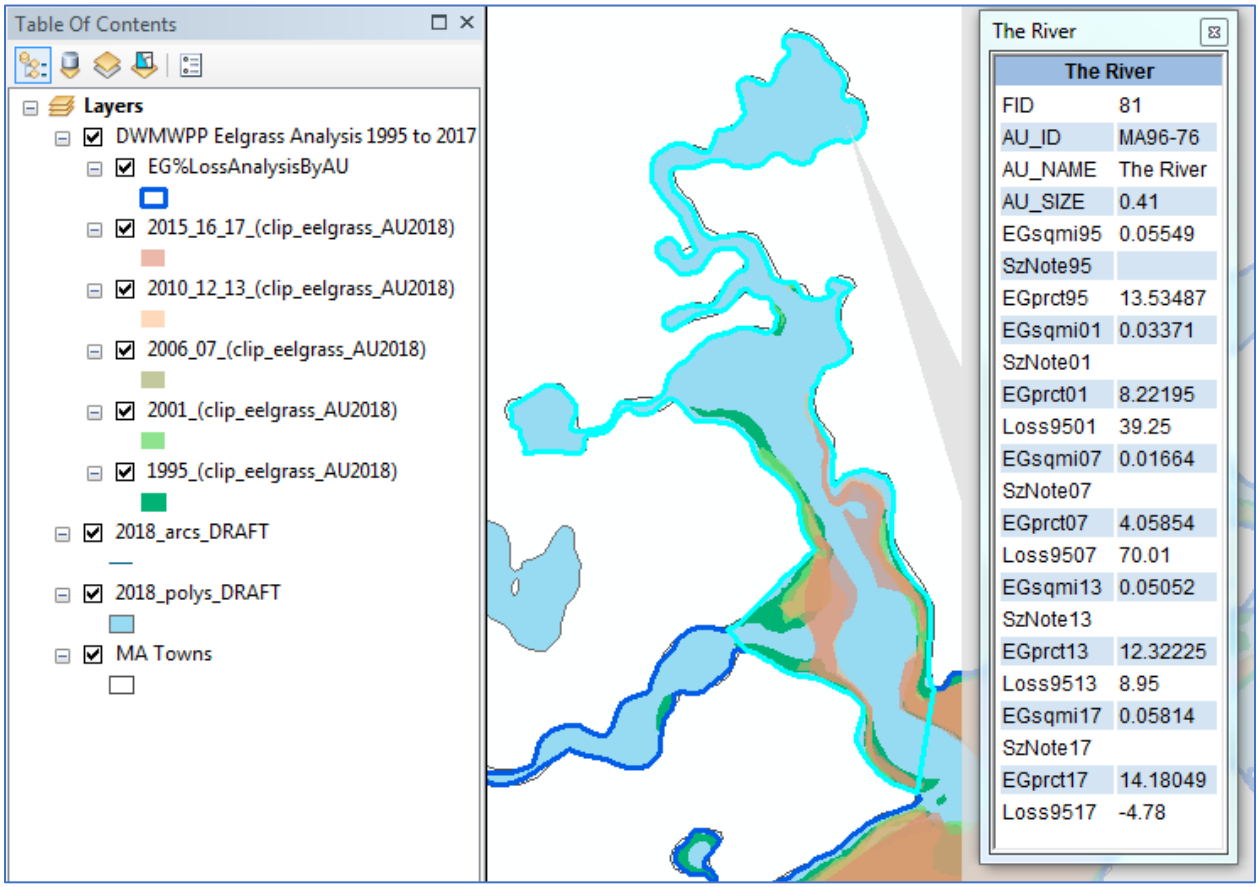
2018/20 Delisted Impairment	Delisting Reason	Delisting Comment
Estuarine Bioassessments	Applicable WQS attained, according to new assessment method	According to the methods described in the 2018 CALM guidance manual eelgrass bed habitat areas mapped in 1995 were compared with the most recent datalayer (2017). This analysis indicates an increase in eelgrass bed coverage between 1995 (35.5 acres) and 2017 (37.1 acres) with gains noted since 2007. Since there has been an increase in eelgrass bed habitat in The River AU (MA96-76) the estuarine bioassessment impairment is being delisted.

Supporting Information for Delisted Impairments

Estuarine Bioassessments

The 2012 CALM guidance manual utilized estimated eelgrass bed habitat data from the 1951 aerial photograph dataset which was only anecdotally validated. The 2018 CALM guidance manual describes the change in the eelgrass bed habitat evaluation which compares data collected as part of the Eelgrass Mapping Project utiling data collected with standardized eelgrass mapping protocols. The comparisons were made based on the data collected as part of the project comparing areas mapped in 1995 with the most recent datalayer (2017). In The River AU, eelgrass area was 0.05549mi^2 in 1995 and 0.05814mi^2 in 2017 an increase of 4.78% (MassGIS 2018, MassDEP 2020):. Based on this gain in eelgrass bed habitat area, the estuarine bioassessment impairment is being removed.

Eelgrass analysis 1995-2017 for The River MA96-76 (MassGIS 2018, MassDEP 2020):



Town Cove (MA96-68)

Location:	Entire cove, Orleans/Eastham (including Rachael Cove and Woods Cove, Orleans) outlet to Nauset Harbor, Orleans (area within Cape Cod National Seashore designated as ORW).
AU Type:	ESTUARY
AU Size:	0.79 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO ('ORW' applies only to portion in Cape Cod National Seashore)

Fish, other Aquatic Life and Wildlife Use: Not Supporting
There has been a complete loss of eelgrass bed habitat in Town Cove (0.001mi^2 in 2001) and none since (note estimated eelgrass bed habitat present in 1951 was 0.103mi^2). The Aquatic Life Use of Town Cove will continue to be assessed as Not Supporting based on the loss of eelgrass bed habitat (estuarine bioassessment).

