

**A Biological, Physical, and Chemical Assessment of
Two Urban Streams in Southern Maine:
Long Creek & Red Brook**



**Volume I
Text, Figures, and Tables**

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Executive Summary

Please refer to the Glossary in Appendix K for definitions of many of the technical terms mentioned throughout this report.

This report presents the findings of a comprehensive watershed assessment of Long Creek and Red Brook, two low-gradient (gently-sloped), sandy-silty bottomed, freshwater streams that flow through the municipalities of South Portland, Scarborough, Westbrook, and a small portion of Portland, Maine into Clark's Pond, the Fore River, and eventually Casco Bay. A variety of land-uses, including retail and other commercial development, office parks, a golf course, some industrial facilities, a portion of a landfill, and some residential areas exist in the study watersheds. Long Creek, having more of its stream length flowing through urbanized areas (evidenced by greater values of percent total impervious area [PTIA¹]), appears to be generally more stressed than Red Brook.

The alteration of the watershed landscape by the human activities just mentioned appeared to have impacted both Long Creek's and Red Brook's ecosystems to varying degrees. Those impacts included:

- Degraded water quality resulting from increased stormwater pollution (e.g., increased concentrations of metals, chloride, suspended solids, polycyclic aromatic hydrocarbons [PAHs], phosphorous, and nitrogen) and reduced dissolved oxygen concentrations
- Increased temperatures
- Altered (more flashy) patterns of stormflow and (potentially) baseflow
- Reduced/degraded streamside forest habitat and in-stream habitat quality and diversity including characteristics such as sparse streamside vegetation (trees, etc.) and shading in certain areas and apparently reduced amounts of large in-stream woody debris
- Destabilized stream geomorphology, especially in the more urbanized areas of the study watersheds.

For the most part, Long Creek and Red Brook both had a statutory water quality class designation² of Class C (State of Maine 2001). However, the portions of Long Creek located in Westbrook had a statutory designation of Class B (see Fig. 3.1.6). Long Creek monitoring stations located within Westbrook violated Class B dissolved oxygen standards on a number of occasions. Biological data also signaled stream ecosystem degradation in certain areas of the study watersheds. Macroinvertebrate communities, comprised largely of insects, crustaceans, and worms, generally were in worse condition in Long Creek samples than in Red Brook samples. Maine DEP water quality modeling analyses of macroinvertebrate data from the nine "rockbag"-method sampling stations had the following outcomes:

- Two Long Creek stations in Westbrook, LC-M-2.270 and LC-Mn-2.274, failed to meet their statutory designation of Class B (in fact, one site was found to be in “non-attainment” of any water quality class standards)
- One Long Creek station in South Portland, designated as Class C, was found to be in “non-attainment” of any water quality class standard
- One upper Red Brook station in Scarborough exceeded its Class C designation with a Class A model outcome.

Additionally, Long Creek had fewer pollution-sensitive macroinvertebrate species (e.g., mayflies, stoneflies, and caddisflies) in its samples than Red Brook. The fish community in the study streams showed a similar pattern. Brook trout were found to be fairly abundant at three out of four study sites in Red Brook. Conversely, brook trout were not found to exist at any of Long Creek’s seven sites, even though brook trout had been documented as existing there at least as recent as the late 1960s.

Analyzing the leading causes of stream ecosystem stress throughout the watersheds, in terms of which stressors are most responsible for biological community degradation, is an ongoing process, and one that falls outside of the funded scope of this watershed assessment project. The Maine Department of Environmental Protection (MDEP) has been working with the U. S. Environmental Protection Agency’s (USEPA) Office of Research and Development (ORD) and USEPA-New England to apply USEPA’s stressor identification (SI) guidance (USEPA 2000) to the Long Creek data. A workshop was conducted February 26-28, 2002 with 26 participants from MDEP, Maine State Planning Office, University of Maine, Vermont Department of Environmental Conservation, USEPA-ORD, and USEPA-New England. During this preliminary workshop, SI guidance was applied to the fish portion of the aquatic life data. In subsequent working group meetings, the SI guidance will be applied to the macroinvertebrate portion of the aquatic life data, and further refinements will be made to reevaluate, prioritize, and streamline suspected causes of impairment. Results from that working group’s efforts are expected to be available by the summer of 2003. A preliminary survey of the data in this report yields a fairly reliable characterization of the types of impairments affecting the biological community and suggests that watershed restoration recommendations include some or all of the following:

