DOCUMENT TITLE	PREPARED BY	DOCUMENT DATE	MAJOR FINDINGS
Trout Brook Watershed Survey	South Portland Land Trust & MEDEP	Survey: Apr-Jun 2003 Report: January 2006	86 sources/types of pollution. **Pollutants:** sediments (67.8%), Nutrients (36.8%), Toxics (8%), Bacteria (4.6%). **Sources:** • Residential (32%): Nutrient pollution from lawns & piles of clippings, bare soil and streambank erosion, erosive roof runoff, polluted runoff from driveways. • Dump sites (23%): Junk yards, trash dumping, large piles of grass clippings & yard debris, uncovered soil piles, pet waste. • Recreation (16%): Bank & shoreline erosion, bare soil, road runoff • Construction (9%) • Trails (7%) • Town roads (13%) **Findings:** • Immediate solutions to pollution, including outreach/education for the following: stormwater runoff reduction, storm drain awareness, car/lawn/garden care, septic systems, animal waste, proper chemical storage. • Minimize impervious surfaces in watershed (code changes, conversion of existing surfaces, new technologies, impervious cover/stormwater utility fee, promote LID) • Stabilize and buffer riparian shoreland areas • Eliminate bacterial contamination sources • Manage stormwater outfalls • Eliminate hazardous and toxics drainage or dumping into the brook. • Investigate pesticide/herbicide use in watershed (test for residue) • Restore natural channel morphology.
Measuring the Impact of Development on Maine Surface	Chandler Morse and Steve Kahl	January 2003	(also referenced in TB Watershed Survey) The study concluded that below a percentage of total impervious area (PTIA) of 6%, degradation to a stream was minimal. A PTIA 6-10% is the threshold over which water quality, biology, and habitat are degraded. TB had a PTIA of 14% at the time

Waters			of the study.
Urban Streams Nonpoint Source Assessments in Maine, Final Report	Susanne Meidel (Partnership for Environmental Technology Education) & MEDEP	February 2005	Detailed Urban Stream Assessment. General list of remedial actions recommended for Trout Brook include: • Reduce impervious surfaces & stormwater runoff • Improve stormwater treatment practices on existing developments • Reduce hazardous substance/toxic spills and illicit discharges • Reduce air pollution • Improve channel morphology. • Replant riparian shoreland buffers • Reduce or eliminate fertilizer use. • Minimize bacterial contributions (pet waste, sewage)
South Portland Conservation Commission Wetland Compensation Fund Planning Report	Sebago Technics	March 11, 2010	General: • Develop a set of criteria to evaluate, rank, and prioritize wetland compensation fund projects • Periodically review and assess the potential projects for additional investigation • Conservation Commission should develop a plan to create public awareness of (this) report for the benefit of the citizens of South Portland. Trout Brook Watershed Specific: • Mahoney Middle School, Trout Brook Crossing at Highland Avenue. Conservation, stormwater improvement, wetland (restoration?) project.
Trout Brook TMDL Report	Susanne Meidel (Partnership for Environmental Technology Education) & MEDEP	September 2007	• IC target is 11% (IC was estimated at 15% as of the date of the report) • Subwatershed survey needed to evaluate "effective" versus "total" IC (interconnected versus disconnected surfaces). • Immediate stormwater remediation may provide good short term results—disconnect hot spots and install bioretention structures (more 'bang for buck' than subwatershed IC survey) • Maintain or restore the riparian buffer • Reclaim flood plains where possible and maintain intact flood plains.

			• Improve channel morphology • Reduce spills • Reduce road sand/road dirt input. • Pick up pet waste • Minimize landscaping runoff. • Eliminate sewer/septic leaks. • Eliminate illicit discharges. • Reduce erosion (use mulches, vegetated overs, geotextile, riprap) • Education & outreach efforts. • Promotes Smart Growth or Low Impact Development guidelines. • Reduce new IC (promote shared parking areas) • Reduce discharge temperature from detention structures. • Expand muni sewer to eliminate septic systems. • Eliminate CSO.
Trout Brook Culvert Analysis	Wright-Pierce	April 2003	All of the culverts on Trout Brook between Fessenden Avenue and Sawyer Street with the exception of the Saywer Street culvert are undersized and do not have sufficient hydraulic capacity to convey peak flows associated with a 25-year storm event. A brief review of the 1984 Flood Insurance Study suggests that capacity issues downstream will likely result in flooding at Highland Avenue, Broadway, and the former Boston & Maine Railroad. Improvements to the upstream (Trout Brook) capacity will most likely exacerbate problems at these downstream hydraulic restrictions.
City of South Portland Comprehensive Plan	City of South Portland	July 20, 1992 (Rev 7/7/2003)	Separate CSOs “preserve unique and critical water resources” (Trout Brook named) • Prepare strategy for preservation/protection of water resources • Determine appropriate buffer • Eliminate problems as identified in Nat’l Estuary Program. • Develop zoning standards to limit amount of impervious permitted & encourage natural site drainage. “Residents consider Trout Brook…to be of value as fishery habitat.” (Low) • Preserve & identify unique and critical natural resources • Request that the Conservation Commission conduct an indepth inventory and

			analysis of existing wildlife and fisheries habitats • Adopt a local wetlands protection ordinance • Review/revise environmental criteria included in "net residential acreage" Balance community benefit of preserving open space with rights of private developers and landowners. Preserve environmentally sensitive areas and areas of critical natural resources such as wetlands and steep slopes. • Develop zoning regulations to limit development in environmentally sensitive areas. • Expand/strengthen the Resource Protection District and ordinances to preserve areas of SP's vital ecosystems. • Expand the definition of 'net residential acreage'' to subtract wetlands, surface waterbodies, and very poorly drained soils to decrease permitted residential density. • Encourage cluster housing on parcels with significant open space or natural features.
Cape Elizabeth Comprehensive Plan	Town of Cape Elizabeth	2007	• Trout Brook is located along the northeastern Cape Elizabeth/South Portland boundary where most of the abutting land is densely developed. Trout Brook has been identified as an urban impaired watershed. The portion of Trout Brook located in Cape Elizabeth is currently listed as Class B, and is designated as not meeting State water quality standards. The South Portland section is classified as Class C, also not meeting standards. The Town is considering adoption of a Community Fee Utilization Plan approved by the Maine Department of Environmental Protection, which would allow the Town to collect a fee from significant new development that could be used to fund projects that will improve the water quality of Trout Brook. • Periodic water quality testing should continue and be expanded to monitor local water quality in order to identify potential problems in the early stages and also to assist in priority setting for infrastructure policy and improvements. Very little water quality data are generated, except as funded by the Town. As funding permits and opportunities arise, the Town should look to itself as the primary collector of water quality testing data necessary to stop possible water quality degradation at its earliest stages. • Expand the periodic water quality testing of Great Pond to a town-wide

			program that includes identifying standard water quality testing sites throughout town which are tested every 5 -10 years on a standard set of parameters. • The Town shall support the continuation of farming and management of woodland areas by working with farmers and land owners to provide for financial rewards and preservation of significant agricultural and forestry areas.
Trout Brook: Water Quality and Next Steps (Meeting Minutes)	Wendy Garland	February 9, 2010	• Existing data tells us a good deal about stream conditions and that it makes sense to move ahead with watershed planning and restoration efforts. The City removed a CSO from the watershed in 2006, so the stream has probably benefited from this as well. • Riparian area restoration and farm BMPs would provide significant benefits in restoring the stream's bug population. Behavior change is needed in the residential areas. • If the dissolved oxygen problems are due to groundwater inputs, it could be improved by aerating the stream in this area (i.e., increasing DO). This could be achieved by adding cascades and woody debris to churn up the water and narrowing the channel to increase velocity. • **Dissolved Oxygen** – It would be very useful to collect more information about Trout Brook's dissolved oxygen. It appears that the DO problem is associated with groundwater from the wetlands, but this should be confirmed. If the problem is associated with groundwater, diurnal differences would not be expected. • **Periphyton monitoring** – Most people familiar with the stream had never noticed periphyton problems in Trout Brook, even in unshaded sections. However, periphyton monitoring in Trout Brook would help identify the extent of potential eutrophication/nutrient issues in the stream. • **Macroinvertebrate monitoring in Cape Elizabeth** – Since low flows prevented the use of rock bags near the church at Rte 77, we don't have a good sense about the stream condition at this point. It would be good to

			collect bug data here, either using rock bags or kick nets (looking for sensitive taxa). This would help us assess how much the farm (and the area above it) impact the stream.
Cape Elizabeth Compensation Fee Utilization Program	Maureen O'Meara, Town Planner, Town of Cape Elizabeth	August 1, 2007	• Data Collection in Cape Elizabeth portion of watershed. Data to include pesticide/herbicide sampling downstream of farm. • Riparian Buffer restoration • Stormwater Outfall Erosion Control (Norman Street, Providence Ave/Marsh Rd, above Highland Ave, below Broadway, all in South Portland, and State Ave/Queen Acres in Cape Elizabeth.) • Sinuosity Restoration • Street Sweeping Upgrade (vacuum or regenerative air system) • Road stormwater runoff treatment including a study by municipal engineers that inventory all road stormwater discharge points to Trout Brook and then design treatment using Stormwater BMPs.
South Portland, Cape Elizabeth, and MEDEP GIS data	emailed by Wendy Garland, ME DEP	Various	• 2003_Stream_Habitat_Survey.dbf • 2003_Stream_Habitat_Survey.prj • 2003_Stream_Habitat_Survey.sbn • 2003_Stream_Habitat_Survey.sbx • 2003_Stream_Habitat_Survey.shp • 2003_Stream_Habitat_Survey.xml • 2003_Stream_Habitat_Survey.shx • Cape_CFUP_sites.dbf • Cape_CFUP_sites.prj • Cape_CFUP_sites.sbn • Cape_CFUP_sites.sbx • Cape_CFUP_sites.shp • Cape_CFUP_sites.shx • TB_watershed_survey_sites.dbf • TB_watershed_survey_sites.prj • TB_watershed_survey_sites.sbn • TB_watershed_survey_sites.sbx

			• TB_watershed_survey_sites.shp • TB_watershed_survey_sites.shx
MDEP Water Quality & Macroinvertebrate Data	ME DEP	1997-2010	See Tables 1 & 2 and Figures 1A-1D (2011 data to be evaluated at a later date)

Table 1. Maine DEP Biomonitoring Data, Trout Brook

STATUTORY CLASS	STATION ID	SAMPLE ID	SAMPLE TYPE	SAMPLE DATE	ATTAINMENT
C	S-302	SA-302-2003	algae	9-Jul-2003	n/a
C	S-302	SA-302-2003(207)	algae	9-Jul-2003	n/a
C	S-302	SA-302-2004	algae	6-Jul-2004	n/a
C	S-302	SA-302-2004(266)	algae	6-Jul-2004	n/a
C	S-302	642	macroinvertebrate	8-Sep-1997	no
C	S-302	798	macroinvertebrate	23-Aug-1999	yes
C	S-302	911	macroinvertebrate	30-Aug-2000	indeterminate
C	S-302	1257	macroinvertebrate	25-Aug-2003	no
C	S-302	1257	macroinvertebrate	25-Aug-2003	no
C	S-302	1396	macroinvertebrate	23-Aug-2004	no
C	S-302	1396	macroinvertebrate	23-Aug-2004	no
C	S-454	916	macroinvertebrate	30-Aug-2000	no
C	S-675	SA-675-2010	algae	23-Jun-2010	n/a
C	S-675	SA-675-2010(936)	algae	23-Jun-2010	n/a
C	S-675	1276	macroinvertebrate	9-Sep-2003	no
C	S-675	1397	macroinvertebrate	23-Aug-2004	no
C	S-675	1320	macroinvertebrate	9-Aug-2005	no
C	S-675	1505	macroinvertebrate	20-Sep-2005	no
C	S-675	1928	macroinvertebrate	13-Aug-2010	no
B	W-093	2003-093	wetland	12-Jun-2003	n/a

B	W-093	DN-2003-093	wetland	12-Jun-2003	n/a
B	W-093	WA-093-2003Y(453)	wetland	12-Jun-2003	n/a

Table 2. Maine DEP Water Quality Data, Trout Brook

SITE ID	Date	Parameter	Concentration	Units
RFRKMTB03	7/21/2003	Dissolved Oxygen	9.38	mg/L
RFRKMTB03	7/21/2003	Temperature	15.1	˚C
RFRKMTB03	7/24/2003	Dissolved Oxygen	9.64	mg/L
RFRKMTB03	7/24/2003	Temperature	17	˚C
RFRKMTB03	7/24/2003	Turbidity	2.21	NTU
RFRKMTB03	8/4/2003	Dissolved Oxygen	8.58	mg/L
RFRKMTB03	8/4/2003	pH	7.31	SU
RFRKMTB03	8/4/2003	Temperature	16.8	˚C
RFRKMTB03	8/4/2003	Turbidity	26.5	NTU
RFRKMTB03	2/11/2004	Dissolved Oxygen	13.8	mg/L
RFRKMTB03	2/11/2004	Temperature	4	˚C
RFRKMTB03	2/11/2004	Turbidity	5.34	NTU
RFRKMTB03	2/17/2004	Dissolved Oxygen	15	mg/L
RFRKMTB03	2/17/2004	Temperature	0.4	˚C
RFRKMTB03	2/17/2004	Turbidity	3.5	NTU
RFRKMTB03	2/20/2004	Dissolved Oxygen	14.47	mg/L
RFRKMTB03	2/20/2004	Temperature	4.6	˚C
RFRKMTB03	2/20/2004	Turbidity	5.02	NTU
RFRKMTB03	2/23/2004	Dissolved Oxygen	14.71	mg/L
RFRKMTB03	2/23/2004	Temperature	2.3	˚C
RFRKMTB03	2/23/2004	Turbidity	14.3	NTU
RFRKMTB03	2/24/2004	Dissolved Oxygen	14.01	mg/L
RFRKMTB03	2/24/2004	Temperature	4.8	˚C
RFRKMTB03	2/24/2004	Turbidity	38	NTU
RFRKMTB03	2/26/2004	Dissolved Oxygen	13.7	mg/L
RFRKMTB03	2/26/2004	Temperature	4.7	˚C
RFRKMTB03	2/26/2004	Turbidity	8.43	NTU
RFRKMTB03	3/17/2004	Dissolved Oxygen	15.54	mg/L
RFRKMTB03	3/17/2004	Temperature	2	˚C
RFRKMTB03	3/17/2004	Turbidity	8.59	NTU
RFRKMTB03	3/24/2004	Dissolved Oxygen	14.99	mg/L
RFRKMTB03	3/24/2004	Temperature	5.4	˚C
RFRKMTB03	4/7/2004	Dissolved Oxygen	15.35	mg/L
RFRKMTB03	4/7/2004	Temperature	3.4	˚C
S-302	8/13/1997	Dissolved Oxygen	7.1	mg/L
S-302	8/13/1997	Specific Conductance	792	us/cm
S-302	8/13/1997	Temperature	13	˚C
S-302	8/13/1997	Velocity	20	cm/sec
S-302	7/26/1999	Dissolved Oxygen	8.7	mg/L
S-302	7/26/1999	Specific Conductance	832	us/cm
S-302	7/26/1999	Temperature	15	˚C
S-302	7/26/1999	Turbidity	10	NTU
S-302	8/1/2000	Dissolved Oxygen	9.2	mg/L

SITE ID	Date	Parameter	Concentration	Units
S-302	8/1/2000	Specific Conductance	695	us/cm
S-302	8/1/2000	Temperature	14.6	˚C
S-302	8/1/2000	Velocity	18.3	cm/sec
S-302	5/6/2003	pH	7.34	SU
S-302	5/6/2003	Specific Conductance	445	us/cm
S-302	5/6/2003	Temperature	9.7	˚C
S-302	5/23/2003	Dissolved Oxygen	9.3	mg/L
S-302	5/23/2003	pH	7.31	SU
S-302	5/23/2003	Specific Conductance	473	us/cm
S-302	5/23/2003	Temperature	10.6	˚C
S-302	6/10/2003	Dissolved Oxygen	9.9	mg/L
S-302	6/10/2003	Dissolved Oxygen	9.9	mg/L
S-302	6/10/2003	pH	7.12	SU
S-302	6/10/2003	Specific Conductance	410	us/cm
S-302	6/10/2003	Temperature	13.3	˚C
S-302	6/10/2003	Velocity	19.8	cm/sec
S-302	6/19/2003	Dissolved Oxygen	8.5	mg/L
S-302	6/19/2003	Dissolved Oxygen	8.6	mg/L
S-302	6/19/2003	pH	7.11	SU
S-302	6/19/2003	Specific Conductance	410	us/cm
S-302	6/19/2003	Temperature	13.6	˚C
S-302	7/9/2003	Dissolved Oxygen	9.2	mg/L
S-302	7/9/2003	Dissolved Oxygen	9.4	mg/L
S-302	7/9/2003	pH	7.03	SU
S-302	7/9/2003	Specific Conductance	734	us/cm
S-302	7/9/2003	Temperature	13.3	˚C
S-302	7/9/2003	Temperature	14.7	˚C
S-302	7/28/2003	Dissolved Oxygen	8.2	mg/L
S-302	7/28/2003	Dissolved Oxygen	8.2	mg/L
S-302	7/28/2003	Dissolved Oxygen	8.8	mg/L
S-302	7/28/2003	Dissolved Oxygen	9.2	mg/L
S-302	7/28/2003	pH	7.5	SU
S-302	7/28/2003	pH	7.5	SU
S-302	7/28/2003	Specific Conductance	711	us/cm
S-302	7/28/2003	Specific Conductance	711	us/cm
S-302	7/28/2003	Temperature	13.5	˚C
S-302	7/28/2003	Temperature	15.4	˚C
S-302	7/28/2003	Temperature	15.4	˚C
S-302	7/28/2003	Temperature	16.6	˚C
S-302	7/28/2003	Velocity	15.7	cm/sec
S-302	8/11/2003	Dissolved Oxygen	8.7	mg/L
S-302	8/11/2003	Dissolved Oxygen	9	mg/L
S-302	8/11/2003	Specific Conductance	711	us/cm
S-302	8/11/2003	Temperature	15.2	˚C
S-302	8/11/2003	Temperature	18.2	˚C