Uncle Harvey Pond (MA96319)

Location:	Orleans.
AU Type:	FRESHWATER LAKE
AU Size:	6 ACRES
Classification/Qualifier:	B

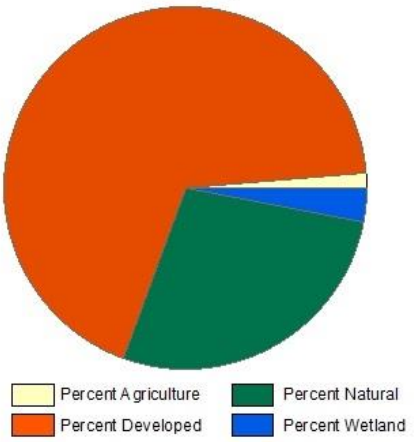
Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)
One prolonged algal bloom occurred in Uncle Harvey Pond in 2013. Based on the guidance outlined in the 2018 CALM manual an Alert will be issued for Uncle Harvey Pond as a result of harmful algal blooms; there are not enough prolonged blooms to warrant an impairment listing. Too limited data are available so the Aquatic Life Use of Uncle Harvey Pond will be assessed as having Insufficient Information. An Alert is being identified because of the algal bloom.

Unnamed Tributary (MA96-100)

Location:	Unnamed tributary to Halls Creek, Barnstable from headwaters south of the intersection of Old Craigville and Old Town roads, Barnstable to confluence with tidal portion just south of Craigville Beach Road, Barnstable.
AU Type:	RIVER
AU Size:	0.5 MILES
Classification/Qualifier:	B

Unnamed Tributary - MA96-100

Watershed Area: 0.46 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.46	0.46	0.07	0.07
Agriculture	1.3%	1.3%	0%	0%
Developed	68.1%	68.1%	32.1%	32.1%
Natural	27.6%	27.6%	49.4%	49.4%
Wetland	3%	3%	18.4%	18.4%
Impervious Cover	27%			

Fish, other Aquatic Life and Wildlife Use: Insufficient Information

MassDEP staff conducted nutrient sampling in this Unnamed Tributary AU (MA96-100) at Craigville Beach Road in Barnstable (W1914) during the summer of 2009. The seasonal average total phosphorus concentration was low (0.018mg/L, maximum of 0.03mg/L). There were no observations of dense/very dense filamentous aglae either.

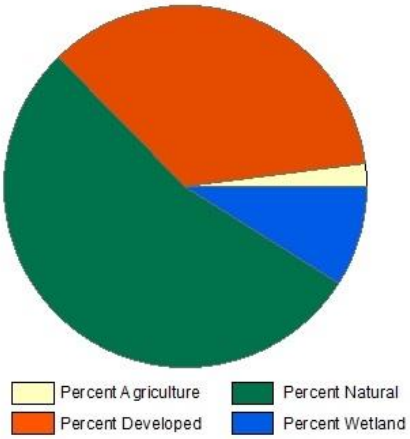
Too limited data are available to assess the Aquatic Life Use for this Unnamed Tributary AU (MA96-100) so is is assessed as having Insufficient Information.

Unnamed Tributary (MA96-104)

Location:	Unnamed tributary to Freemans Pond, Brewster from outlet of channelized wetland south of Lower Road, Brewster to mouth at inlet Freemans Pond, Brewster.
AU Type:	RIVER
AU Size:	0.6 MILES
Classification/Qualifier:	B

Unnamed Tributary - MA96-104

Watershed Area: 1.91 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	1.91	1.91	0.86	0.86
Agriculture	2%	2%	2.2%	2.2%
Developed	35.3%	35.3%	28.7%	28.7%
Natural	53.7%	53.7%	53.3%	53.3%
Wetland	8.9%	8.9%	15.7%	15.7%
Impervious Cover	12.4%			

Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)

Nutrient samples were collected in this Unnamed Tributary (MA96-104) at Lower Road in Brewster (W1921) on five occasions during the 2009 sampling season (May-September). The seasonal average total phosphorus concentration was 0.1mg/L (maximum 0.13mg/L) which is higher than EPA's recommended "Gold Book" concentration for rivers entering a lake (0.05mg/L). The ammonia-nitrogen concentrations were all $\leq$0.12mg/L, and total nitrogen concentrations ranged from 0.6 to 1.0mg/L. There were no observations of any dense/very dense filamentous algae noted during any of the site visits.

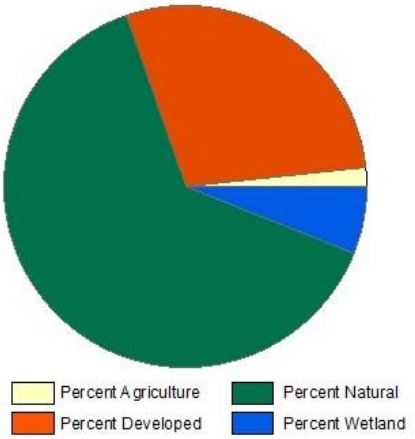
Too limited data are available to assess are available to assess the Aquatic Life Use of this Unnamed Tributary AU (MA96-104). This Unnamed Tributary will be identified with an Alert Status, however, because of the elevated total phosphorus concentration.

Unnamed Tributary (MA96-105)

Location:	Unnamed tributary to Herring River, headwaters outlet Walkers Pond, Harwich to outlet channelized wetland south of Great Western Road, Harwich.
AU Type:	RIVER
AU Size:	3.3 MILES
Classification/Qualifier:	B

Unnamed Tributary - MA96-105

Watershed Area: 4.23 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	4.23	3.18	1.43	1.25
Agriculture	1.7%	2.3%	2.7%	3.1%
Developed	28.6%	31.7%	16.8%	19.2%
Natural	63.7%	58.6%	65.4%	61.4%
Wetland	6%	7.4%	15%	16.3%
Impervious Cover	12.4%			

Fish, other Aquatic Life and Wildlife Use: Insufficient Information

Water quality monitoring was conducted by MassDEP staff at one site along this Unnamed Tributary AU (MA96-105) at Great Western Road in Harwich (W1919) during the summer of 2009. The seasonal average total phosphorus concentration was 0.07mg/L with a maximum of 0.11mg/L. Ammonia nitrogen concentrations were also very low (≤ 0.06mg/L) and total nitrogen ranged from 0.57 to 0.73mg/L. There were no observations of dense/very dense filamentous algae noted during any of the site visits.

