Appendix 4.14-A

Detailed Bridge and Culvert Inventory

Identification	Figure #	Structure Description	Area Setting: (Ur)ban, (S)uburban, (Un)developed; (C)ommercial, (I)ndustrial or (I)institutional, (O)pen space, (R)esidential (East/West)	ANRAD Wetland Description (East/West) (ND= no ANRAD description, X= no wetland)	Function	CAPS Landscape (see Appendix 4-2)	Connectivity Value (Wildlife Habitat, Fishery)	T&E Species	Environmental Recommendations/Notes
Stoughton Line									
Bridge over Forge Pond [Pequit Brook]	Fig. 4.14-11a	18' long stone arch bridge (historic)	SR/SC	Open water with a bordering forested wetland associated with Forge Pond/Open Water with a bordering forested wetland associated with Forge Pond	Pond connector.	Freshwater wetland and aquatic (at bridge site only)	DFW & DMF fishery; no wildlife habitat	No	Historic nature of bridge precludes meeting Stream Crossing standards.
Bridge over Mill Brook [Beaver Meadow Brook]	Fig. 4.14-11a	12' long stone arch bridge	UrR/UrR	Forested wetland system associated with Beaver Meadow Brook/ Red Maple wetland with scrub shrub components associated with Beaver Meadow Brook pond system	Perennial stream conveyance.	None	No fishery; no wildlife habitat	No	Meet Stream Crossing standards.
CV-ST 2.47	Fig.4.14-11a	NA	UrR/SO	X/Intermittent stream channel	Upland drainage.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-ST 3.40	Fig. 4.14-11a	NA	SCI/SO	X/Intermittent stream channel	Upland drainage.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-ST 4.47	Fig. 4.14-11b	2.5'x2.5' stone box culvert, 55' long	SCI/SO	Forested wetland associated with perennial stream/ Perennial stream originating from unnamed pond east of Rt. 138 and flowing into Woods Pond	Perennial stream conveyance.	None	No fishery; no wildlife habitat	No	Hydraulic analysis. If providing hydrologic control do not alter hydrology; if not providing hydrologic control replace to meet Stream Crossing standards
CV-ST 4.94	Fig. 4.14-11b	2'x2' stone box culvert, 40' long	SC/SR	Intermittent stream channel connected to ST3 (100 series)/ Intermittent stream channel associated with a pond and its emergent wetland system	Intermittent stream conveyance.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-ST 5.04	Fig. 4.14-11b	12" VCP culvert, 15' long	SCI/SR	X/Isolated depression with standing water and minimal emergent wetland vegetation	Upland drainage.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-ST 5.26	Fig. 4.14-11b	3'x3' stone box culvert, 30' long	SCI/SR	Intermittent stream channel/ Intermittent stream channel connected to ST4A (100 series)	Intermittent stream conveyance.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-ST 5.76	Fig. 4.14-11b	4'x5' stone box culvert, 50' long	SC/SO	X/Large forested wetland with an intermittent stream channel	Upland drainage.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-ST 5.82	Fig. 4.14-11b	3'x4' stone box culvert, unknown length	SC/SO	Intermittent stream channel connected to ST7/ Large forested wetland with an intermittent stream channel	Wetland equalizer.	None	No fishery; no wildlife habitat	No	Replace in kind.

Identification	Figure #	Structure Description	Area Setting: (Ur)ban, (S)uburban, (Un)developed; (C)ommercial, (I)ndustrial or (I)institutional, (O)pen space, (R)esidential (East/West)	ANRAD Wetland Description (East/West) (ND= no ANRAD description, X= no wetland)	Function	CAPS Landscape (see Appendix 4-2)	Connectivity Value (Wildlife Habitat, Fishery)	T&E Species	Environmental Recommendations/Notes
CV-ST 5.94	Fig. 4.14-11b	2'x2' stone box culvert, 55' long	SO/SO	Large open marsh associated with Whitman Brook/ Associated with Whitman Brook	Upland drainage.	None	No fishery; wildlife habitat at Stoughton Memorial Conservation Land	No	Replace in kind
CV-ST 6.17	Fig. 4.14-11b	2'x2' stone box culvert, 50' long	UnO/UnO	Forested wetland associated with intermittent stream/ Forested wetland along intermittent stream connected to ST10 (100 series)	Wetland equalizer.	Freshwater wetland and aquatic adjacent west	No fishery; no wildlife habitat	No	Replace in kind.
CV-ST 6.45	Fig. 4.14-11b	2'x2.5' stone box culvert, 75' long	UnO/S-UnO	ND/Intermittent stream	Intermittent stream conveyance.	Freshwater wetland and aquatic adjacent east	No fishery; wildlife habitat at Stoughton Memorial Conservation Land northwest.	No	Meet Stream Crossing Standards.
CV-ST 6.69	Fig. 4.14-11b	3'x3' stone box culvert, 70' long	UnO/UnO	Large forested wetland associated with an intermittent stream (BF 98-101) and Whitman Brook (200 and 300 series)/ Forested wetland with shrub-scrub components	Wetland equalizer.	Freshwater wetland and aquatic adjacent west	No fishery; wildlife habitat in Whitman Brook wetland system	No	Meet Stream Crossing Standards.
Bridge over Cowessett Brook [Whitman Brook]	Fig. 4.14-11b	20' long deck stringer bridge	UnO/UnO	Large forested wetland associated with an intermittent stream (BF 98-101) and Whitman Brook (200 and 300 series)/ Forested wetland with shrub-scrub components	Perennial stream conveyance.	Freshwater wetland and aquatic	DFW & DMF fishery; wildlife habitat in Whitman Brook wetland system	No	Meet Stream Crossing Standards.
CV-ST 6.83	Fig. 4.14-11b	3.5'x5' stone box culvert, 30' long	UnO/UnO	Shrub-scrub wetland associated with intermittent stream to Whitman Brook/ Intermittent stream connected to EA5.3; separated from EA6 [to north] by unpaved walkway	Intermittent stream conveyance.	Freshwater wetland and aquatic	No fishery; wildlife habitat in Whitman Brook wetland system	No	Meet Stream Crossing Standards.
CV-ST 7.06	Fig. 4.14-11b	2.5'x2.5' stone box culvert, 40' long	UnO/UnO	Forested wetland associated with intermittent stream channel, connected to EA7/ Red Maple swamp connected to a larger wetland outside limit of delineation	Intermittent stream conveyance.	None	No fishery; wildlife habitat in wetland system	No	Meet Stream Crossing Standards.
CV-ST 7.21	Fig. 4.14-11b	2.5'x4' stone box culvert, 50' long	UnO/UnO	Intermittent stream channel connected to EA8 and EA10/ Red Maple swamp connected to EA9 under ROW by an intermittent channel	Intermittent stream conveyance.	None	No fishery; wildlife habitat in wetland system	No	Meet Stream Crossing Standards.

Identification	Figure #	Structure Description	Area Setting: (Ur)ban, (S)uburban, (Un)developed; (C)ommercial, (I)ndustrial or (I)institutional, (O)pen space, (R)esidential (East/West)	ANRAD Wetland Description (East/West) (ND= no ANRAD description, X= no wetland)	Function	CAPS Landscape (see Appendix 4-2)	Connectivity Value (Wildlife Habitat, Fishery)	T&E Species	Environmental Recommendations/Notes
CV-ST 7.23	Fig. 4.14-11b	2'x3' stone box culvert, 55' long	UnO/UnO	Intermittent stream channel connected to EA8 and EA10/ Scrub-shrub wetland connected to EA9	Intermittent stream conveyance.	None	No fishery; wildlife habitat in wetland system	No	Meet Stream Crossing Standards.
CV-ST 7.42	Fig. 4.14-11b	4'x6' stone box culvert, 40' long	SR/SR	Intermittent stream/ Intermittent stream	Intermittent stream conveyance.	None	No fishery; wildlife habitat in wetland system	No	Replace in kind.
Bridge over Small Creek [Quesett Brook]	Fig. 4.14-11b	15' long deck stringer bridge	UrR/UrC	Detention basin/ Large forested wetland associated with an intermittent stream.	Perennial stream conveyance.	None	DFW & DMF fishery; no wildlife habitat	No	Meet Stream Crossing Standards.
CV-ST 8.76	Fig. 4.14-11b	2'x1' stone box culvert, unknown length	UnO/S-UnO	Large depression connected to EA16 under ROW/X	Wetland equalizer.	None	No fishery; no wildlife habitat	No	Hydraulic analysis. If providing hydrologic control do not alter hydrology; if not providing hydrologic control replace to meet Stream Crossing standards
CV-ST 9.22	Fig. 4.14-11c	5'x6' stone box culvert, unknown length	UnO/S-UnO	NA	Open upland passage.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-ST 9.35	Fig. 4.14-11c	4'x4' stone box culvert, 50' long	UnO/UnO	Forested wetland connected to EA22 under ROW/ Certified Vernal Pool	Wetland equalizer.	None	No fishery; wildlife habitat in wetland system	No	Meet Stream Crossing Standards
CV-ST 9.65	Fig. 4.14-11c	3'x3' stone box culvert, 50' long	UnO/UnO	Red Maple swamp connected to EA24 under ROW/ Forested wetland includes a Certified Vernal Pool	Intermittent stream conveyance.	None	No fishery; wildlife habitat in wetland system	No	Meet Stream Crossing Standards.
CV-ST 9.83	Fig. 4.14-11c	3'x3.5' stone box culvert, unknown length	UnO/UnR	Connected to EA26 under ROW/ ND	Wetland equalizer.	None	No fishery; wildlife habitat in wetland system	No	Replace in kind.
No #	Fig. 4.14-11c	1.2'x2' stone box culvert, unknown length	UnO/UnI	ND/X	Upland drainge.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-ST 10.05	Fig. 4.14-11c	2'x2' stone box culvert, 40' long	UnO/UnR	Certified Vernal Pool/ Certified Vernal Pool	Wetland equalizer.	None	No fishery; wildlife habitat	Yes	Meet Stream Crossing Standards.
CV-ST 10.41	Fig. 4.14-11c	18" CIP culvert, 40' long	UnO/UnR	X/X	Upland drainage.	None	No fishery; no wildlife habitat	Yes	Replace in kind.
CV-ST 10.90	Fig. 4.14-11c	12" CMP culvert, 50' long	UnR/UnR	Forested wetland associated with Black Brook wetland system/ Part of the Black Brook wetland system	Wetland equalizer.	None	No fishery; wildlife habitat in wetland system	Yes	Meet Stream Crossing Standards.
CV-ST 10.95	Fig. 4.14-11c	4'x6' stone box culvert, 40' long	UnO/UnR	Black Brook and its associated wetland system [Crossing 1]	Perennial stream conveyance.	None	DMF fishery; wildlife habitat	Yes	Meet Stream Crossing Standards.

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CV-ST 11.11	Fig. 4.14-11c	18" CIP culvert, 30' long	UnO/UnR	Black Brook and its associated wetland system [Crossing 1]	Wetland equalizer.	None	No fishery; wildlife habitat in wetland system	Yes	Meet Stream Crossing Standards.
Bridge over Black Brook	Fig. 4.14-11c	12" CIP culvert, 30' long (washed out)	UnO/UnR	Black Brook and its associated wetland system [Crossing 2]	Perennial stream conveyance.	Freshwater wetland and aquatic adjacent west	DMF fishery; wildlife habitat	Yes	Meet Stream Crossing Standards.
CV-ST 11.23	Fig. 4.14-11c	18" CIP culvert, unknown length	UnO/UnO	Hockomock Swamp/ Hockomock Swamp	Upland drainage.	None	No fishery; wildlife habitat in upland	Yes	Replace in kind.
CV-ST 11.33	Fig. 4.14-11c	18" CIP culvert, 40' long	UnO/UnO	Hockomock Swamp/ Hockomock Swamp	Upland drainage.	None	No fishery; wildlife habitat in upland	Yes	Replace in kind.
CV-ST 11.34	Fig. 4.14-11c	18" CIP culvert, 40' long	UnO/UnO	Hockomock Swamp/ Hockomock Swamp	Upland drainage.	None	No fishery; wildlife habitat in upland	Yes	Replace in kind.
CV-ST 11.44	Fig. 4.14-11c	18" DIP/CIP culvert, 30' long	UnO/UnO	Scrub-shrub wetland/ Intermittent stream connected to EA86.	Wetland equalizer.	None	No fishery; wildlife habitat in wetland system	Yes	Replace in kind.
CV-ST 11.59	Fig. 4.14-11c	3'x3' stone box culvert, 50' long	UnO/UnO	Forested wetland connected to EA82 under ROW/ Bordering an intermittent stream	Wetland equalizer.	Freshwater wetland and aquatic	No fishery; wildlife habitat in wetland system	Yes	Meet Stream Crossing Standards.
CV-ST 11.61	Fig. 4.14-11c	36" CMP culvert, 50' long	UnO/UnO	Forested wetland connected to EA82 under ROW/ Bordering an intermittent stream	Wetland equalizer.	None	No fishery; wildlife habitat in wetland system	Yes	Meet Stream Crossing Standards.
CV-ST 11.65	Fig. 4.14-11c	2'x2' stone box/ 12" CMP culvert, 40' long	UnO/UnO	Forested wetland connected to EA82 under ROW/ Bordering an intermittent stream	Wetland equalizer.	None	No fishery; wildlife habitat in wetland system	Yes	Meet Stream Crossing Standards.
CV-ST 11.91	Fig. 4.14-11c	8'x6' stone/rail box culvert, 25' long	UnI/UnO	Certified Vernal Pool connected to EA78 under ROW/ Certified Vernal Pool	Intermittent stream conveyance.	None	No fishery; wildlife habitat in wetland system	Yes	Meet Stream Crossing Standards.
No #	Fig. 4.14-11c	18" PVC culvert, unknown length	UnO/UnO	ND/X	Upland drainage.	None	No fishery; no wildlife habitat	No	Could be eliminated.
CV-ST 12.09	Fig. 4.14-11c	6'x6' stone/rail box culvert, unknown length	UnO/UnO	Intermittent stream connected to EA67 under ROW/ Certified Vernal Pool	Wetland equalizer.	Freshwater wetland and aquatic	No fishery; wildlife habitat in wetland system	Yes	Daylight culvert under new trestle

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CV-ST 12.38	Fig. 4.14-11c	8'x6' stone/rail box culvert, 30' long	UnO/UnO	Hockomock Swamp	Wetland equalizer.	Forest	No fishery; wildlife habitat in wetland system	Yes	Daylight culvert under new trestle
CV-ST 12.68	Fig. 4.14-11c	6'x6' stone/rail box culvert, 30' long	UnO/UnO	Hockomock Swamp	Perennial stream conveyance.	Freshwater wetland and aquatic, Forest	DMF fishery; wildlife habitat in wetland system	Yes	Daylight culvert under new trestle
CV-ST 12.99	Fig. 4.14-11c	6'x4' stone/rail box culvert, 30' long	UnO/UnO	Hockomock Swamp	Wetland equalizer.	Forest	No fishery; wildlife habitat in wetland system	Yes	Daylight culvert under new trestle
CV-ST 13.12	Fig. 4.14-11c	6'x4' stone box culvert, 30' long	UnO/UnO	Hockomock Swamp	Wetland equalizer.	Forest	No fishery; wildlife habitat in wetland system	Yes	Daylight culvert under new trestle
CV-ST 13.42	Fig. 4.14-11d	6'x6' stone/rail box culvert, 30' long	UnO/UnO	Hockomock Swamp	Wetland equalizer.	Forest	No fishery; wildlife habitat in wetland system	Yes	Daylight culvert under new trestle
CV-ST 13.83	Fig. 4.14-11d	6'x6' stone box culvert, 50' long	UnO/UnO	Hockomock Swamp	Wetland equalizer.	Forest	No fishery; wildlife habitat in wetland system	No	Meet Stream Crossing Standards.
CV-ST 14.02	Fig. 4.14-11d	4'x4' stone box culvert, 30' long (collapsed)	UnI/UnO	Hockomock Swamp	Wetland equalizer.	Forest adjacent west	No fishery; no wildlife habitat	No	Meet Stream Crossing Standards.
CV-ST 15.80	Fig. 4.14-11d	4'x3' stone box culvert, 25' long	UnCR/UnCR	Red Maple-dominated wetland, connects to R50 under ROW/ Red Maple-dominated wetland, connects to R49 under ROW.	Wetland equalizer.	None	No fishery; no wildlife habitat	No	Replace in kind.

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CV-ST 16.00	Fig. 4.14-11d	4'x4' stone box culvert, 25' long	UnO/UnO	Red Maple dominated wetland, connects to R49 under Carver Street and R 2 under ROW/ Red Maple-dominated wetland, connects to R44 under ROW	Wetland equalizer.	None	No fishery; wildlife habitat in wetland system	No	Meet Stream Crossing Standards.
CV-ST 16.73	Fig. 4.14-11d	3'x3' stone box culvert, unknown length	UnO/UnO	Red Maple-dominated wetland with associated perennial stream, connects to R113 under ROW/ Red Maple-dominated wetland with associated perennial stream, connects to R116 under ROW	Perennial stream conveyance.	None	Possible fishery; wildlife habitat in wetland system	No	Meet Stream Crossing Standards.
Bridge over Pine Swamp Brook 1	Fig. 4.14-11d	15' long wood/stone bridge	UnO/UnO	Red Maple swamp associated with Pine Swamp Brook (R12.1 BF 100-103) and an intermittent stream (R12.1 BF 200-203), connects to R 12.1 (100 series) outside limit of delineation/ Red Maple-dominated wetland associated with Pine Swamp Brook (R12.2 BF 128-131) and an intermittent stream (BF R12.2 BF 161-164)	Perennial stream conveyance.	None	DFW & DMF fishery; wildlife habitat	No	Meet Stream Crossing Standards.
Bridge over Pine Swamp Brook 2	Fig. 4.14-11d	12' long wood bridge	UnO/UnO	Red Maple swamp/ Red Maple-dominated wetland associated with Pine Swamp Brook (R12.2 BF 128-131) and an intermittent stream (R12.2 BF161 to 164)	Wetland equalizer.	Freshwater wetland and aquatic adjacent west	No fishery; wildlife habitat in wetland system	No	Meet Stream Crossing Standards.
CV-ST 18.18	Fig. 4.14-11e	3'x2' stone box culvert, 20' long	UnO/UnO	Connects to T5 under ROW/ Red Maple swamp, connects to T4 under ROW	Wetland equalizer.	Freshwater wetland and aquatic adjacent west	No fishery; wildlife habitat in wetland system	No	Replace in kind.
CV-ST 19.10	Fig. 4.14-11e	2'x2' stone box culvert, 60' long	UrI/UrI	Forested wetland bordering an intermittent stream/ Forested Wetland	Upland drainage.	None	No fishery; no wildlife habitat	No	Hydraulic analysis. If providing hydrologic control do not alter hydrology; if not providing hydrologic control replace to meet Stream Crossing standards
Bridge over Taunton River at MP 34.38	Fig. 4.14-11e	118' long deck girder bridge	UrCR/UrR	Taunton River	Perennial stream conveyance.	None	DFW & DMF fishery; wildlife habitat in Taunton River wetland system	No	Meet Stream Crossing Standards.

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Bridge over Taunton River at MP 34.62	Fig. 4.14-11e	171' long deck girder bridge	UrR/UrO	Taunton River	Perennial stream conveyance.	None	DFW & DMF fishery; wildlife habitat in Taunton River wetland system	No	Meet Stream Crossing Standards.
Bridge over Taunton River at MP 34.73	Fig. 4.14-11e	176' long deck stringer bridge	UrRC/UrO	Taunton River/Backwater of Taunton River	Perennial stream conveyance.	None	DFW & DMF fishery; wildlife habitat in Taunton River wetland system	No	Meet Stream Crossing Standards.
Bridge over Mill River	Fig. 4.14-11e	37' long deck girder bridge	UrOI/UrRI	Mill River	Perennial stream conveyance.	None	DFW & DMF fishery; wildlife habitat in Mill River wetland system	No	Meet Stream Crossing Standards.
New Bedford Main Line									
Bridge over Taunton River at MP 35.56	Fig. 4.14-11e	113' long thru girder bridge	UrI/UrO	Taunton River	Perennial stream conveyance.	None	DFW & DMF fishery; wildlife habitat in Taunton River wetland system	No	Meet Stream Crossing Standards.
Bridge over Brickyard Road	Fig. 4.14-11e	20' long deck stringer bridge	UrO/UrO	Forested wetland bordering Taunton River and Oakland Mills Pond/ Forested wetland, connected to with TCM1 West	Open upland passage.	None	No fishery; wildlife habitat in wetland system	No	Replace in kind.
No #	Fig. 4.14-11e	2.5'x2' stone box culvert, unknown length	UrO/UrO	Forested wetland bordering Taunton River and Oakland Mills Pond/ Forested wetland, connected to with TCM1 West	Wetland equalizer.	None	No fishery; wildlife habitat in wetland system	No	Meet Stream Crossing Standards.
CV-NB 14.25	Fig. 4.14-11e	2'x2' stone box culvert	SO/UnR	Forested wetland with emergent wetland components/ Connects to TCM7 East via culvert under ROW	Wetland equalizer.	None	No fishery; no wildlife habitat	No	Hydraulic analysis. If providing hydrologic control do not alter hydrology; if not providing hydrologic control replace to meet Stream Crossing standards
CV-NB 14.52	Fig. 4.14-12a	3'x3' stone box/36" CMP culvert, unknown length	SO/SO	Red Maple swamp bordering an unnamed perennial stream, connected to TCM14 (200 series)/ Red Maple swamp bordering an unnamed perennial stream in Berkley	Perennial stream conveyance.	None	Possible fishery; wildlife habitat in wetland system	No	Meet Stream Crossing Standards.