SITE ID	Date	Parameter	Concentration	Units
S-302	8/11/2003	Velocity	11.65	cm/sec
S-302	8/25/2003	Dissolved Oxygen	8.9	mg/L
S-302	8/25/2003	Dissolved Oxygen	9.32	mg/L
S-302	8/25/2003	Dissolved Oxygen	9.32	mg/L
S-302	8/25/2003	Dissolved Oxygen	9.4	mg/L
S-302	8/25/2003	pH	7.15	SU
S-302	8/25/2003	pH	7.29	SU
S-302	8/25/2003	Specific Conductance	665	us/cm
S-302	8/25/2003	Specific Conductance	679	us/cm
S-302	8/25/2003	Temperature	12.7	˚C
S-302	8/25/2003	Temperature	13.9	˚C
S-302	8/25/2003	Temperature	14	˚C
S-302	8/25/2003	Temperature	14.5	˚C
S-302	8/25/2003	Velocity	12.55	cm/sec
S-302	9/9/2003	Dissolved Oxygen	8.4	mg/L
S-302	9/9/2003	Dissolved Oxygen	8.6	mg/L
S-302	9/9/2003	pH	7.21	SU
S-302	9/9/2003	Specific Conductance	685	us/cm
S-302	9/9/2003	Temperature	12.2	˚C
S-302	9/9/2003	Temperature	14.6	˚C
S-302	9/9/2003	Velocity	12.4	cm/sec
S-302	9/24/2003	Dissolved Oxygen	7.7	mg/L
S-302	9/24/2003	Dissolved Oxygen	7.8	mg/L
S-302	9/24/2003	Dissolved Oxygen	8.3	mg/L
S-302	9/24/2003	pH	7.31	SU
S-302	9/24/2003	Specific Conductance	346	us/cm
S-302	9/24/2003	Temperature	14.8	˚C
S-302	9/24/2003	Temperature	16.4	˚C
S-302	9/24/2003	Velocity	24.2	cm/sec
S-302	10/7/2003	Dissolved Oxygen	10	mg/L
S-302	10/7/2003	Dissolved Oxygen	10	mg/L
S-302	10/7/2003	pH	7.35	SU
S-302	10/7/2003	Specific Conductance	461	us/cm
S-302	10/7/2003	Temperature	8.8	˚C
S-302	10/7/2003	Velocity	18.25	cm/sec
S-302	7/6/2004	Dissolved Oxygen	9.2	mg/L
S-302	7/6/2004	pH	7.18	SU
S-302	7/6/2004	Specific Conductance	673	us/cm
S-302	7/6/2004	Temperature	16	˚C
S-302	7/6/2004	Velocity	45.8	cm/sec
S-302	7/26/2004	Dissolved Oxygen	9.1	mg/L
S-302	7/26/2004	Specific Conductance	687	us/cm
S-302	7/26/2004	Temperature	14.9	˚C
S-302	7/26/2004	Velocity	29.7	cm/sec
S-302	8/23/2004	Dissolved Oxygen	8.9	mg/L

SITE ID	Date	Parameter	Concentration	Units
S-302	8/23/2004	Specific Conductance	389	us/cm
S-302	8/23/2004	Temperature	14.8	˚C
S-302	8/23/2004	Velocity	40.7	cm/sec
S-454	8/1/2000	Specific Conductance	693	us/cm
S-454	8/1/2000	Temperature	14.4	˚C
S-454	8/1/2000	Velocity	11.5	cm/sec
S-675	7/28/2003	Dissolved Oxygen	4.5	mg/L
S-675	7/28/2003	Dissolved Oxygen	5	mg/L
S-675	7/28/2003	Dissolved Oxygen	5.5	mg/L
S-675	7/28/2003	pH	6.57	SU
S-675	7/28/2003	Specific Conductance	714	us/cm
S-675	7/28/2003	Temperature	14.5	˚C
S-675	7/28/2003	Temperature	16.1	˚C
S-675	7/28/2003	Velocity	15.7	cm/sec
S-675	8/11/2003	Dissolved Oxygen	5.1	mg/L
S-675	8/11/2003	Dissolved Oxygen	6.1	mg/L
S-675	8/11/2003	Dissolved Oxygen	6.38	mg/L
S-675	8/11/2003	Specific Conductance	685	us/cm
S-675	8/11/2003	Temperature	14	˚C
S-675	8/11/2003	Temperature	17	˚C
S-675	8/11/2003	Temperature	17.1	˚C
S-675	8/11/2003	Velocity	10.65	cm/sec
S-675	8/12/2003	Dissolved Oxygen	5.5	mg/L
S-675	8/12/2003	Specific Conductance	685	us/cm
S-675	8/12/2003	Temperature	17.1	˚C
S-675	8/12/2003	Velocity	11.7	cm/sec
S-675	8/25/2003	Dissolved Oxygen	4.1	mg/L
S-675	8/25/2003	Dissolved Oxygen	922	mg/L
S-675	8/25/2003	Dissolved Oxygen Saturation	4.63	%
S-675	8/25/2003	Temperature	11.6	˚C
S-675	8/25/2003	Temperature	13	˚C
S-675	9/9/2003	Dissolved Oxygen	2.8	mg/L
S-675	9/9/2003	Dissolved Oxygen	4.2	mg/L
S-675	9/9/2003	Dissolved Oxygen	4.4	mg/L
S-675	9/9/2003	pH	7.21	SU
S-675	9/9/2003	pH	7.3	SU
S-675	9/9/2003	Specific Conductance	716	us/cm
S-675	9/9/2003	Specific Conductance	718	us/cm
S-675	9/9/2003	Temperature	11.8	˚C
S-675	9/9/2003	Temperature	14.5	˚C
S-675	9/9/2003	Temperature	15	˚C
S-675	9/9/2003	Velocity	9.6	cm/sec
S-675	9/9/2003	Velocity	9.6	cm/sec
S-675	9/24/2003	Dissolved Oxygen	5.1	mg/L
S-675	9/24/2003	Dissolved Oxygen	5.9	mg/L

SITE ID	Date	Parameter	Concentration	Units
S-675	9/24/2003	pH	7.31	SU
S-675	9/24/2003	Specific Conductance	360	us/cm
S-675	9/24/2003	Temperature	14.6	˚C
S-675	9/24/2003	Temperature	15.8	˚C
S-675	9/24/2003	Velocity	22.4	cm/sec
S-675	10/7/2003	Dissolved Oxygen	7.2	mg/L
S-675	10/7/2003	pH	6.8	SU
S-675	10/7/2003	Specific Conductance	460	us/cm
S-675	10/7/2003	Temperature	10.4	˚C
S-675	10/7/2003	Velocity	14.2	cm/sec
S-675	7/26/2004	Dissolved Oxygen	6.6	mg/L
S-675	7/26/2004	Specific Conductance	692	us/cm
S-675	7/26/2004	Temperature	15	˚C
S-675	7/26/2004	Velocity	10.5	cm/sec
S-675	8/23/2004	Dissolved Oxygen	8.1	mg/L
S-675	8/23/2004	Specific Conductance	386	us/cm
S-675	8/23/2004	Temperature	15.9	˚C
S-675	8/23/2004	Velocity	34.2	cm/sec
S-675	7/13/2005	Dissolved Oxygen	6.7	mg/L
S-675	7/13/2005	Specific Conductance	586	us/cm
S-675	7/13/2005	Temperature	16.9	˚C
S-675	7/13/2005	Velocity	14.3	cm/sec
S-675	8/9/2005	Dissolved Oxygen	5.4	mg/L
S-675	8/9/2005	pH	6.52	SU
S-675	8/9/2005	Specific Conductance	831	us/cm
S-675	8/9/2005	Temperature	14.2	˚C
S-675	8/9/2005	Velocity	15	cm/sec
W-093	6/12/2003	Dissolved Oxygen	9	mg/L
W-093	6/12/2003	pH	7.36	SU
W-093	6/12/2003	Specific Conductance	318	us/cm
W-093	6/12/2003	Temperature	20.7	˚C

Notes:

cm/sec: centimeters per second
˚C: degrees Celsius
mg/L: milligrams per liter
SU: Standard Units
us/cm: microsiemens per centimeter

Figure 1A. Dissolved Oxygen and Temperature at Site RFRKMTB03, MEDEP Data, 2003-2004

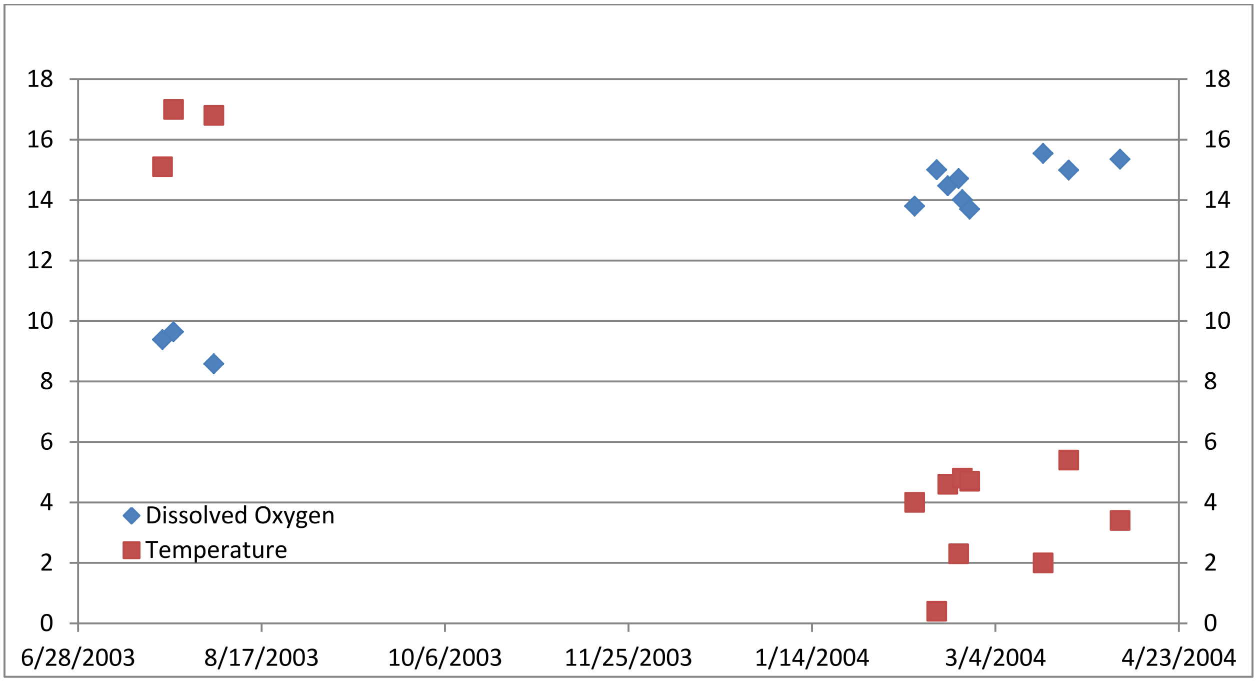


Figure 1B. Dissolved Oxygen and Temperature at Site 302, MEDEP Data, 1997-2004

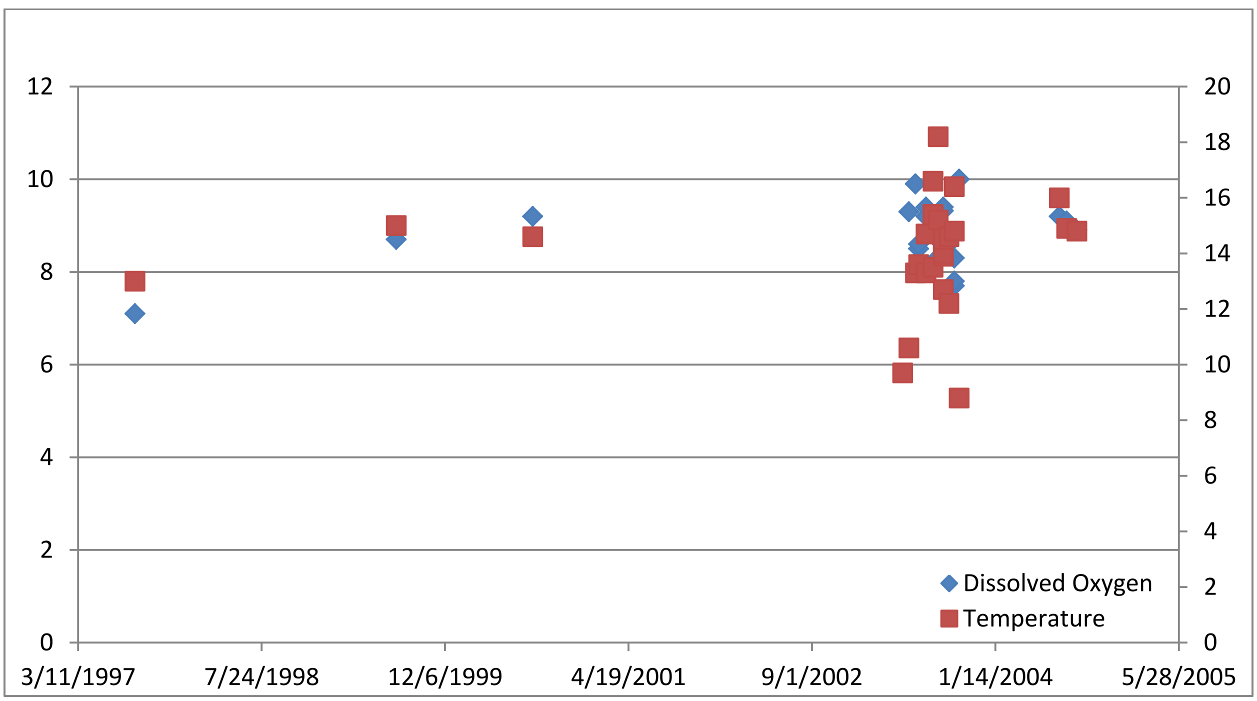


Figure 1C. Dissolved Oxygen and Temperature at Site 675, MEDEP Data, 2003-2004

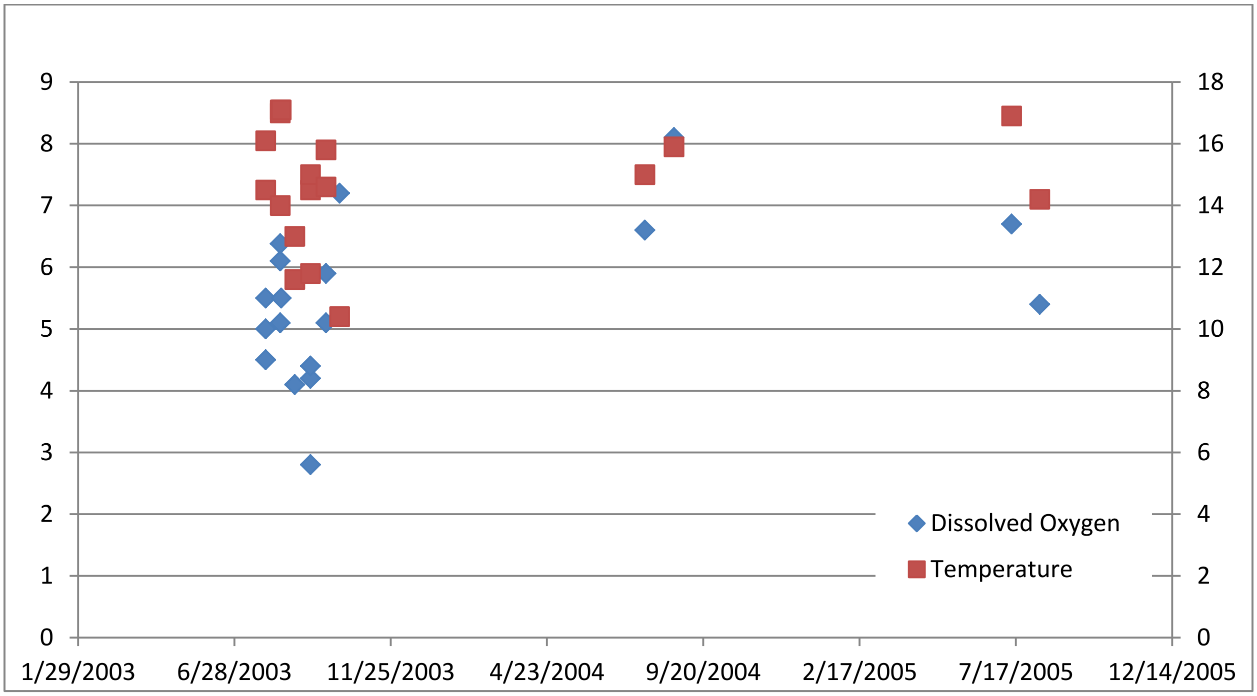
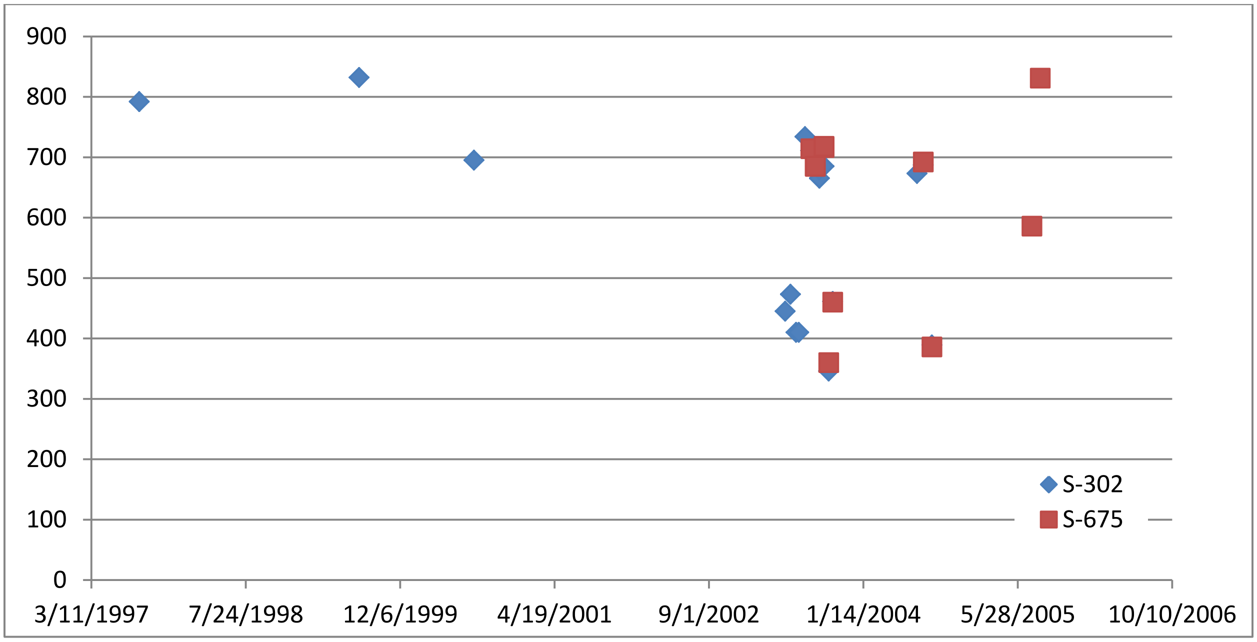


Figure 1D. Specific Conductance, Site 302 & Site 675, MEDEP Data, 1997-2004

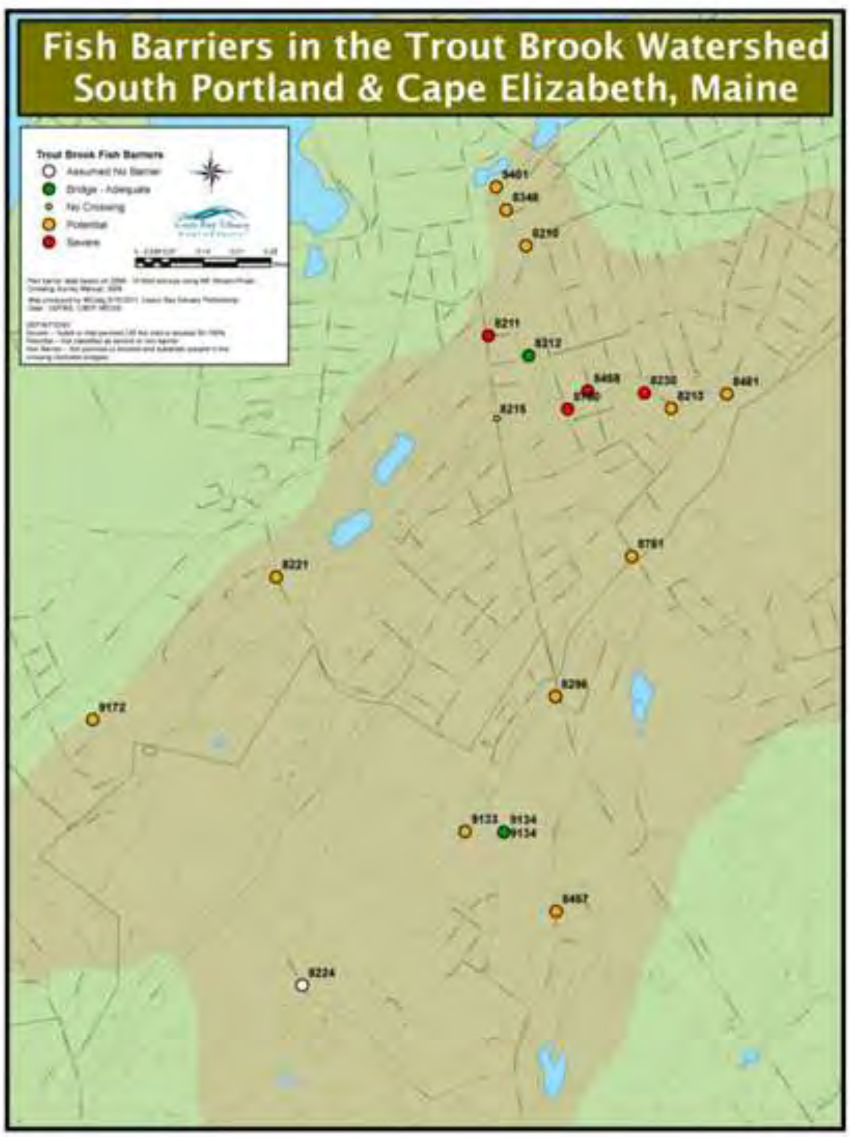


1.0 Stream Channel Assessments

Current and past project partners have completed several stream channel assessments in the Trout Brook Watershed. The evaluation methods and criteria as well as the findings are summarized in the following sections.