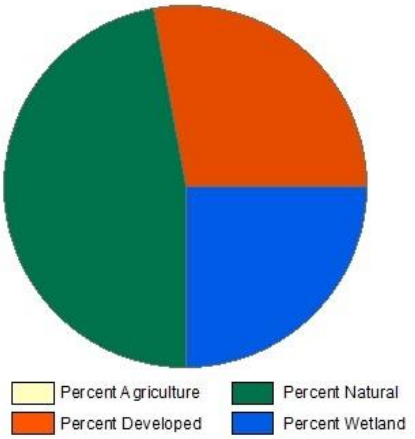
Too limited water quality data are available to assess the Aquatic Life Use of this Unnamed Tributary AU (MA96-105), so it is assessed as having Insufficient Information.

Unnamed Tributary (MA96-108)

Location:	Unnamed tributary to Herring River, headwaters outlet Perch Pond, Wellfleet to mouth at confluence with Herring River, Wellfleet (area within Cape Cod National Seashore designated as ORW).
AU Type:	RIVER
AU Size:	2 MILES
Classification/Qualifier:	B: ORW ('ORW' applies only to portion in Cape Cod National Seashore)

Unnamed Tributary - MA96-108

Watershed Area: 1.98 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	1.98	1.98	1.02	1.02
Agriculture	0%	0%	0%	0%
Developed	27.8%	27.8%	17.1%	17.1%
Natural	47.3%	47.3%	36.4%	36.4%
Wetland	24.9%	24.9%	46.4%	46.4%
Impervious Cover	13.6%			

Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)

MassDEP staff conducted limited water quality monitoring on this Unnamed Tributary AU (MA96-108) at Pole Dike Rd (W1917) during the summer of 2009. No physico-chemical data were collected. There were no observations of any dense/very dense filamentous algae noted during any of the surveys. The seasonal average total phosphorus concentration was elevated at 0.29mg/L (maximum 0.76mg/L. There were no acute or chronic ammonia criteria exceedances. The seasonal average total nitrogen was 2.15mg/L Except for copper which slightly exceeded the acute (1.12TU) and chronic (1.52TU) criteria during one and one chronic lead exceedance (1.73TU), no other metals being evaluated exceeded their criteria (n=three sampling events).

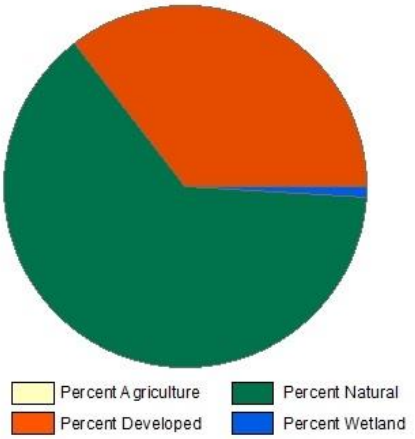
Too limited data are available to assess the Aquatic Life Use for this Unnamed Tributary AU (MA96-108) so it is assessed as having Insufficient Information. An Alert is being identified for elevated total phosphorus.

Unnamed Tributary (MA96-128)

Location:	Unnamed tributary to Long Pond, headwaters outlet Wequaquet Lake at dam (NATID# MA02391), Barnstable to mouth at inlet Long Pond, Barnstable.
AU Type:	RIVER
AU Size:	0.3 MILES
Classification/Qualifier:	B

Unnamed Tributary - MA96-128

Watershed Area: 4.29 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	4.29	4.29	1.04	1.04
Agriculture	0.5%	0.5%	1.3%	1.3%
Developed	35.3%	35.3%	43.1%	43.1%
Natural	63.2%	63.2%	52.1%	52.1%
Wetland	1%	1%	3.4%	3.4%
Impervious Cover	12.1%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
--	4c	(Fish Passage Barrier*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to DMF biologists the outlet control structure at the Wequaquet Lake Dam (NatID# MA02391), has a passage score of 6 (restricted passage) for river herring and American eel.

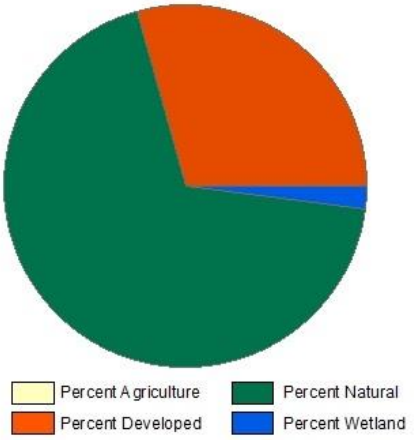
The Aquatic Life Use for this Unnamed Tributary (MA96-128) is assessed as “Not Supporting” due to the limitations for diadromous fish passage of river herring and American eel at the Wequaquet Lake Dam.