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No #	Fig.4.14-12a	1'x'1 box culvert, unknown length	UnO/UnO	Red Maple swamp connected to TCM14 (100 series) under ROW/ Red Maple swamp	Wetland equalizer.	None	No fishery; wildlife habitat in wetland system	No	Hydraulic analysis. If providing hydrologic control do not alter hydrology; if not providing hydrologic control replace to meet Stream Crossing standards
CV-NB 14.74	Fig. 4.14-12a	4'x4' stone box culvert, unknown length	UnO/UnO	Red Maple swamp connected to TCM14 (100 series) under ROW/ Red Maple swamp	Wetland equalizer.	None	No fishery; wildlife habitat in wetland system	No	Replace in kind.
CV-NB 15.01	Fig. 4.14-12a	4'x6' stone box culvert, 30' long	UnO/UnR	Red Maple swamp connected to BKCM1 under ROW/ Scrub-shrub wetland connected to BKCM8 under ROW	Wetland equalizer.	None	No fishery; no wildlife habitat	No	Replace in kind.
Bridge over Cotley River at MP 38.93	Fig. 4.14-12a	20' long deck girder bridge	UnO/UnO	Red Maple swamp associated with Cotley River/ Red Maple swamp bordering Cotley River	Perennial stream conveyance.	Forest; Freshwater wetland and aquatic adjacent west	DFW & DMF fishery; willdife habitat in Cotley River wetland system	No	Meet Stream Crossing Standards.
Bridge over Cotley River at MP 39.46	Fig. 4.14-12a	21' long deck girder bridge	UnO/UnO	Red Maple swamp bordering Cotley River/ Cotley River with adjacent Red Maple swamp	Perennial stream conveyance.	Forest; Freshwater wetland and aquatic adjacent east	DFW & DMF fishery; willdife habitat in Cotley River wetland system	No	Meet Stream Crossing Standards.
CV-NB 16.89	Fig. 4.14-12a	2'x1' stone box/12" CIP culvert, 40' long	UnO/UnO	Red Maple swamp/ Red Maple swamp bordering an intermittent stream	Wetland equalizer.	None	No fishery; wildlife habitat in wetland system	No	Meet Stream Crossing Standards.
CV-NB 17.33	Fig. 4.14-12b	2'x2' stone box culvert, 50' long	UnO/UnR	Red Maple swamp bordering a perennial stream/ Scrub-shrub wetland bordering an unnamed perennial stream	Perennial stream conveyance.	None	Possible fishery; wildlife habitat in wetland system	No	Hydraulic analysis. If providing hydrologic control do not alter hydrology; if not providing hydrologic control replace to meet Stream Crossing standards
CV-NB 17.89	Fig. 4.14-12b	36" CMP culvert, 25' long	UnO/UnO	Unnamed stream [identified as Pierce Brook in USGS topo], Cedar Swamp River (upstream) and Atlantic White Cedar swamp/ Unnamed stream [Pierce Brook] & Cedar Swamp River (downstream) and Atlantic White Cedar swamp.	Perennial stream conveyance.	Freshwater wetland and aquatic, Forest	Possible fishery; wildlife habitat in wetland system	No	Meet Stream Crossing Standards.
Bridge over Cedar Swamp River at MP 42.14	Fig. 4.14-12b	21' long timber pile trestle bridge	UnO/UnO	Unnamed stream [identified as Pierce Brook in USGS topo], Cedar Swamp River (upstream) and Atlantic White Cedar swamp/ Unnamed stream [Pierce Brook] & Cedar Swamp River (downstream) and Atlantic White Cedar swamp.	Perennial stream conveyance.	Freshwater wetland and aquatic, Forest	DFW & DMF fishery; wildlife habitat	No	Meet Stream Crossing Standards.

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No #	Fig. 4.14-12b	NA	UnR/UnO	Red Maple swamp/ Red Maple swamp	Wetland equalizer.	None	No fishery; wildlife habitat in wetland system	No	Meet Stream Crossing Standards.
CV-NB 20.37	Fig. 4.14-12b	3'x2' stone box culvert, 45' long	UnR/UnO	Red Maple swamp bordering an intermittent stream/ Red Maple swamp bordering an intermittent stream, connected to LK14	Wetland equalizer.	None	No fishery; wildlife habitat in wetland system	No	Meet Stream Crossing Standards.
CV-NB 20.89	Fig. 4.14-12b	4'x3' stone box culvert, 42' long	UnO/UnO	Red Maple swamp, connected to LK19/ Red Maple swamp bordering an intermittent stream	Wetland equalizer.	Freshwater wetland and aquatic, Forest	No fishery; wildlife habitat in wetland system	No	Meet Stream Crossing Standards.
CV-NB 21.51	Fig. 4.14-12b	Two 3'x3' stone box culverts, unknown length	UnO/UnO	Red Maple swamp/ Red Maple swamp, connected to LK20	Wetland equalizer.	Freshwater wetland and aquatic, Forest	No fishery; wildlife habitat in wetland system	No	Meet Stream Crossing Standards.
CV-NB 21.66	Fig. 4.14-12b	4'x3' concrete and stone box culvert, 35' long	UnO/UnO	Red Maple swamp/ Red Maple swamp, connected to LK20	Intermittent stream conveyance.	None	No fishery; wildlife habitat in wetland system	No	Meet Stream Crossing Standards.
CV-NB 21.68	Fig. 4.14-12b	7'x7' stone box culvert, 30' long	UnO/UnO	Red Maple swamp/ Bordering an unnamed perennial stream, connected to LK21 East	Intermittent stream conveyance.	None	No fishery; wildlife habitat in wetland system	No	Meet Stream Crossing Standards.
CV-NB 21.93	Fig. 4.14-12b	3'x3' stone box culvert, unknown length	UnO/UnO	Red Maple swamp, connected to FRN13/ Intermittent tributary to Fall Brook	Intermittent stream conveyance.	None	No fishery; no wildlife habitat	No	Replace in kind.
Bridge over Fall Brook	Fig. 4.14-12b	17' long deck stringer bridge	UnO/UnO	Fall Brook/Fall Brook	Perennial stream conveyance.	Freshwater wetland and aquatic	DFW & DMF fishery; wildlife passage in wetland system	No	Meet Stream Crossing Standards.
CV-NB 22.24	Fig.4.14-12b	6'x3.5' stone box culvert, unknown length	UI/UI	X/X	Upland drainage.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-NB 22.58	Fig. 4.14-12b	3'x3' stone box culvert, 45' long	SI/SR	Borders a stormwater swale outside the limits of delineation/X	Upland drainage.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-NB 22.71	Fig. 4.14-12c	24" CMP culvert, unknown length	UnI/UnO	Cranberry bog, connected to FRN6B (100 series)/ Red Maple swamp bordering an intermittent stream	Intermittent stream conveyance.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-NB 22.84	Fig. 4.14-12c	3'x1' stone box/24" CIP culvert, 45' long	UnO/UnO	Red Maple swamp bordering an intermittent stream/ Red Maple swamp bordering an intermittent stream	Intermittent stream conveyance.	None	No fishery; no wildlife habitat	No	Replace in kind.

Identification	Figure #	Structure Description	Area Setting: (Ur)ban, (S)uburban, (Un)developed; (C)ommercial, (I)ndustrial or (I)institutional, (O)pen space, (R)esidential (East/West)	ANRAD Wetland Description (East/West) (ND= no ANRAD description, X= no wetland)	Function	CAPS Landscape (see Appendix 4-2)	Connectivity Value (Wildlife Habitat, Fishery)	T&E Species	Environmental Recommendations/Notes
CV-NB 23.65	Fig. 4.14-12c	2'x2' stone box/36" VCP culvert, 40' long	UnO/UnO	Red Maple swamp with wet meadow/ Red Maple swamp bordering an intermittent stream, connected to FRN23	Wetland equalizer.	Forest adjacent west	No fishery; no wildlife habitat	No	Replace in kind.
CV-NB 24.31	Fig. 4.14-12c	6'x3' stone box culvert, 50' long	UnO/UnO	Open channel/ Forested wetland with intermittent stream connected to NB1	Intermittent stream conveyance.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-NB 26.47	Fig.4.14-12c	8'x3' wood/stone box culvert, 26' long	UrC/UnO	Perennial stream parallel to the ROW/ Perennial stream channel with bordering forested wetland, part of the Acushnet Cedar Swamp	Wetland equalizer.	None	No fishery; wildlife habitat in wetland system	No	Hydraulic analysis. If providing hydrologic control do not alter hydrology; if not providing hydrologic control replace to meet Stream Crossing standards
CV-NB 26.68	Fig.4.14-12c	5'x5' steel/stone box culvert, 25' long	UrR/UnO	Perennial stream parallel to the ROW/ Perennial stream channel with bordering forested wetland, part of the Acushnet Cedar Swamp	Wetland equalizer.	None	No fishery; wildlife habitat in wetland system	No	Hydraulic analysis. If providing hydrologic control do not alter hydrology; if not providing hydrologic control replace to meet Stream Crossing standards
CV-NB 26.96	Fig. 4.14-12c	6'x5' steel/stone box culvert, 30' long	UrO/UnO	Perennial stream parallel to the ROW/ Perennial stream channel with bordering forested wetland, part of the Acushnet Cedar Swamp	Wetland equalizer.	None	No fishery; wildlife habitat in wetland system	No	Hydraulic analysis. If providing hydrologic control do not alter hydrology; if not providing hydrologic control replace to meet Stream Crossing standards
CV-NB 28.47	Fig. 4.14-12d	12" CMP culvert, 20' long	UrC/UrC	X/X	Upland drainage.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-NB 28.60	Fig. 4.14-12d	36" CMP culvert, unknown length	UrC/UrC	Emergent wetland/ Emergent wetland	Wetland equalizer.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-NB 28.87	Fig. 4.14-12d	36" RCP culvert, 80' long	UrC/UrC	Emergent wetland/ Emergent wetland	Wetland equalizer.	None	No fishery; no wildlife habitat	No	Replace in kind.
Fall River Secondary									
CV-FR 0.42	Fig. 4.14-13a	2'x2' stone box culvert, 20' long	UnO/UnR	Intermittent channel/ Intermittent channel crosses ROW and connected to BK2B	Intermittent stream conveyance.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-FR 0.58	Fig. 4.14-13a	10" CMP culvert, 20' long	UnO/UnRC	X/Red Maple Swamp bordering an intermittent stream	Upland drainage.	None	No fishery, wildlife habitat in wetland system	No	Meet Stream Crossing Standards.
Bridge over Cedar Swamp River at MP 41.51	Fig. 4.14-13a	64' long deck stringer bridge	UnO/UnO	Red Maple Swamp and Cedar Swamp River/ Red Maple Swamp, borders an intermittent tributary to Cedar Swamp River	Perennial stream conveyance.	None	DFW & DMF fishery; wildlife habitat in wetland system	No	Meet Stream Crossing Standards.

Identification	Figure #	Structure Description	Area Setting: (Ur)ban, (S)uburban, (Un)developed; (C)ommercial, (I)ndustrial or (I)institutional, (O)pen space, (R)esidential (East/West)	ANRAD Wetland Description (East/West) (ND= no ANRAD description, X= no wetland)	Function	CAPS Landscape (see Appendix 4-2)	Connectivity Value (Wildlife Habitat, Fishery)	T&E Species	Environmental Recommendations/Notes
CV-FR 1.14	Fig. 4.14-13a	4'x4' stone box culvert, 20' long	UnO/UnO	Connected to LKF1 under ROW/ Red Maple Swamp connected to FRF 1. Separated from LKF 1.1 by an upland mound	Wetland equalizer.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-FR 1.20	Fig. 4.14-13a	3'x3' stone box culvert, 15' long	UnR/UnO	Intermittent stream channel/ Intermittent stream channel	Intermittent stream conveyance.	None	No fishery; no wildlife habitat	No	Hydraulic analysis. If providing hydrologic control do not alter hydrology; if not providing hydrologic control replace to meet Stream Crossing standards
CV-FR 1.47	Fig. 4.14-13a	2.5'x2.5' stone box culvert, 15' long	UnR/UnO	Red Maple Swamp associated with Cedar Swamp River/ Red Maple Swamp associated with Cedar Swamp River	Intermittent stream conveyance.	None	Possible fishery; wildlife habitat in wetland system	No	Hydraulic analysis. If providing hydrologic control do not alter hydrology; if not providing hydrologic control replace to meet Stream Crossing standards
CV-FR 1.76	Fig. 4.14-13a	3'x3' stone box culvert, 25' long	UnR/UnO	ND/Red Maple Swamp associated with Cedar Swamp River	Wetland equalizer.	None	No fishery; no wildlife habitat	No	Hydraulic analysis. If providing hydrologic control do not alter hydrology; if not providing hydrologic control replace to meet Stream Crossing standards
CV-FR 2.13	Fig. 4.14-13a	1.5'x1.5' stone box culvert, 25' long	UnR/UnO	ND/Connected to FRF8 under ROW	Intermittent stream conveyance.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-FR 2.21	Fig. 4.14-13a	4'x4' stone box culvert, 25' long	UnRO/UnO	Red Maple swamp associated with Forge Pond/ Forested wetland associated with Forge Pond, connected to FRF10	Intermittent stream conveyance.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-FR 2.71	Fig. 4.14-13a	18" CIP;2.5'x1.5' stone box culvert, unknown length	UnO/UnR	Forested wetland connected to a larger wetland east of ROW, outside limits of delineation/ Forested wetland connected to a larger wetland east of ROW, outside limits of delineation	Intermittent stream conveyance.	None	No fishery, wildlife habitat in wetland system	No	Meet Stream Crossing Standards.
CV-FR 2.95	Fig. 4.14-13a	2'x3' concrete/stone box culvert, 40' long	UnR/UnR	Intermittent stream channel/ Shrub-scrub wetland bordering an intermittent stream	Intermittent stream conveyance.	Freshwater wetland and aquatic	No fishery; no wildlife habitat	No	Hydraulic analysis. If providing hydrologic control do not alter hydrology; if not providing hydrologic control replace to meet Stream Crossing standards
CV-FR 4.50	Fig. 4.14-13a	Two 2'x2' stone box culverts, 30' long	UnO/UnO	Red Maple swamp bordering an unnamed pond/ Red Maple swamp bordering an unnamed pond	Pond connector.	Freshwater wetland and aquatic	DMF fishery; no wildlife habitat	No	Replace in kind.
CV-FR 5.49	Fig. 4.14-13b	3'x2' stone box culvert, unknown length	UnO/UnO	Large Red Maple swamp, connected to Wetland 6 [proposed station site]/ND	Wetland equalizer.	None	No fishery; no wildlife habitat	No	Replace in kind.

Identification	Figure #	Structure Description	Area Setting: (Ur)ban, (S)uburban, (Un)developed; (C)ommercial, (I)ndustrial or (I)institutional, (O)pen space, (R)esidential (East/West)	ANRAD Wetland Description (East/West) (ND= no ANRAD description, X= no wetland)	Function	CAPS Landscape (see Appendix 4-2)	Connectivity Value (Wildlife Habitat, Fishery)	T&E Species	Environmental Recommendations/Notes
CV-FR 5.62	Fig. 4.14-13b	12" CMP culvert, 25' long	UnO/UnI	Shrub-scrub wetland/ Forested wetland connected to FRF26.2	Wetland equalizer.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-FR 5.68	Fig.4.14-13b	12" DIP culvert, 20' long	UnO/UnI	Shrub-scrub wetland/ Forested wetland connected to FRF26.2	Wetland equalizer.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-FR 5.72	Fig. 4.14-13b	10" CMP culvert, 25' long	UnO/UnO	X/Forested wetland bordering an intermittent stream	Upland drainage.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-FR 5.79	Fig. 4.14-13b	3'x5' stone box culvert, unknown length	UnO/UnO	Separated from FRF26 by stone wall/ Red Maple swamp with an intermittent stream connected to FRF26.1.1	Wetland equalizer.	None	No fishery; wildlife habitat in wetland system	No	Meet Stream Crossing Standards.
Bridge over Farm Road	Fig.4.14-13b	18' long deck stringer bridge	UnI/UnO	X/Scrub-shrub wetland bordering an intermittent stream that connects to FRF29 (200 series)	Open upland passage.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-FR 6.01	Fig. 4.14-13b	36" CMP culvert, 100' long	UnI/UnO	X/Forested wetland with an intermittent stream; scrub-shrub wetland bordering an intermittent stream that connects to FRF29 (200 series)	Intermittent stream conveyance.	None	No fishery; no wildlife habitat	No	Replace in kind.
Bridge over Farm Road	Fig. 4.14-13b	17' long deck stringer bridge	UnR/UnO	X/X	Open upland passage.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-FR 6.86	Fig. 4.14-13b	3'x8' stone box culvert, 30' long	UnR/UnO	Intermittent stream channel under ROW/Intermittent stream channel under ROW	Intermittent stream conveyance.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-FR 7.11	Fig. 4.14-13b	3'x3' stone box culvert, 30' long	UnO/UnO	Intermittent stream channel/Intermittent stream channel	Intermittent stream conveyance.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-FR 7.24	Fig. 4.14-13b	4'x3' stone box culvert, 30' long	SR/SO	X/X	Upland drainage.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-FR 7.31	Fig. 4.14-13b	4'x3' stone box culvert, 25' long	SR/SO	X/X	Upland drainage.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-FR 7.58	Fig. 4.14-13b	3.5'x3' stone box culvert, 70' long	SO/SO	Intermittent stream channel/ Small forested wetland connected to FA1A	Intermittent stream conveyance.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-FR 7.60	Fig. 4.14-13b	4'x5' stone box culvert, 50' long	SC/SO	Disturbed forested wetland connected to FA2/ Forested wetland connected to Taunton River	Wetland equalizer.	None	No fishery; no wildlife habitat	No	Replace in kind.

Identification	Figure #	Structure Description	Area Setting: (Ur)ban, (S)uburban, (Un)developed; (C)ommercial, (I)ndustrial or (I)institutional, (O)pen space, (R)esidential (East/West)	ANRAD Wetland Description (East/West) (ND= no ANRAD description, X= no wetland)	Function	CAPS Landscape (see Appendix 4-2)	Connectivity Value (Wildlife Habitat, Fishery)	T&E Species	Environmental Recommendations/Notes
Bridge over Miller's Cove Road	Fig. 4.14-13b	15' long concrete slab bridge	SC/SO	Large forested wetland bordering an intermittent stream that is connected to Taunton River/X	Open upland passage.	None	No fishery; no wildlife habitat	No	Replace in kind.
Bridge over Collins Street	Fig. 4.14-13b	35' long thru girder bridge	SR/SO	X/X	Open upland passage.	None	No fishery; no wildlife habitat	No	Replace in kind.
Bridge over Ashley's underpass	Fig. 4.14-13b	23' long timber stringer bridge	SR/SO	X/X	Open upland passage.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-FR 8.97	Fig. 4.14-13b	8' arch culvert, 30' long	SO/SI	X/X	Upland drainage.	None	No fishery; no wildlife habitat	No	Could eliminate.
CV-FR 9.28	Fig. 4.14-13b	8' arch culvert, 32' long	SO/SI	X/X	Upland drainage.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-FR 11.43	Fig. 4.14-13c	24" CMP/ 18"DIP culvert, 25' long	UrC/UrI	X/X	Upland drainage.	None	No fishery; no wildlife habitat	No	Replace in kind.
CV-FR 11.65	Fig. 4.14-13c	24" CIP culvert, 20' long	UrC/UrI	X/X	Perennial stream conveyance.	None	No fishery; no wildlife habitat	No	Hydraulic analysis. If providing hydrologic control do not alter hydrology; if not providing hydrologic control replace to meet Stream Crossing standards
Bridge over channel near Battleship Cove	Fig. 4.14-13c	20' long timber bridge	UrC/UrI	Forested wetland connected to Taunton River/Disturbed forested wetland connected to FA2	Perennial stream conveyance.	None	No fishery; no wildlife habitat	No	Meet Stream Crossing Standards.

Appendix 4.14-B

University of Massachusetts, Amherst. Conservation Assessment and Prioritization System (CAPS) South Coast Rail Analysis

Conservation Assessment and Prioritization System (CAPS)
South Coast Rail Analysis

September 18, 2009

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Introduction

CAPS (the Conservation Assessment and Prioritization System) was used to assess several alternative routes of the proposed South Coast Rail system in southeastern Massachusetts. A CAPS analysis was conducted for each of the proposed routes (Attleboro, Stoughton, and Stoughton-Whittenton) and compared to a base scenario representing current conditions. Versions of the Stoughton and Stoughton-Whittenton route were analyzed with and without a trestle through Hockomock Swamp. The CAPS landcover grid was modified to include proposed rail lines, and CAPS was run to estimate the Index of Ecological Integrity (IEI) for each route scenario. The difference between the IEI for each route scenario and the base IEI values provided an estimate of the loss in ecological integrity for that route. These differences are expressed graphically and in terms of IEI units. A sensitivity analysis was run to assess the effect of uncertainty in parameters.

Overview of CAPS

The Conservation Assessment and Prioritization System (CAPS) is an ecosystem-based (coarse-filter) approach for assessing the ecological integrity of lands and waters. We define *ecological integrity* as the ability of an area to support biodiversity and the ecosystem processes necessary to sustain biodiversity, over the long term. CAPS is a computer software program and an approach to prioritizing land for conservation based on the assessment of various ecological communities (e.g. forest, shrub swamp,

headwater stream) within an area. This approach combines principles of landscape ecology and conservation biology with the capacity of modern computers to compile spatial data and characterize landscape patterns.

The CAPS approach begins with the characterization of both the developed and undeveloped elements of the landscape (Appendix A). With a computer base map depicting various classes of developed and undeveloped land, we then evaluate a variety of landscape-based variables ("metrics"; Appendix C). A metric may, for example, take into account how well a point in the landscape is connected to similar points, the intensity traffic on nearby roads, or the expected vulnerability to invasions by exotic plants. The results of each metric are rescaled by percentiles for each community so that, for instance, the best 10% of marshes have values ≥ 0.90, and the best 25% have values ≥ 0.75. This is done to adjust for differences in units of measurement among metrics and to account for differences in the range of metric values for each community. The rescaling by community is done to facilitate identifying the "best" of each community, as opposed to the best overall – which is strongly biased towards the dominant, matrix-forming communities.

Various metrics are applied to the landscape and then integrated in weighted linear combinations as models for predicting ecological integrity. The rescaled values are weighted using weights determined by expert teams, to reflect the relative importance of each metric for each community (Appendix D), and then added together to compute an overall IEI. Thus, the final index of ecological integrity for each cell is a weighted combination of the metric outputs for that cell, based on the community the cell falls in. This process results in a final Index of Ecological Integrity (IEI) for each point in the landscape based on models constructed separately for each ecological community.

Because CAPS provides a quantitative assessment of ecological integrity it can be used for comparing various scenarios. In essence, scenario analysis involves running CAPS separately for each scenario, and comparing results to determine the loss (or gain) in IEI units. This scenario testing capability can be used to evaluate and compare the impacts of development projects on habitat conditions as well as the potential benefits of habitat management or environmental restoration. CAPS is an objective and flexible approach for assessing ecological integrity and supporting decision-making for land protection, habitat management, ecological restoration, project review and permitting to protect habitat and biodiversity.

Methods

This analysis was based on the most recent CAPS statewide run (CAPSma 2009; Conservation Assessment and Prioritization System (CAPS) Preliminary Statewide Massachusetts Assessment, June 2, 2009), with modifications as necessary to more fully represent the effects of railroads.