1.1 Fish Barrier Assessment

The Casco Bay Estuary Partnership (CBEP) conducted a fish barrier survey of the Trout Brook watershed in 2009 using the Maine Stream Road Crossing Survey Manual (2008). Surveyors assessed all stream – road culverts and measured culvert size, outlet drop, pool depth and several other parameters. CBEP staff evaluated the data and rated fish culverts as passable, severe barriers or potential barriers. Of the 18 culverts, three were rated as passable, 11 were rated as potential barriers and 4 were rated as severe barriers (Figure 1). The Hinckley Park ponds on Kimball Brook were not evaluated through the study since they are not road culverts. However, the lower pond presents a severe fish barrier since there is a drop of several feet between the dam outlet and the stream channel below.



The watershed's fish barriers were also associated with flooding concerns and undersized culverts. The CBEP study found that all three severe barriers on Trout Brook were also considered flood hazards by Cumberland County Emergency

Management Agency or CBEP analysis. Four additional culverts in the watershed were also mapped as flood hazards. Flooding issues related to Trout Brook culverts have been a chronic issue in South Portland.

Crossing	Culvert Material	Culvert Type	Barrier Class
Sawyer Street	Metal	Pipe Arch	Potential
Fessenden Avenue	Metal	Pipe Arch	Severe
Providence Avenue	Concrete	Round	Severe
Providence Avenue	Concrete	Round	Potential
Boothby Road	Metal	Round	Severe

Table 1. Summary of Fish Barriers in Trout Brook

1.2 Fluvial Geomorphology Assessment

Fluvial geomorphology is the study of the shape and stability of stream systems. Although all streams change over time, human disturbance can destabilize the natural equilibrium in stream systems. In-stream and bank erosion can increase dramatically with significant increases in the stream flow (by increasing impervious surfaces and runoff) or increases in the amount of sediment reaching the stream. This instability also directly affects stream habitat conditions. In addition, past alterations to stream channels (e.g., straightening and widening) can slow down stream flow, which can also impact stream habitat and dissolved oxygen levels.

1.2.1 Methodology

In 2003, a fluvial geomorphic assessment was conducted on Trout Brook as part of the DEP's Urban Streams Study (DEP, 2004). The study involved a historical analysis, measurements of the stream channel at several reaches, and a qualitative Rapid Geomorphic Assessment (RGA) of the entire stream to assess the stream stability in response to human disturbance.

1.2.2 Findings

The study found that nearly half of Trout Brook had been channelized (i.e., straightened), half was slightly or deeply entrenched, and about 20% of the stream had eroding or armored banks. Despite these alterations, however, most of Trout Brook (8 of 11 stream segments) ranked *Good* in the Geomorphic Assessment (ranking scale is Poor, Fair, Good, Reference). Even the three segments rated as *Poor* received scores close to the Good rating. These three *Poor* segments were described as follows in the study. The stream segments above Boothby Ave. (in the Trout Brook Preserve) and below Highland Ave. had overwidened channels. As a result, sediment was aggrading, or building up, on the stream bottom to reach a new equilibrium. In addition, the tributary originating from the Simmons Street area in South Portland, showed signs of downcutting.

According to the study, since the stream was channelized many years ago (likely before 1964, Field 2003), the stream has had time to adjust to the alteration and is now approaching a new equilibrium. As a result, there are good opportunities to improve the geomorphology of the three segments currently rated as *Poor* (unless peak storm flows are expected to change significantly). Both the aggrading sections mentioned above (Trout Brook Preserve[1] and below Highland Ave.) would be good candidates for reestablishing sinuosity and habitat with logs and/or boulders. The tributary that is downcutting has a high potential for rapid natural recovery, but recovery could also be accelerated with restoration activities.

1.3 Stream Corridor Survey

In September 2011, project staff conducted a Stream Corridor Assessment Survey along most of Trout and Kimball Brooks. The SCA survey method (Maryland DNR, 2001) rapidly assesses the general physical condition of the stream and identifies the location of a variety of environmental problems and restoration opportunities within the stream corridor. The primary types of problems sites documented in Trout Brook included erosion sites, inadequate stream buffers, yard waste dumping sites, stream channel alterations and exposed or discharging pipes.[2] Survey teams collected information about the size, location and severity of each site and also rated the relative cost and feasibility of restoration. Stream Corridor Survey locations and findings are summarized on Table 2.

1.3.1 Methodology

The Maryland Department of Natural Resources (DNR) developed a Stream Corridor Assessment Survey handbook (Maryland DNR 2001) that provides detailed survey and ranking methods. The Maryland DNR protocols include the following:

- **Identify Environmental Problems:** identify environmental problems that can be seen by walking along a stream and observing conditions. Water chemistry and other scientific data is not collected as part of the survey. The problems identified in the SCA survey may include, but are not limited to: pipe outfalls, trash and yard waste dumping, exposed pipes, fish barriers, erosion, downcut banks, sedimentation, evidence of nutrient enrichment (excessive algae growth), and unusual odors.
- **Assign a Site Number:** Establish a system to assign field identification numbers to problem and representative sites. Give each survey site a unique number so that it can be entered into the project database.
- **Record the Problem Locations** using field maps, photography, field data sheets, and other appropriate recording strategies. Record enough accurate information so that the sites can be

[1] Some of the recommended geomorphic restoration work was completed in September 2012 in this segment with funding from a Casco Bay Estuary Partnership grant.

[2] The 2003 Trout Brook Watershed Survey Report (South Portland Land Trust, 2003) also documented some of these erosion and yard waste dumping sites, but this report was not mentioned in depth since the SCA was more recent and collected more detailed information about each problem site.

revisited for follow-up assessment(s) and restoration as necessary. The Trout Brook survey team used a Trimble GPS unit to geolocate identified sites and record their coordinates on the project GIS maps.

- **Severity, Correctability, and Access Ratings** are developed for each site in order to prioritize restoration work.
  - **Severity** is ranked 1 (most severe) through 5 (minor problems). A ranking of 1 indicates that the problem is among the worst that the field team has seen or would expect to see. Example: a pipe discharge that was visibly impacting a long stretch of stream (>1/2 mile).
  - **Correctability** is ranked 1 (minor problems) through 5 (major restoration) problems. A ranking of 5 would require a large expensive effort to correct using heavy equipment, a large amount of funding, and more than a month of construction time. Example: fish barrier caused by a dam.
  - **Accessibility** is the relative measure of how difficult it is to reach an identified site and is ranked 1 (easily accessible by car or foot) through 5 (difficult to access both by foot and vehicle). Examples of a site that could be ranked "5" include access over steep or heavily wooded terrain with no trails or roads nearby.
- **Analyze & Prioritize Projects:** Tabulate the problem site data by entering information into the project database. The tables should include the Site Identification Table, the Problem Identification Table, and the Representative Site Table (detailed description of each provided in Maryland DNR 2001).
- **Develop the Final Stream Corridor Assessment Report** to provide a list of the environmental problems and recommendations on possible steps that could be taken to improve environmental conditions.

Except where noted herein, project staff completed the stream corridor assessment using the methodology summarized above.

1.3.2 Findings

Stream Corridor Survey locations and findings are summarized on Table 2 and described in detail in the following sections.

1.3.2.1 Erosion Sites

Streams naturally transport a certain amount of sediment through their systems, but excess sediment can be harmful to both stream habitat and water quality. Excess sediments can fill in the spaces between gravels and other rocks in stream bottoms, eliminating spawning areas, suffocating eggs, and eliminating habitat for aquatic insects (Maine DEP Stream Survey Manual, 2010). Nutrients and other pollutants attached to soil particles can impair water quality.

The SCA survey documented 66 soil erosion problems in and adjacent to the stream (see attached tables). Some sites were limited in size (10-15' long), and others extended over 100' in length. The total length of eroded sites was over 4,700 feet. Many of the erosion sites were associated with areas of inadequate buffers with lawn growing along the streambanks. Other erosion sites were associated with stormwater outfall pipes, road crossings or footpaths (primarily in Hinckley Park). In terms of severity, 11 sites were rated as high severity, 39 were medium severity and 16 were rated low severity.

1.3.2.2 Inadequate Buffers

Trees and shrubs alongside streams, known as ***buffers*** or ***riparian areas***, provide many stream benefits. These plants provide shade to keep water temperatures cool and filter out pollutants carried by stormwater. The deep roots of trees and shrubs help stabilize streambanks and reduce erosion. In terms of stream habitat, the leaves and twigs from buffer plants provide food for aquatic life in the stream. Large wood that falls into the stream channel also captures this food, provides cover for fish, and helps create pools and other diverse habitats of aquatic life.

The SCA survey documented 28 areas where the stream buffer was absent or inadequate. The length of inadequate buffer was just over 2,000 feet on each side of the stream. In terms of relative severity, there were 4 high, 12 medium and 12 low severity sites. As mentioned above, many of these were associated with other types of problems. 21 of the inadequate buffer sites were also associated with erosion. In many cases, lawn or invasive Japanese knotweed left streambanks vulnerable to bank streambank erosion. Seven of the sites were also locations with yard waste dumping, where the piles of debris had likely smothered the natural streamside vegetation.

1.3.2.3 Yard Waste Dumping Sites

Although yard waste piles located outside the buffer area are usually benign, dumping on streambanks can impact stream health. Grass clippings can carry excess nutrients and pesticides into the stream. Piles of yard waste also destroy natural vegetation and leave the stream vulnerable to bank erosion.

Dumping was documented at 25 sites adjacent to the stream. 24 of the sites were piles of grass clippings and brush. One site was used for dumping sand and other debris was documented next to the stream adjacent to Mahoney Middle School.[3] There were two sites with evidence of grass clippings being dumped directly into the stream, four large neighborhood dumping sites (approximately 10 truckloads) and numerous small to medium-sized debris piles on private lots. In terms of severity of the sites, there were 14 medium, 10 low and zero high severity sites. As mentioned above, many of these sites were also associated with bank erosion and inadequate buffers since the piles tended to smother natural vegetation and leave areas vulnerable to erosion. It would be relatively easy to remove all of the accumulated debris; however, landowner education and alternatives would need to be provided to help change the long term behavior.

1.3.2.4 Stream Channel Alteration

Cobble dam in Trout Brook Preserve.

Stream channel alterations include any human-made changes to the stream course or channel shape (such as straightening or widening the stream). Alterations can also include additions of dams, retaining walls or other channel armoring. Such structures and alterations can block fish passage, impair stream habitat, slow down stream flow and create channel instability.

14 channel alteration sites were identified in the SCA survey (Figure _).[4] Three of these sites were located in the Trout Brook Preserve, which was a former gravel pit and significantly altered in the past.[5] Seven other sites had retaining walls armoring the streambanks, two sites in Kimball Brook had corroding metal pipes lying in the stream and one site had concrete abutments from a former road crossing or dam. The section of stream running through Sawyer Marsh was also documented since it was channelized many years ago.

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[3] School staff was made aware of the negative impacts from this and have since changed their practices. In May 2012, students planted vegetation along this streambank with a stewardship grant from the Maine DEP.

[4] Note that five sites identified in the Urban Streams Study were added to the maps and spreadsheet for this category. These are noted in the Site Type on the spreadsheet.

[5] Three of these sites were fixed in September 2012. Cobble dams were removed from two parts of the stream; a opening was cut in the streamside berm to connect the stream to its floodplain; and root wads were added to help narrow this channelized section of stream.

1.3.2.5 Exposed or Discharging Sewer Pipes

Sewer pipes that are not maintained adequately have the potential to release sewage to nearby surface waters. There may also be situations when sewer pipes intentionally or inadvertently discharge to stormwater systems. In any event, sewage released into surface waters adds bacteria, nutrients and organics – all of which can contribute to nonattainment of water quality standards. Routine inspection and maintenance programs for sewer and stormwater infrastructure are therefore essential to ensure that both systems are functioning properly and not unintentionally discharging sewage to surface waters.

The SCA survey evaluated the condition of stormwater pipes that discharged into or near the stream and sewer pipes that crossed over or adjacent to the stream. No discharges were noted from most of the pipes during the survey, so this information is not summarized in the Plan. However, three sites of concern were identified near the bottom of the watershed. A gray-colored, sewage-smelling substance was flowing out of a stormwater outfall (lower right photo) into the stream. Potential problems were also noted at two sewer and combined sewer pipes that cross the stream. One of these pipes was missing several supports between the pipe and pilings, which could make it vulnerable to failure and future discharges into Trout Brook (above right photo). Liquid was dripping from a second pipe directly into the stream. These issues were brought to the attention of the City of South Portland, and the City addressed all three issues in 2012.[6]

1.4 Stream Habitat Survey

Class B and C streams must provide habitat for fish and other aquatic life. In addition to macroinvertebrate problems, Trout Brook and Kimball Brooks are listed as impaired because the streams do not meet this aquatic life criteria. (Table ??) To support fish and other aquatic life, stream habitat should include the following components: a wide variety of pools, fast flowing riffles, large woody debris, overhead tree canopy and a stable stream bottom (Maine DEP, 2011). These features create diverse conditions required by different aquatic organisms for survival and reproduction. Pools and large wood in streams trap food and provide cover and refuge for creatures. Stable stream beds covered with gravels provide spawning areas and homes to diverse macroinvertebrates. Canopy trees shade the stream and fallen leaves provide food for aquatic organisms.

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[6] Following the discovery of sewage discharge from stormwater outfall TB-3 during the SCA survey, City staff confirmed an inadvertent cross connection between the sewer and stormwater systems through bacteria testing and televising. In April 2012, the City installed a new catch basin and section of pipe to separate the sewer and stormwater systems; the supports for the insulated sewer line crossing the stream near this location were also repaired. Total project cost was just under $11K.

As watersheds become more urbanized, stream habitat is often degraded and destabilized. Construction activities adjacent to streams can remove tree canopy and relocate and artificially armor stream channels. As impervious surfaces increase in the watershed the changing flow regime can increase streambank erosion; increase sedimentation in pools and spawning areas; and destabilize the stream bottom and large woody debris. Several assessments have been conducted to evaluate the quality of Trout Brook's stream habitat. Maine DEP and local volunteers conducted a Stream Corridor Survey in conjunction with the South Portland Land Trust's watershed survey in June, 2003. A qualitative Rapid Habitat Survey was also conducted in 2003 in conjunction with the Rapid Geomorphic Survey. In addition, the MDEP Urban Streams Study evaluated habitat conditions such as flow regime, substrate, pool variability and woody debris at two reaches.

In contrast to the relatively good geomorphology ratings, Trout Brook only had only one segment with a *Good* rating in the Rapid Habitat Assessment (RHA). The remaining 10 segments were rated as having *Poor* habitat. Approximately 95% of the stream was completely lacking in large woody debris (greater than 8" in diameter), and the remaining 5% of the stream only had 1-2 pieces of large woody debris per 100 feet.

Similar to the RHA study above, the MDEP Urban Streams (2004) study found that large wood was absent in their study reaches, but smaller pieces of wood (in both the > 5 cm. and 2-5 cm. size classes) were moderately abundant in both reaches. A separate Habitat Assessment also evaluated ten habitat parameters important for aquatic life (scoring fell into categories *Poor*, *Marginal*, *Suboptimal* and *Optimal*). Both stream segments received ratings of *Suboptimal* or worse in 9 of the 10 categories (Table 3).

Table 3. Rapid Habitat Survey

Habitat Parameter	Downstream Station (below Highland Ave.)	Upstream Station (Trout Brook Preserve)
Stream substrate	Suboptimal	Suboptimal
Pool substrate	Suboptimal (mostly mud)	Suboptimal (mostly mud)
Pool variability	Suboptimal (mostly deep pools)	Suboptimal (mostly shallow pools)
Sediment deposition	Suboptimal	Marginal
Channel Flow Status	Optimal	Marginal (riffle substrates exposed)
Channel Sinuosity	Suboptimal	Marginal
Channel Alteration	Suboptimal	Suboptimal
Bank stability	Suboptimal/Marginal	Suboptimal
Vegetative Protection	Suboptimal/Poor	Suboptimal
Riparian Vegetative Zone	Suboptimal/Poor	Suboptimal/Optimal

Table 1. Catchment Scoring Summary

Map ID	Stormwater Outfall Catchment	Impact	Benefit	Retrofit Feasibility	Cost	Priority Ranking	Description of Potential Retrofits and Limitations
Phase I Retrofits							
M	29 Ocean House Road (near Site TB)	Medium	High	High	Medium	16	Connect runoff from upper parking lot and horse paddocks with existing stormwater pond and/or gravel wetland. Retrofit pond to provide better treatment
G	Rte 77 & Harrison	Medium	Medium	Medium	Low	14	Work with business owner to explore installing treatment/infiltration system and/or using P-free products.
O	29 Ocean House Road (near Site TB)	Low	Low	High	Low	12	Create series of curb cuts and install wildflower buffer in grassed area to treat parking lot runoff.
Z	Office building on Spurwink	Medium	Medium	Medium	Medium	12	Possible bioretention cell; close off catch basin and install level spreader to grass filter strip; or remove berm adjacent to building to allow sheet flow into grass/field. Catchment not mapped yet.
Z2	Pleasant Ave. neighborhood	Medium	Medium	Medium	Medium	12	Large part of neighborhood drains to stream. Retrofit would be beneficial since impact to small stream could be significant. Catchment not mapped yet.
DD	Wildrose (Kimball)	Medium	Low	Medium	Medium	12	Stabilize large gully.