Unnamed Tributary (MA96-129)

Location:	Unnamed tributary to Ryder Cove, headwaters outlet Stillwater Pond, Chatham to mouth at inlet Ryder Cove, Chatham.
AU Type:	RIVER
AU Size:	0.2 MILES
Classification/Qualifier:	B

Unnamed Tributary - MA96-129

Watershed Area: 0.16 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.16	0.16	0.10	0.10
Agriculture	0%	0%	0%	0%
Developed	29.3%	29.3%	25.6%	25.6%
Natural	68.7%	68.7%	71.6%	71.6%
Wetland	2%	2%	2.9%	2.9%
Impervious Cover	9.7%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
--	4c	(Fish Passage Barrier*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to DMF biologists this Unnamed Tributary (MA96-129) is a short stretch of stream and there are three barriers for diadromous fish passage from Ryder Cove up into Stillwater Pond. The target species for these structures are river herring and American eel. From upstream to downstream these structures are: the "Stillwater Pond control structure" and associated "vertical slot" fishway (project completed in 2010 and has a final operation/maintenance plan in place) has passage score of 1 (minor obstruction), "Stillwater Pond elevation change" located immediately downstream of Stillwater Pond on the Unnamed Tributary AU (MA91-129) has an unusual notched weir-pool pipe ladder and vertical slot ladder with passage score of 3 (minor obstruction) and the "Ryders Cove Culvert" at Rt. 28 has a passage score of 5 (restricted passage). DMF biologists note the culvert is undersized and will be a difficult replacement.

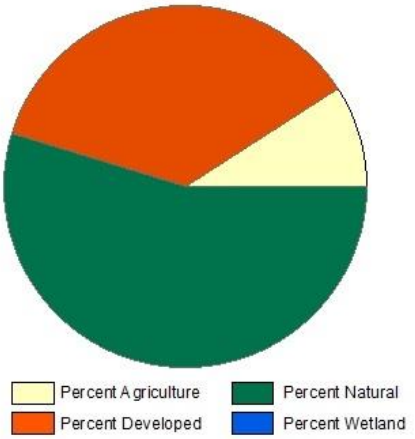
The Aquatic Life Use of this Unnamed Tributary (MA96-129) is assessed as Not Supporting due to the diadromous fish passage barrier that restricts passage of river herring and American eel at the Rt. 28 culvert connection to Ryder Cove.

Unnamed Tributary (MA96-131)

Location:	Unnamed tributary to Coonamessett River, headwaters outlet Flax Pond, Falmouth to mouth at confluence with Coonamessett River, Falmouth.
AU Type:	RIVER
AU Size:	0.3 MILES
Classification/Qualifier:	B

Unnamed Tributary - MA96-131

Watershed Area: 0.21 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.21	0.21	0.11	0.11
Agriculture	9.1%	9.1%	16.7%	16.7%
Developed	36.2%	36.2%	27.4%	27.4%
Natural	54.7%	54.7%	55.9%	55.9%
Wetland	0%	0%	0%	0%
Impervious Cover	16.2%			

Fish, other Aquatic Life and Wildlife Use: Insufficient Information

According to DMF biologists there are two structures along this Unnamed Tributary (MA96-131) that have minor impact to the passage of river herring and American eel from upstream to downstream including the control culvert with a single stream baffle at the outlet of Flax Pond which has flow and maintenance limitations which has a passage score of 3 (minor obstruction) and the John Parker Road culvert (and blog flume) passage score of 3 (minor obstruction).

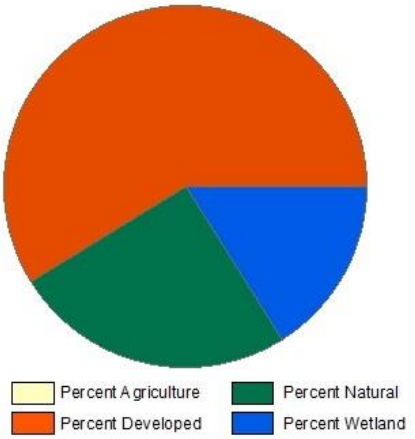
Too limited data are available to assess the Aquatic Life Use of this Unnamed Tributary (MA96-131) so it is assessed as having Insufficient Information.

Unnamed Tributary (MA96-132)

Location:	Unnamed tributary to unnamed tributary to Centerville River, headwaters outlet Lake Elizabeth, Barnstable to saltwater portion approximately 125 feet upstream from Prospect Avenue, Barnstable.
AU Type:	RIVER
AU Size:	0.2 MILES
Classification/Qualifier:	B

Unnamed Tributary - MA96-132

Watershed Area: 0.28 square miles



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.28	0.28	0.14	0.14
Agriculture	0%	0%	0%	0%
Developed	58.8%	58.8%	45.1%	45.1%
Natural	25.2%	25.2%	35.6%	35.6%
Wetland	16%	16%	19.3%	19.3%
Impervious Cover	21.4%			

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
--	4c	(Fish Passage Barrier*)		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to DMF biologists there are two structures that are potential barriers to diadromous fish passage along this Unnamed Tributary AU (MA96-132). From upstream to downstream, the Lake Elizabeth Dam (off Lake Elizabeth Drive in Barnstable) located at the outflow from Lake Elizabeth, has an "unorthodox" fish ladder that was installed at the dam in 2007 and has a passage score of 8 (severe impediment) and further downstream near Lake Elizabeth Drive, where the culvert is undersized and the channel is choked with phragmites with a passage score of 5 (restricted passage) at both sites for river herring.

The Aquatic Life Use is assessed as Not Supporting for this Unnamed Tributary AU (MA96-132) because of the two barriers for diadromous fish (river herring) passage.

Unnamed Tributary (MA96-97)

Location:	Unnamed tributary to Hyannis Inner Harbor (referred to in TMDL as Inner Harbor Creek), from salt water portion north of Park Avenue, Yarmouth to mouth at inlet Hyannis Inner Harbor, Yarmouth.
AU Type:	ESTUARY
AU Size:	0.001 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
No new data are available for this Unnamed Tributary (MA96-97), so the Aquatic Life Use will continue to be assessed as Not Supporting with the impairment for Total Nitrogen carried forward.