Study area – The study area consisted of the entire Taunton watershed, plus a 5 km buffer around the Northeast Main Line, the New Bedford Corridor, and all rail lines included in various scenarios (Fig. 1). This buffer allows CAPS to capture all changes in

IEI among scenarios. Using the entire Taunton watershed gives CAPS a large enough context to reasonably scale IEI.

Scenarios – Six scenarios were represented in the analysis (scenario abbreviations, used in grid names, are supplied in brackets):

1. [X] Current (base) scenario
2. [A] Attleboro
3. [S] Stoughton at grade
4. [ST] Stoughton with trestle
5. [W] Stoughton-Whittenton at grade
6. [WT] Stoughton-Whittenton with trestle

The base scenario represents the current conditions. It was determined that the Rapid Bus alternative would essentially be the same as the base scenario because this alternative would at most differ in CAPS only in a very slight increase in traffic rate (on the order of 0.01%). In fact one could argue that the bus scenario would actually result in a decrease in traffic.

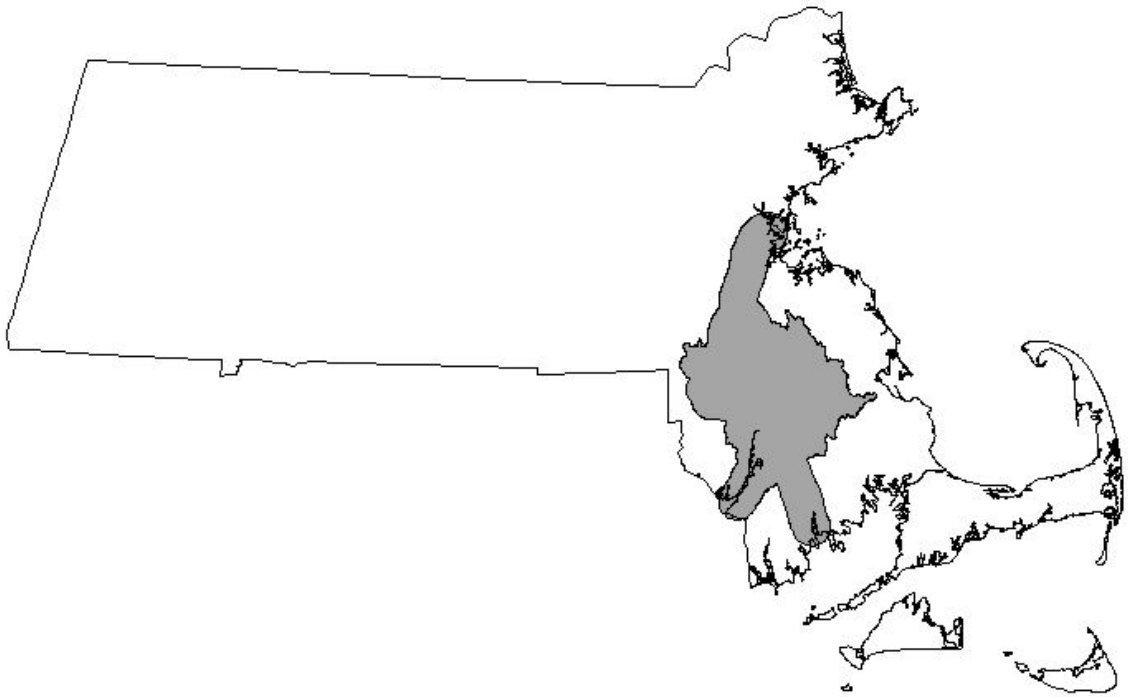


Fig. 1. Study area for South Coast Rail analysis.

Representing rail lines – We added several new cover types to CAPS to adequately represent rail lines. We split the abandoned rail class into "abandoned rail with tracks" and "abandoned rail without tracks." New classes were added for freight, passenger, and commuter rail lines, as well as "commuter rail line with a trestle" and "commuter rail

line with a retaining wall." Abandoned rail lines represented in CAPS (from MassGIS trains layer) were considered to have no tracks. Existing abandoned rails were replaced where they were more accurately represented in SCR data. The classes of trains (freight, passenger, commuter, and combinations of these) were derived from MassGIS data and SCR data. The number of tracks on each line were estimated based on supplied track numbers in MassGIS data. In general, lines from SCR scenarios were represented as having two sets of tracks, with the exception of the Northeast Corridor from Readville to the Attleboro bypass, which has three sets.

The frequency of trains was estimated as 2 trains/day for freight, as 33 trains/day for commuter (based on a survey of MBTA schedules), and passenger lines were assigned a number of trains/day by line from Amtrack schedules, varying from 2 to 20 trains/day. The number of cars per train were estimated at 25 for freight, 8 for passenger, and 6 for commuter rail.

Abandoned rail beds without tracks were assumed to have lost their ballast due to erosion over time; abandoned rails with tracks were assumed to have retained ballast. All rails were assumed to be unfenced; although commuter rails are generally fenced in populated areas, these areas generally have little value in CAPS anyway.

Parameters for rail lines – New cover types were parameterized by an expert team consisting of Mark Anderson, Andy Finton, and Jessica Dyson, from The Nature Conservancy, James deNormandie from MassAudubon and MassWildlife, and Brad Compton and Scott Jackson from UMass Amherst. The group met on July 16 and came up with a scheme for parameterizing a new variable, terrestrial barriers (Table 1; including barriers on highways and other anthropogenic barriers to movement). This expert team also decided to represent traffic rates for rails based on a multiple of the estimated number of train cars per day. We discounted the traffic rate for trains running over a trestle because collision mortality would be essentially eliminated, although avoidance because of noise would remain essentially unchanged. Parameters used for trains are shown in Table 2. Rail stations were given the same values as the commercial and industrial land cover class.

Analysis – CAPS was run for each scenario. Watershed metrics, which are essentially unaffected by the various scenarios, were used directly from the 2009 statewide run. Direct loss (where rail lines or stations fell on undeveloped land) was calculated by the complete loss of IEI for affected cells. Indirect loss was calculated for each metric, and the integrity model was used to create an overall indirect loss grid for each scenario. Finally, direct and indirect losses were combined to give a delta grid for each scenario. A sensitivity analysis was conducted by varying the relative traffic rate for trains from 1 train car = 5 automobiles to 1 train car = 100 automobiles. The sensitivity analysis was run for the three metrics that are affected by traffic rate: connectedness, similarity, and traffic intensity. The sensitivity analysis gives a range of percent loss for each scenario, to help bracket our uncertainty.

Appendices – Land cover classes and codes are given in Appendix A. Input data sources are described in Appendix B. Appendix C describes the CAPS metrics, and

Appendix D gives the weights used for each metric and community or group of communities. Appendix E lists the GIS grids and coverages supplied with the results. Finally, Appendix F includes detailed images of the IEI change grids.

Table 1. Scheme for assigning values for terrestrial barriers. A feature with multiple values (e.g., double rail with ballast) is assigned the sum of the maximum value and one half of other values.

Value	Terrestrial Barriers
1	No barrier Abandoned rail without tracks Trestle (≥ 3 m high)
2	Single set of rails Ballast Trestle (<3 m high)
3	Standard fence* Double set of rails Abandoned rail with tracks Single rail + ballast
4	Double rail + ballast [Triple rail + ballast =4.5]
5	
6	
7	Jersey barrier
8	Enhanced fence†
9	
10	Noise barrier wall Retaining wall

* Standard fence = 4' chain link, poorly maintained
† Enhanced fence = 10' chain link, barbed ware on top, well-maintained

Table 2. Assignment of scores for terrestrial barriers and traffic rate for rail lines.

<table>
<tr><th>Rail type</th><th>Ballast?</th><th>Number of tracks</th><th>Fence?</th><th>Terrestrial barrier score</th><th>Trains/ day</th><th>Cars/train</th><th>Traffic rate</th></tr>
<tr><td>Rail trail</td><td>No</td><td>0</td><td>No</td><td>1</td><td>0</td><td>0</td><td rowspan="11">cars/day × 20*</td></tr>
<tr><td>Abandoned railbed no tracks</td><td>No</td><td>0</td><td>No</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>Abandoned rail with tracks</td><td>Yes</td><td>1-3</td><td>No</td><td rowspan="8">single track: 3
double track: 4
triple track: 4.5</td><td>0</td><td>0</td></tr>
<tr><td>Train (freight)</td><td>Yes</td><td>1-3</td><td>No</td><td>2</td><td>25</td></tr>
<tr><td>Train (passenger)</td><td>Yes</td><td>1-3</td><td>No</td><td>ntrains</td><td>8</td></tr>
<tr><td>Train (commuter)</td><td>Yes</td><td>1-3</td><td>No</td><td>33</td><td>6</td></tr>
<tr><td>Train (freight + passenger)</td><td>Yes</td><td>1-3</td><td>No</td><td rowspan="4">Combined</td><td rowspan="4">Combined</td></tr>
<tr><td>Train (freight + commuter)</td><td>Yes</td><td>1-3</td><td>No</td></tr>
<tr><td>Train (passenger + commuter)</td><td>Yes</td><td>1-3</td><td>No</td></tr>
<tr><td>Train (freight + passenger + commuter)</td><td>Yes</td><td>1-3</td><td>No</td></tr>
<tr><td>Train (retaining wall)</td><td>No</td><td>1-3</td><td>Retaining wall: 10</td><td>10</td><td>33</td><td>6</td></tr>
<tr><td>Train (trestle)†</td><td>No</td><td>0</td><td>No</td><td>2</td><td>33</td><td>6</td><td>As above / 3</td></tr>
</table>

* Varied for sensitivity analysis, range from 5-100.
† Assumed to be commuter rail.

Results

The results of the CAPS scenario analysis are shown graphically in Fig. 2, Appendix F, and summarized in Table 3. Overall the two routes through Hockomock Swamp showed the greatest estimated loss in ecological integrity, followed by the Attleboro route with considerably less influence (77-80% of the loss for the various Stoughton and Stoughton-Whittenton alternatives). The trestle alternatives through Hockomock Swamp reduced the modeled loss of ecological integrity somewhat, although many of the benefits of a trestle are likely to occur at a local scale below that of the CAPS analysis.

Differences among the various scenarios are obscured to some degree by large sections of the routes common to all the alternatives. To better highlight the differences among the scenarios we computed IEI loss for each scenario only for those sections that were not shared among all alternatives (Fig. 3, Table 3). Focusing only on those sections of the routes that differ among the alternatives serves to further differentiate the Attleboro route as the alternative with the least impact on IEI values.

Table 3. Assessment of South Coast Rail scenarios in terms of IEI units.

Scenario	Loss of IEI Units Full Extent	Loss of IEI Units Excluding Common Route Sections
Base	0.0	0.0
Attleboro	379.3	206.8
Stoughton with trestle	474.5	302.0
Stoughton-Whittenton with trestle	481.8	309.3
Stoughton at grade	484.6	312.1
Stoughton-Whittenton at grade	492.0	319.5

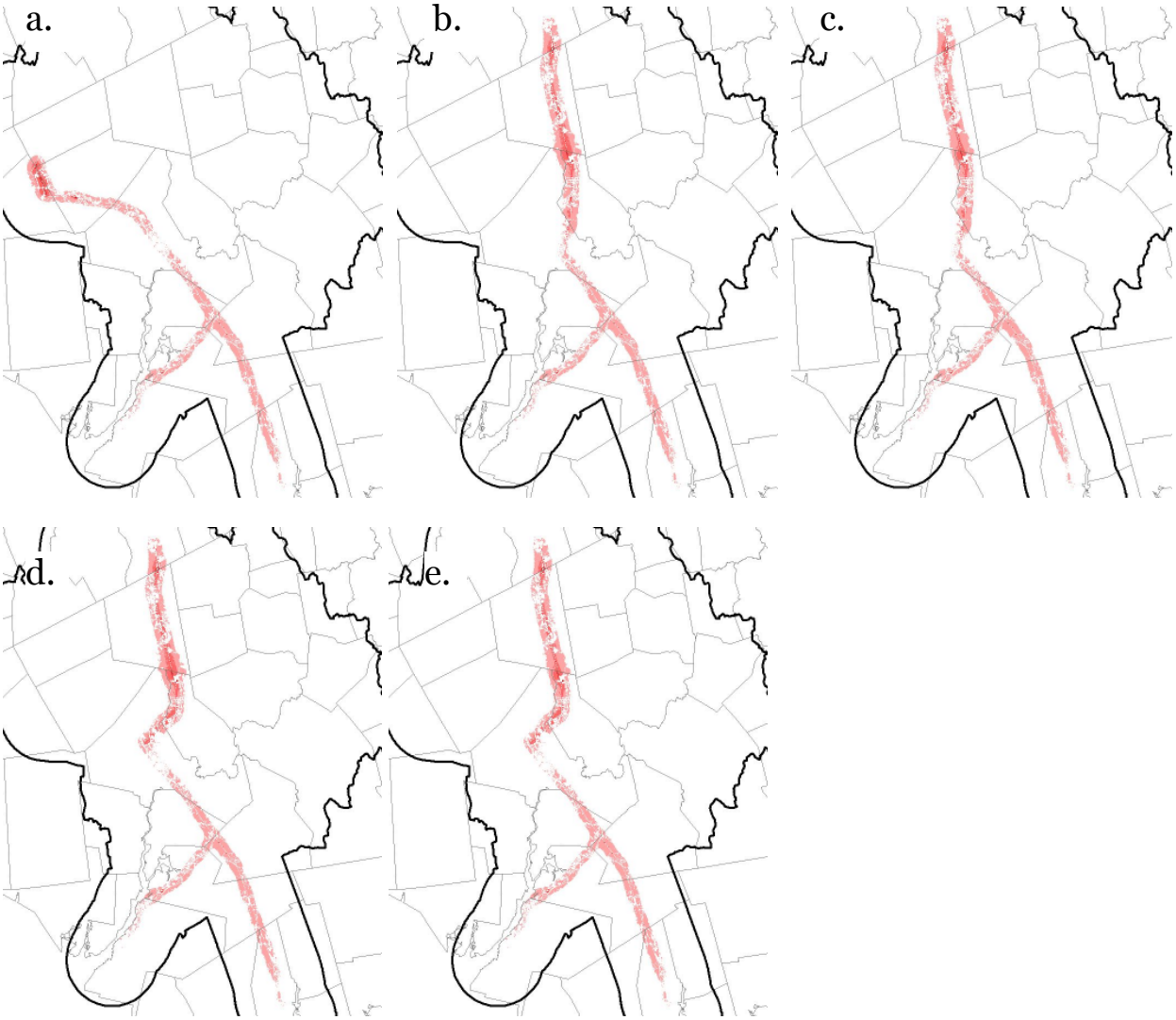


Fig. 2. Modeled loss in ecological integrity for (a) the Attleboro route, (b) the Stoughton route at grade, (c) the Stoughton route with the proposed trestle, (d) Stoughton-Whittenton route at grade, and (e) the Stoughton-Whittenton route with the proposed trestle. Darker areas represent greater loss. See Appendix F for more detailed versions of these images.

Table 4 shows loss split into direct loss (within the footprint of new development) and indirect loss. Not surprisingly, direct loss is a small proportion of the total IEI loss, mostly attributable to stations, because most of the rails would run on land already mapped as developed (such as abandoned rail beds).

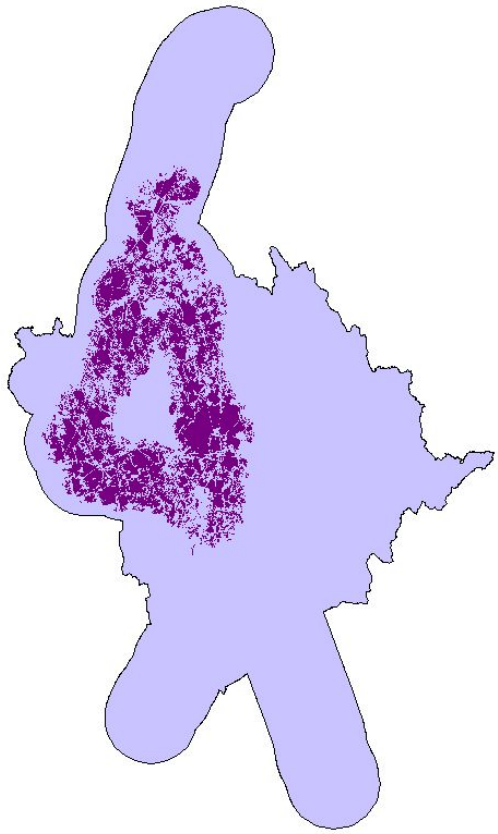


Fig. 3. Areas (denoted in purple) in which the IEI of two or more scenarios differ from each other. Areas that are not highlighted are either unaffected by any of the scenarios, or affected identically by all scenarios.

Table 4. Loss of IEI Units (from Table 3) split into direct and indirect loss.

Scenario	**Direct loss (IEI units)**	**Indirect loss (IEI units)**
Base	0.0	0.0
Attleboro	54.6	324.8
Stoughton with trestle	17.6	456.9
Stoughton-Whittenton with trestle	17.7	464.1
Stoughton at grade	17.6	467.1
Stoughton-Whittenton at grade	17.7	474.3

Results of the sensitivity analysis for three metrics, showing the range of expected results given the uncertainty in the effects of train traffic, are given in Table 5. Note that the ranking of the scenarios does not change under either the high or low traffic parameterization, and only the Attleboro route shows more than a very slight change in

percent as compared to the worst-case scenario. The sensitivity analysis suggests that our uncertainty in parameterizing traffic effects of railroads has only a minor effect on the results. (Note that these losses are not directly comparable with those in Table 3, because the sensitivity analysis only takes three metrics into account.)

Table 5. Results of sensitivity analysis for three metrics (connectedness, similarity, and traffic intensity), showing range of loss in acres and loss in terms of percent of worst-case scenario for each scenario, given uncertainty in equivalent traffic rates of trains.

	Loss in IEI units		**Range in percent**	
Scenario	**Minimum**	**Maximum**	**Minimum**	**Maximum**
Base	0.0	0.0	0.0	0.0
Attleboro	325.5	367.9	82.5	71.2
Stoughton with trestle	379.6	500.5	96.2	96.9
Stoughton-Whittenton with trestle	384.6	506.8	97.5	98.1
Stoughton at grade	390.0	510.4	98.8	98.8
Stoughton-Whittenton at grade	394.6	516.7	100.0	100.0

The bulk of the effect of these scenarios is reflected in three metrics: connectedness, similarity, and traffic intensity. Connectedness, with its broader scale and integration of landscape resistance, is the most relevant single metric. Images of connectedness deltas are shown for four focal areas: Assonet Swamp (Fig. 4), Hockomock Swamp (Fig. 5), Pine Swamp (Fig. 6), and the Attleboro Bypass area (Fig 7). Note that the color gradient used in these four figures are the same, thus they are visually comparable.

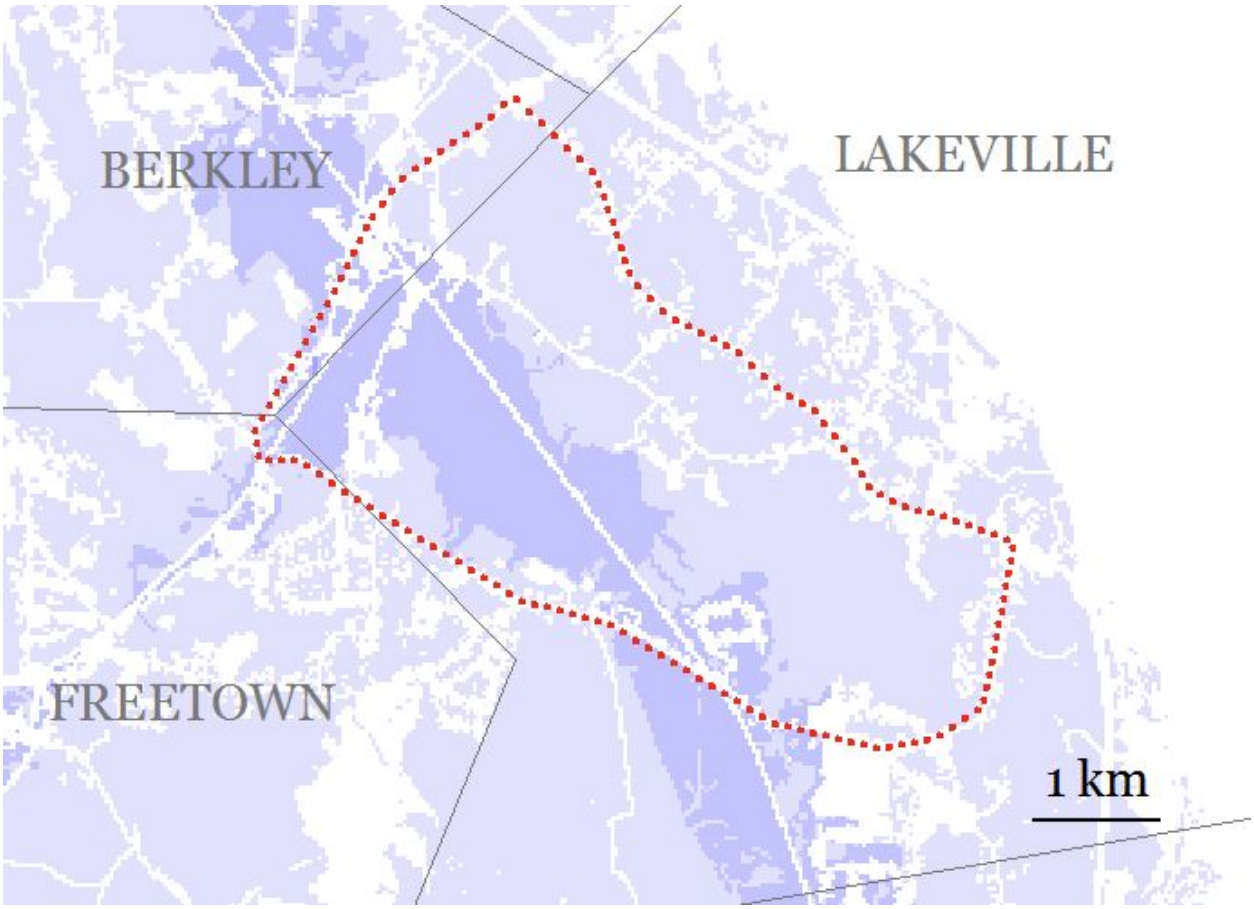


Fig. 4. Connectedness delta (darker areas = higher loss) for Assonet Swamp focal area for all scenarios. Note that color gradient is scaled the same for Figs. 4-7.