Table 1. Catchment Scoring Summary

Map ID	Stormwater Outfall Catchment	Impact	Benefit	Retrofit Feasibility	Cost	Priority Ranking	Description of Potential Retrofits and Limitations
Phase II Retrofits							
D	Sawyer/Parrot	Low	Low	High	Medium	10	Manhole on public path ROW with pipe leaving manhole ~5-6' to invert. Could replace with shallower pipe, daylight @ edge of property and install a buffer, spreader system along 300' x 100' area @ low cost/high treatment if salt infiltration is not a concern. If there are salt infiltration concerns, install system(s) that do(es) not infiltrate water . Need to complete basic geological assessment as part of design.
E	Rte 77 and State	Mediu m	Medium	Medium	High	10	Tree boxes and rain gardens. Neighborhood also interested in rain gardens and Yardscaping. Need to consider chronic water/flooding problems in neighborhood.
G	Rte 77 & Harrison	Mediu m	Medium	Medium	High	10	Install tree box filters above each catch basin on Route 77 (about 4 total, two on each side of street). Could also install linear underdrained filter under the swale in front of the building. Could possibly be designed to cover catch basins, build up bump at top of driveway and cut curbing to treat large amount of road. Better storage and treatment than tree boxes.
B	Rte 77 and Bellaire	Mediu m	Medium	Medium	High	10	Tree box filters would address nutrients and flow issues (possible location @ #72). If infiltration of road salt is a concern, rain gardens should only capture driveway and roof runoff.

Table 1. Catchment Scoring Summary

Map ID	Stormwater Outfall Catchment	Impact	Benefit	Retrofit Feasibility	Cost	Priority Ranking	Description of Potential Retrofits and Limitations
Q	Wilton Ln -off State	Low	Medium	Low	Medium	8	Evaluated possibility of installing a shallow culvert out of existing catch basin or a paved swale to send runoff into existing buffer and a level spreader. Low feasibility since this neighborhood has chronic flooding issues.
H	Bellaire/Beaufor t	Low	Low	High	High	8	Could install tree boxes on each side of catch basins on corner of Beaufort and Fessenden and one near stream on either side of road (6 total).
I	Boothby	Mediu m	Medium	Low	High	8	Small gravel wetland could treat first flush and bypass larger flows. Adjacent neighbors concerned about flooding, aesthetics and City maintenance of existing ROW, exposed pipe and brush.
K	Waterhouse	Low	Low	Medium	Medium	8	Stable outfall outlet. Does not appear to be large flows & buffer to stream.
L	Walnut Cul de Sac	Low	Medium	Low	Medium	8	1 tree box possible above catch basin (by basketball hoop), but would need to remove one pine tree.
U	Fessenden	Low	Low	Medium	Medium	8	One tree box possible across from residence next to catch basin.
A	Kaler/Clifford	Mediu m	Low	Low	High	6	Stormwater outfall retrofits not feasible since outfall drains into wetland. No space or elevation for BMP installation and NRPA restrictions. Yardscaping campaign to reduce phosphorus and salt.

Table 1. Catchment Scoring Summary

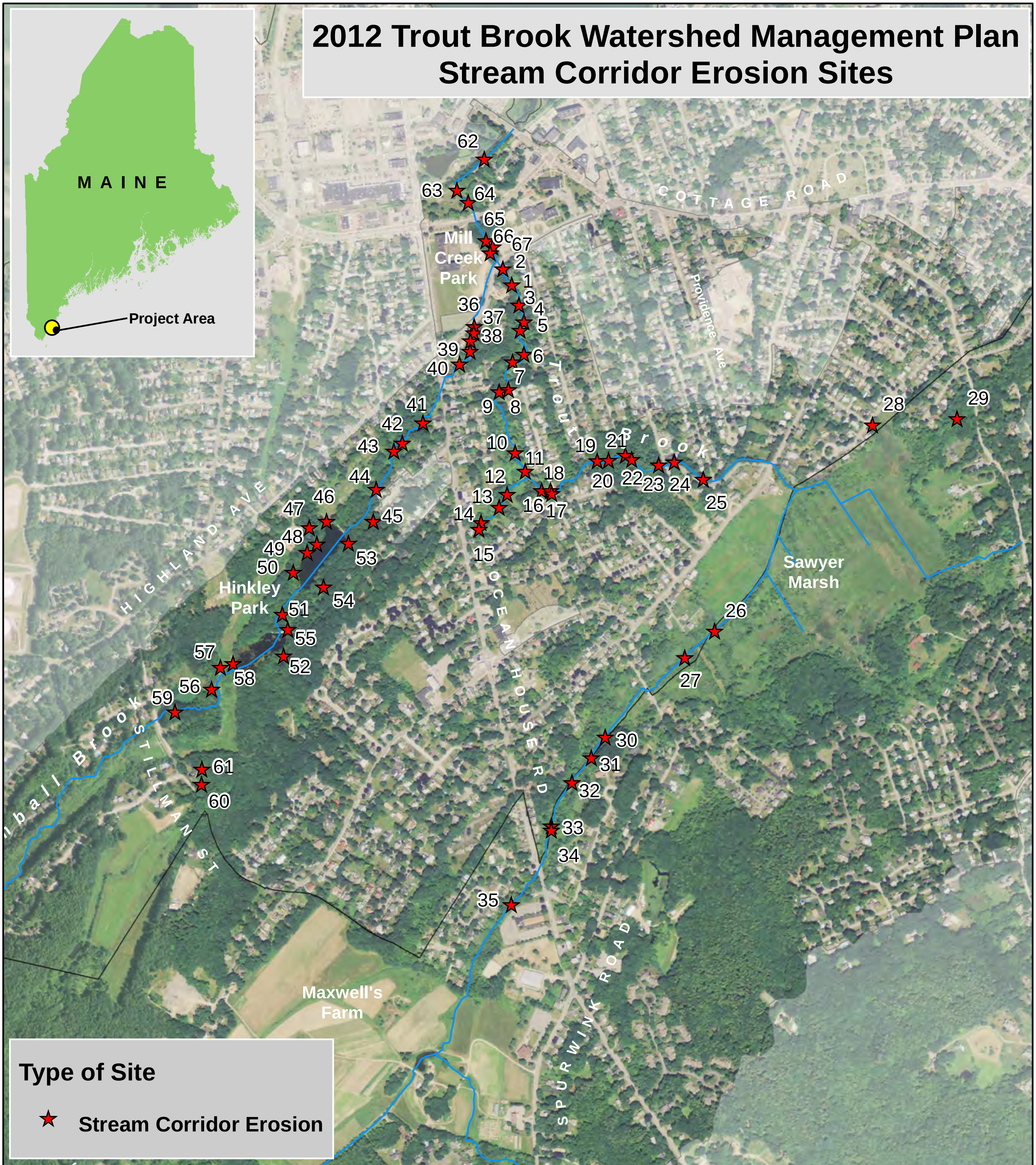
Map ID	Stormwater Outfall Catchment	Impact	Benefit	Retrofit Feasibility	Cost	Priority Ranking	Description of Potential Retrofits and Limitations
F	Mitchell	Low	Low	Low	Medium	6	Road and new development drains to and blows out intermittent stream, but flow disperses into Sawyer Marsh before reaching Trout Brook.
R	Linwood	Low	Low	Low	Medium	6	Outfall drains into Sawyer Marsh. Low priority since no channelized flow to stream. No room for tree boxes.
S	Waterhouse Cul de sac	Low	Low	Low	Medium	6	Did not evaluate yet, but deemed low priority since small area discharges via sheet flow to Sawyer Marsh.
T	Sawyer and Marsh (south)	Low	Low	Low	Medium	6	Did not evaluate yet, but deemed low priority since small size.
V	Marsh/Sawyer	Low	Low	Low	Medium	6	Did not evaluate yet, but deemed low priority since small size.
W	Marsh Rd	Low	Low	Low	Medium	6	Did not evaluate yet, but deemed low priority since small size.
X	Norman/Spear	Low	Low	Low	Medium	6	Outfall drains into Sawyer Marsh. Low priority since no channelized flow to stream and permitting restrictions.
Y	Linwood 2	Low	Low	Low	Medium	6	Small drainage area. Outfall drains into wetland. Low priority since no channelized flow to stream.
Z1	Pleasant Ave. tributary	Low	Low	Low	Medium	6	Did not delineate yet. Pleasant Ave. drainage to stream trib. No retrofit opportunities evident.
C	Florence/Somer set	Low	Low	Low	High	4	Outfall drains into Sawyer Marsh so difficult to install retrofits. Low priority since no channelized flow to stream.
J	Sawyer/Marsh (north)	Low	Low	Low	High	4	No possibilities evident due to sidewalks, slope and walls etc. at catch basin locations.
N	Sawyer Brook Circle	Low	Low	Low	High	4	No possibilities evident.

Table 1. Catchment Scoring Summary

Map ID	Stormwater Outfall Catchment	Impact	Benefit	Retrofit Feasibility	Cost	Priority Ranking	Description of Potential Retrofits and Limitations
P	Lawrence/Fessenden	Low	Low	Low	High	4	Large base flow from springs. Too much water to design/treat effectively. Could do one tree box above the catch basin.
AA	Pilgrim/Stillman	Low	Low	Low	High	4	Did not evaluate yet, but stormwater not deemed primary issue for Kimball.
BB	Rte 77 and Brenton	Low	Low	Low	High	4	Did not evaluate yet, but stormwater not deemed primary issue for Kimball.
CC	Higgins/Stillman	Low	Low	Low	High	4	Did not evaluate yet, but stormwater not deemed primary issue for Kimball.

Impact		Considers catchment land use, size, impervious cover etc.
	High	Catchment with relatively high contribution of pollution related to the subwatershed's primary stressor (5 points)
	Medium	Catchment with moderate contribution to the subwatershed's primary stressor or significant contrib to a secondary stressor (3 pts)
	Low	Catchment with little contribution of pollution related to primary or secondary stressor (1 point)
Benefit		
	High	Recommended BMPs would effectively address pollutants associated with primary and secondary stressors (5 points)
	Medium	Recommended BMPs would address multiple issues, but not the primary or secondary stressor (3 points)
	Low	Recommended BMPs would address a single, lower priority issue (1 point)
Feasibility		Based on anticipated interest, ownership, space, accessibility, permit needs etc.
	High	(5 points)
	Medium	(3 points)
	Low	(1 point)
Cost		
	High	>$15,000 (1 point)
	Medium	$5,000-15,000 (3 points)
	Low	<$5,000 (5 points)

2012 Trout Brook Watershed Management Plan
Stream Corridor Erosion Sites



Department of Environmental Protection, State of Maine | City of South Portland Water Resource Protection | Town of Cape Elizabeth, Maine, Incorporated Nov. 1, 1765 | Cumberland County Soil & Water Conservation District

0 | 0.25 | 0.5 | 0.75 Miles

N

Data Sources: CoSP, Maine GIS, MDEP
Map Date: 10/7/12

Trout and Kimball Brook Stream Corridor Survey
Stream Corridor Erosion Sites

Site	Cause	Length (ft)	Avg Bank Hgt (ft)	Land Use (left)	Land Use (right)	Infrastructure Threatened?	Impact / Severity	Benefit	Restoration Feasibililty	Cost	Connected w/Other Problems?	Priority	Photo	Comments
Phase I Restoration Sites														
65	Landuse Change	15	6	Lawn	Paved	No	Medium	Low	High	Low	Instream Restoration Site	14		
3	Pipe Outfall	25	2	Invasives	Lawn	Yes	High	High	Medium	High	Possible Bacteria Source	14		large silt deposit in stream from pipe, sewage?
7	Pipe Outfall	50	4	Forest	Forest	Yes	High	High	Medium	High	Pipe break, possible bacteria source	14		located at pipeline crossing
12	Landuse Change	20	3	Forest	Lawn	No	Medium	Medium	Medium	Low	Inadequate Buffer	14		
17	Pipe Outfall	6	5	Multiflora Rose	Low	No	Medium	Low	High	Low		14		knotweed
18	Pipe Outfall	6	8	Multiflora Rose	Low	No	Medium	Low	High	Low		14		knotweed
21	Below Road Crossing	10	4	Forest	Forest	No	High	Medium	Medium	Medium	Instream Restoration Site	14		old trail xing
23	Landuse Change	75	5	Forest	Forest	No	Medium	Low	High	Low		14		trail erosion, coordinate with Preserve Plan

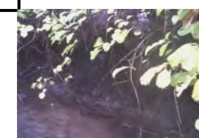
Trout and Kimball Brook Stream Corridor Survey
Stream Corridor Erosion Sites

Site	Cause	Length (ft)	Avg Bank Hgt (ft)	Land Use (left)	Land Use (right)	Infrastructure Threatened?	Impact / Severity	Benefit	Restoration Feasibililty	Cost	Connected w/Other Problems?	Priority	Photo	Comments
24	Below Channelization	75	6	Other	Lawn	No	High	Medium	Medium	Medium	Inadequate Buffer, Yard Waste	14		
25	Below Road Crossing	50	5	Other	Lawn	No	High	Low	Medium	Low	Inadequate Buffer	14		
26	Landuse Change	30	2	Lawn	Shrubs/Small Trees	No	Medium	Low	High	Low	Inadequate Buffer	14		
28	Pipe Outfall	15	3	Shrubs/Small Trees	Pasture		High	Low	Medium	Low	Yard Waste	14		
63	Below Road Crossing	15	5	Lawn	Lawn	Yes	Medium	Low	High	Low	In stream Restoration Site	14		bike path
67	Landuse Change	25	0	Paved	Paved	No	Low	Medium	High	Low	Instream Restoration Site	14		erosion from school parking lot
1	Landuse Change	150	3	Shrubs/Small Trees	Lawn	No	Medium	Low	High	Medium	Inadequate Buffer	12		banks undercut
4	Below Road Crossing	25	4	Shrubs/Small Trees	Lawn	No	Medium	Low	Medium	Low	Inadequate Buffer	12		cutting under bridge

Trout and Kimball Brook Stream Corridor Survey
Stream Corridor Erosion Sites

Site	Cause	Length (ft)	Avg Bank Hgt (ft)	Land Use (left)	Land Use (right)	Infrastructure Threatened?	Impact / Severity	Benefit	Restoration Feasibililty	Cost	Connected w/Other Problems?	Priority	Photo	Comments
8	Pipe Outfall	12	16	Forest	Forest	No	High	Low	Medium	Medium		12		residential drain
15	Below Road Crossing	50	4	Lawn	Shrubs/Small Trees	No	High	Medium	Low	Medium	Instream Rest. Site, Inadequate Buffer, Yard Waste	12		
22	Unknown	50	5	Forest	Forest	No	Medium	Medium	Medium	Medium	Instream Restoration Site	12		
35	Landuse Change	75	4	Lawn	Pasture	No	Medium	Medium	Medium	Medium	Inadequate Buffer	12		
62	Other	0	8	Lawn	Other	No	Medium	Medium	Medium	Medium	Inadequate Buffer, Instream Restoration Site	12		stormwater and tidal
20	Unknown	75	5	Forest	Forest	No	Medium	Medium	Medium	Medium	Instream Restoration Site	12		Opening created in berm to provide floodplain access in 2012.
Phase II Restoration Sites														
36	Below Road Crossing	12	12	Forest	Lawn	Yes	Low	Low	Medium	Low		10		material dumped to clear edge, pavement breaking

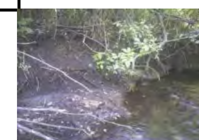
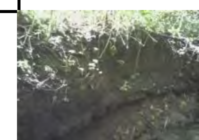
Trout and Kimball Brook Stream Corridor Survey
Stream Corridor Erosion Sites

Site	Cause	Length (ft)	Avg Bank Hgt (ft)	Land Use (left)	Land Use (right)	Infrastructure Threatened?	Impact / Severity	Benefit	Restoration Feasibililty	Cost	Connected w/Other Problems?	Priority	Photo	Comments
39	Landuse Change	100	3	Lawn	Shrubs/Small Trees	No	Medium	Low	Medium	Medium	Metal deflectors in stream, Inadequate buffer	10		Kimball Brook
40	Unknown	40	2	Lawn	Multiflora Rose	No	Low	Low	Medium	Low	Inadequate Buffer	10		Kimball Brook - eroded runoff rill entering stream
2	Below Road Crossing	15	12	Lawn	Other	Yes	Low	Low	Medium	Low		10		pavement breaking above
37	Bend at steep Slope	50	4	Shrubs/Small Trees	Shrubs/Small Trees	No	Medium	Low	Low	Low	Inadequate Buffer	10		Kimball Brook
38	Bend at steep Slope	50	4	Shrubs/Small Trees	Shrubs/Small Trees	No	Medium	Low	Low	Low	Inadequate Buffer	10		Kimball Brook
47	Below Road Crossing	150	1	Forest	Forest	No	Low	Low	Medium	Low		10		Kimball Brook. Hinckley Park - install trail waterbars
41	Bend at steep Slope	75	3	Multiflora Rose	Lawn	No	Medium	Low	Medium	Medium	Inadequate Buffer, Retaining Walls along edge	10		Kimball Brook - knotweed
45	Below Road Crossing	300	2	Forest	Forest	No	Medium	Low	Medium	Medium		10		Kimball Brook - gully from wild rose

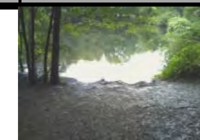
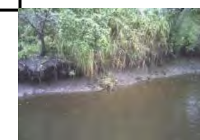
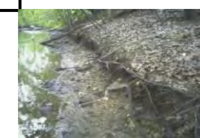
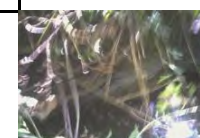
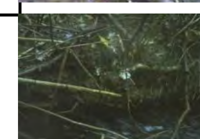
Trout and Kimball Brook Stream Corridor Survey
Stream Corridor Erosion Sites

Site	Cause	Length (ft)	Avg Bank Hgt (ft)	Land Use (left)	Land Use (right)	Infrastructure Threatened?	Impact / Severity	Benefit	Restoration Feasibililty	Cost	Connected w/Other Problems?	Priority	Photo	Comments
42	Other	10	2	Forest	Forest	No	Low	Low	Medium	Low	Inadequate Buffer	10		Kimball Brook - drainage from stanley
44	Unknown	50	5	Forest	Shrubs/Small Trees	No	Medium	Medium	Low	Medium		10		Kimball Brook
46	Landuse Change	75	4	Forest	Forest	No	Medium	Low	Medium	Medium		10		Kimball Brook. Hinckley Park
48	Landuse Change	25	3	Forest	Forest	No	Medium	Low	Medium	Medium		10		Kimball Brook. Hinckley Park - culvert feeds into site
49	Landuse Change	50	10	Forest	Forest	No	Medium	Low	Medium	Medium		10		Kimball Brook. Hinckley Park
50	Landuse Change	75	12	Forest	Forest	No	Medium	Low	Medium	Medium		10		Kimball Brook. Hinckley Park
52	Landuse Change	75	0	Other	Other	No	Low	Low	Medium	Low		10		Kimball Brook. Hinckley Park - trail erosion into stream
54	Landuse Change	150	0	Forest	Forest	No	Low	Low	Medium	Low		10		Kimball Brook. Hinckley Park - trail erosion into stream