Upper Mill Pond (MA96324)

Location:	Brewster.
AU Type:	FRESHWATER LAKE
AU Size:	249 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Fully Supporting (Alert)
MassDEP staff conducted water quality montoring at the deep hole in Upper Mill Pond (W0747) during the summer of 2009. Three depth profiles were measured once in June and twice in September. DO ranged from 7.9 to 9.8mg/L except for at the maximum depth (7.5m) on 3 September (<0.2mg/L). The maximum saturation was 106%, pH ranged from 6.2-7.2SU, and the maximum temperature was 23.3°C. and the secchi disk depth was good for all three months ranging 1.9-2.0m. The integrated depth chlorophyll a concentration measured in early September was 15.4µg/L. The seasonal average total phosphorus concentration was 0.026mg/L at the surface and slightly higher at depth (0.039mg/L near bottom both slightly higher than EPA's Gold Book criterion of 0.025mg/L for lakes). The Aquatic Life Use of Upper Mill Pond is assessed as Fully Supporting. The use is identified with an Alert status due to slightly elevated seasonal average total phosphorus concentrations at the surface and at depth.

Upper Shawme Lake (MA96326)

Location:	Sandwich.
AU Type:	FRESHWATER LAKE
AU Size:	21 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed
DMF reports that there is one control structure at the outlet of Upper Shawme Lake known as the "Upper Shawme Dam" (NatID#MA02214). The Town repaired the dam and fishway at this location back in 2008/early 2009, replacing the previous earthen dam with a concrete structure and spillway. The new dam was also equipped with an aluminum fish ladder. Once the work was complete the dam was assigned a passage score of 3 (minor obstruction) for the river herring and American eel. There are no other data available to assess the Aquatic Life Use of Upper Shawme Lake, so it is Not Assessed.

Village Pond (MA96329)

Location:	Truro.
AU Type:	FRESHWATER LAKE
AU Size:	2 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of Village Pond, so it is Not Assessed.

Wakeby Pond (MA96346)

Location:	Mashpee/Sandwich.
AU Type:	FRESHWATER LAKE
AU Size:	353 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Insufficient Information (Alert)

An alert was identified due to anadromous fish passage issues of concern noted by DMF biologists (vandalization of the Mashpee Pond outlet control structure to adjust pond levels for self-serving purposes). According to DMF biologists, the existing fishway at the Mashpee pond outlet/dam (NatID# MA01039) has a passage score of 1 (minor obstruction) to the movement of river herring and American eel up into Mashpee/Wakeby ponds. Since no mention was made of the vandalism issue it is assumed this no longer problematic. Additionally, there was an alert identified because of concern for chlorinated solvents originating from the J. Braden Thompson groundwater contamination plume from the former Crocker Junkyard in Sandwich to discharge to the Pickerel Cove area of Wakeby Pond. The Former Crocker Junkyard is not on the EPA National priorities list, but according to EPA there is a State lead cleanup ongoing. In 2002 operation of a "groundwater treatment system" began. Six surface water samples were collected from Pickerel Cove every year from the early 1990s to 2016 and target CVOC's were not detected in any of the samples over the years after 2002. It was indicated that operation of the groundwater treatment system had a positive effect on surface water quality in the pond. Based on a thorough review of historical sampling results conducted in 2016, the MassDEP reduced the monitoring program by eliminating some of the monitoring wells that are sampled and eliminating all surface water sampling. The alert associated with the chlorinated solvents concern should be removed.
Although Wakeby and Mashpee ponds are listed as separate waterbodies, the two are hydrologically connected. According to the DCR database of non-native species, there is a 2007 report of an infestation of *Corbicula fluminea* in Mashpee Pond but confirmation of the presence of live organisms is needed. Considering the hydrological connectivity of the two ponds, this potential infestation is also being identified as an alert for Wakeby Pond.
Too limited data are available to assess the Aquatic Life Use for Wakeby Pond, so it is assessed as having Insufficient Informaiton. An alert is being identified because of a potential infestation of Asian Clam. The former alerts for fish passage issues and chlorinated solvents from the contaminated groundwater plume are being removed.

Walkers Pond (MA96331)

Location:	Brewster.
AU Type:	FRESHWATER LAKE
AU Size:	100 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	Nutrient/Eutrophication Biological Indicators		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

Water quality monitoring was conducted by MassDEP staff at the deep hole in Walkers Pond (W0746) in the summer of 2009. Three depth profiles were taken once in June and twice in September and the oxygen concentrations were good at all depths (DO minimum 8.3 mg/L) with no indication of supersaturation, though concentrations were slightly elevated at times (range 89-121%). pH was elevated outside of the natural background range in September (ranging 8.0-8.9SU in early September and 8.1-9.1SU in late September) and the secchi disk depth often did not meet criteria ranging 0.8-1.4m. The depth integrated chlorophyll a concentrations were very high in both June and September (20.8 and 33.0µg/L). The seasonal average total phosphorus concentration was elevated 0.062mg/L at the surface and was 0.0675mg/L at depth (near bottom) both higher than EPA's Gold Book criterion of 0.025mg/L for lakes. Direct observations of turbid waters were made during all three surveys and a dense algal bloom was noted by MassDEP staff in June 2009. DPH reported prolonged algal blooms in Walker Pond in 2009 and 2012.

The Aquatic Life Use of Walkers Pond will continue to be assessed as Not Supporting with the algae, total phosphorus and turbidity impairments being carried forward. Nutrient Eutrophication Biological Indicators is being added as an impairment based on the elevated chlorophyll a and pH, and low Secchi data, all indicative of enriched conditions as well as worsening conditions since the summer of 2004 surveys.