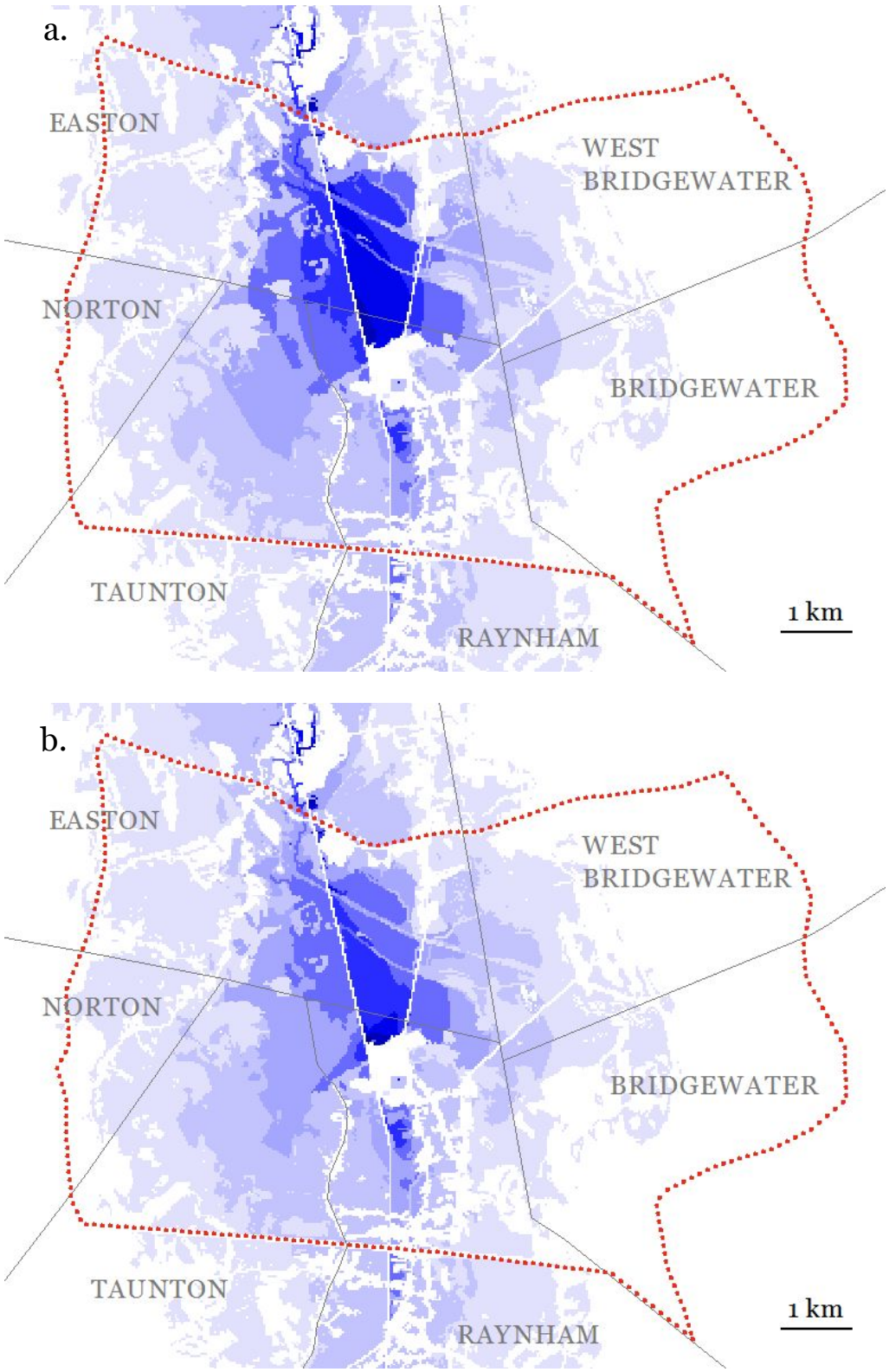


Fig. 5. Connectedness delta (darker areas = higher loss) for Hockomock Swamp focal area for (a) Stoughton at grade, and (b) Stoughton with trestle. The Stoughton and Stoughton-Whittenton scenarios are the same within Hockomock Swamp.

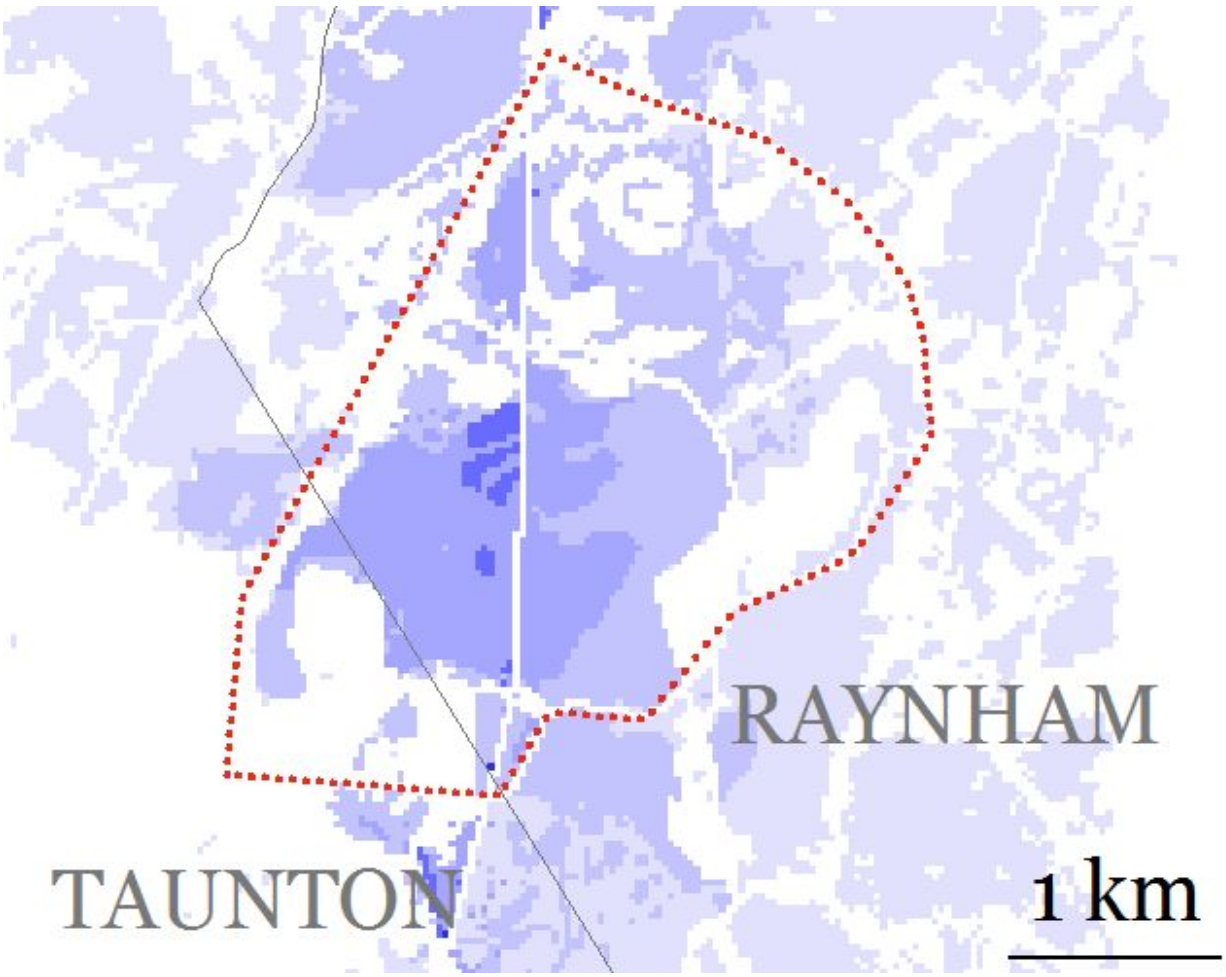


Fig. 6. Connectedness delta (darker areas = higher loss) for Pine Swamp focal area for Stoughton scenarios.

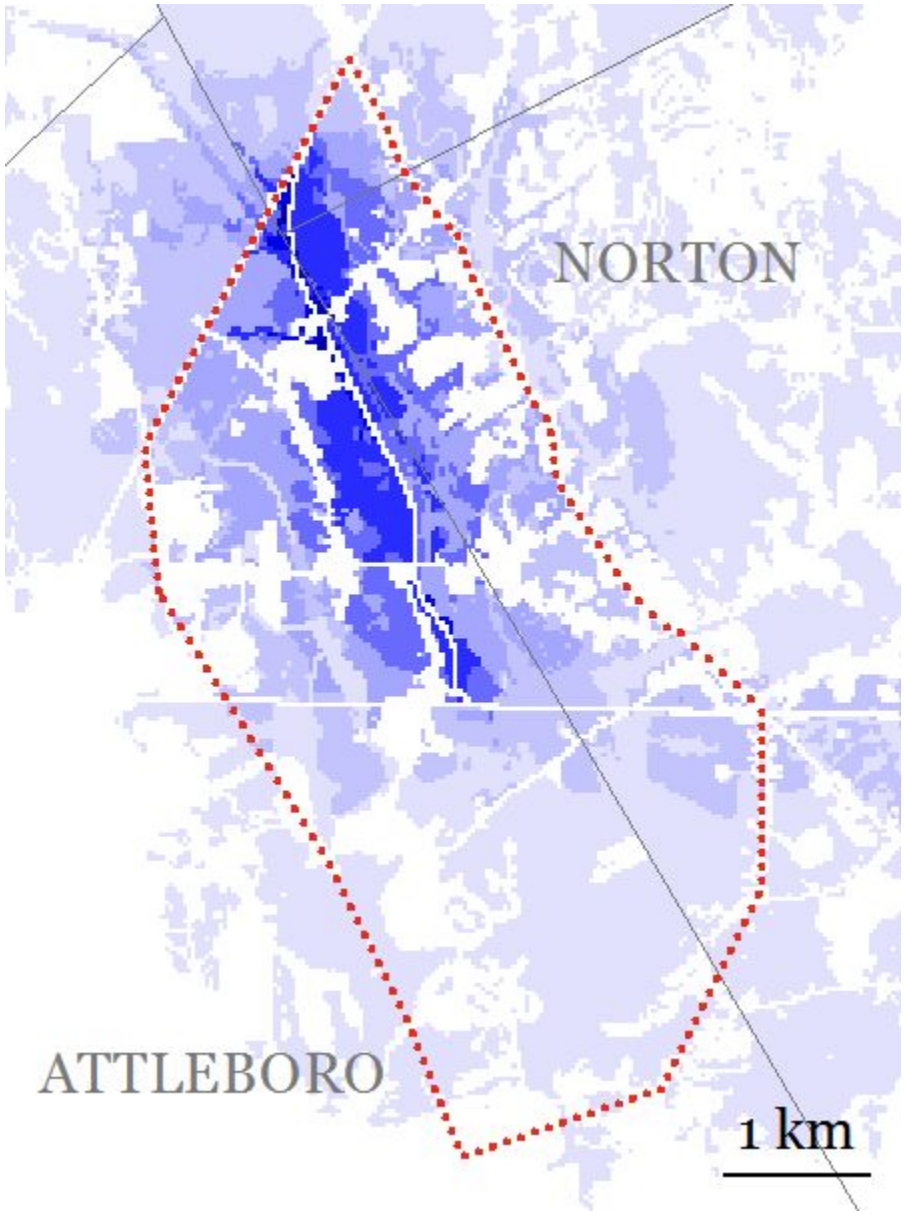


Fig. 7. Connectedness delta (darker areas = higher loss) for Attleboro bypass focal area for the Attleboro scenario.

Appendix A: Land cover classes

Land cover classes are listed below, with numeric codes for each class. New classes added for the South Coast Rail project are italicized.

Developed

1 Cropland
5 Mining
7 Participatory recreation
8 Spectator recreation
9 Water based recreation
10 Multi-family residential
11 High-density residential
12 Medium-density residential
13 Low-density residential
15 Commercial
16 Industrial
17 Urban open
18 Transportation
19 Waste disposal
26 Golf
29 Marina
31 Urban public
34 Cemetery
35 Orchard
36 Nursery
39 Junkyard
41 Train station
61 Large dam
62 Medium dam
63 Small dam
64 Tiny dam
71 Expressway
72 Primary highway
73 Secondary highway
74 Light duty road
75 Unpaved road
77 Rail trail
78 Abandoned railbed no tracks
79 Abandoned rail with tracks
81 Train (freight)
82 Train (passenger)
83 Train (commuter)
84 Train (freight + passenger)
85 Train (freight + commuter)
86 Train (passenger + commuter)
87 Train (freight + passenger + commuter)
88 Train (trestle)
89 Train (retaining wall)
91 Bridge
92 Culvert

Terrestrial

102 Pasture
103 Forest
106 Open land
124 Powerlines
151 Sea cliff
152 Barrier beach system
156 Coastal dune
167 Barrier beach coastal beach
169 Barrier beach coastal dune
191 Deciduous forested wetland
192 Mixed forested wetland
193 Coniferous forested wetland

Palustrine

331 Pond
354 Bog
355 Cranberry bog
357 Deep marsh
358 Shallow marsh
362 Shrub swamp
396 Vernal pool

Riverine

411 First order flatwater
412 First order pool-riffle
413 First order plane-bed
414 First order step-pool
415 First order cascade
421 Second order flatwater
422 Second order pool-riffle

423 Second order plane-bed
424 Second order step-pool
425 Second order cascade
431 Third order flatwater
432 Third order pool-riffle
433 Third order plane-bed
434 Third order step-pool
435 Third order cascade
441 Fourth order flatwater
442 Fourth order pool-riffle
443 Fourth order plane-bed
444 Fourth order step-pool
445 Fourth order cascade
451 Fifth order flatwater
452 Fifth order pool-riffle
453 Fifth order plane-bed
454 Fifth order step-pool
455 Fifth order cascade
461 Sixth order flatwater
462 Sixth order pool-riffle
463 Sixth order plane-bed
464 Sixth order step-pool
465 Sixth order cascade

Lacustrine
532 Lake
581 Reservoir

Estuarine
621 Salt pond
622 Bay
652 Barrier beach pond
661 Salt marsh
668 Barrier beach bog
670 Barrier beach deep marsh
671 Barrier beach marsh
673 Barrier beach shrub swamp
674 Barrier beach deciduous forested wetland
675 Barrier beach coniferous forested wetland
676 Barrier beach mixed forested wetland
677 Barrier beach salt marsh
681 First order estuary
682 Second order estuary
683 Third order estuary
684 Fourth order estuary
685 Fifth order estuary
686 Sixth order estuary

Marine
753 Coastal beach
760 Rocky intertidal
763 Tidal flat
790 Ocean

Appendix B: Input Data Layers

Note: changes from the 2009 preliminary Massachusetts run are denoted with change bars.

Nonforested Uplands – Three of these communities came from the MassGIS 2005 Land Use: pasture, powerlines, and open land (formerly called old fields in CAPS).

Wetlands – We used Massachusetts DEP Wetlands. DEP wetlands were photo-interpreted, and are generally of high quality, although beaver pond disturbance/succession has introduced many "errors," most commonly current shrub swamps mapped as forested wetland. Note that many new coastal wetlands have been added for this run.

Vernal Pools – We used Potential Vernal Pools from MassWildlife's Natural Heritage and Endangered Species Program. Potential vernal pools that fell within a terrestrial type were treated as a single pixel pool (30 m × 30 m). When a potential vernal pool fell within a wetland mapped by DEP, we retained DEP's classification. We added a number of vernal pools and dropped one spurious PVP in the vicinity of proposed rail lines based on surveys by NHESP.

Streams and Rivers – Streams and rivers are based on our work for Natural Heritage and Endangered Species Program's Living Waters project. MassGIS 1:25k stream centerlines were used to define streams. Streams are classified by order and gradient. Order is calculated from the stream centerline data; and gradient is based on the digital elevation model. We identified rivers that flow into the state to correct the order of these stream networks. For rivers wider than 30 m, the open water class from Land Use was used to represent the entire river basin, and the class based on order and gradient was applied to the entire width.

Developed Land – Developed land comes directly from the MassGIS 2005 Land Use. Proposed rail stations were added from SCR data.

Dams – Dams (in four size classes) were developed in collaboration with DEP and Mass Riverways as part of Natural Heritage's Living Waters project. Dams were derived from a MassDEP point shapefile and digitized as lines over stream centerlines overlaid on the MassGIS 1 meter, 1:5000 black and white orthophotos. Dams are treated as a developed type.

Roads and Railroads – Roads are railroads are from MassGIS's 1:25k EOT roads and trains layers. Roads were reclassified into five types based on original road classes as well as surface type (for unpaved roads). We also used interpolated traffic rates from the EOT roads layer. Railroads from MassGIS were mapped in several classes: abandoned railbed without tracks, rail trail, and combinations of freight, passenger, and commuter rail. Additional rail types were mapped for various scenarios from SCR data, including abandoned railbed with tracks, proposed commuter rails, commuter rail on trestle, and

commuter rail with retaining walls. Rail traffic rates were based on an estimated number of trains per day and cars per train.

Elevation – A digital elevation model (DEM) was created by David Goodwin of the UMass Resource Mapping Unit from MassGIS digital terrain model (DTM) elevation contours, elevation points, and topographic breaklines as part of the Living Waters project.

Flow – A flow grid (giving the direction of expected water flow for each cell) based on a digital elevation model was created for all of mainland Massachusetts by our lab as part of the Living Waters project. This flow grid conforms to MassGIS centerline data. We used this flow grid directly.

Aquatic Resistance – We modified the approach of Randhir et al. 2001 (Forest Ecology and Management 143:47-56) to build a time-of-travel grid for each cell in the project area, based on land cover, slope, flow, and stream gradient. This grid was used to define the influence area within the watershed of each point for our watershed metrics.

Point-source Pollution – Point-source pollution was defined by Massachusetts Natural Heritage and Endangered Species Program as part of their Living Waters project. These data are based on an assessment of pollution risk compiled from six DEP and EPA data layers: TRI (Toxic Release Inventory), RCRIS (Resource Conservation and Recovery Information), PCS (Permit Compliance System), MINES (Mineral Industry Locations), IFD (Industrial Facility Discharge Sites), and CERCLIS (Superfund National Priority List Sites) from the EPA Basins 3.0 website (http://www.epa.gov/waterscience/basins/metadata.htm). UST (Underground Storage Tank Locations), GRWTR (Ground Water Discharge Permits), and DEP Solid Waste Facilities point sources are available from MassGIS. See Heritage's Living Waters Technical Report for details.

Imperviousness – Impervious surfaces are from MassGIS. This layer is at 1 m resolution, based on the 2005 orthophotos. Imperviousness is summarized as percent impervious in 30 m cells.

Appendix C: CAPS integrity metrics

These ecological integrity metrics are included in the Conservation Assessment and Prioritization System (CAPS). Integrity metrics include both anthropogenic *stressor* metrics that measure the level of anthropogenic activities exclusively and *resiliency* metrics that measure the combined effect of anthropogenic stressor and landscape context.

Stressor Metrics	
Development & roads	
Habitat loss	Measures the intensity of habitat loss caused by all forms of development in the neighborhood surrounding the focal cell, based on a logistic function of Euclidean distance.
Wetland buffer insults	Measures the adverse effect of impervious surfaces within the 100-foot regulatory buffer around a wetland.
Traffic	Measures the intensity of road and rail traffic (based on measured road traffic rates) in the neighborhood surrounding the focal cell, based on a logistic function of distance.
Microclimate alterations	Measures the adverse effects of induced (human-created) edges on the microclimate of patch interiors, such as moisture, temperature, and wind. The edge effects metric is based on the "worst" edge effect among all adverse edges in the neighborhood surrounding the focal cell, where each adverse edge is evaluated using a "depth-of-edge" function in which the "effect" is scaled using a logistic function of distance.
Pollution	
Road salt	Measures the intensity of road salt application in the watershed above an aquatic focal cell weighted by road class and the modeled "influence value" for each cell, which is the aquatic distance from the focal cell based on a time-of-flow model. This metric is a surrogate for road salt application rates.

Sedimentation	Measures the intensity of road sediment production in the watershed above an aquatic focal cell weighted by road class (i.e., size, substrate, gradient) and the modeled "influence value" for each cell, which is the aquatic distance from the focal cell based on a time-of-flow model. This metric is a surrogate for road sediment production rates.
Nutrient loading	Measures the intensity of fertilizer application in the neighborhood surrounding the focal cell, based on the aquatic distance from the focal cell based on a time-of-flow model to development classes (primarily agriculture and residential land uses). This metric is a surrogate for fertilizer application rate.
Toxic pollution	Measures the intensity of actual or potential point-sources of pollution (such as permitted discharges into streams, municipal and industrial sewage plants, and underground storage tanks) in the watershed above an aquatic focal cell, weighted by type and size of point source and by the modeled "influence value" for each cell, which is the aquatic distance from the focal cell based on a time-of-flow model.
Biotic alterations	
Domestic predators	Measures the intensity of development associated with sources of domestic predators (e.g., cats) in the neighborhood surrounding the focal cell, based on a logistic function of distance to development classes. This metric is a surrogate for domestic predator abundance measured directly in the field.
Edge predators	Measures the intensity of development associated with sources of human commensal mesopredators (e.g., raccoons and skunks) and nest parasites (cowbirds) in the neighborhood surrounding the focal cell, based on a logistic function of distance to development classes. This metric is a surrogate for mesopredator/nest parasite abundance measured directly in the field.
Non-native invasive plants	Measures the intensity of development associated with sources of non-native invasive plants in the neighborhood surrounding the focal cell, based on a logistic function of distance to development classes. This metric is a surrogate for non-native invasive plant abundance measured directly in the field.

Non-native invasive earthworms	Measures the intensity of development associated with sources of non-native invasive earthworms in the neighborhood surrounding the focal cell, based on a logistic function of distance to development classes. This metric is a surrogate for non-native invasive earthworm abundance measured directly in the field.
Hydrological alterations	
Imperviousness	Measures the intensity of impervious surface in the watershed above the focal cell, based on imperviousness and the modeled "influence value" for each cell, which is the aquatic distance from the focal cell based on a time-of-flow model.
Percent impounded	Measures the proportion of the watershed above an aquatic focal cell that is impounded by dams, weighted by the modeled "influence value" for each cell, which is the aquatic distance from the focal cell based on a time-of-flow model.
Upstream road crossings	Measures the number of upstream road crossings per kilometer of stream above an aquatic focal cell weighted by the modeled "influence value" for each cell, which is the aquatic distance from the focal cell based on a time-of-flow model.
Dam intensity	Measures the number of dams in the watershed above an aquatic focal cell weighted by dam size and the modeled "influence value" for each cell, which is the aquatic distance from the focal cell based on a time-of-flow model.