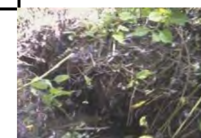
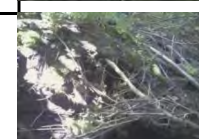
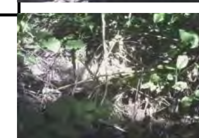
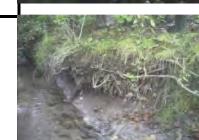
Trout and Kimball Brook Stream Corridor Survey
Stream Corridor Erosion Sites

Site	Cause	Length (ft)	Avg Bank Hgt (ft)	Land Use (left)	Land Use (right)	Infrastructure Threatened?	Impact / Severity	Benefit	Restoration Feasibililty	Cost	Connected w/Other Problems?	Priority	Photo	Comments
57	Landuse Change	15	0	Shrubs/Small Trees	Shrubs/Small Trees	No	Low	Low	Medium	Low		10		Kimball Brook. Hinckley Park - trail ford
60	Below Road Crossing	50	4	Lawn	Forest	No	Medium	Medium	Medium	High	Inadequate Buffer	10		Kimball Brook
10	Landuse Change	100	3	Shrubs/Small Trees	Lawn	No	Medium	Low	Medium	Medium	Inadequate Buffer	10		
11	Landuse Change	100	3	Crop field	Shrubs/Small Trees	No	Medium	Low	Medium	Medium	Inadequate Buffer	10		
29	Pipe Outfall	150	4	Forest	Forest	No	Medium	Low	Medium	Medium		10		
31	Unknown	75	2	Shrubs/Small Trees	Shrubs/Small Trees	No	Medium	Low	Medium	Medium	Inadequate Buffer	10		
32	Unknown	75	3	Shrubs/Small Trees	Pasture	No	Medium	Low	Medium	Medium	Inadequate Buffer	10		
33	Unknown	75	3	Shrubs/Small Trees	Shrubs/Small Trees	No	Medium	Low	Medium	Medium		10		

Trout and Kimball Brook Stream Corridor Survey
Stream Corridor Erosion Sites

Site	Cause	Length (ft)	Avg Bank Hgt (ft)	Land Use (left)	Land Use (right)	Infrastructure Threatened?	Impact / Severity	Benefit	Restoration Feasibililty	Cost	Connected w/Other Problems?	Priority	Photo	Comments
53	Landuse Change	25	0	Forest	Forest	No	Low	Low	Medium	Low		10		Kimball Brook - crushed stone placed down
56	Landuse Change	25	0	Forest	Forest	No	Low	Low	Medium	Low		10		Kimball Brook - Hinckley Park
64	Below Road Crossing	75	8	Lawn	Lawn	No	Medium	Medium	Medium	High	Inadequate Buffer, Instream Restoration Site	10		
66	Below Road Crossing	300	8	Paved	Lawn	No	Medium	Medium	Medium	High	Instream Restoration Site	10		
14	Below Road Crossing	75	3	Pasture	Shrubs/Small Trees	No	High	Medium	Low	Inadequate Buffer, Instream Rest. Site	Instream Rest. Site, Inadequate Buffer	9		
43	Landuse Change	75	3	Multiflora Rose	Multiflora Rose	No	Low	Low	Medium	Medium		8		Kimball Brook
59	Landuse Change	100	3	Shrubs/Small Trees	Shrubs/Small Trees	No	Low	Low	Medium	Medium	Inadequate Buffer	8		Kimball Brook - knotweed
55	Landuse Change	50	5	Forest	Forest	No	Medium	Low	Low	Medium		8		Kimball Brook - Hinckley Park

Trout and Kimball Brook Stream Corridor Survey
Stream Corridor Erosion Sites

Site	Cause	Length (ft)	Avg Bank Hgt (ft)	Land Use (left)	Land Use (right)	Infrastructure Threatened?	Impact / Severity	Benefit	Restoration Feasibililty	Cost	Connected w/Other Problems?	Priority	Photo	Comments
58	Landuse Change	45	0	Shrubs/Small Trees	Shrubs/Small Trees	No	Low	Low	Medium	Medium		8		Kimball Brook - Hinckley Park
61	Below Channelization	25	15	Lawn	Forest	No	Medium	Low	Low	Medium		8		Kimball Brook - Hinckley Park - knotweed
5	Unknown	250	3	Invasives	Invasives	No	High	Low	Low	High	Inadequate Buffer	8		undercut right bank
6	Landuse Change	250	3	Invasives	Invasives	No	Medium	Low	Medium	High	Inadequate Buffer	8		knotweed vertical banks
9	Landuse Change	100	20	Forest	Forest	No	Medium	Low	Medium	High		8		erosion on steep banks
13	Unknown	200	4	Forest	Forest	No	High	Low	Low	High	Instream Rest. Site	8		
16	Landuse Change	40	5	Shrubs/Small Trees	Multiflora Rose	No	Medium	Low	Low	Medium		8		knotweed
27	Unknown	30	3	Shrubs/Small Trees	Shrubs/Small Trees	No	Low	Low	Medium	Medium		8		

Trout and Kimball Brook Stream Corridor Survey
Stream Corridor Erosion Sites

Site	Cause	Length (ft)	Avg Bank Hgt (ft)	Land Use (left)	Land Use (right)	Infrastructure Threatened?	Impact / Severity	Benefit	Restoration Feasibililty	Cost	Connected w/Other Problems?	Priority	Photo	Comments
30	Pipe Outfall	200	2	Pasture	Pasture	No	Medium	Low	Medium	High		8		Result of SW outfall - catchment A
34	Landuse Change	25	3	Shrubs/Small Trees	Shrubs/Small Trees	No	Low	Low	Medium	Medium		8		
51	Unknown	40	6	Forest	Forest	No	Medium	Low	Low	High		6		Kimball Brook
		4726												

Cost

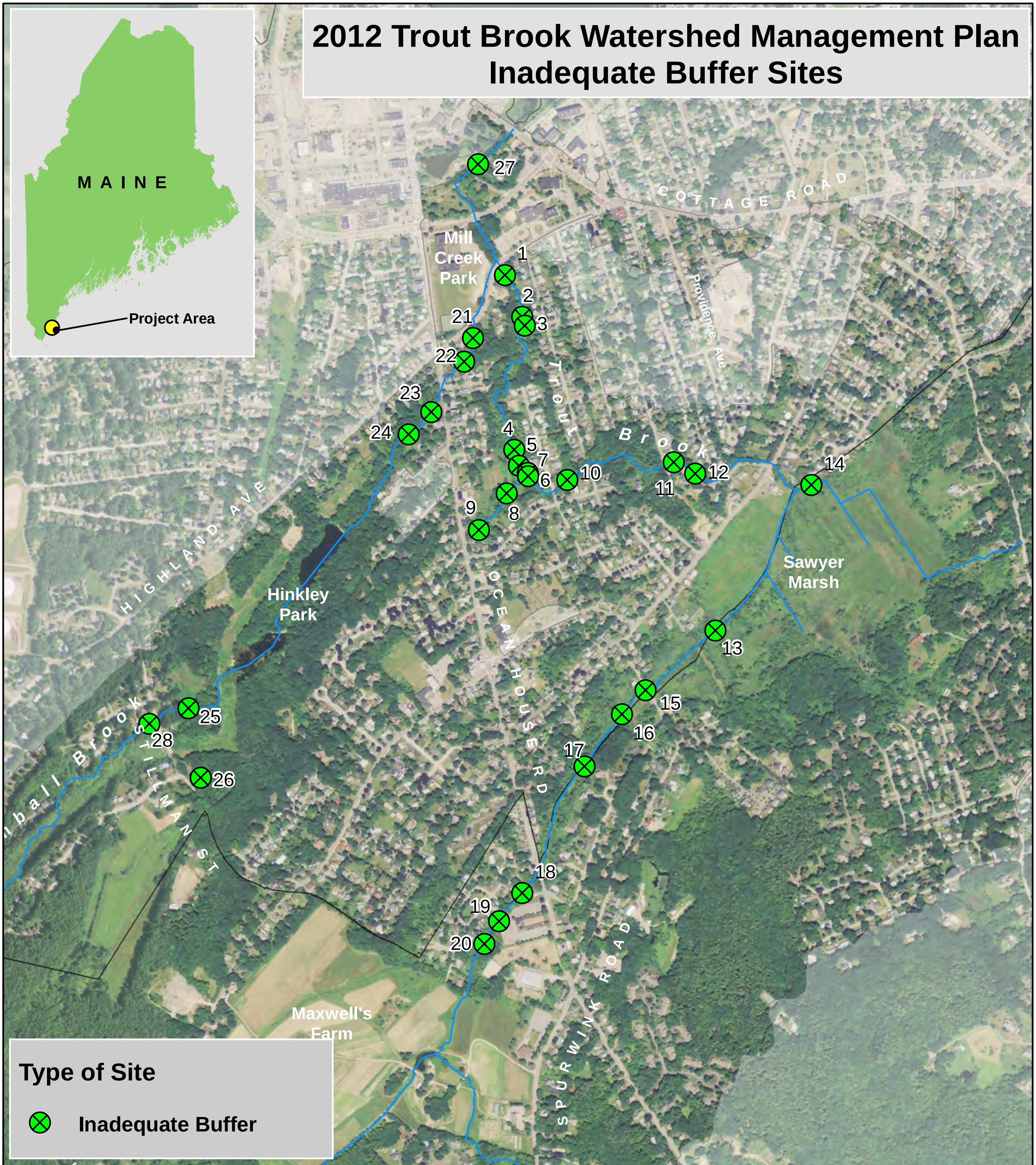
High	<$5,000
Medium	$1,000-$5,000
Low	$<1,000

Trout and Kimball Brook Stream Corridor Survey

Exposed Pipe Sites

Pipe Location	Type	Diameter (inches)	Length Exposed (ft)	Discharge	Impact/ Severity	Benefit	Restoration Feasibility	Cost	Connect w/ Other Problems?	Priority	Photo	Comments
Phase I Restoration Sites												
Adjacent to stream	Metal			Yes	High	High	High	High	Bacteria	20		Sewer pipe in road connected to outfall, drains to stream. City repaired in 2012.
Above stream	Concrete	24	30	Yes	Medium	High	High	High	Bacteria	18		Combined sewer pipe leaking into stream.
Above stream	Concrete	24	30	No	Low	Medium	High	Low	Bacteria	10		Pilings in stream missing 2 supports. City repaired in 2012.

2012 Trout Brook Watershed Management Plan
Inadequate Buffer Sites



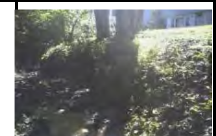
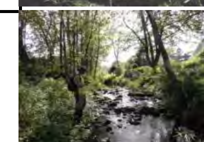
Cumberland County Soil & Water Conservation District

City of South Portland Water Resource Protection

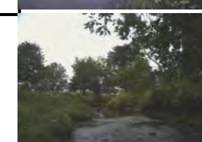
Miles
0 0.25 0.5 0.75

Data Sources: CoSP, Maine GIS, MDEP
Map Date: 10/7/12

Trout and Kimball Brook Stream Corridor Assessment
Inadequate Buffer Sites

Site	Side(s) of Stream	Buffer Width Left (ft)	Buffer Width Right (ft)	Length Left (ft)	Length Right (ft)	Land Use Left	Land Use Right	Impact/ Severity	Benefit	Restoration Feasibility	Cost	Connected w/ Other Problems?	Priority	Photo	Comments
Phase I Restoration Sites															
20	Left	0	0	75	0	Lawn	Shrubs/ Small Trees	High	High	High	Medium	Bank Erosion, Lawn Nutrients	18		Multiple landowners. Interested in plantings.
9	Left	0	0	50	0	Lawn	Shrubs/S mall Trees	Medium	Medium	High	Low	Bank Erosion, Yard Waste, Instream	16		
19	Left	10	0	75	0	Lawn	Shrubs/ Small Trees	Low	High	High	Low	Yard Waste, Erosion, Lawn Nutrients	16		Multiple landowners. Interested in plantings.
18	Both	10	15	100	100	Lawn	Parking Lot	High	Medium	High	Medium	Nutrients, Bank erosion, Shading	16		Multiple landowners. Interested in plantings.
2	Right	0	0	0	50	Invasives	Lawn	Medium	Low	High	Low	Bank Erosion	14		
4	Right	200	0	0	25	Lawn	Invasives	Medium	Low	High	Low	Bank Erosion	14		
8	Right	0	0	0	50	Forest	Lawn	Low	Medium	High	Low	Bank Erosion	14		
11	Right	10	0	150	150	Other	Lawn	Medium	Medium	High	Medium	Bank Erosion, Yard Waste	14		

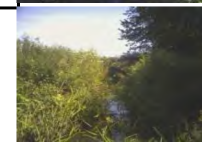
Trout and Kimball Brook Stream Corridor Assessment
Inadequate Buffer Sites

Site	Side(s) of Stream	Buffer Width Left (ft)	Buffer Width Right (ft)	Length Left (ft)	Length Right (ft)	Land Use Left	Land Use Right	Impact/ Severity	Benefit	Restoration Feasibility	Cost	Connected w/ Other Problems?	Priority	Photo	Comments
14	Right	4	0	0	40	Shrubs/Small Trees	Lawn	Medium	Low	High	Low	Yard Waste	14		
1	Both	0	25	0	75	Invasives Knotweed	Lawn	Medium	Low	High	Medium	Bank Erosion	12		knotweed
6	Right	0	0	0	100	Shrubs/Small Trees	Lawn	Medium	Low	High	Medium	Bank Erosion	12		
10	Right	0	2	50	100	Shrubs/Small Trees	Lawn	High	Low	High	High	Bank Erosion	12		Recent planting with help from City and DEP
12	Both	3	5	150	150	Other	Shrubs/Small Trees	Medium	Medium	Medium	Medium	Yard Waste	12		roadside, extend to Sawyer Rd.
13	Left	0	0	25	0	Lawn	Shrubs/Small Trees	Low	Low	High	Low	Yard Waste	12		
27	Both	5	5	250	250	Lawn	Lawn	Medium	Medium	High	High	Bank Erosion, In stream	12		Adjacent to Mill Creek Park, extends to Hannaford
Phase II Restoration Sites															
28	Left	5	0	25	0	Lawn	Shrubs/ Small Trees	Low	Low	Medium	Low		10		

Trout and Kimball Brook Stream Corridor Assessment
Inadequate Buffer Sites

Site	Side(s) of Stream	Buffer Width Left (ft)	Buffer Width Right (ft)	Length Left (ft)	Length Right (ft)	Land Use Left	Land Use Right	Impact/ Severity	Benefit	Restoration Feasibility	Cost	Connected w/ Other Problems?	Priority	Photo	Comments
5	Left	0	5	90	90	Pasture	Invasives	Low	Low	High	Medium	Bank Erosion	10		
7	Left	5	15	75	0	Pasture	Shrubs/Small Trees	Low	Low	High	Medium		10		
15	Left	6	0	75	0	Paved	Pasture	Low	Low	High	Medium	Bank Erosion	10		
22	Both	5	5	75	75	Lawn	Lawn	Medium	Low	High	High	Bank Erosion	10		extends to highland ave, knotweed 75'
23	Right	50	10	100	100	Invasives	Lawn	High	Low	Medium	High	Bank Erosion	10		knotweed , extend another 75' upstream
21	Left	0	0	100	0	Lawn	Shrubs/ Small Trees	Low	Low	High	Medium	Bank Erosion	10		Kimball Brook
26	Left	0	0	100	0	Lawn	Forest	Low	Low	High	Medium	Bank Erosion	10		Kimball Brook
17	Right	100	0	0	150	Shrubs/Small Trees	Pasture	Low	Low	Medium	Medium	Bank Erosion	8		no shrubs or trees only forbs buffer, extends towards spear ave [not quite to 77]

Trout and Kimball Brook Stream Corridor Assessment
Inadequate Buffer Sites

Site	Side(s) of Stream	Buffer Width Left (ft)	Buffer Width Right (ft)	Length Left (ft)	Length Right (ft)	Land Use Left	Land Use Right	Impact/ Severity	Benefit	Restoration Feasility	Cost	Connected w/ Other Problems?	Priority	Photo	Comments
3	Both	50	50	200	200	Invasives	Invasives	Medium	Low	Low	High		6		all invasives
16	Both	100	100	300	300	Pasture	Pasture	Low	Low	Medium	High	Bank Erosion	6		extends to sawyer rd, no shrubs or trees only forbs buffer
24	Right	0	20	0	100	Invasives	Forest	Medium	Low	Low	High	Bank Erosion	6		lots knotweed some lawn, extend another 75' upstream
25	Both	0	0	200	200	Invasives	Invasives	Low	Low	Low	High	Bank Erosion, Yark Waste	4		Kimball Brook - all knotweed down to trib
		Total Length		**2065**	**2105**										

Cost

High >$5,000

Medium $2,500-$5,000

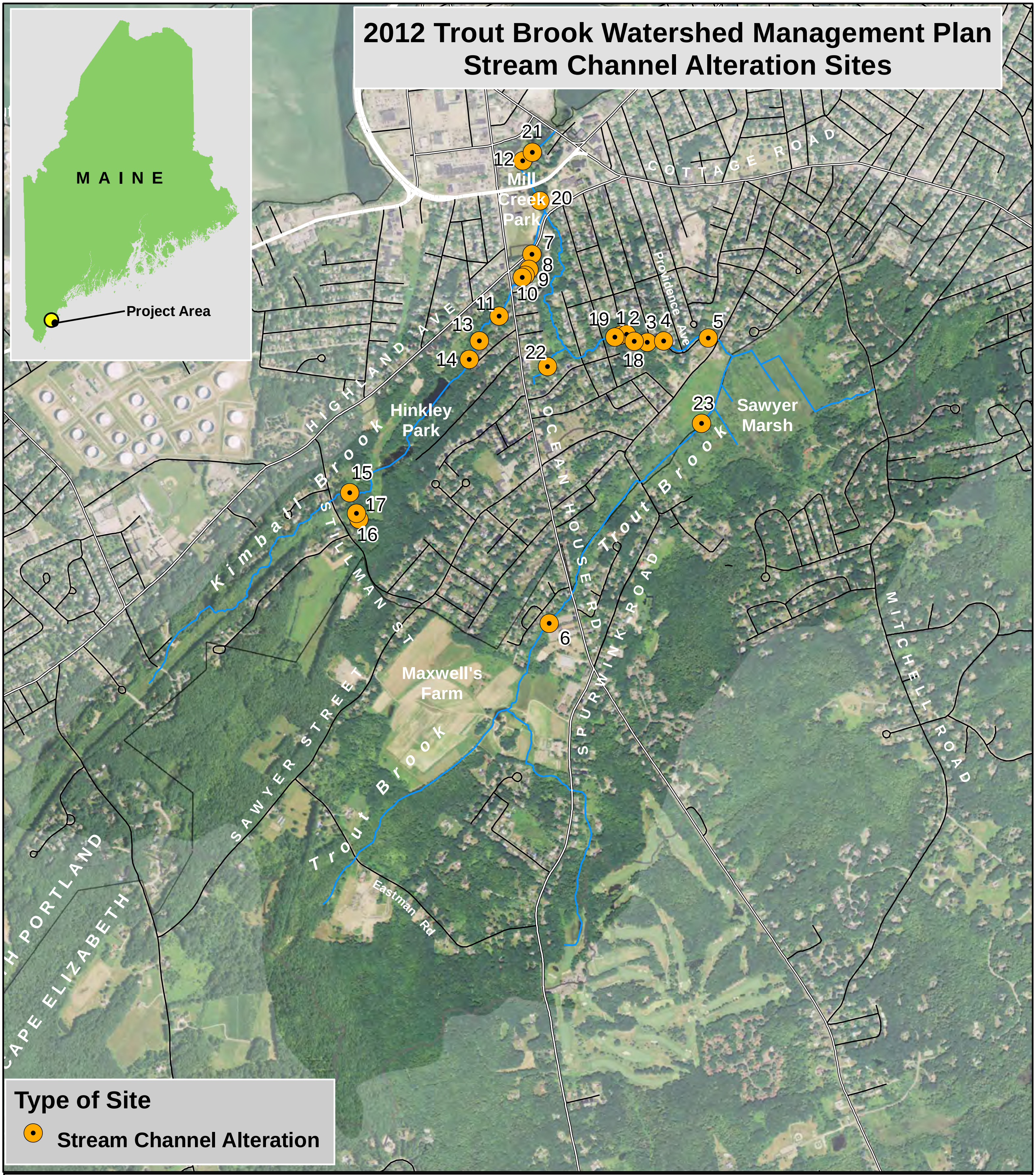
Low <$2,500

Assumes $5.00/sf for landscaped buffer, including plants, labor and 10 foot wide buffer