Waquoit Bay (MA96-21)

Location:	From mouths of Seapit River, Quashnet River (also known as Moonakis River), Falmouth and Great River, Mashpee to inlet of Vineyard Sound, Falmouth/Mashpee.
AU Type:	ESTUARY
AU Size:	1.43 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	4a	Dissolved Oxygen	R1_MA_2020_08	Changed
5	4a	Estuarine Bioassessments	R1_MA_2020_08	Changed
5	4a	Nitrogen, Total	R1_MA_2020_08	Added
5	4a	Nutrient/Eutrophication Biological Indicators	R1_MA_2020_08	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical report benthic sampling was conducted at 11 stations in Waquoit Bay in the fall of 2006. The northern area was characterized by high numbers of individuals, moderate number of species (15), low numbers of stress indicator species, amphipod mats-transitional community organic enrichment species and the southern area was characterized by moderate-high number of individuals, low to moderate species (13), dominated by crustaceans, some patches of amphipod mats, community associated with drift algal accumulations, dominated by organic enrichment species. It was concluded that these data were indicative of between "moderately" and "significantly impaired" benthic animal habitat. Sparse ubiquitous *Gracillaria* with *Codium* were present in the uppermost region with dense accumulations of *Cladophora* and a variety of branched and filamentous forms in the southern area and eelgrass was absent. Chlorophyll a concentrations from the Town of Mashpee Water Quality Monitoring Program (MWQMP) collected between June and September (2000-2010) in the northern area averaged 6.3µg/L and at the southern lower basin 4.5µg/L. SMAST mooring data was collected during the summer of 2007 with average chlorophyll measurements in the northen area 15.3µg/L, frequently (18%) >20µg/L of 22day record and in the southern area mid-basin average 6.8µg/L, generally 5-10µg/L (89%) of 22day record with slightly lower levels in the lower basin (mean 5.4µg/L, <10µg/L 98% of 42 day record, rarely >10µg/L). DO data from MWQMP in the northern area was <4mg/L 5% of 34 dates and in the southern area mid-basin was <4mg/L 5% of 34 dates while in the lower basin was >5mg/L, and >6mg/L 72% on 34 dates. Time series DO records were obtained in summer 2005 and SMAST mooring data was collected during the summer of 2007 with the following results: northern area generally >5mg/L 95% of record, southern mid-basin <5mg/L 24%, <3mg/L 11% and <3mg/L 5% of record and in lower-basin was <5mg/L 15%, <4mg/L 3% of record. Yearly mean total nitrogen collected at two monitoring stations (summers 2005 through 2010) ranged from 0.421 to 0.588mg/L (overall mean 0.469mg/L) in the upper bay and ranged from 0.357 to 0.496mg/L (overall mean 0.392mg/L) in the lower bay.

The Aquatic Life Use for Waquoit Bay will continue to be assessed as Not Supporting with the dissolved oxygen and estuaring bioassessment impairments being carried forward. Based on the evidence of benthic habitat degradation, macroalgal accumulations, elevated chlorophyll a in the MEP technicial report impairments for nutrient/eutrophication biological indicators and total nitrogen are being added. Aggregated estuary watershed nitrogen loads were partitioned by the major types of nitrogen sources in order to focus development of nitrogen management alternatives. According to the MEP Linked Watershed Embayment Approach to Determine Critical Nitrogen Loading Thresholds for the Waquoit Bay and eel Pond Embayment System, Towns of Falmouth and Mashpee, MA within the Waquoit Bay watershed the major types (sources) of

nitrogen loads in descending order of percent contribution were wastewater (e.g. septic systems), impervious surfaces and fertilizers.

2018/20 Delisted Impairment	Delisting Reason	Delisting Comment
Dissolved Oxygen	TMDL approved or established by EPA (4a)	Impairment covered under TMDL: Waquoit Bay System; including Eel Pond, Quashnet River, Hamblin Pond, and Jehu River Total Maximum Daily Loads for Total Nitrogen (Report CN 378.1, approved 6/18/2020, ATTAINS Action ID: R1_MA_2020_08)
Estuarine Bioassessments	TMDL approved or established by EPA (4a)	Impairment covered under TMDL: Waquoit Bay System; including Eel Pond, Quashnet River, Hamblin Pond, and Jehu River Total Maximum Daily Loads for Total Nitrogen (Report CN 378.1, approved 6/18/2020, ATTAINS Action ID: R1_MA_2020_08)

Weir Creek (MA96-116)

Location:	Headwaters, outlet Mill Pond, Yarmouth to mouth at confluence with Muddy Creek, Yarmouth.
AU Type:	ESTUARY
AU Size:	0.02 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
--	4a	Nitrogen, Total	68003	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP Linked Watershed- Embayment Model to Determine Critical Nutrient Loading Thresholds for the Bass River Embayment System, Towns of Yarmouth and Dennis, MA Technical Report a gage was installed in the Weir Creek at North Dennis Road in Dennis. At this location MEP scientists made flow measurements to estimate nutrient load in the Bass River System. The gage operated for 16 months between October 2003 and October 2004. The average total nitrogen concentration estimated at this location was 1.041mg/L. The MEP project technical report and TMDL indicated that the creek was impaired (extrapolation of conditions in the up and downstream AUs Mill Pond (MA96-117) and Follins Pond (MA96-114), repectively) as a result of nitrogen impairment.

The Aquatic Life Use for Weir Creek is assessed as Not Supporting based on the results of the MEP project identifying total nitrogen impairment.

Wellfleet Harbor (MA96-34)

Location:	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 (area within Cape Cod National Seashore designated as ORW).
AU Type:	ESTUARY
AU Size:	9.16 SQUARE MILES
Classification/Qualifier:	SA: ORW, SFO ('ORW' applies only to portion in Cape Cod National Seashore)