Resiliency Metrics	
Connectedness	Measures the disruption of habitat connectivity caused by all forms of development between each focal cell and surrounding cells as well as the "resistance" of the surrounding undeveloped landscape. A hypothetical organism in a highly connected cell can reach a large area with minimal crossing of "hostile" cells. This metric uses a least-cost path algorithm to determine the area that can be reached from each focal cell. The focal cell gets a "bank account," which represents the distance a hypothetical organism could move through the undeveloped landscape. Each cell is assigned a travel cost, based on a resistance matrix, as a function of its ecological similarity to the focal cell. The algorithm then creates a least-cost hull around the focal cell, representing the maximum distance that can be moved from the cell until the "bank account" is depleted.
Similarity	Measures the amount of similarity between the ecological setting at the focal cell and those of neighboring cells, weighted by a logistic function of distance. Similarity is based on the ecological distance between the focal cell and each neighboring cell, where ecological distance is a multivariate distance across all ecological setting variables.

Appendix D: Metric Parameterizations

This table gives relative weights for each metric by community.

	Development & roads	Habitat loss	Watershed habitat loss	Wetland buffer insults	Road traffic	Microclimate alterations	Pollution	Road salt	Sedimentation	Nutrient loading	Toxic pollution	Biotic alterations	Domestic predators	Edge predators	Non-native invasive plants	Non-native invasive earthworms	Hydrological alterations	Imperviousness	Percent impounded	Upstream road crossings	Dam intensity	Resiliency metrics	Connectedness	Similarity
Terrestrial																								
Forest		2			2	1							1	2	2	2							5	3
Deciduous forested wetland		2		1	2	1		1	1	1	1			1	2	1							4	2
Mixed forested wetland		2		1	2	1		1	1	1	1			1	2	1							4	2
Coniferous forested wetland		2		1	2	1		1	1	1	1			1	2	1							4	2
Powerlines		4			2								1	2	2	1							5	3
Open land		4			2								1	2	2	1							5	3
Pasture		4			2								1	2	2								5	4
Sea cliff		4												1	1								2	1
Barrier beach system		4			2									2	1								2	1
Coastal dune		4			2									3	1								2	1
Barrier beach coastal beach		4			2									3	1								2	1
Barrier beach coastal dune		4			2									3	1								2	1
Palustrine																								

	Development & roads	Habitat loss	Watershed habitat loss	Wetland buffer insults	Road traffic	Microclimate alterations	Pollution	Road salt	Sedimentation	Nutrient loading	Toxic pollution	Biotic alterations	Domestic predators	Edge predators	Non-native invasive plants	Non-native invasive earthworms	Hydrological alterations	Imperviousness	Percent impounded	Upstream road crossings	Dam intensity	Resiliency metrics	Connectedness	Similarity
Bog		2		2	1			2	1	2	1			1	1			1					4	2
Deep marsh		2		2	2			1	1	1	1			1	2			1					4	2
Shallow marsh		2		2	2			1	1	1	1			1	2			1					4	2
Shrub swamp		2		2	2			1	1	1	1			1	2			1					4	2
Pond		2		2	2			1	1	2	1			1	1			1					4	2
Vernal pool		2			2			2	1	1	1			1	1			1					4	2
Cranberry bog		2		2	2			2	1	2	1			1	2			1					4	2
Lacustrine																								
Lake		2		2	1			1	1	2	2			1	1			1					4	2
Reservoir		2		2	1			1	1	2	2			1	1			1					4	2
Riverine																								
First order streams					1	1			1	1	1			1	1			2	1	1	1		6	
Second order streams					1	1			1	1	1			1	1			2	1	1	1		6	
Third order streams					1	1			1	1	1			1	1			2	1	1	1		6	
Fourth order streams					1				1	1	1			1	1			2	1	1	2		6	
Fifth order streams					1				1	1	1			1	1			2	1	1	2		6	
Sixth order streams					1				1	1	1			1	1			2	1	1	2		6	
Estuarine																								

	Development & roads	Habitat loss	Watershed habitat loss	Wetland buffer insults	Road traffic	Microclimate alterations	Pollution	Road salt	Sedimentation	Nutrient loading	Toxic pollution	Biotic alterations	Domestic predators	Edge predators	Non-native invasive plants	Non-native invasive earthworms	Hydrological alterations	Imperviousness	Percent impounded	Upstream road crossings	Dam intensity	Resiliency metrics	Connectedness	Similarity
First order estuary					1				1	1	1			1	1			1	1	1	1		6	
Second order estuary					1				1	1	1			1	1			1	1	1	1		6	
Third order estuary					1				1	1	1			1	1			1	1	1	1		6	
Fourth order estuary					1				1	1	1			1	1			1	1	1	2		6	
Fifth order estuary					1				1	1	1			1	1			1	1	1	2		6	
Sixth order estuary					1				1	1	1			1	1			1	1	1	2		6	
Salt pond		2		2	2				1	2	1			1				1					4	2
Bay					1				1	1	3												6	
Barrier beach pond		2		2	2				1	2	1			1	1			1					4	2
Salt marsh		2	2	2	1				1		2			1				1					3	3
Barrier beach bog		2		2	1				1	2	1			1	1			1					4	2
Barrier beach deep marsh		2		2	2				1	1	1			1	2			1					4	2
Barrier beach marsh		2		2	2				1	1	1			1	2			1					4	2
Barrier beach shrub swamp		2		2	2				1	1	1			1	2			1					4	2
Barrier beach deciduous forested wetland		1		1	2	1			1	1	1			1	2								4	2
Barrier beach mixed forested wetland		2		1	2	1			1	1	1			1	2								4	2
Barrier beach coniferous forested wetland		2		1	2	1			1	1	1			1	2								4	2
Barrier beach salt marsh		2	2	2	1				1		2			1				1					3	3

	Development & roads	Habitat loss	Watershed habitat loss	Wetland buffer insults	Road traffic	Microclimate alterations	Pollution	Road salt	Sedimentation	Nutrient loading	Toxic pollution	Biotic alterations	Domestic predators	Edge predators	Non-native invasive plants	Non-native invasive earthworms	Hydrological alterations	Imperviousness	Percent impounded	Upstream road crossings	Dam intensity	Resiliency metrics	Connectedness	Similarity
Marine																								
Coastal beach		4			2									3	1								2	1
Rocky intertidal		2							1		1												2	1
Tidal flat		2							1	1	3												1	2

Appendix E: GIS Data Directory

This appendix lists all GIS data provided on our FTP site. Each directory is supplied as a .zip file. All data are Arc/Info grids unless otherwise noted.

Grids listed with a trailing dash are provided for each scenario; for instance, iei- refers to grids named ieiX (base scenario), ieiA (Attleboro alternative), etc. Grids for sensitivity analyses are not provided.

Landcover grids (landcover.zip)

landcover\flc-	Landcover map, including roads and streams

Final results (final.zip)

final\iei-	Index of Ecological Integrity
final\delta-	Difference grids from base for each scenario

Scaled landscape metric* results (scaled.zip)

scaled\...	Rescaled landscape metric results

Raw landscape metric* results (raw.zip)

raw\...	Raw (unscaled) landscape metric results

Indirect loss for each landscape metric* (deltas.zip)

deltas\...	Raw (unscaled) landscape metric results

* For a list of landscape metrics and their corresponding grid names, see *CAPS Landscape Metrics*, below.

CAPS Landscape Metrics

The following grids are supplied in the \results folder, both in raw and scaled forms. Raw metrics are the original, unscaled results. Scaled metrics are rescaled by percentiles within each community, thus values of "connect" ≥ 0.90 represent the 10% best locations for connectedness for each community. These scaled metrics were combined using the weights listed in Appendix C to create the final Indices of Ecological Integrity. Note that watershed-based metrics were the same across all scenarios.

Grid name	Landscape metric
Development & roads	
habloss-	Habitat loss
whabloss	Watershed habitat loss
insults	Wetland buffer insults
traffic-	Road traffic
edges-	Microclimate alterations
Pollution	
salt	Road salt
sediment	Sedimentation
fertilize	Nutrient loading
pointsource	Toxic pollution
Biotic alterations	
cats-	Domestic predators
edgepred-	Edge predators
badplants-	Non-native invasive plants
worms-	Non-native invasive earthworms
Hydrological alterations	
imperv	Imperviousness
impound	Percent impounded
roadx	Upstream road crossings
damint	Dam intensity
Resiliency metrics	
connect-	Connectedness
sim-	Similarity

Appendix F: Difference Images

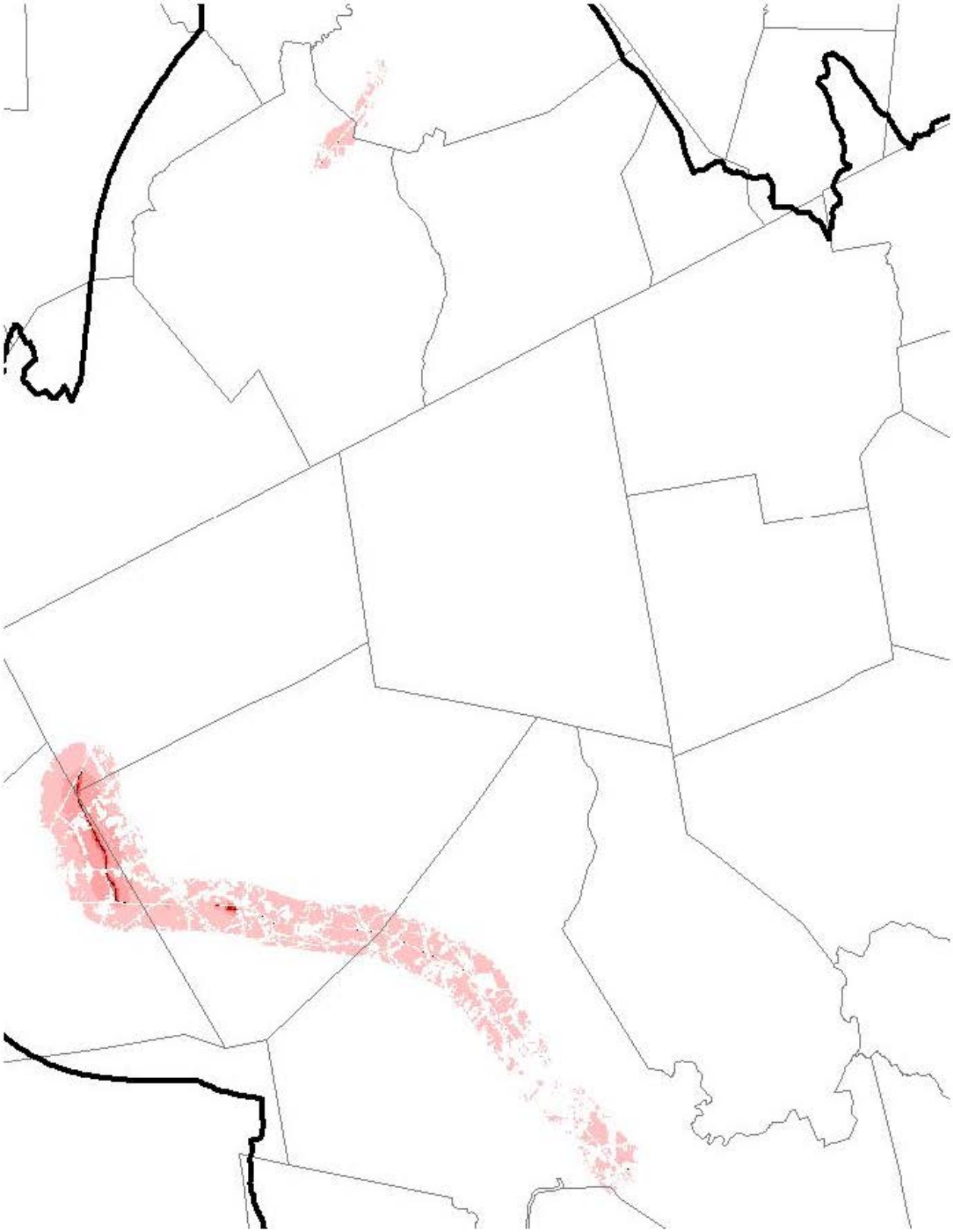


Fig. F-1. Difference image for Attleboro scenario.

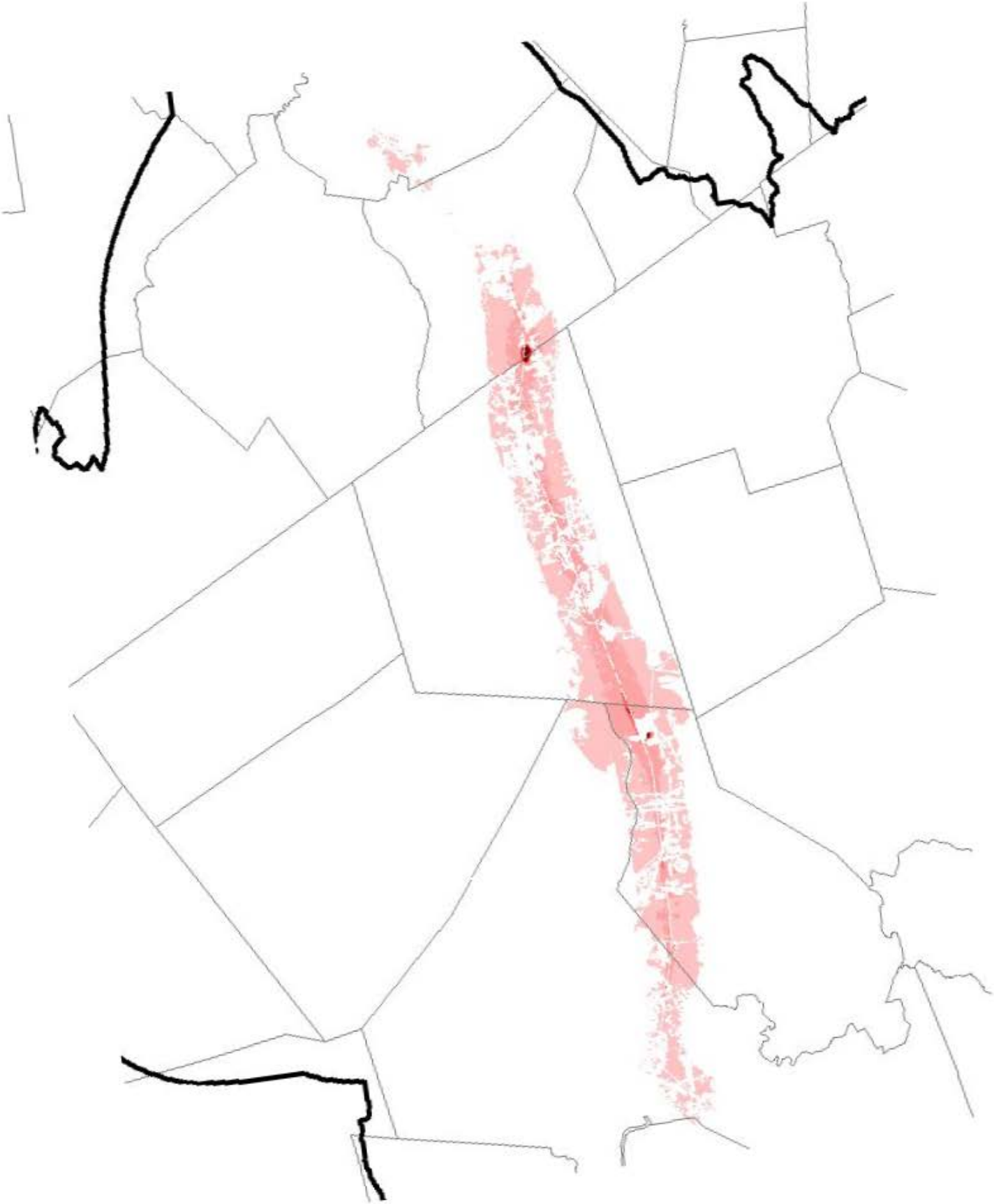


Fig. F-2. Difference image for Stoughton at-grade scenario.

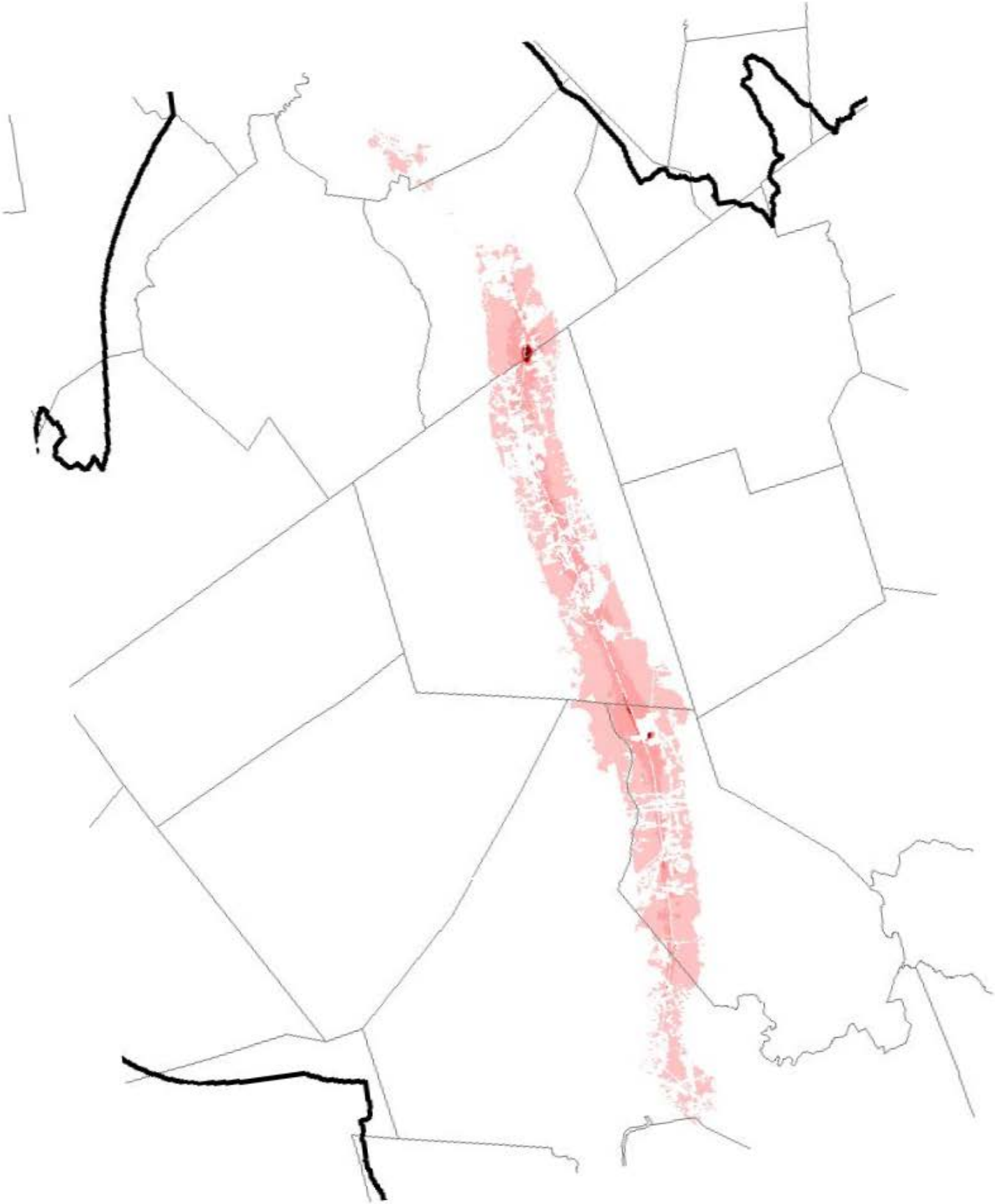


Fig. F-3. Difference image for Stoughton with trestle scenario.

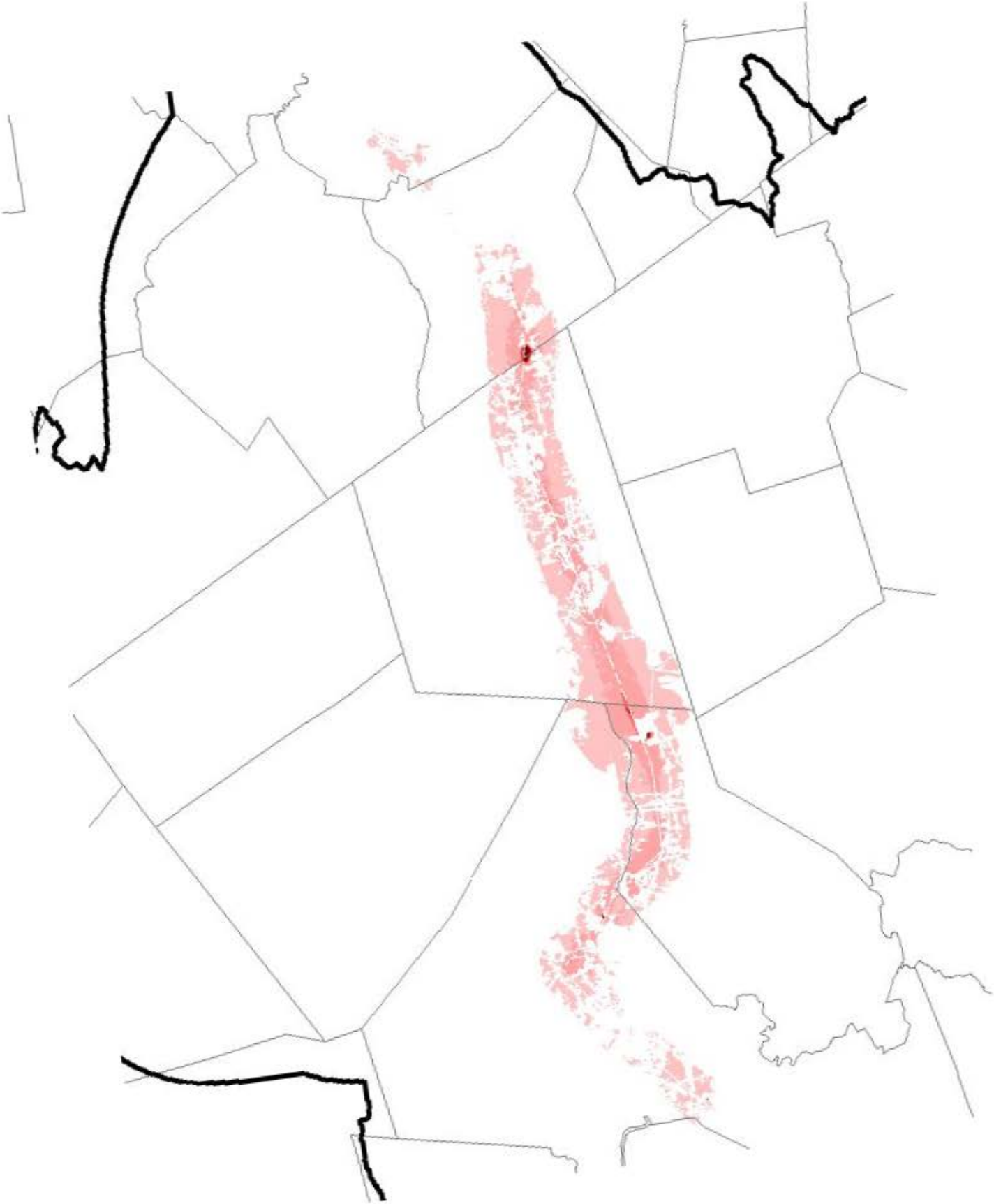


Fig. F-4. Difference image for Stoughton-Whittenton at-grade scenario.