Assumes $3.00/sf for forested buffer, including plants, labor and 20 foot wide buffer

Assumes high cost to remove invasives and do long term control and replanting

2012 Trout Brook Watershed Management Plan
Stream Channel Alteration Sites



Cumberland County Soil & Water Conservation District

City of South Portland Water Resource Protection

Department of Environmental Protection State of Maine

Town of Cape Elizabeth, Maine

0 0.5 1 1.5 Miles

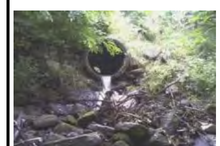
N

Data Sources: CoSP, Maine GIS, MDEP
Map Date: 10/7/12

Trout and Kimball Brook
Stream Channel Alterations, Fish Barriers and Restoration Sites

Site	Survey	Description	Bottom Width (ft)	Length (ft)	Impact/Severity	Benefit	Restoration Feasbility	Cost	Connected w/Other Problems?	Priority	Photo	Comments
Phase I Restoration Sites												
1	Stream Corridor Assessment	Rocks placed across stream	13	3	Low	Medium	High	Low	Lowers aeration and DO	14		Cobble dam removed in 9/12 as part of CBEP habitat restoration project.
2	Stream Corridor Assessment	Rocks placed across stream	13	6	Low	Medium	High	Low	Lowers aeration and DO	14		Cobble dam removed in 9/12 as part of CBEP habitat restoration project.
19	Urban Streams Study	TB Preserve (above Boothby) - Channel straightened, overwidened and aggrading.		200'	Medium	High	Medium	Medium	Low velocity and DO, lack of pools	14		Partially fixed in 9/12 as part of CBEP habitat restoration project. Added root wads/woody debris and created opening in streamside berm to reconnect stream with floodplain.
18	Urban Streams Study	Braided Channel in TB Preserve		150'	Medium	High	Medium	High	Undefined channel, poor flow velocity, less favorable habitat, lack of pools, low DO area	12		Restore in conjunction with Site CA 3. Add LWD and narrow channel to create pools.
5	Stream Corridor Assessment	Marsh Road between Richland and Sawyer. Fence and armor in stream; low gradient and channelized	15	150	Medium	Medium	Medium	Medium	Silt, Iron bacteria, petroleum sheen and sewage smell.	12		Work with landowner to restore, narrow channel and increase velocity (e.g., possible Colonel Westbrook -type project)

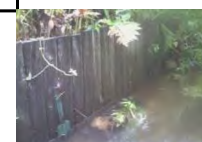
Trout and Kimball Brook
Stream Channel Alterations, Fish Barriers and Restoration Sites

Site	Survey	Description	Bottom Width (ft)	Length (ft)	Impact/Severity	Benefit	Restoration Feasbility	Cost	Connected w/Other Problems?	Priority	Photo	Comments
Phase II Restoration Sites												
8760	CBEP Fish Barrier Survey	Fessenden Ave. - Severe fish barrier in CBEP Survey.			High	Medium	Medium	Very High		11		All culvert replacements will require hydrologic study. Conduct work in conjunction with Site CA3. Move to Phase III if Phase I restoration goals are not met.
8458	CBEP Fish Barrier Survey	Boothby Ave. - Severe fish barrier in CBEP Survey.			High	Medium	Medium	Very High		11		All culvert replacements will require hydrologic study. Move to Phase III if Phase I restoration goals are not met.
8230	CBEP Fish Barrier Survey	Providence Ave. - Severe fish barrier in CBEP Survey.			High	Medium	Medium	Very High	Habitat impacts below culvert.	11		All culvert replacements will require hydrologic study. Conduct work in conjunction with Site 3 (below). Move to Phase III if Phase I restoration goals are not met.
3	Stream Corridor Assessment	Rip rap from culvert washed into stream. No defined channel.	25	75	Medium	Medium	Medium	High	Fish barrier, causes braiding of channel below	10		Create step pools as part of final fish passage restoration. Due to sewer lines, would need to build up to current culvert height.
22	Urban Streams Study	Tributary @ Simmons Road outfall	12	800	Medium	Medium	Medium	High	Channel actively incising	10		Urban Streams Study noted that channel may be reaching equilibrium, but restoration work could speed progress.

Trout and Kimball Brook
Stream Channel Alterations, Fish Barriers and Restoration Sites

Site	Survey	Description	Bottom Width (ft)	Length (ft)	Impact/Severity	Benefit	Restoration Feasbility	Cost	Connected w/Other Problems?	Priority	Photo	Comments
13	Stream Corridor Assessment	Kimball Brook. Corroded pipe lying in stream (3' diameter)		40	Low	Low	Medium	Low	Erosion in stream channel & streambanks associated with pipes	10		
14	Stream Corridor Assessment	Kimball Brook. Corroded pipe lying in stream (3' diameter)		75	Low	Low	Medium	Low	Erosion in stream channel & streambanks associated with pipes	10		
20	Urban Streams Study	Mill Creek (Highland to Broadway) - Channel straightened, overwidened and aggrading.		350'	Medium	Low	Medium	Medium	Lack of buffer, bank erosion	10		Restoration can involve addition of woody debris to narrow channel and increase sinuosity.
21	Urban Streams Study	Mill Creek (Broadway to Cottage) - Channel straightened, overwidened and aggrading.		850'	Medium	Low	Medium	Medium	Lack of buffer, bank erosion	10		Restoration same as Site JF3. Restoration project in conjunction with Site CA 12. Part of Mill Creek Park Plan to create salt marsh system.
23	Stream Corridor Assessment	Sawyer Marsh		1000'	Medium	Low	Medium	High		8		Need to evaluate cost/benefit, but could remove berms along mainstem to connect floodplain. Close off drainage ditches.
6	Stream Corridor Assessment	Retaining wall on stream bank	0	15	Low	Low	Medium	Medium	Lack of buffer	8		

Trout and Kimball Brook
Stream Channel Alterations, Fish Barriers and Restoration Sites

Site	Survey	Description	Bottom Width (ft)	Length (ft)	Impact/Severity	Benefit	Restoration Feasbility	Cost	Connected w/Other Problems?	Priority	Photo	Comments
4	Stream Corridor Assessment	Old dam remnants	15	5	Unknown	Low	Medium	Medium		7		Remove concrete footings on edges of channel.
8	Stream Corridor Assessment	Metal deflectors	5	10	Unknown	Medium	Medium	High	Lack of buffer	7		
9	Stream Corridor Assessment	Wooden deflectors	5	15	Unknown	Low	Medium	Medium		7		
10	Stream Corridor Assessment	Retaining walls along edge	5	75	Unknown	Medium	Medium	High	Lack of buffer	7		Lower end at Highland Ave
11	Stream Corridor Assessment	Retaining walls along edge	40	75	Unknown	Medium	Medium	High		7		
7	Stream Corridor Assessment	Rip rap	5	15	Medium	Low	Low	High		6		

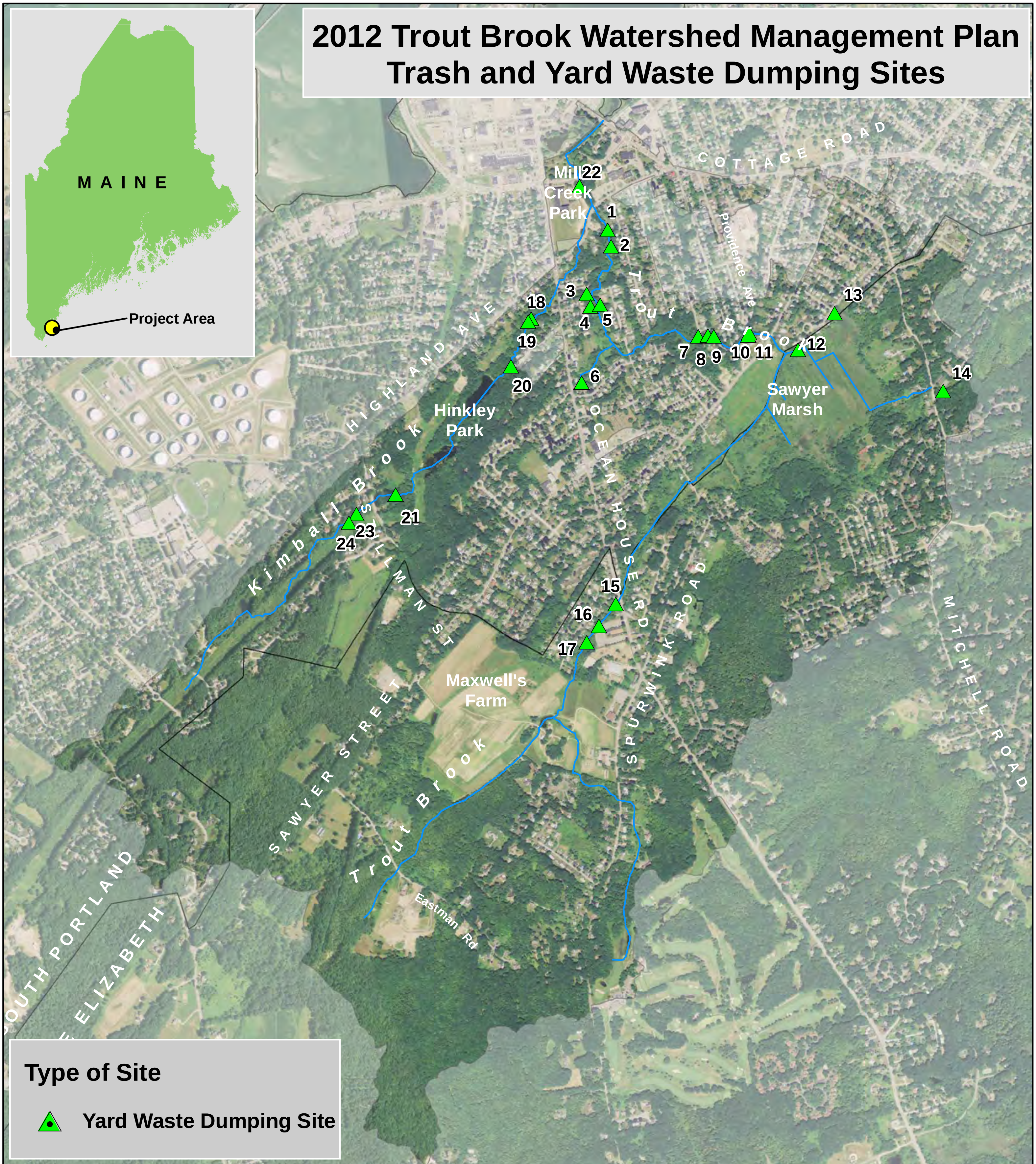
Trout and Kimball Brook
Stream Channel Alterations, Fish Barriers and Restoration Sites

Site	Survey	Description	Bottom Width (ft)	Length (ft)	Impact/Severity	Benefit	Restoration Feasbility	Cost	Connected w/Other Problems?	Priority	Photo	Comments
16	Stream Corridor Assessment	Kimball Brook. Concrete structure and pipe in stream			Unknown	Low	Medium	High		5		
17	Stream Corridor Assessment	Kimball Brook. Pipe in stream			Unknown	Low	Medium	High		5		
12	Stream Corridor Assessment	Metal deflectors	15	100	Unknown	Low	Low	High	Stream channel realignment, Lack of buffer	3		Would need to realign and stabilize this sharp bend in stream.
15	Stream Corridor Assessment	Concrete structure			Unknown	Low	Low	High		3		

Cost

High	Over $7,500
Medium	Between $2,500 - $7,500
Low	Less than $2,500

2012 Trout Brook Watershed Management Plan
Trash and Yard Waste Dumping Sites



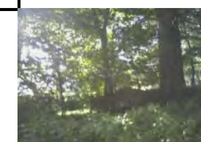
0 0.5 1 1.5 Miles

Data Sources: CoSP, Maine GIS, MDEP
Map Date: 10/7/12

Trout and Kimball Brook Stream Corridor Assessment
Trash and Yard Waste Dumping Sites

Site	Type	Amount	Good for Volunteers	Land Owner	Impact / Severity	Benefit	Restoration Feasibility	Cost	Connected w/ Other Problems?	Priority	Photo	Comments
Phase I Restoration Sites												
15	Yard Waste	4 pick up trucks	Yes	Private	Medium	High	High	Medium	Inadequate Buffer, Nutrient Source	16		
6	Yard Waste	0.5 pick up trucks	Yes	Private	Medium	High	High	Low	Bank Erosion, Inadequate Buffer, Instream restoration site	14		
16	Yard Waste	2 pick up trucks	Yes	Private	Medium	High	High	Low	Inadequate Buffer, Nutrient Source	14		
8	Yard Waste	0.5 cubic yard	Yes	Private	Medium	Medium	High	Low	Bank Erosion, Inadequate Buffer	12		
9	Yard Waste	5 pick up trucks	Yes	Private	Medium	Low	High	Medium	Inadequate Buffer, In Stream Habitat	12		owners might be trying to armor banks
17	Yard Waste	0.5 pick up trucks	Yes	Private	Low	High	High	Low	Inadequate Buffer, Nutrient Source	12		
22	Other - old sand pile or plow bank possibly	NA	No	Public	Medium	Medium	High	Low	Bank Erosion, Instream Restoration Site	12		Fixed - City and School removed and planted in 2012.
1	Yard Waste	1 cubic yard	No	Private	Medium	Medium	High	Low	Bank Erosion Inadequate Buffer	12		grass clippings dumped in stream, BOD

Trout and Kimball Brook Stream Corridor Assessment
Trash and Yard Waste Dumping Sites

Site	Type	Amount	Good for Volunteers	Land Owner	Impact / Severity	Benefit	Restoration Feasibility	Cost	Connected w/ Other Problems?	Priority	Photo	Comments
12	Yard Waste	0.5 cubic yard	Yes	Private	Medium	Medium	High	Low	Inadequate Buffer	12		grass clippings dumped in stream - BOD
Phase II Restoration Sites												
2	Yard Waste	1 cubic yard	No	Private	Low	Medium	High	Low	Bank Erosion Inadequate Buffer	10		
3	Yard Waste	5 pick up trucks	Yes	Unknown	Medium	Low	Medium	Medium		10		end of street
7	Yard Waste	4 pick up trucks	Yes	Public	Low	Low	High	Medium		10		Set back from stream
10	Yard Waste	1 pick up trucks	Yes	Public	Medium	Medium	High	Low		12		
11	Yard Waste	2 pick up trucks	Yes	Unknown	Medium	Low	Medium	Medium		10		
23	Yard Waste	0.2 pick up trucks	No	Public	Medium	Low	High	Low		10		Kimball Brook
18	Yard Waste	3 pick up trucks	Yes	Unknown	Low	Medium	Medium	Medium	Bank Erosion, Inadequate Buffer	10		Kimball Brook
19	Yard Waste	3 pick up trucks	Yes	Unknown	Low	Medium	Medium	Medium	Bank Erosion, Inadequate Buffer	10		Kimball Brook

Trout and Kimball Brook Stream Corridor Assessment
Trash and Yard Waste Dumping Sites

Site	Type	Amount	Good for Volunteers	Land Owner	Impact / Severity	Benefit	Restoration Feasibility	Cost	Connected w/ Other Problems?	Priority	Photo	Comments
20	Yard Waste	10 pick up trucks	Yes	Public	Low	Low	Medium	High	Bank Erosion	10		Kimball Brook
21	Yard Waste	3 pick up trucks	Yes	Public	Low	Low	High	Medium	Inadequate Buffer	10		Kimball Brook
4	Yard Waste	3 pickup trucks	Yes	Public	Low	Low	Medium	Medium		8		end of street
5	Yard Waste	2 pick up trucks	Yes	Public	Medium	Low	Medium	Low		8		next to foot bridge
14	Yard Waste	0.5 cubic yard	Yes	Private	Low	Low	High	Low		8		
24	Yard Waste	0.5 pick up trucks	No	Public	Medium	Low	Medium	Low		8		Kimball Brook
13	Yard Waste	2 pick up trucks	Yes	Private	Low	Low	Medium	Low		6		

Cost

High	>$1,000
Medium	$500-$1,000
Low	<$500

Benefit

High	Can contribute to primary stressor for the subwatershed
Medium	Can contribute to secondary stressor for the subwatershed or site associated with more than one other problem sites (e.g., erosion, inadequate buffer etc.)
Low	Associated with one or none other problem sites

1 Data Summary

The following sections summarize the data that has been collected in the Trout Brook Watershed and made available as part of the Watershed Management Plan. The Criterion Chronic Concentration (CCC) and Criteria Maximum Concentration (CMC) as published in Chapter 584, *Surface Water Quality Criteria for Toxic Pollutants*, are used as comparative criteria for contaminant concentrations in site surface water. The CCC, or chronic criterion, is the highest in-stream concentration to which organisms can be exposed indefinitely without causing unacceptable effect (generally represented in the regulations as a maximum duration of 4 days every 3 years), and the CMC, or acute criterion, is the highest concentration to which organisms can be exposed for a brief period of time without causing an acute effect (represented in the regulations as a maximum duration of 1 hour every 3 years) (EPA 2012). The CCC and CMC for each constituent are provided on the applicable data tables.

1.1 Grab Sampling

Maine DEP conducted grab sampling for numerous constituents in 2003 and 2004 including metals, phosphorus/phosphate, nitrogen/nitrate/nitrite, petroleum compounds, and carbon. Cumberland County Soil & Water Conservation District and the City of South Portland conducted additional monitoring for bacteria, dissolved oxygen, specific conductance, water temperature, chloride, and phosphorus during 2010 and 2011. The following sections summarize the findings of the analytical sampling program.

1.1.1 Metals

The DEP sampling program detected copper above the CCC at two sampling locations during May & November 2003. Exceedances of the criterion are red/bold text. Subsequent metals sampling has not been performed in Trout Brook.