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
2	5	Nitrogen, Total		Added
2	5	Nutrient/Eutrophication Biological Indicators		Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP Technical Report data on benthic infaunal communities was collected at sixteen stations in Wellfleet Harbor in the summer/fall 2004 with the following results: in the low velocity areas of main basin there were moderate-high numbers of species (15-20) and individuals (123-1079 per grab), in the lower basin near inlet/upper main basin there were low-moderate numbers of individuals (83) and species (9), and in the Cove area there were moderate numbers of species (9), high numbers of individuals (164) dominated by amphipods (*Ampelisca abdita*, a transitional species comprising >80% of the community). Sediments in the upper main basin were noted to be characterized by consolidated sands and muds with a visible oxidized surface layer and in the lower main basin by physically disturbed unstable swept medium-coarse sands. It was concluded that benthic habitat was between "healthy" and "moderately impaired" in the main basin but "moderately impaired" in the shallow eastern sub-basin of the harbor known locally as "The Cove" (or Chipman's Cove). A general absence of macroalgal accumulations were present during the summer of 2004. It was also concluded that based on historical data and MEP surveys, there was little evidence of eelgrass present in Wellfleet Harbor. Chlorophyll a data from the Town of Wellfleet Water Quality Monitoring Program (WQMP) was collected between June and September (2005-2011) with the following results: upper main basin overall average of 6-7µg/L; lower main basin 6µg/L; the Cove area ~7µg/L. SMAST mooring data was collected during the summer of 2004 with the following results: upper main basin was <10µg/L 99%, >5µg/L 13-42% of record averaging 3.5-5µg/L over deployment; the Cove area average was 11µg/L with blooms typically 15-20µg/L. It was concluded overall that chlorophyll a in the main basin of Wellfleet Harbor was indicative of "healthy habitat conditions" and in the Cove was indicative of "moderately impaired conditions". DO data were collected by WQMP at seven stations June-September (2005-2011) with the following results: mid-upper basin generally >5mg/L 97% of samples; lower basin >5mg/L 98%; the Cove area <4mg/L only >6mg/L 26%. SMAST mooring data was collected at three stations during the summer of 2004: with the following results: mid-upper basin >5mg/L 90% of record; lower basin >6mg/L 87%; Cove >6mg/L 47%, <5mg/L 10%, periodic declines to <4mg/L. DO in main Wellfleet Harbor basin was indicative of "healthy habitat conditions", but was "moderately to significantly impaired" in the Cove area. Total nitrogen data collected at seven sites in summers between 2003 and 2011 overall means ranged from 0.511-0.762mg/L.

The Aquatic Life Use of Wellfleet Harbor is assessed as Not Supporting based primarily on the overall MEP analysis indicating moderately impaired nutrient related habitat health conditions in the Cove area and the healthy/moderately impaired conditions in the upper main basin of the harbor. **Given the evidence of benthic habitat degradation, elevated chlorophyll a, and low DO in the Cove area of the harbor an impairment for nutrient/eutrophication biological indicators is being added as well as total nitrogen.** It should be noted however that the lower main baisn area has healthy habitat conditions. Aggregated estuary watershed nitrogen loads were partitioned by the major types of nitrogen sources in order to focus development of nitrogen

management alternatives. Overall within the Wellfleet Harbor Watershed the major types (sources) of nitrogen loads in descending order of percent contribution are; wastewater (e.g. septic systems), impervious surfaces and fertilizers.

Wequaquet Lake (MA96333)

Location:	Barnstable.
AU Type:	FRESHWATER LAKE
AU Size:	577 ACRES
Classification/Qualifier:	B

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
4a	4a	(Fanwort*)		Added
4a	4a	(Fish Passage Barrier*)		Added
4a	4a	(Non-Native Aquatic Plants*)		Removed

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to DMF biologists there is a control structure at the Wequaquet Lake Dam (NatID# MA02391), which has a passage score of 6 (restricted passage) for river herring and American eel between the unnamed tributary AU (MA96-128), and the Lake. The Town of Barnstable reported an infestation of the non-native aquatic macrophyte, *Cabomba caroliniana*, in Wequaquet Lake in 2001 and has since applied for permits to treat the lake with herbicides to control this infestation multiple years between 2004 to 2014.

The Aquatic Life Use for Wequaquet Lake will continue to be assessed as impaired due to the infestation of *Cabomba caroliniana* (fanwort) and an impairment of fish passage barrier will be added as a result of the restricted passage for river herring and American eel at the Wequaquet Lake Dam.

2018/20 Delisted Impairment	Delisting Reason	Delisting Comment
Non-Native Aquatic Plants	Clarification of listing cause	The generic "Non-Native Aquatic Plants" is not needed since the specific macrophyte Cabomba caroliniana (fanwort) has been utilized.

Supporting Information for Delisted Impairments

Non-Native Aquatic Plants

Original source of the information in the 1999 WQAR (CN 50.0) based on a personal communication:

> Gatewood, Rob. 2001. Personal Communication. *Presence of Cabomba caroliniana in Bearse Pond and Wequaquet Lake, Barnstable*. Town of Barnstable Conservation Division. Barnstable, MA.

There is an infestation of the non-native aquatic macrophyte, *Cabomba caroliniana*, in Wequaquet Lake (MassDEP Undated). The Town of Barnstable applied for herbicide application permits to treat Wequaquet Lake for *Cabomba caroliniana* in multiple years between 2004 to 2014 (MassDEP, Herbicide Database, as of January 2017 2017).

West Bay (MA96-65)

Location:	From south of the Bridge Street bridge, Barnstable outlet to Nantucket Sound including Eel River, Barnstable (excludes Seapuit River).
AU Type:	ESTUARY
AU Size:	0.52 SQUARE MILES
Classification/Qualifier:	SA: SFO

Fish, other Aquatic Life and Wildlife Use: Not Supporting
MassDEP eelgrass mapping project data indicates a complete loss of eelgrass bed habitat since 1995 (0.00755mi^2). The Aquatic Life Use of West Bay will continue to be assessed as Not Supporting with the estuarine bioassessment impairment being carried forward.