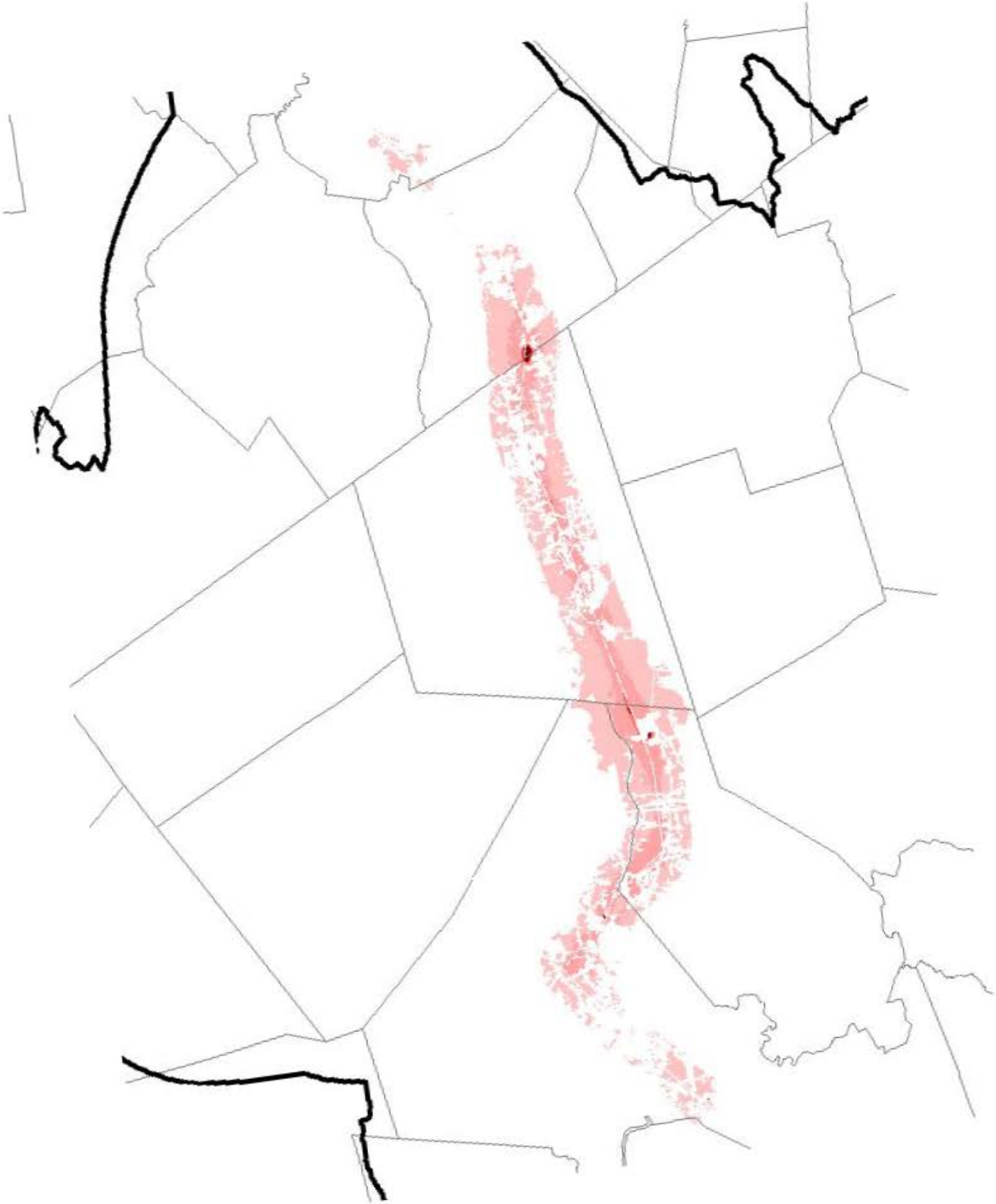


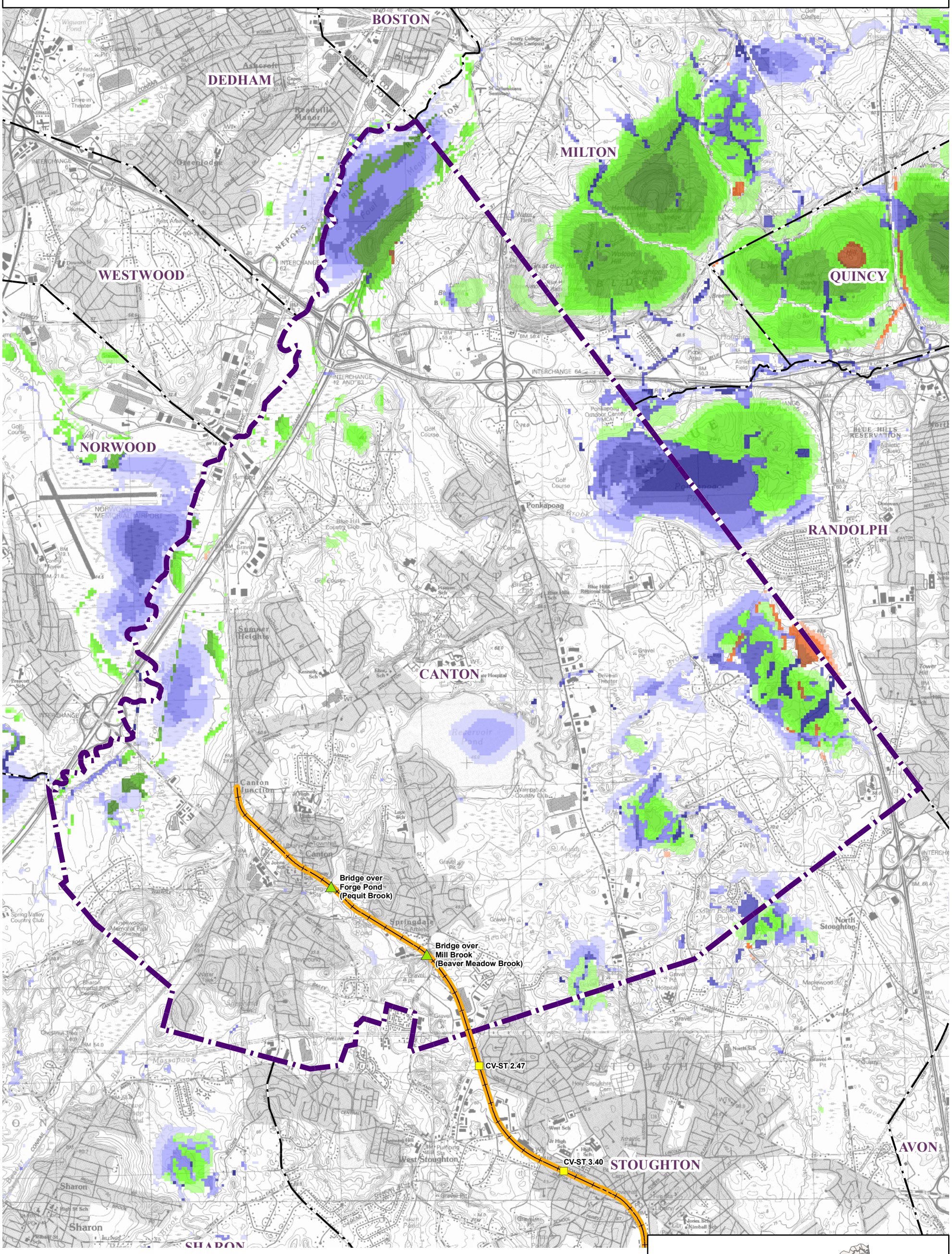
Fig. F-5. Difference image for Stoughton-Whittenton with trestle scenario.

University of Massachusetts, Amherst. Conservation Assessment and Prioritization System (CAPS) South Coast Rail Analysis

CAPS Index of Ecological Integrity Maps
Top 50% of the Landscape By Municipality

\\mabos\projects\10111.00\GIS\project\FEIS\Bridge_Culvert\CAPS_Canton_USGS.mxd

Town of Canton, MA



Legend

Rail

- Fall River Secondary
- New Bedford Main Line
- Stoughton Line

Culverts

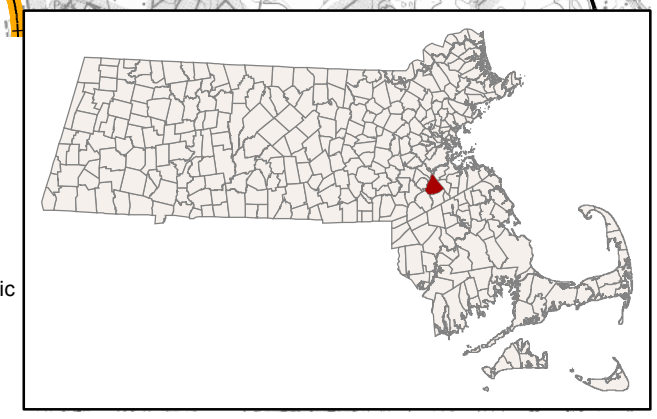
- Hydraulic Analysis, Replace in kind, or Eliminate
- Recommended to be Daylighted
- Recommended to meet MA River and Stream Crossing Standards
- Bridge

0 1,600 3,200 Feet

CAPS Index of Ecological Integrity
Top 50% of the Landscape

- Coastal Upland
- Coastal Wetland Aquatic
- Forest
- Freshwater Wetland & Aquatic
- Shrubland

50-60% 60-70% 70-80% 80-90% 90-100%



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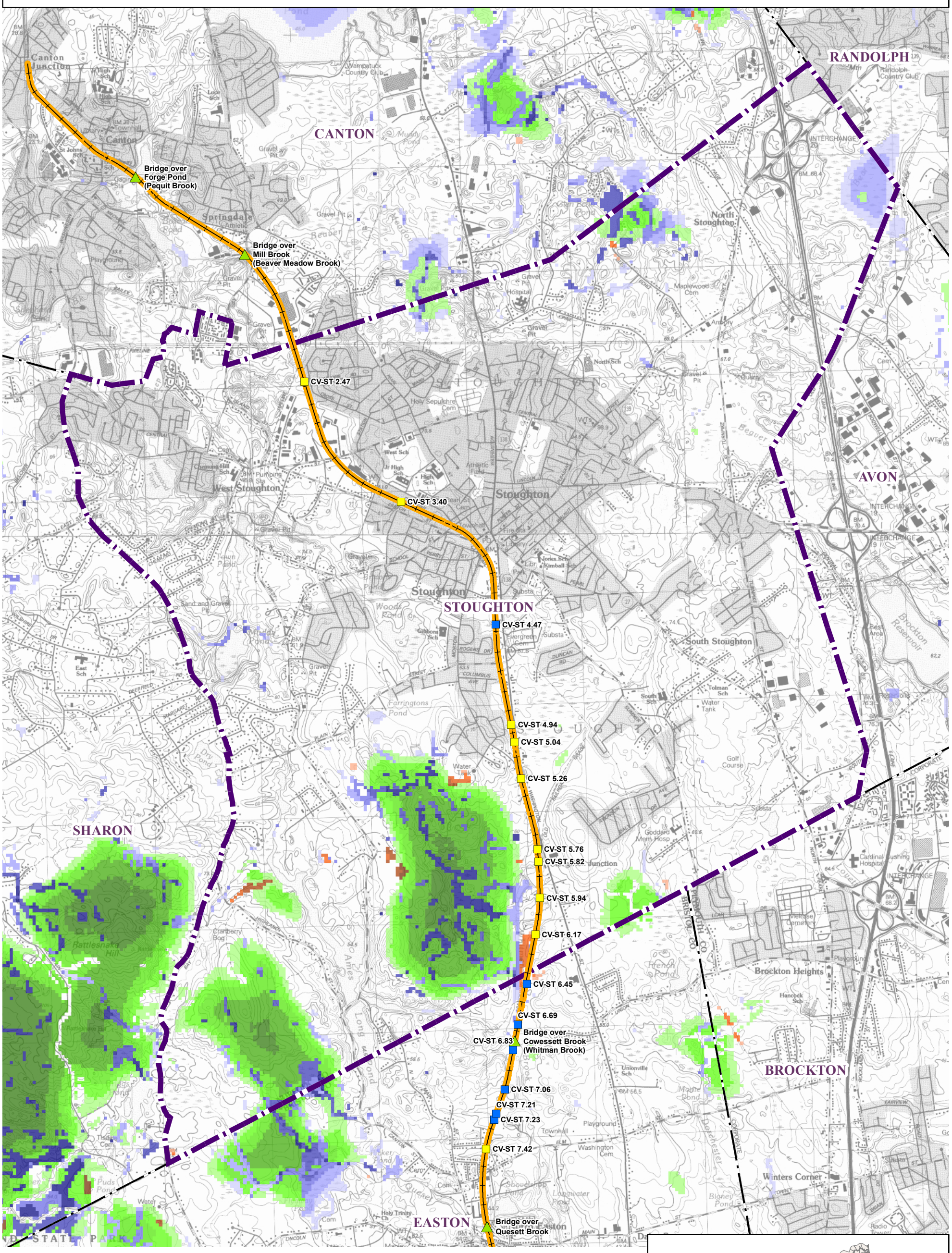
Town of Stoughton, MA



Legend

Rail

- Fall River Secondary
- New Bedford Main Line
- Stoughton Line

Culverts

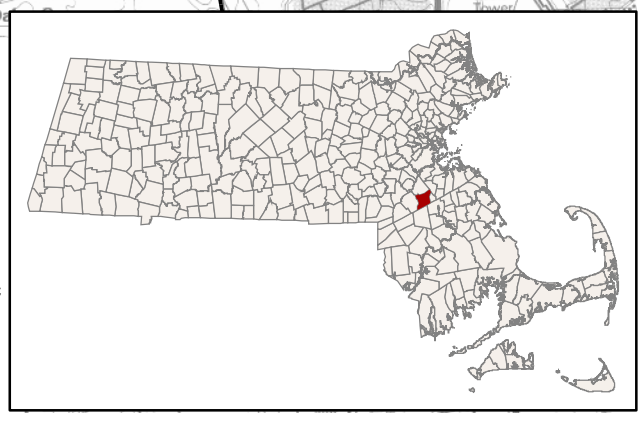
- Hydraulic Analysis, Replace in kind, or Eliminate
- Recommended to be Daylighted
- Recommended to meet MA River and Stream Crossing Standards
- Bridge

0 1,400 2,800 Feet

CAPS Index of Ecological Integrity
Top 50% of the Landscape

- Coastal Upland
- Coastal Wetland Aquatic
- Forest
- Freshwater Wetland & Aquatic
- Shrubland

50-60% 60-70% 70-80% 80-90% 90-100%



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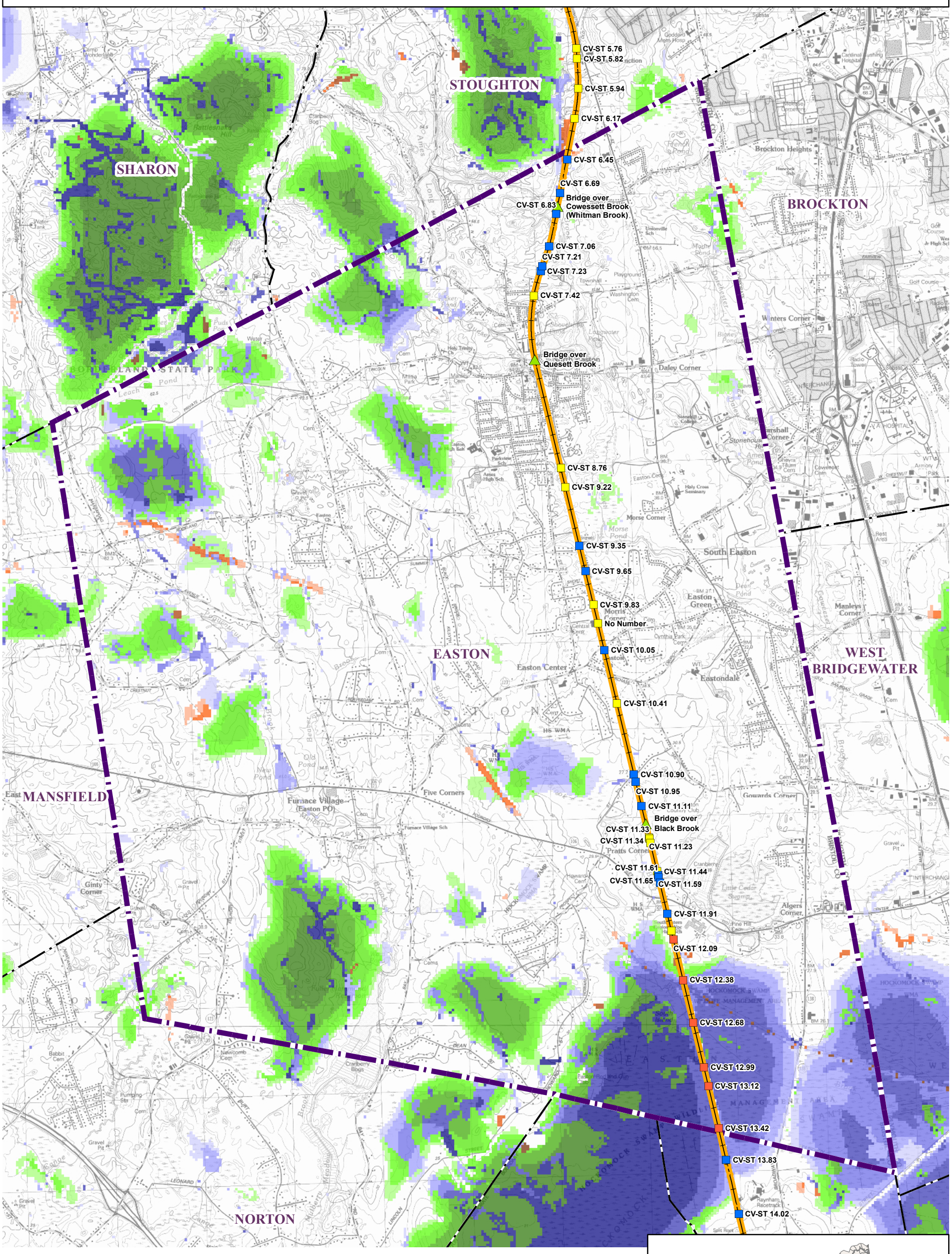
Town of Easton, MA



Legend

Rail

- Fall River Secondary
- New Bedford Main Line
- Stoughton Line

Culverts

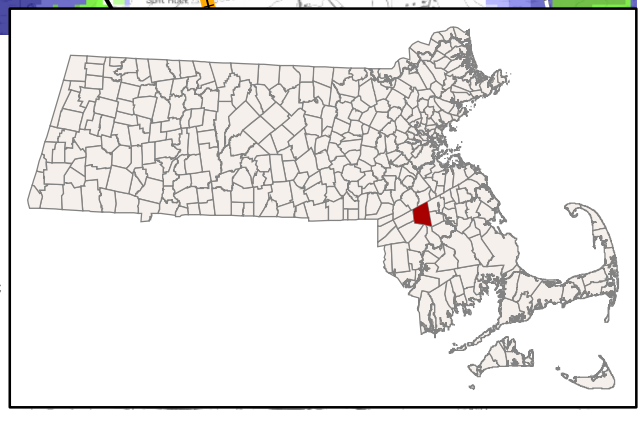
- Hydraulic Analysis, Replace in kind, or Eliminate
- Recommended to be Daylighted
- Recommended to meet MA River and Stream Crossing Standards
- Bridge

0 1,700 3,400 Feet

CAPS Index of Ecological Integrity
Top 50% of the Landscape

- Coastal Upland
- Coastal Wetland Aquatic
- Forest
- Freshwater Wetland & Aquatic
- Shrubland