Table 1.
Metals concentrations exceeding criterion in Trout Brook

Sample Location	Sample Date	Aluminum[1]	Copper[2]	Zinc
	units	(mg/L)	(mg/L)	(mg/L)
Criterion Continuous Concentration		0.087	0.00236	0.0306
S-675	5/27/2003	**2.000**	**0.007**	**0.031**[3]
S-302	5/27/2003	**0.970**	**0.006**	0.022
S-675	11/21/2003	**0.850**	ND	0.016
S-302	11/21/2003	**0.500**	ND	0.010

Metals sampling was completed in Kimball Brook during 2005 and 2006 and is summarized on Table 2. Exceedances of the criterion are red/bold text.

Table 2.
Metals concentrations exceeding criterion in Kimball Brook

Sample Location	Sample Date	Aluminum	Iron	Lead	Zinc
	units	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Criterion Continuous Concentration		0.087	1.000	0.0025	0.0306
S-795	8/30/2005	0.080	**1.100**	ND	not sampled
S-795	9/8/2005	**0.190**	**2.700**	**0.004**	not sampled
S-795	10/24/2005	**0.480**	**10.000**	**0.029**	0.013
S-795	11/6/2005	**0.100**	0.500	**0.009**	**0.048**
S-795	8/30/2006	**0.100**	**1.400**	ND	0.012
S-795	11/17/2006	**0.330**	**6.400**	0.020	**0.080**

1.1.2 Chloride

Chloride was identified as a possible constituent of concern due to slightly elevated specific conductance readings identified at DEP Monitoring Site S-454 (located at the downstream end of the Trout Preserve near Fessenden Avenue). Monitoring at S-675 (located upstream of two springs that discharge into the stream) did not identify elevated chloride (less than 50 mg/L in June and July 2012 and less than 150 mg/L in August 2003 and July 2003). The two springs were sampled in July 2012 and Spring 1 contained chloride at concentrations slightly above the CCC during two baseflow monitoring events. This suggests a possible groundwater source of chloride to Trout Brook near Site 454.

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[1] Aluminum is a Non-Priority Pollutant Pollutants pursuant to Chapter 584, *Surface Water Quality Criteria for Toxic Pollutants.*

[2] Copper and Zinc are Priority Pollutants pursuant to Chapter 584, *Surface Water Quality Criteria for Toxic Pollutants.*

[3] Estimated value, from MDEP *Urban Streams Report*.

Table 3.
Chloride samples exceeding criterion

Sample Location	Sample Date	Chloride
	units	(mg/L)
Criterion Continuous Concentration		230
Spring 1	7/26/2012	250
Spring 1	7/31/2012	260

Additional information correlating chloride concentrations to specific conductivity in the Watershed is discussed below.

The chloride data suggest that there may be a chloride source located hydrogeologically upgradient of site S-454. There has been speculation that the municipal salt storage facility (located outside of the watershed to the northwest) may be a source. These data (and the specific conductance data presented below) suggest that SP-1 is contributing to chronic low-levels of chloride in the stream, and further work should be done to identify and address (if possible) the source of chloride to SP-1.

1.1.3 Nutrients

Total phosphorus was collected throughout the watershed in order to evaluate nutrient impacts to Trout Brook. The water quality criterion for phosphorus is 0.030 mg/L, which was derived from the 25th percentile of EPA's *Reference Conditions for Aggregate Ecoregion XIV Streams* (EPA 2000).

Total phosphorus data collected between 2000 and 2004 ranged from 0.011 mg/L to 0.22 mg/L with an average concentration of 0.05 mg/L (standard deviation of 0.05 mg/L). The 2012 total phosphorus data was collected over a variety of hydrological conditions (storm flow and baseflow), and from a variety of locations within the watershed. The data reflected this differing sampling strategy. In 2012, the total phosphorus concentrations ranged from 0.01 to 0.79 mg/L with an average concentration of 0.09 mg/L (standard deviation of 0.14 mg/L).

Table 4 summarizes the phosphorus data collected in the watershed. Each site had at least one sample that exceeded the phosphorus criterion of 0.03 mg/L and the average total phosphorus for each site also exceeded the criterion. For all sites except for site TF (located in the Upper Subwatershed), the maximum phosphorus concentration was observed during stormflow conditions. Site TF was not sampled during stormflow conditions.

Table 4.
Total phosphorus data summary

Site ID	Maximum Phosphorus Concentration	Sample Date	Average Phosphorus Concentration	Standard Deviation	Maximum Storm Concentration	Maximum Baseflow Concentration
	(mg/L)		(mg/L)		(mg/L)	(mg/L)
S-302	0.15	5/27/2003	0.04	0.04	unknown	unknown
S-454	0.10	6/13/2012	0.05	0.03	0.10	0.04
S-675	0.35	6/25/2012	0.09	0.10	0.35	0.06
KA	0.07	6/13/2012	0.03	0.03	0.07	0.02
TB	0.79	6/25/2012	0.17	0.28	0.79	0.05
TC	0.30	6/25/2012	0.09	0.11	0.30	0.05
TD	0.06	6/13/2012	0.05	0.004	0.06	0.05
TE	0.29	6/25/2012	0.10	0.09	0.29	0.05
TF	0.05	7/31/2012	0.04	0.02	n.s.	0.05
W-093	0.04	6/12/2003	0.04	--	unknown	unknown

Due to the low frequency and variability of data collection, definitive conclusions cannot be drawn from these data. These data suggest, however, that nutrients may be contributing to water quality degradation within the watershed. While phosphorus tends to be elevated during stormflow conditions, baseflow sampling suggests that the high concentrations pass through the system quickly. While this may pose a water quality concern for the receiving waterbody (Casco Bay), it is unlikely that phosphorus concentrations are the primary source of impairment in Trout Brook. For this reason, the following actions are appropriate for addressing nutrients within the watershed:

- Education and outreach to residential landowners to encourage proper fertilizer application techniques, appropriate yard waste disposal, and alternatives to chemical fertilizers.
- Outreach to agricultural landowners to ensure that they are receiving adequate support for nutrient management planning, fertilizer BMPs, and farm conservation planning activities. Provide additional support as necessary to ensure continued buffer protection and water quality protection.
- Outreach to other commercial property owners to encourage proper fertilizer application techniques and alternatives to chemical fertilizers.

1.2 Sonde Deployments

Two Yellow Springs Instruments Company (YSI) model 6600 OMS water quality monitoring sondes were deployed in the watershed during 2010, 2011, and 2012. The sondes monitored DO, water temperature, and specific conductance continuously at Sites

454, 675, and TB. Periodic DO, water temperature, and specific conductance results were also collected with hand-held water quality meters during fall 2011 and summer 2012.

1.2.1 Temperature and Dissolved Oxygen

Continuous monitoring of DO in 2010 and 2012 indicates that DO fails to meet water quality criteria much of the time at monitoring sites 675 (Class C) and TB (Class B). Site TB typically contains its highest DO concentrations in the evening when the plant community has been producing oxygen throughout the day and low concentrations in the morning following a night of no oxygen production. Diurnal DO variation is normal in all streams, but large swings between the daily highs and lows (similar to that observed at TB) is typical of systems with nutrient enrichment. Nutrient enrichment is discussed in more detail in Section 4.2.3.3.

At Site 675, the continuous data sonde measurements showed DO above the 5 milligram per liter (mg/L) Class C DO criterion during the periods of continuous monitoring in 2012; however, the measurements are frequently below percent saturation criterion of 60% at Site 675. The continuous sonde data downstream of Route 77 (also downstream of TB) showed low percent saturation (between 55 and 59%) during one period on July 16 and 17, 2012; however, the remainder of the data passed the Class C DO criteria for both percent saturation and concentration. This suggests that this portion of the stream (which is classified as Class B) is not a major source of low-DO water to Site 675, and the source of reduced DO at Site 675 is likely located downstream of Site TB.

These data support data provided in the MDEP Urban Streams Report that suggests that the low DO in the lower part of the watershed (i.e., within the Trout Preserve) is due to low DO groundwater inflow (as evidenced by several visible springs along this stretch of Trout Brook) and contribution of low DO surface water from the wetland area upstream of Site 675.

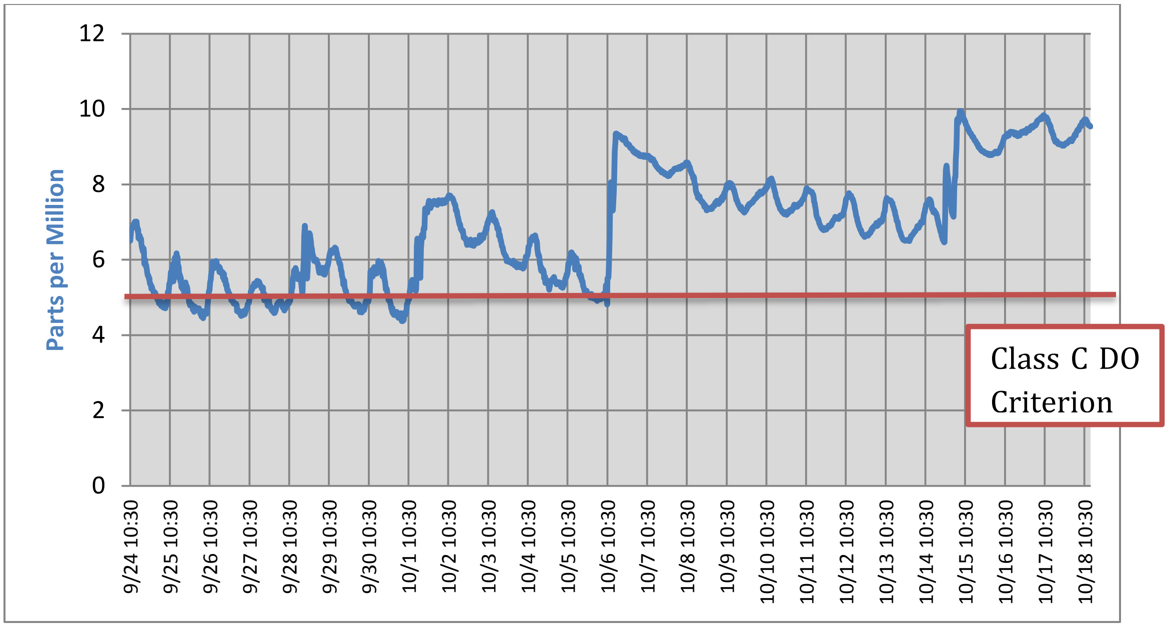


Figure 1. Site 675 Dissolved oxygen concentration, fall 2010

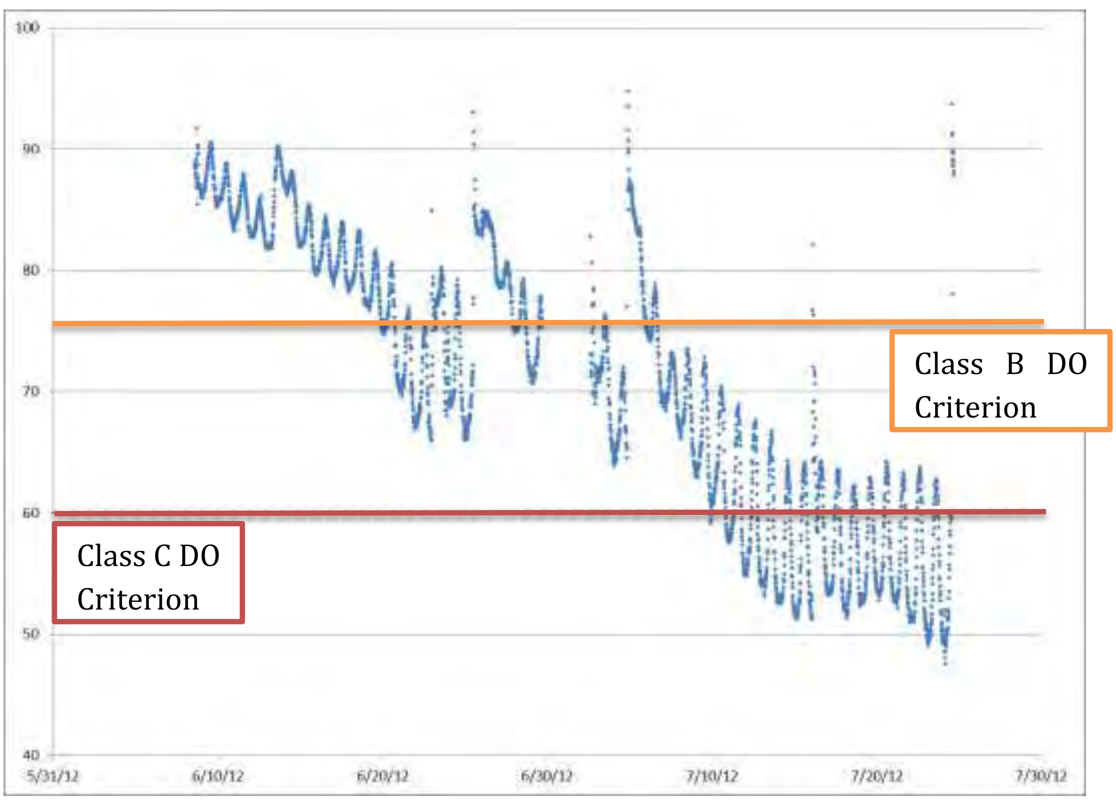


Figure 2. Site 675 Dissolved oxygen percent saturation, June 2012 through July 2012

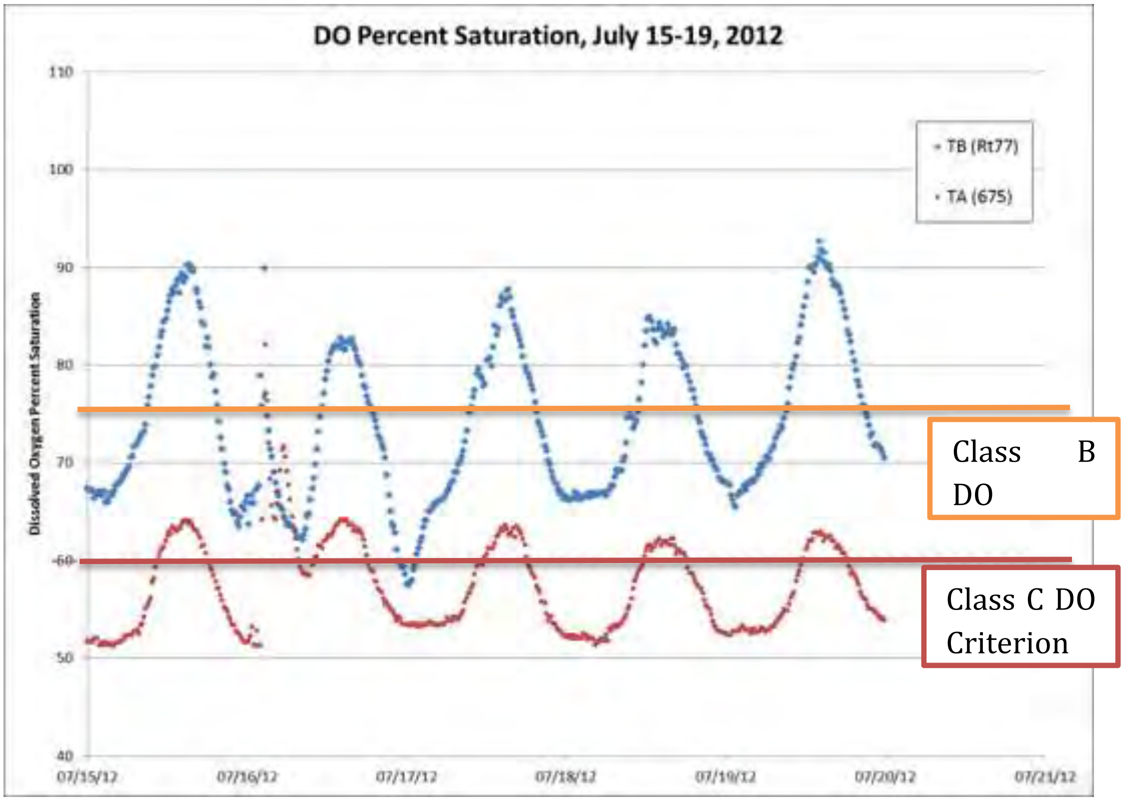


Figure 3. Site 675 & Route 77 Dissolved oxygen percent saturation, July 15 through 21, 2012

1.2.2 Specific Conductivity

Specific conductivity, or specific conductance, is the ability of water to conduct an electrical current at 25 degrees C. The specific conductivity measures the ionic content of water, and, in a stream with certain water chemistry, can be used as a surrogate for chloride measurements.

The following section discusses the specific conductivity data collected throughout the watershed. The results presented herein are a combination of the data sondes installed at each monitoring point and side-by-side field parameter measurements collected during the 2012 sampling events.

A total of 41 chloride samples with corresponding specific conductance were collected in the Trout Brook Watershed in 2012. These sample points were used to develop a regression equation which can be used to estimate chloride concentrations based on specific conductance data within the Trout Brook Watershed (Figure 3). The resulting regression has an R^2 value of 0.882 and a standard error of 19.43.

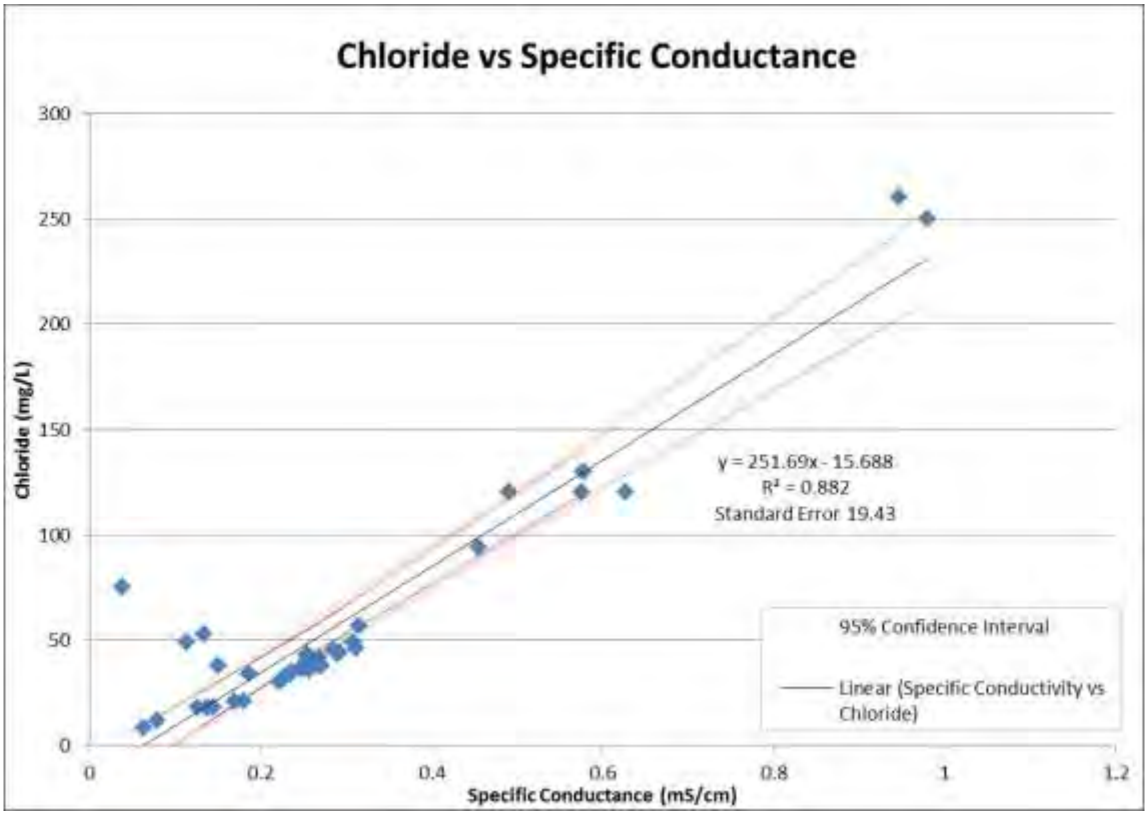


Figure 3. Specific Conductance versus Chloride, Trout Brook Watershed Aggregate Data

y = 251.69x-15.688
Where y = chloride in mg/L
x = specific conductance, in milliSiemens per centimeter (mS/cm)

Due to the scarcity of chloride measurements above 250 mg/L, however, it is likely that the current regression equation underestimates chloride concentrations for specific conductance values above 0.8 microSiemens per centimeter (mS/cm).