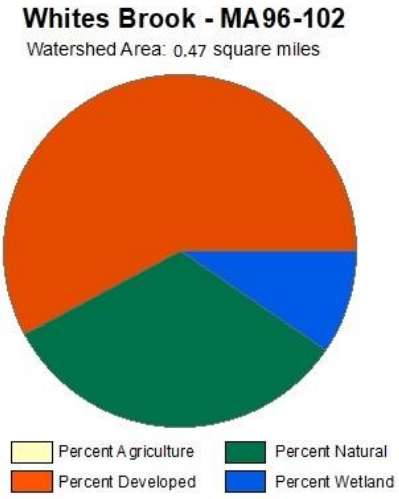
White Pond (MA96338)

Location:	Dennis/Harwich.
AU Type:	FRESHWATER LAKE
AU Size:	11 ACRES
Classification/Qualifier:	B

Fish, other Aquatic Life and Wildlife Use: Not Assessed
No data are available to assess the Aquatic Life Use of White Pond, so it is Not Assessed.

Whites Brook (MA96-102)

Location:	Headwaters in channelized wetland south of Route 6A, Yarmouth to confluence with tidal portion north of Route 6A, Yarmouth.
AU Type:	RIVER
AU Size:	0.3 MILES
Classification/Qualifier:	B



Landuse Type	Entire Basin	5km Radius Proximal Subbasin	100m Stream Buffer	Proximal Stream Buffer
Land Use Area (square miles)	0.47	0.47	0.15	0.15
Agriculture	0%	0%	0%	0%
Developed	57.9%	57.9%	24.5%	24.5%
Natural	32.6%	32.6%	48.1%	48.1%
Wetland	9.5%	9.5%	27.4%	27.4%
Impervious Cover	19.6%			

Fish, other Aquatic Life and Wildlife Use: Fully Supporting (Alert)

MassDEP biologists conducted backpack electrofishing in Whites Brook just upstream of Route 6A (SampleID 4543) in September 2009. Four species (52 individuals) and the sample was dominated by ninespine stickleback, considered moderately tolerant to pollution. These fish are considered freshwater species but are often found in tidal streams and salt marshes, moving upstream into fresh water during late spring/early summer to spawn. MassDEP staff also conducted water quality monitoring upstream of Rt.6A (W1924) in 2009. The minimum DO during the June and July continuous probe deployments was 5.4mg/L, maximum diel shift 0.93mg/L, maximum saturation 74%, and maximum temperature 21.1°C. The mean DOs during the June and July deploys was 6.36 and 6.23mg/L, respectively (slightly below the 7day mean warmwater criteria of 6.5mg/L for early life stages of anadromous fish present, however these deploys were too short –only two full days as opposed to at least full days). Slightly low DO will be identified as an alert. For attended probes the minimum DO was 5.3mg/L, the maximum saturation was 74% and the maximum temperature was 19.4^{o}C. The pH was low (ranged from 5.6 to 5.9SU, n=5) however the sampling site was just downstream of a large wetland area (shrub swamp and wooded swamp) so considered representative of natural conditions. The total phosphorus concentrations ranged from 0.017 to 0.049mg/L (seasonal average 0.032mg/L, n=4). There were no observations of dense/very dense filamentous aglae present either.

The Aquatic Life Use of White Brook is assessed as Fully Supporting based on the fish sample and the water quality data indicative of generally good conditions. An alert is being identified because DO is slightly below the warmwater 7-day mean of 6.5mg/L recommended for early life stages of anadromous fish present in coastal streams) as the 2-day means were slightly low (6.36 and 6.23mg/L) but not enough data were collected to make an impairment decision.

Wychmere Harbor (MA96-96)

Location:	south of Route 28, Harwich outlet to Nantucket Sound, Harwich.
AU Type:	ESTUARY
AU Size:	0.02 SQUARE MILES
Classification/Qualifier:	SA: SFO

2016 AU Category	2018/20 AU Category	Impairment	ATTAINS Action ID	Impairment Change Summary
5	5	Nitrogen, Total	65882	Added
5	5	Nutrient/Eutrophication Biological Indicators	65882	Added

Fish, other Aquatic Life and Wildlife Use: Not Supporting

According to the MEP project technical report benthic sampling was conducted at three sample stations in Wychmere Harbor by SMAST staff in the summer and fall of 2004. The harbor was found to be characterized by moderate numbers of species (12) and very high numbers of individuals (1057), dominated by moderate organic enrichment indicator species (gammarid amphipods). It was concluded that the Wychmere Harbor AU in general supports "moderately to significantly impaired" benthic animal habitat. Drift algae (*Ulva, Gracillaria, Codium*) were present as was a sparse microphyte mat. No eelgrass bed habitat were documented. Chlorophyll a was frequently elevated (generally ~10-25µg/L, often >25µg/L) at the SMAST mooring station during the summer of 2004 indicative of between "significant impairment" and "severe degradation" and DO was generally >4mg/L with periodic depletions to 4-3mg/L. Sediments were observed to be soft/fluid organic muds, thin oxidized surface zone (RPD 1-3mm) with regions showing recent anoxia (sulfidic) or patches of sulfur bacterial mat. It was concluded that these data were indicative of "moderate impairment". Yearly mean total nitrogen concentrations collected by the Town of Harwich Water Quality Monitoring Program from 2001-2008 were between 0.639 and 0.956mg/L with an overall mean of 0.812mg/L.

The Aquatic Life Use of Wychmere Harbor is assessed as Not Supporting based on the MEP analysis indicating the overall "Nutrient Related Habitat Health" was between "Moderately Impaired" and "Significantly Impaired as evidenced by the degraded benthic habitat conditions, frequently elevated chlorophyll a, and low DO which is being added as the nutrient/eutrophication biological indicators impairment and total nitrogen. Aggregated estuary watershed nitrogen loads were partitioned by the major types of nitrogen sources in order to focus development of nitrogen management alternatives. According to the MEP report MEP-Linked Watershed Embayment Model to Determine Critical Nitrogen Loading Thresholds for the Allen, Wychmere, and Saquatucket Harbor Embayment Systems, Harwich, MA the major types (sources) of nitrogen loads in Wychmere Harbor area in descending order of percent contribution were wastewater (e.g. septic systems), impervious surfaces, cranberry fertilizer and residential lawn fertilizer.

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