50-60% 60-70% 70-80% 80-90% 90-100%



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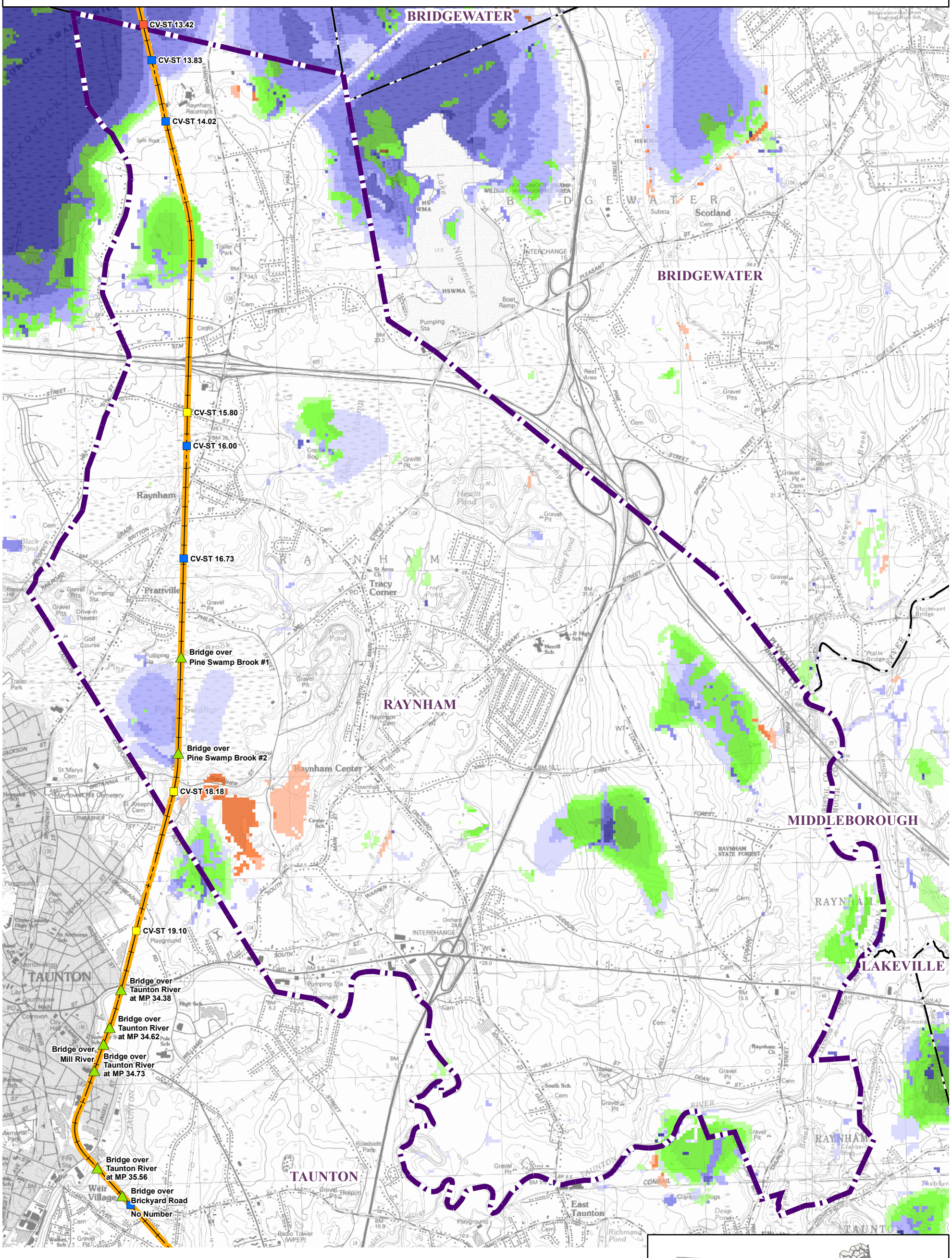
Town of Raynham, MA



Legend

Rail

- Fall River Secondary
- New Bedford Main Line
- Stoughton Line

Culverts

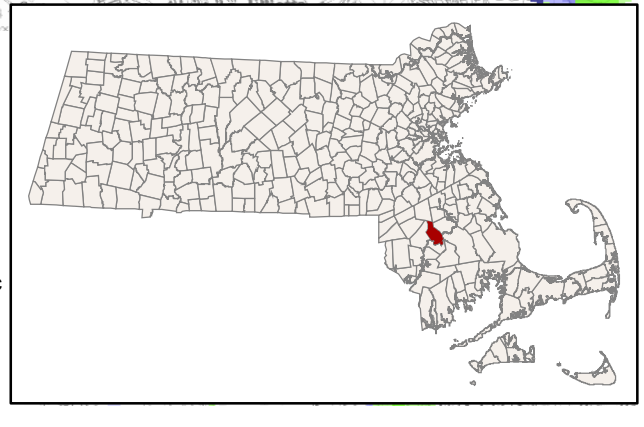
- Hydraulic Analysis, Replace in kind, or Eliminate
- Recommended to be Daylighted
- Recommended to meet MA River and Stream Crossing Standards
- Bridge

0 1,500 3,000 Feet

CAPS Index of Ecological Integrity
Top 50% of the Landscape

- Coastal Upland
- Coastal Wetland Aquatic
- Forest
- Freshwater Wetland & Aquatic
- Shrubland

50-60% 60-70% 70-80% 80-90% 90-100%



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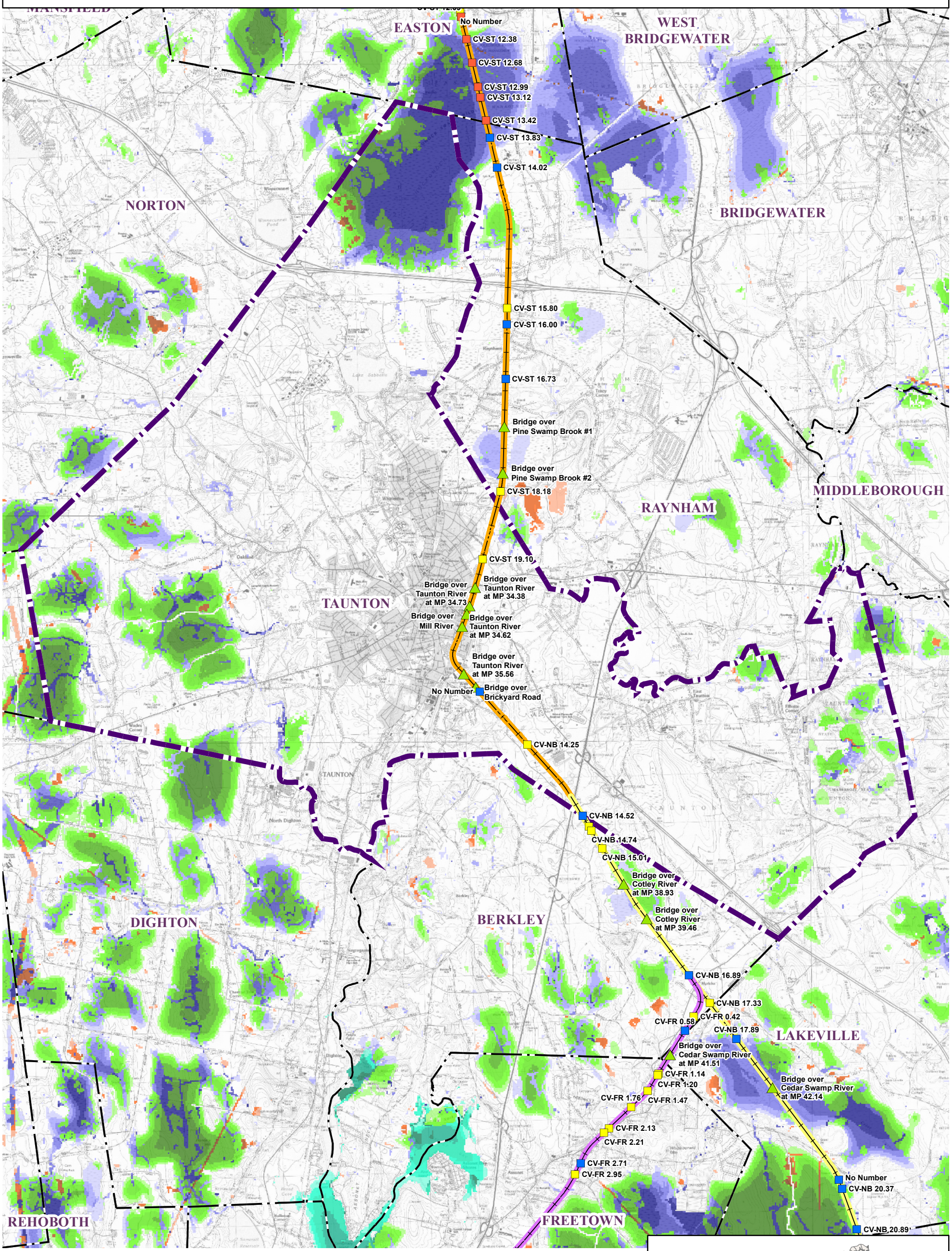
Town of Taunton, MA



Legend

Rail

- Fall River Secondary
- New Bedford Main Line
- Stoughton Line

Culverts

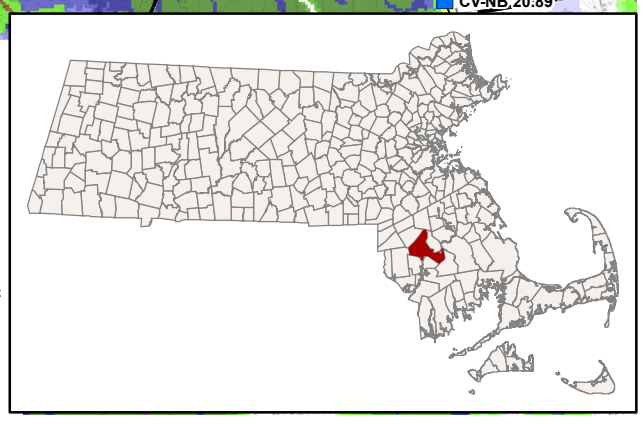
- Hydraulic Analysis, Replace in kind, or Eliminate
- Recommended to be Daylighted
- Recommended to meet MA River and Stream Crossing Standards
- Bridge

0 3,100 6,200 Feet

CAPS Index of Ecological Integrity
Top 50% of the Landscape

- Coastal Upland
- Coastal Wetland Aquatic
- Forest
- Freshwater Wetland & Aquatic
- Shrubland

50-60% 60-70% 70-80% 80-90% 90-100%



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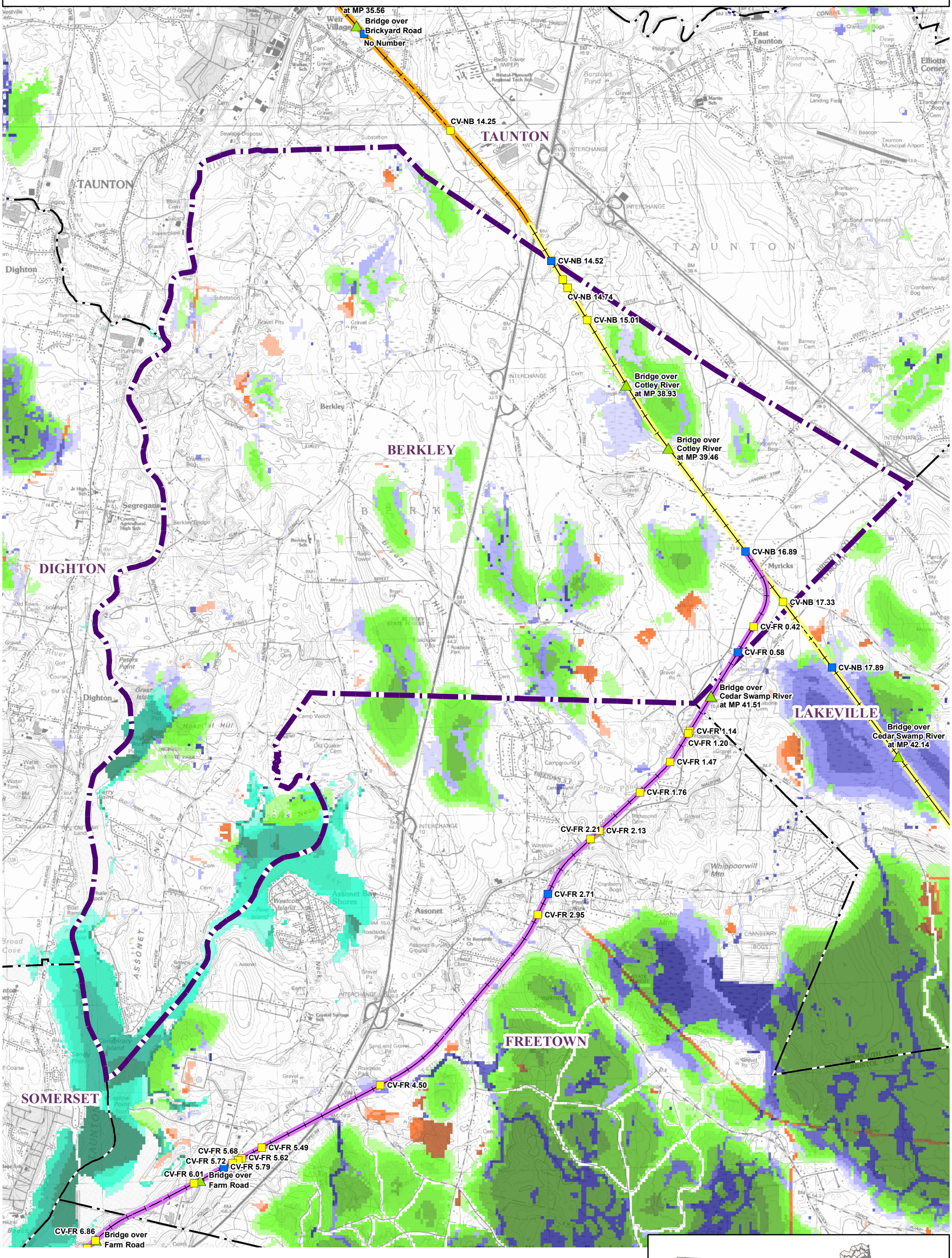
Town of Berkley, MA



Legend

Rail

- Fall River Secondary
- New Bedford Main Line
- Stoughton Line

Culverts

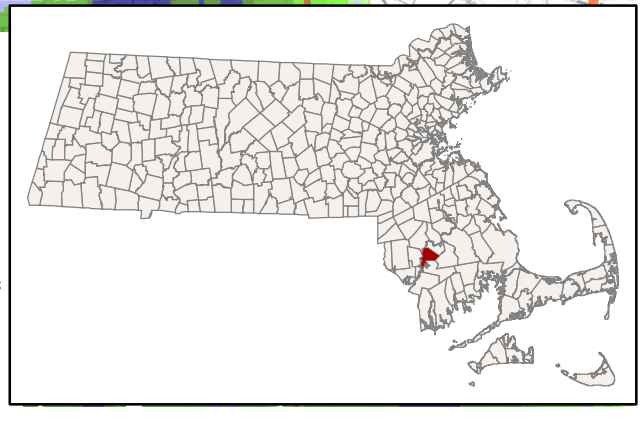
- Hydraulic Analysis, Replace in kind, or Eliminate
- Recommended to be Daylighted
- Recommended to meet MA River and Stream Crossing Standards
- Bridge

0 1,400 2,800 Feet

CAPS Index of Ecological Integrity
Top 50% of the Landscape

- Coastal Upland
- Coastal Wetland Aquatic
- Forest
- Freshwater Wetland & Aquatic
- Shrubland

50-60% 60-70% 70-80% 80-90% 90-100%



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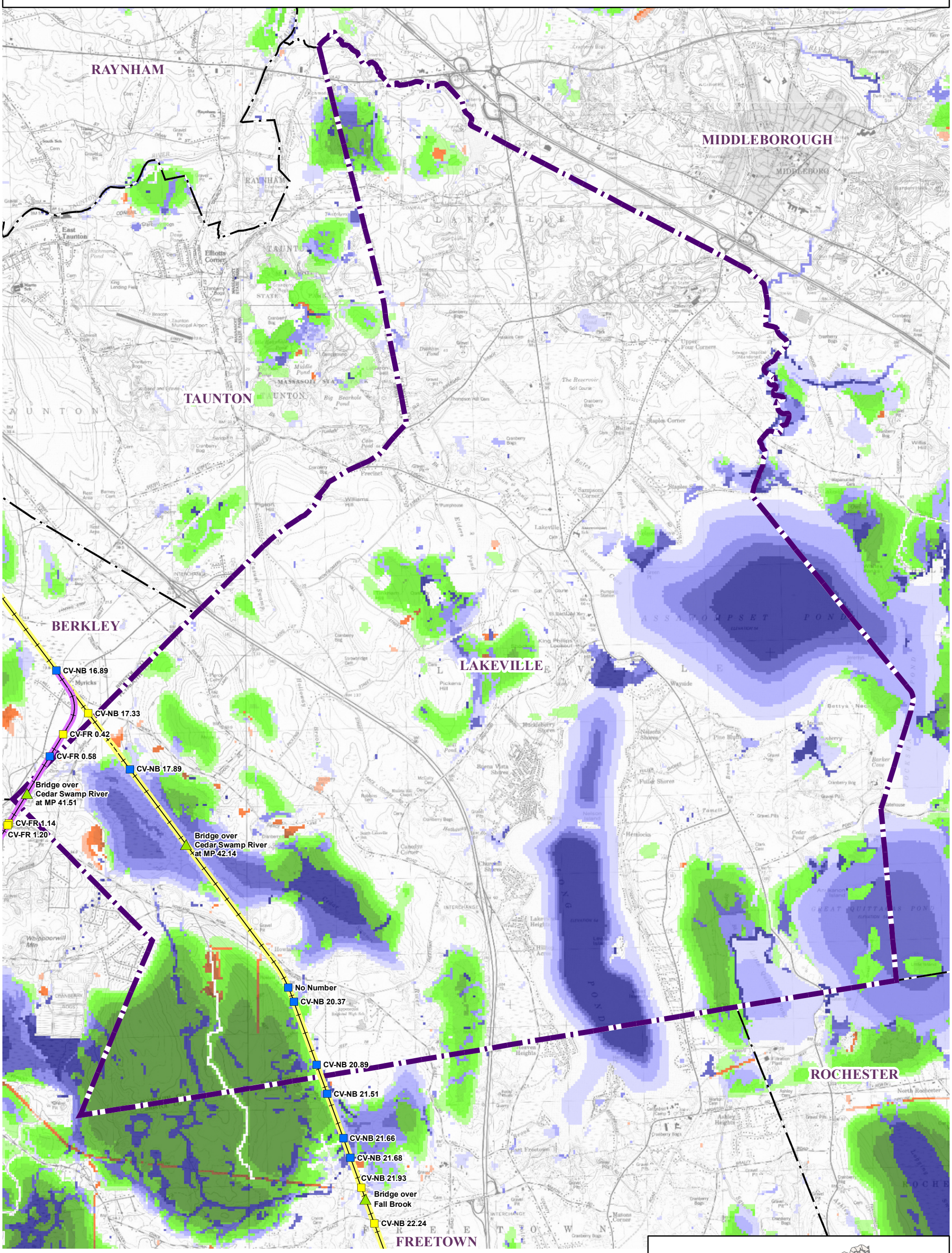
Town of Lakeville, MA



Legend

Rail

- Fall River Secondary
- New Bedford Main Line
- Stoughton Line

Culverts

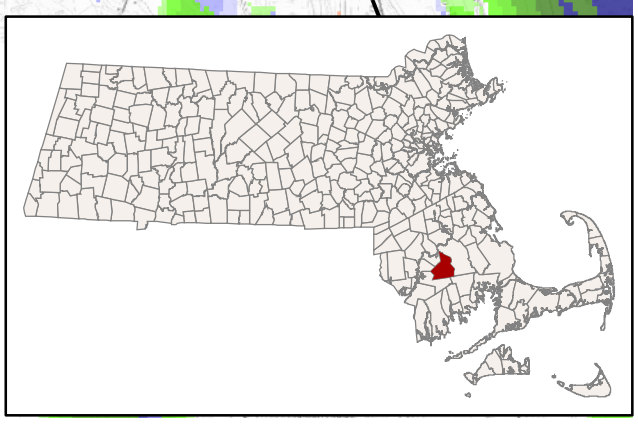
- Hydraulic Analysis, Replace in kind, or Eliminate
- Recommended to be Daylighted
- Recommended to meet MA River and Stream Crossing Standards
- Bridge

0 2,000 4,000 Feet

CAPS Index of Ecological Integrity
Top 50% of the Landscape

- Coastal Upland
- Coastal Wetland Aquatic
- Forest
- Freshwater Wetland & Aquatic
- Shrubland

50-60% 60-70% 70-80% 80-90% 90-100%



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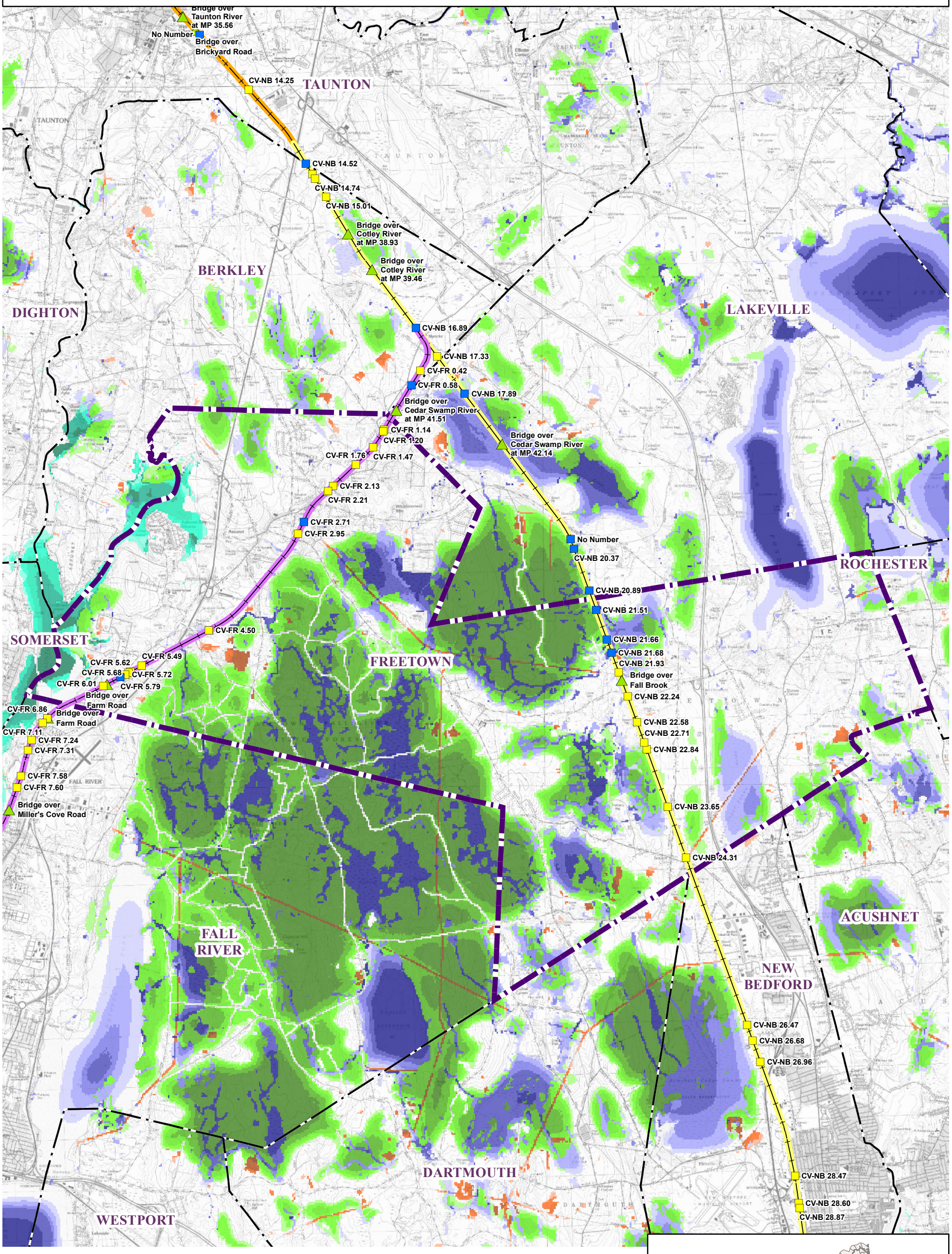
Town of Freetown, MA