- Improve both stormwater quality- and quantity-control best management practices (e.g., minimize impervious surfaces throughout the watershed wherever possible, clean up potential pollutants residing on impervious surfaces as frequently as possible, construct/retrofit the stormwater release structures of stormwater detention ponds so that they are not maintaining stream flows at or above highly erosive bankfull [channel-forming] conditions longer than they normally would under natural conditions)
- Consider extending, in current municipal ordinances, the width of riparian/shoreland zoning protection beyond the minimum of 75 feet required by the State of Maine because an increase in the effectiveness of “riparian buffer benefits” such as sediment

and nutrient removal, flood mitigation, and wildlife habitat availability³ generally is associated with an increase beyond a width of 75 feet

- Protect/enhance streamside (riparian) and floodplain forest conditions throughout the watershed (where necessary) by organizing tree plantings and bioengineering projects as well as developing more stringent controls on town shoreland (riparian zone) timber harvesting ordinances (e.g., develop “no cut zones” within 15-35 ft of streams in order to increase canopy cover to shade streams [cooler water can hold more dissolved oxygen], increase bank stability, and provide more opportunities for large woody debris to fall into the streams and become fish and macroinvertebrate habitat structures)
- Preserve the parcel of land between LC-M-1.1~ and LC-M-2.3~, believed to be within/adjacent to an open-space/clearance zone for FAA airport regulations, appeared to be one of the most contiguous, intact stream/riparian forest and floodplain complexes in the Long Creek watershed
- Minimize impervious surfaces through the use of pervious parking spaces, parking garages, and rooftop gardens/turf
- Improve in-stream habitats where necessary (e.g., strategically place large woody debris structures, where appropriate⁴, in order to provide more stable habitat for macroinvertebrates, more retention devices to trap food material for microbes and macroinvertebrates, more cover for fish, and [possibly] an increased number of opportunities for stream water re-aeration)
- Evaluate the usefulness of at least two known in-stream stormwater detention basins in two reaches of Long Creek (upstream of Spring Street) and determine if they should be retrofitted, removed, or re-engineered so that stormwater is treated outside of the channel region
- Evaluate and replace as many poorly-functioning culverts as necessary with large box- (or bottomless arch-) culvert style culverts to minimize drainage plugging and increased erosion while simultaneously minimizing the amount of large woody debris needed to be removed from the system; also consider engineering and installing floodplain-sited “release” culverts in order to have channels functioning more naturally and not ponding up water behind poorly-functioning culverts
- Work with local golf courses, businesses with lawns, and homeowners to ensure that fertilizers and pesticides are only being applied to the extent that they truly are needed.

It is likely that most of the measures described above also would benefit stream ecosystems in other Maine municipalities experiencing rapid urbanization.

¹ **Impervious surfaces** were defined as areas that were impermeable and, therefore, did not allow rainfall and other precipitation to penetrate beneath the Earth’s surface unless by artificial means [e.g., stormwater conveyance systems]. Examples of impervious surfaces included parking lots, roads, rooftops, driveways, etc. PTIA (or analogous measures) was used to estimate the intensity of urban land use in the study watersheds. Recently, this variable has been used by a number of studies of urban streams (Schueler 1994, Morse 2001).

² See Appendix H or State of Maine (2001) for definitions of the various water quality classes.

³ Some wildlife species, such as deer, bear, and (breeding) migratory birds require widths of 100-300 ft in order to use riparian corridors as habitat (U. S. Forest Service 1997).

⁴ The designs of stream restoration practices such as the placement of large woody debris need to be carefully planned and engineered as well as tailored to each site so as to not increased in-stream erosion.