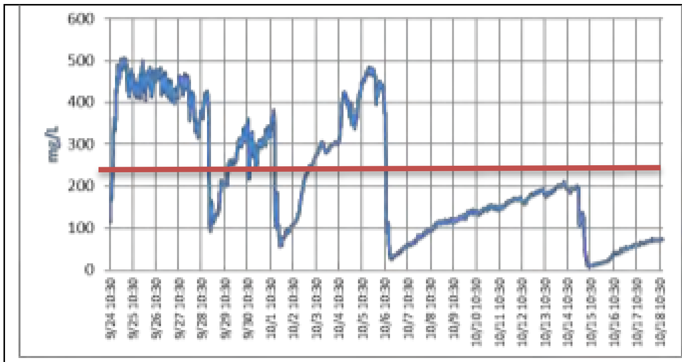
Table 5 presents the range of chloride values calculated from specific conductance measurements collected from the stream. Figures 6 and 7 depict calculated chloride concentrations for S454 and S675 (monitored in 2010) and S675 and TB (monitored in 2012).

Table 5. Range of Mean Chloride Values Calculated from Specific Conductance Data (2012)

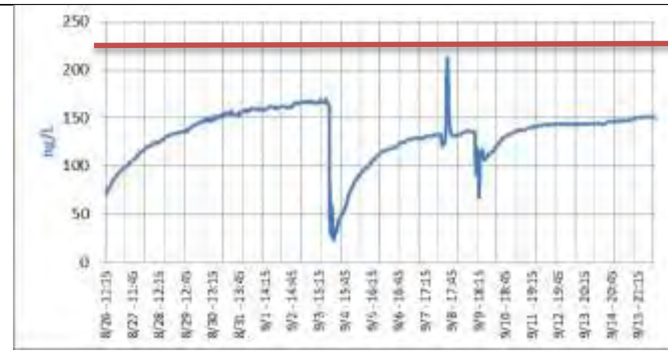
Site	Number of Data Points	Mean Minimum Chloride (mg/L)	Mean Maximum Chloride (mg/L)
675	4117	7.23	158.12
TB	4135	2.20	109.00

Table 6. Range of Mean Chloride Values Calculated from Specific Conductance Data (2010 & 2012)

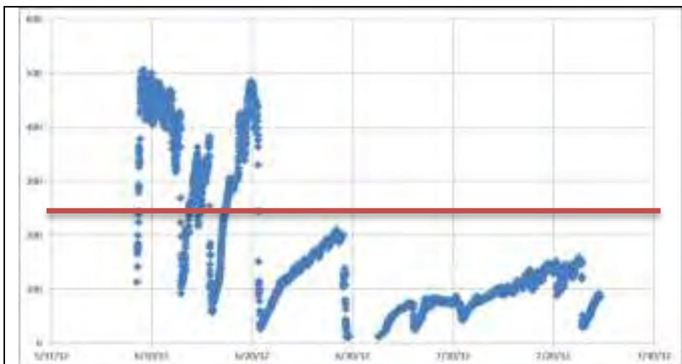
Site	Number of Data Points	Mean Minimum Chloride (mg/L)	Mean Maximum Chloride (mg/L)
675	6436	2.20	506.25
TB	4135	7.23	158.12



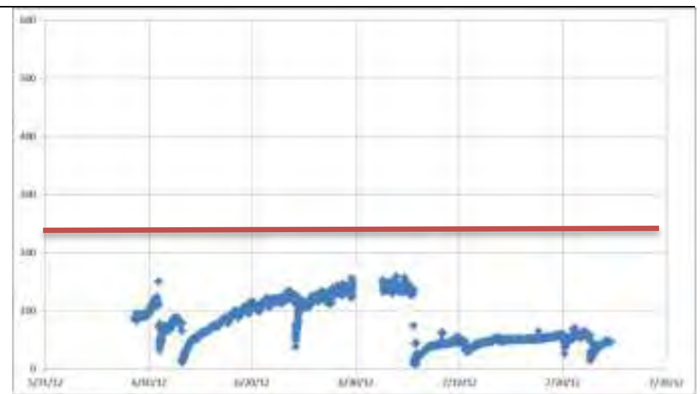
6a. Calculated Chloride at S675, Sept. & Oct. 2010



6b. Calculated Chloride at S454, Sept. & Oct. 2010



7a. Calculated Chloride at S675, June & July 2012



7b. Calculated Chloride at Site TB (Upstream of S675), June & July 2012

The 2010 and 2012 data suggest that Trout Brook does not always exceed the chloride criterion during summer baseflow and storm conditions. This is probably due to a heterogeneous contaminant plume. It is likely that periods of rain cause higher concentrations of chloride to infiltrate to groundwater and during dry periods, the groundwater is relatively unimpacted by the chloride source. This would explain the high chloride concentrations observed in 2010 at Site 675 and the relatively low in-stream concentrations observed in 2012. Based on data observed in other similar watersheds as well as the watershed's runoff patterns, it is likely that runoff from winter salt application to municipal roads and private driveways causes elevated chloride in the late winter/early spring runoff period.

The South Portland Public Works Department is in the process of evaluation solutions for the sand-salt storage pile. Since Trout Brook does not appear to have a chronic chloride contamination problem due to road salt, it is in the best interests of the watershed stakeholders to ensure that the Brook doesn't add chronic chloride to its list of impairments. Therefore, landowner and municipal outreach should be conducted to educate stakeholders on the importance of reduced and targeted salt use, salt application BMPs, and minimizing the amount of chloride-contaminated snow that is stored on pervious surfaces wherever possible.

2012 Trout Brook Watershed Management Plan
Water Quality Monitoring Sites

City of South Portland
Water Resource Protection

Cumberland County Soil & Water Conservation District

Miles

Data Sources: CoSP; Maine GIS; MEDEP, CCSWC

Cumberland County Soil & Water Conservation District
35 Main Street, Suite 3
Windham, ME 04062
Phone: 207.892.4700
Fax: 207.892.4773

TECHNICAL MEMORANDUM

TO: Maureen O'Meara, Town Planner, Town of Cape Elizabeth

Fred Dillon, Stormwater Program Coordinator, City of South Portland

FROM: Kate McDonald, Project Scientist

DATE: October 15, 2012

RE: **Phosphorus Sampling, Trout Brook Watershed, South Portland & Cape Elizabeth, Maine**

Cumberland County Soil & Water Conservation District collected total phosphorus throughout the Trout Brook watershed in order to evaluate nutrient impacts to the brook and support development of the Watershed Management Plan. The water quality criterion for phosphorus is 0.030 mg/L, which was derived from the 25th percentile of EPA's *Reference Conditions for Aggregate Ecoregion XIV Streams* (EPA 2000).

Total phosphorus data collected between 2000 and 2004 ranged from 0.011 mg/L to 0.22 mg/L with an average concentration of 0.05 mg/L (standard deviation of 0.05 mg/L). The 2012 total phosphorus data was collected over a variety of hydrological conditions (stormflow and baseflow), and from a variety of locations within the watershed. The data reflected this differing sampling strategy. In 2012, the total phosphorus concentrations ranged from 0.01 to 0.79 mg/L with an average concentration of 0.09 mg/L (standard deviation of 0.14 mg/L).

Figure 1 depicts the sampling locations, and Table 1 summarizes the phosphorus data collected within the watershed. Each site had at least one sample that exceeded the phosphorus criterion of 0.03 mg/L and the average total phosphorus for each site also exceeded the criterion. For all sites except for site TF (located in the Upper Subwatershed), the maximum phosphorus concentration was observed during stormflow conditions. Site TF was not sampled during stormflow conditions.

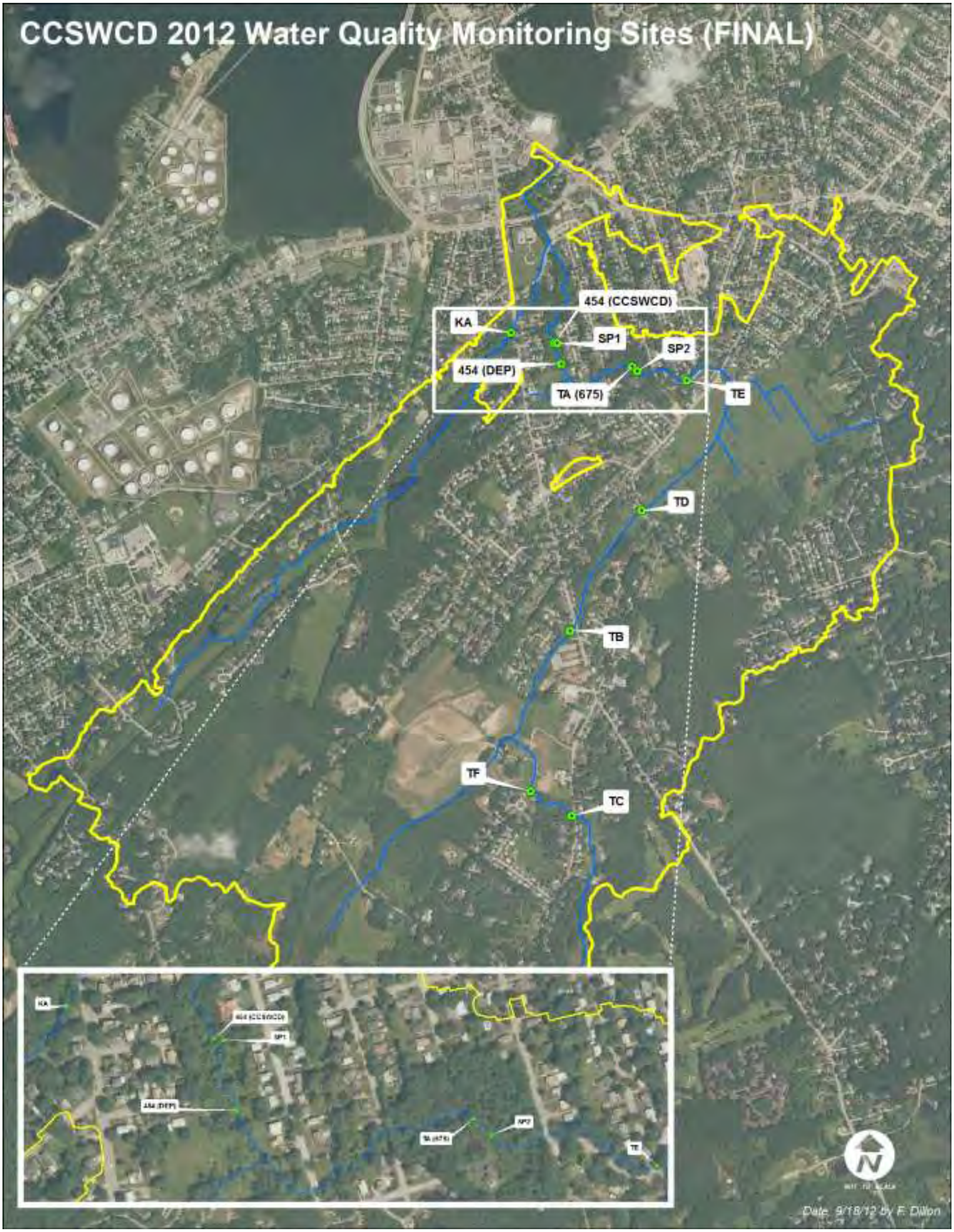

CCSWCD 2012 Water Quality Monitoring Sites (FINAL)
454 (CCSWCD)
KA
SP1
SP2
454 (DEP)
TA (675)
TE
TD
TB
TF
TC
N
Date: 9/18/12 by F. Dillon

Table 1.
Total Phosphorus Data Summary

Site ID	Sample Date	Maximum Phosphorus Concentration (mg/L)	Average Phosphorus Concentration (mg/L)	Standard Deviation	Maximum Storm Concentration (mg/L)	Maximum Baseflow Concentration (mg/L)
S-302*	5/27/2003	0.15	0.04	0.04	n.s.	n.s.
S-454	6/13/2012	0.10	0.05	0.03	0.10	0.04
S-675	6/25/2012	0.35	0.09	0.10	0.35	0.06
KA	6/13/2012	0.07	0.03	0.03	0.07	0.02
TB	6/25/2012	0.79	0.146	0.201	0.79	0.05
TC	6/25/2012	0.30	0.09	0.11	0.30	0.05
TD	6/13/2012	0.06	0.05	0.004	0.06	0.05
TE	6/25/2012	0.29	0.10	0.09	0.29	0.05
TF	7/31/2012	0.05	0.04	0.02	n.s.	0.05
W-093	6/12/2003	0.04	0.04	--	n.s.	n.s.

* Site 302 was discontinued by MDEP when it was discovered that it is tidally influenced at times.
n.s.: Not Sampled

The elevated phosphorus concentrations observed at sample site TB during stormflow sampling prompted additional stormflow sampling near site TB in early October. The summer 2012 stormflow samples were collected on the rising stage to ascertain "first flush" conditions (i.e., the period when the highest concentrations of contaminants are entering the stream). The October storm samples were collected after the first flush and when ground conditions were saturated. The saturated ground conditions allowed us to observe phosphorus concentrations that might typically enter the stream during a prolonged rain event rather than the "worst case scenario" that we observed with the first flush samples. The October 2-3, 2012 storm event saw 0.7 inches of rain over approximately 48 hours. Approximately 0.5 inches of rain had fallen at the time of sampling. There was no channelized runoff observed during sampling.

Table 2.
Supplemental Phosphorus Sampling

Site ID	Sample Date	Sampling Conditions	Phosphorus Concentration (mg/L)
TB	10/3/12	End of storm	0.09
TB1	10/3/12	End of storm	0.08
TB1 (duplicate)	10/3/12	End of storm	0.09
TB2	10/3/12	End of storm	0.04

Sample location TB is located in Trout Brook upstream of Route 77. Sample location TB1 is located approximately 400 feet upstream of TB and sample location TB2 is located approximately 800 feet upstream of TB. All samples were collected from within the stream channel.

The supplemental data suggest that during certain types of storm events, the horse paddocks located southeast of the brook are a source of nutrients in the stream. Overall, the sampling data suggest that the high concentrations observed in stormflow pass through the system quickly. The stream also appears to have persistent elevated phosphorus (i.e., above 0.03 mg/L) even during baseflow conditions. This poses a water quality concern for the receiving waterbody (Casco Bay), and the elevated phosphorus concentrations are likely contributing to depressed dissolved oxygen within Trout Brook.

Based on the data collected during the Watershed Management Plan development process, nutrient enrichment within Trout Brook should be addressed to the extent practicable as part of the Watershed Management Plan. We propose including the following items in Watershed Management Plan to ensure that continued agricultural land uses are supported and watershed stakeholders are also able to move forward with the Trout Brook restoration process:

- Education and outreach to residential landowners to encourage proper fertilizer application techniques, appropriate yard waste disposal, and alternatives to chemical fertilizers.
- Outreach to agricultural landowners to ensure that they are receiving adequate support for nutrient management planning, fertilizer BMPs, and farm conservation planning activities. Provide additional support as necessary to ensure continued buffer protection and water quality protection.
    - Identify the area between TB and TB2 as a restoration site. Restore the flood plain and address erosion issues.
    - Install BMPs to adjacent landowners to minimize parking lot and agricultural runoff and flood plain erosion.
    - Identify specific nutrient management BMPs for livestock sites adjacent to the Brook.
- Outreach to other commercial property owners to encourage proper fertilizer application techniques and alternatives to chemical fertilizers.

Appendix E - Impervious Analysis for Watershed and Outfall Catchments

Map ID	Catchment Location	Total Area of Basin (Acres)	Total Impervious Area	% Imperviousness of Subbasin	% of Total Watershed Imperviousness
Trout Brook Watershed (without Kimball)[1]		**1133.11**	**153.52**	**13.55%**	**10.47%**
A	Kaler/Clifford	61.61	**17.80**	28.88%	11.59%
B	Rte 77 and Bellaire	58.39	**16.52**	28.29%	10.76%
C	Florence/Somerset	27.74	**9.93**	35.79%	6.47%
D	Sawyer/Parrot	14.06	**5.35**	38.03%	3.48%
E	Rte 77 and State	15.24	**4.47**	29.30%	2.91%
F	Mitchell	18.84	**4.00**	21.23%	2.61%
G	Rte 77and Harrison (Spurwink)	8.86	**2.91**	32.84%	1.90%
H	Bellaire/Beaufort	8.36	**2.44**	29.21%	1.59%
I	Boothby	7.01	**2.35**	33.47%	1.53%
J	Sawyer/Marsh (north)	4.18	**1.45**	34.75%	0.95%
K	Waterhouse	3.64	**1.07**	29.42%	0.70%
L	Walnut Cul de Sac	1.83	**1.04**	57.14%	0.68%
M	LDS Church on 77	2.65	**1.03**	38.89%	0.67%
N	Sawyer Brook Circle	1.50	**0.72**	47.86%	0.47%
O	LDS Church (2) on 77	0.77	**0.66**	86.26%	0.43%
P	Lawrence/Fesseden	2.22	**0.62**	28.09%	0.41%
Q	Wilton Ln -off State	1.51	**0.62**	41.02%	0.40%
R	Linwood	1.23	**0.52**	42.43%	0.34%
S	Waterhouse Cul de sac	1.63	**0.44**	27.14%	0.29%
T	Sawyer and Marsh (south)	0.68	**0.43**	63.67%	0.28%
U	Fessenden	0.91	**0.36**	38.94%	0.23%
V	Marsh/Sawyer	1.04	**0.28**	26.75%	0.18%
W	Marsh Rd	0.76	**0.26**	34.28%	0.17%
X	Norman/Spear	0.58	**0.18**	31.55%	0.12%
Y	Linwood 2	0.15	**0.08**	48.64%	0.05%
Kimball Watershed[2]		**333.43**	**22.64**	**6.79**	**1.54%**
AA	Pilgrim/Stillman	6.65	**2.97**	44.74%	13.14%
BB	Rte 77 and Brenton	4.28	**2.37**	55.41%	10.46%
CC	Higgins/Stillman	6.84	**1.66**	24.33%	7.35%
DD	Wildrose	1.73	**0.43**	24.75%	1.89%
Overall Watershed (Trout + Kimball)[2]		**1466.55**	**176.17**	**12.01**	**12.01%**

NOTES:

1 This excludes the tidal portion of the watershed, which consists of approximately 44 acres.

2 Total watershed area based on DEP's delineation is 1509 acres (including tidal portion of watershed).