Legend

Rail

- Fall River Secondary
- New Bedford Main Line
- Stoughton Line

Culverts

- Hydraulic Analysis, Replace in kind, or Eliminate
- Recommended to be Daylighted
- Recommended to meet MA River and Stream Crossing Standards
- Bridge

0 3,000 6,000 Feet

CAPS Index of Ecological Integrity
Top 50% of the Landscape

- Coastal Upland
- Coastal Wetland Aquatic
- Forest
- Freshwater Wetland & Aquatic
- Shrubland

50-60% 60-70% 70-80% 80-90% 90-100%

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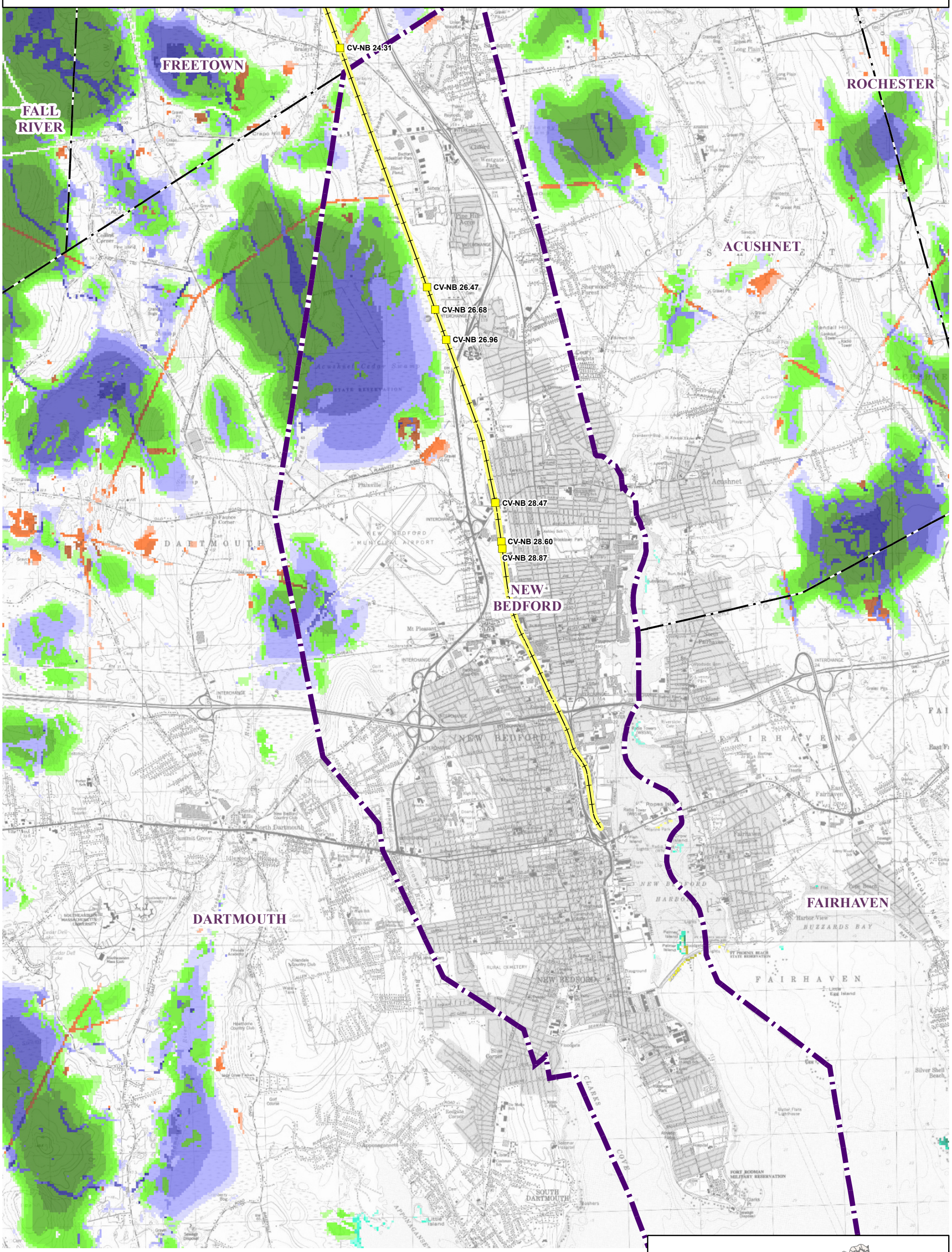
Town of New Bedford, MA



Legend

Rail

- Fall River Secondary
- New Bedford Main Line
- Stoughton Line

Culverts

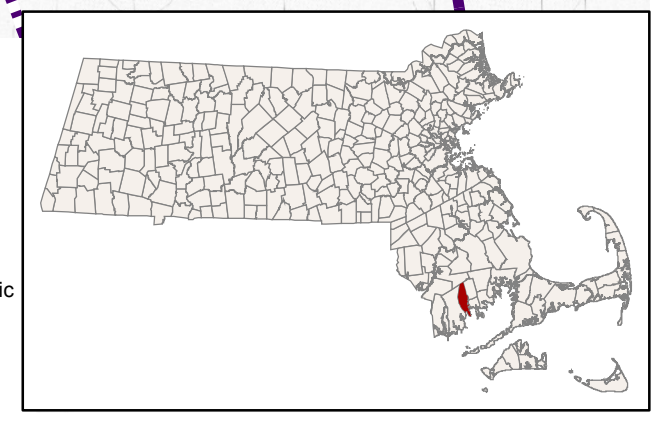
- Hydraulic Analysis, Replace in kind, or Eliminate
- Recommended to be Daylighted
- Recommended to meet MA River and Stream Crossing Standards
- Bridge

0 2,100 4,200 Feet

CAPS Index of Ecological Integrity
Top 50% of the Landscape

- Coastal Upland
- Coastal Wetland Aquatic
- Forest
- Freshwater Wetland & Aquatic
- Shrubland

50-60% 60-70% 70-80% 80-90% 90-100%



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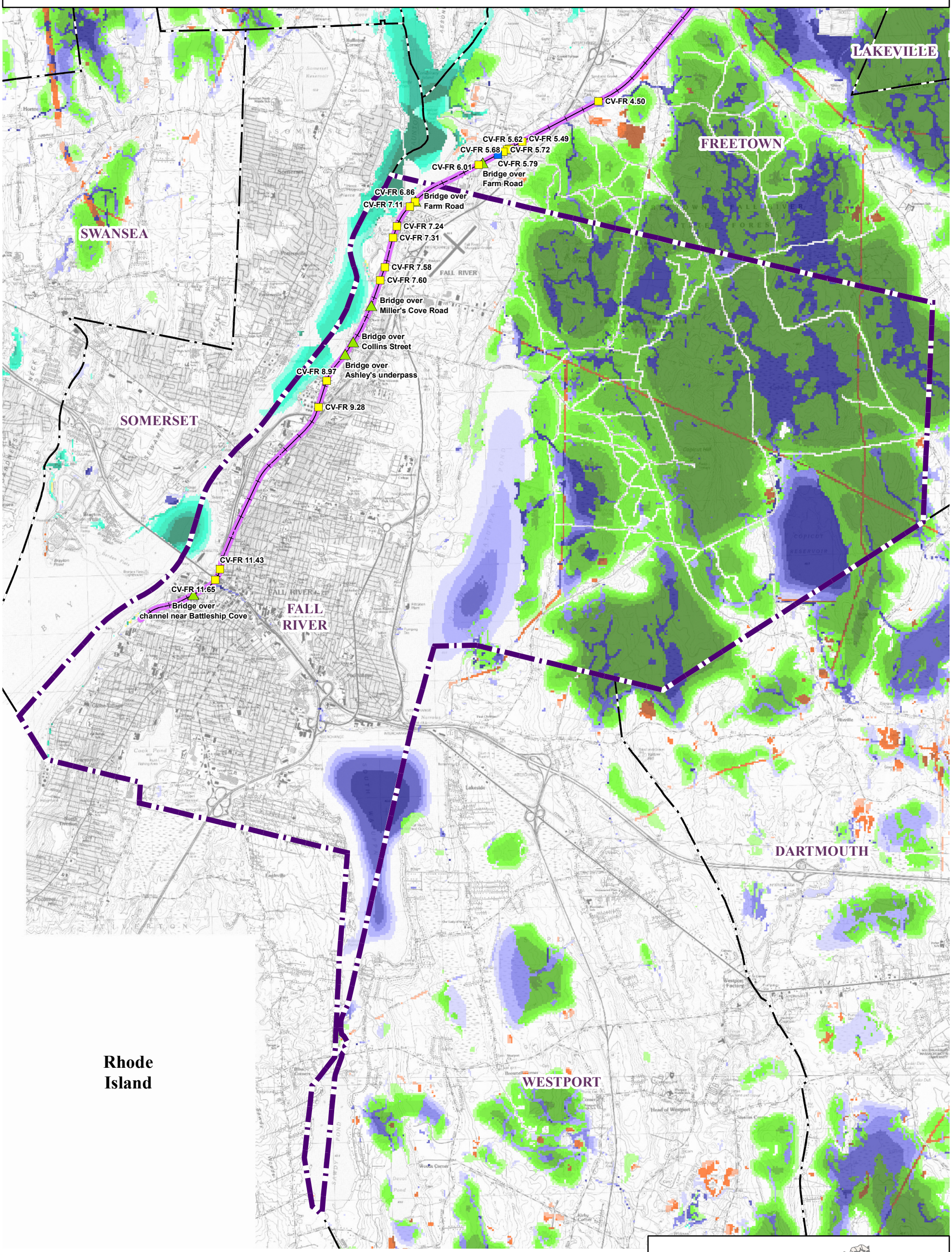
Town of Fall River, MA



Legend

Rail

- Fall River Secondary
- New Bedford Main Line
- Stoughton Line

Culverts

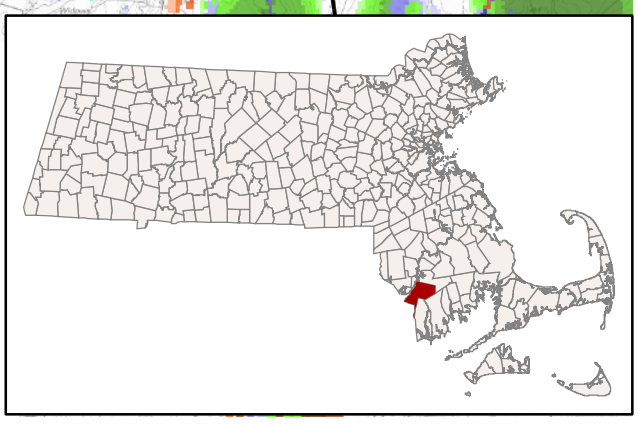
- Hydraulic Analysis, Replace in kind, or Eliminate
- Recommended to be Daylighted
- Recommended to meet MA River and Stream Crossing Standards
- Bridge

0 0.5 1 Miles

CAPS Index of Ecological Integrity
Top 50% of the Landscape

- Coastal Upland
- Coastal Wetland Aquatic
- Forest
- Freshwater Wetland & Aquatic
- Shrubland

50-60% 60-70% 70-80% 80-90% 90-100%



Appendix 4.14-C

Comprehensive Summary of Impacts to Vernal Pools

Comprehensive Summary of Impacts to Vernal Pools

Municipality	Pools Directly Filled	Amount of Fill (Ac.) / Percent Filled	Pools with area of VP Habitat Impacted	Amount of Impact (Ac.) / Percent Impacted	Pools with area of Upland Buffer Habitat Impacted	Amount of Impact (Ac.) / Percent Impacted	Pools with area of Surrounding Upland Habitat Impacted	Amount of Impact (Ac.) / Percent Impacted
Stoughton	PVP 23791	0.03 / 17.2%	PVP 23791	0.00 / 0.8%	PVP 23791	0.09 / 12.5%	PVP 23791	0.63 / 6.0%
							PVP 23778	1.72 / 4.8%
					PVP 23784	0.57 / 19.3%	PVP 23784	8.63 / 15.9%
			CVP 2140	0.01 / 1.1%	CVP 2140	0.49 / 20.6%	CVP 2140	
Stoughton Total	1	0.03	2	0.01	3	1.15	4	10.98
Easton	PVP 7222	0.05 / 21.3%	PVP 7222	0.02 / 1.6%	PVP 7222	1.19 / 26.8%	PVP 7222	4.15 / 6.3%
			CVP 2152		CVP 2152		CVP 2152	
	VP-10	0.00 / 4.7%			VP-10		VP-10	
					VP-3		VP-3	
			PVP 7218	0.00 / 0.4%	PVP 7218	0.28 / 10.0%	PVP 7218	
					VP-6	0.28 / 34.8%	VP-6	
			CVP 2377	0.01 / 0.6%	CVP 2377		CVP 2377	
			VP-11		VP-11	0.41 / 14.5%	VP-11	
					VP-7		VP-7	
							PVP 7220	
							PVP 7221	
							PVP 7219	
							CVP 2153	
							CVP 2154	
							PVP 7223	
							VP 2	
							VP 4	
							CVP 1827	0.19 / 1.2%
	EA-2	0.02 / 2.3%	EA-2	0.04 / 2.0%	EA-2	0.28 / 9.4%	EA-2	1.39 / 2.9%
			EA-1		EA-1		EA-1	
	CVP 1462	0.00 / 1.9%			CVP-1462	0.39 / 13.3%	CVP-1462	
					NCVP-3		NCVP-3	
	NCVP-2	0.01 / 1.1%			NCVP-2	0.41 / 26.6%	NCVP-2	
	CVP 1463	0.01 / 1.5%	CVP 1463	0.07 / 3.6%	CVP 1463	0.26 / 40.5%	CVP 1463	
							PVP 7242	
			PVP 7255	0.01 / 0.3%	PVP 7255	0.28 / 11.2%	PVP 7255	1.60 / 3.4%
			PVP 7256		PVP 7266		PVP 7266	
							PVP 7254	
							PVP 7324	
							PVP 7257	
							PVP 7325	
					NHESP 1	0.29 / 22.8%	NHESP 1	0.61 / 5.7%
					CVP 1712	0.09 / 8.3%	CVP 1712	1.57 / 2.6%
			CVP 1665		CVP 1665		CVP 1665	
			NHESP 2	0.02 / 1.9%	NHESP 2	0.25 / 12.0%	NHESP 2	
			CVP 1710		CVP 1710		CVP 1710	
Easton Total	6	0.09	13	0.16	22	4.41	36	9.50

Comprehensive Summary of Impacts to Vernal Pools (continued)

Municipality	Pools Directly Filled	Amount of Fill (Ac.) / Percent Filled	Pools with area of VP Habitat Impacted	Amount of Impact (Ac.) / Percent Impacted	Pools with area of Upland Buffer Habitat Impacted	Amount of Impact (Ac.) / Percent Impacted	Pools with area of Surrounding Upland Habitat Impacted	Amount of Impact (Ac.) / Percent Impacted
					PVP 20158 NHESP 3	0.21 / 33.0% 0.11 / 66.9%	PVP 20158 NHESP 3	0.75 / 16.4%
							PVP 20178 PVP 20179 PVP 20181 PVP 20182	1.99 / 3.5%
							PVP 20186 PVP 20189	0.40 / 1.2%
							PVP 20193	0.70 / 4.1%
Raynham	CVP 1972 CVP 1971	0.02 / 1.9% 0.01 / 7.1%	VP-12 CVP 1972 CVP 1971	0.05 / 4.8% 0.02 / 4.4%	VP-12 CVP 1972 CVP 1971	0.10 / 13.5% 0.40 / 23.5%	VP-12 PVP 20197 PVP 20233 CVP 1972 CVP 1971 PVP 20198 PVP 20196 PVP 20195 PVP 20208 PVP 20209 PVP 20210 PVP 20211 PVP 20214 PVP 20215	2.11 / 2.2%
	PVP 20231 PVP 20230 PVP 20235	0.01 / 6.3% 0.01/100.0% 0.03 / 18.3%	PVP 20231 PVP 20230 PVP 20235	0.10 / 9.4% 0.06 / 11.9% 0.13 / 19.9%	PVP 20231 PVP 20230 PVP 20235	0.17 / 6.4% 0.11 / 34.0% 0.16 / 16.1%	PVP 20231 PVP 20230 PVP 20235 PVP 20232	0.78 / 2.2%
Raynham Total	5	0.07	6	0.35	8	1.25	27	6.72

Comprehensive Summary of Impacts to Vernal Pools (continued)

Municipality	Pools Directly Filled	Amount of Fill (Ac.) / Percent Filled	Pools with area of VP Habitat Impacted	Amount of Impact (Ac.) / Percent Impacted	Pools with area of Upland Buffer Habitat Impacted	Amount of Impact (Ac.) / Percent Impacted	Pools with area of Surrounding Upland Habitat Impacted	Amount of Impact (Ac.) / Percent Impacted
	VP-13	0.08 / 96.4%	VP-13	0.08 / 47.6%	VP-13	0.12 / 12.8%	VP-13	
			PVP 25087	0.12 / 100.0%	PVP 25087	0.23 / 19.3%	PVP 25087	
	PVP 25089	0.01 / 3.3%	PVP 25089		PVP 25089		PVP 25089	
	PVP 25090	0.01 / 6.4%	PVP 25090	0.06 / 3.1%	PVP 25090	0.39 / 11.7%	PVP 25090	
	PVP 25092	0.01 / 13.5%	PVP 25092		PVP 25092		PVP 25092	
							PVP 25099	
							PVP 25091	0.85 / 1.0%
							PVP 25098	
							PVP 25097	
							PVP 25096	
							PVP 25095	
							PVP 25094	
							PVP 250-93	
							PVP 25109	
			PVP 25270	0.02 / 5.6%	PVP 25270	0.07 / 8.1%	PVP 25270	
			PVP 25271	0.03 / 2.8%	PVP 25271	0.01 / 1.4%	PVP 25271	
Taunton							PVP 25278	0.84 / 1.1%
							PVP 25295	
							PVP 25294	
			PVP 25303	0.04 / 2.3%	PVP 25303	0.07 / 7.0%	PVP 25303	
			PVP 25306	0.05 / 1.0%	PVP 25306	0.06 / 15.3%	PVP 25306	
			PVP 25302		PVP 25302		PVP 25302	
							PVP 25304	
							PVP 25305	0.38 / 1.8%
							PVP 25308	
							PVP 25307	
							PVP 25309	
							PVP 25310	
			PVP 25314	0.01 / 7.4%				
			PVP 25317	0.10 / 24.9%	PVP 25317	0.03 / 1.3%	PVP 25317	
					PVP 25316		PVP 25316	0.58 / 1.2%
							PVP 25315	
							PVP 25318	
							PVP 25395	1.29 / 3.9%
							PVP 25397	
Taunton Total	4	0.10	12	0.51	12	0.98	34	3.93

Comprehensive Summary of Impacts to Vernal Pools (continued)

Municipality	Pools Directly Filled	Amount of Fill (Ac.) / Percent Filled	Pools with area of VP Habitat Impacted	Amount of Impact (Ac.) / Percent Impacted	Pools with area of Upland Buffer Habitat Impacted	Amount of Impact (Ac.) / Percent Impacted	Pools with area of Surrounding Upland Habitat Impacted	Amount of Impact (Ac.) / Percent Impacted
							PVP 2316	0.83 / 3.8%
					PVP 2318	0.43 / 24.9%	PVP 2318	
					PVP 2319		PVP 2319	1.60 / 2.6%
			PVP 2320	0.15 / 5.0%	PVP 2320	0.20 / 23.7%	PVP 2320	
							PVP 2317	
Berkley			PVP 2353	0.05 / 14.1%	PVP 2353	0.05 / 6.3%	PVP 2353	0.39 / 2.1%
							PVP 2354	
							PVP 2356	0.46 / 1.5%
							PVP 2358	
							PVP 2360	0.96 / 6.3%
							PVP 2361	0.02 / 0.1%
Berkley Total	0	0.00	2	0.20	4	0.68	11	4.26
					PVP 11932	0.13 / 2.3%	PVP 11932	0.38 / 2.0%
Lakeville							PVP 11931	0.20 / 0.8%
							PVP 11883	0.12 / 1.4%
Lakeville Total	0	0.00	0	0.00	1	0.13	3	0.70
			PVP 8348	0.00 / 0.3%	PVP 8348	0.04 / 9.2%	PVP 8348	0.42 / 3.0%
							PVP 8362	0.33 / 1.2%
	PVP 8324	0.10 / 8.4%	PVP 8324	0.10 / 5.6%	PVP 8324	0.03 / 3.2%	PVP 8324	0.17 / 1.4%
			PVP 8326	0.02 / 6.6%	PVP 8326	0.02 / 4.5%	PVP 8326	0.48 / 1.9%
					PVP 8308	0.13 / 12.2%	PVP 8308	
Freetown							PVP 8309	1.34 / 2.1%
							PVP 8310	
							PVP 8312	0.46 / 1.6%
							PVP 8313	
	PVP 8284	0.02 / 17.7%			PVP 8284	0.15 / 13.7%	PVP 8284	
	PVP 8286	0.11 / 59.8%	PVP 8286	0.03 / 9.7%	PVP 8286	0.25 / 15.8%	PVP 8286	
							PVP 8283	3.05 / 5.5%
							PVP 8285	
							PVP 8287	
Freetown Total	3	0.23	4	0.15	6	0.62	14	6.26
							CVP 1892	0.23 / 0.7%
							CVP 1893	
New Bedford			CVP 2647	0.03 / 3.5%	CVP 2647	0.03 / 6.6%	CVP 2647	0.28 / 1.5%
							PVP 15554	
							CVP 2525	0.29 / 1.1%
							PVP 15571	0.26 / 0.7%
							PVP 15572	
New Bedford Total	0	0.00	1	0.03	1	0.03	7	1.06
Totals	19	0.53	40	1.42	57	9.26	136	43.40