SECTION 3. INVENTORY AND FORECAST OF CONDITIONS

3.1 INTRODUCTION

This section provides an inventory and forecast of critical resources relevant to the problems and opportunities under consideration in the planning area. A quantitative and qualitative description of these resources is made and is used to define existing and future without-project conditions. The project life is considered 50 years, so the future without-project conditions are based on conditions up to the year 2054.

3.2 SITE CHARACTERIZATION

The first step of the evaluation process involved the characterization of the ecological conditions and restoration opportunities along the Mill River and Mill Pond. The study team conducted a detailed site assessment that involved assessing potential restoration opportunities with specific emphasis given to areas outlined by the local sponsor, the city of Stamford. Locations were assessed primarily for the potential to benefit the aquatic health and function of the Mill River. Site characterization included the evaluation of 17 river cross sections within the project area (Figure 5). Habitat assessment at each location included cataloging vegetation, erosion, river bottom quality, wildlife, and adjacent land use.

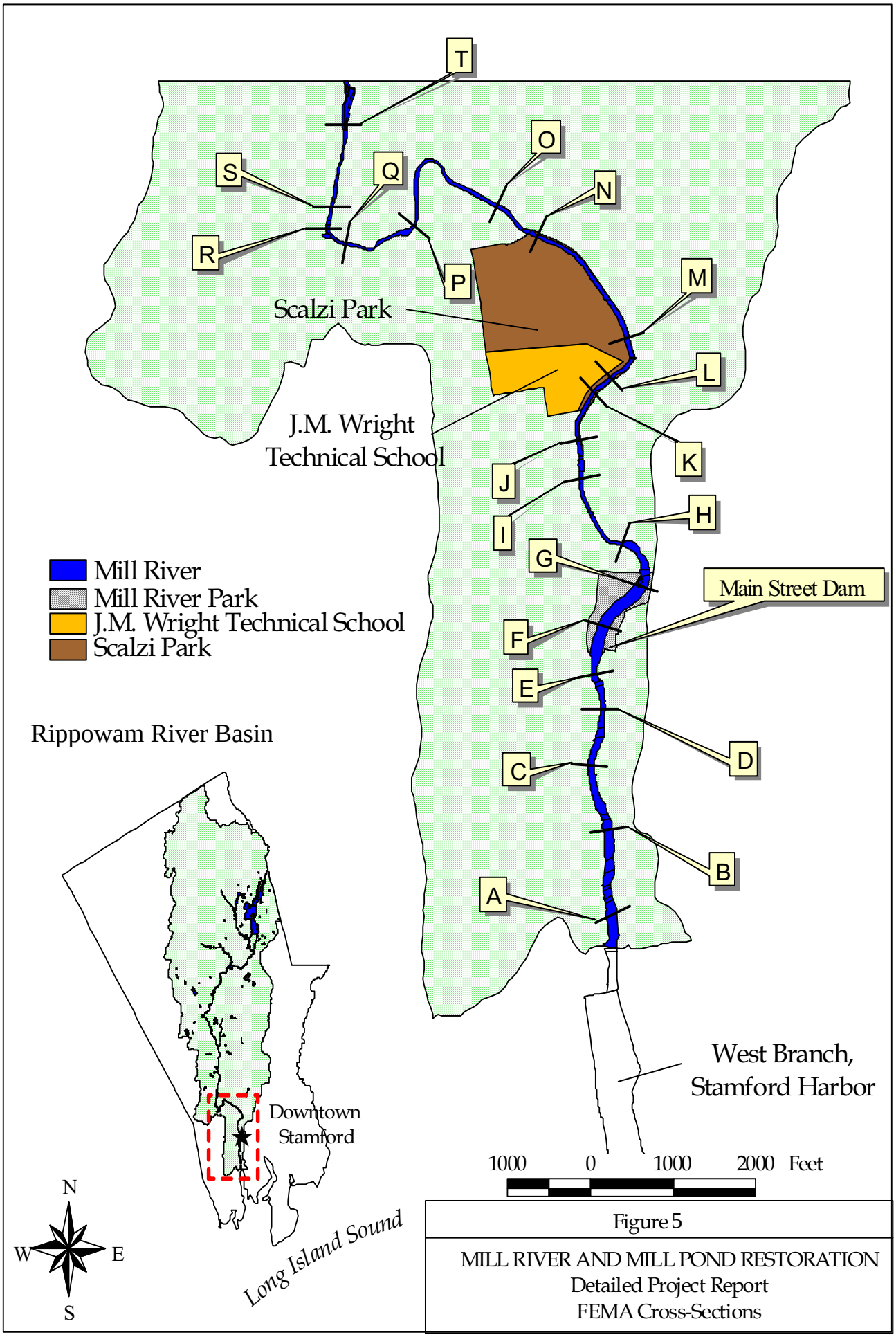


Figure 5

MILL RIVER AND MILL POND RESTORATION
Detailed Project Report
FEMA Cross-Sections

FIGURE 5: FEMA Cross-Section locations within the Project Area.

3.2.1 Data Collection

The following data were collected from each cross section location.

1. Buffer Condition
   The collected data included information on surrounding land use, topography/gradient, and riparian buffer conditions.

2. Condition of In-stream Habitat
   A general rating of very natural/good habitat, moderately natural/moderate habitat quality or degraded/altered/low habitat quality was noted.

3. Habitat Assessment
   Indicators of restoration opportunities included (1) the presence of invasive or exotic plant communities, (2) riparian buffer in a natural and high quality state providing the opportunity to improve the overall habitat value, (3) high quality in-stream habitat, and (4) human impact with potential to improve degraded conditions.

4. Education and Aesthetics
   This objective characterized the feasibility and potential interactions with the community. Indicators of restoration opportunities included (1) site visibility; (2) physical access or potential access to the public by foot, bike, or car; (3) proximity of the site to a school or densely populated area; and (4) in-stream habitat of high quality with opportunities to view wildlife, native plant communities or other characteristics of a naturally functioning stream corridor.

5. Cost Considerations
   Potential feasibility and cost considerations were noted for each cross section. Components evaluated included, but are not limited to, the potential to install native buffer plants, remove/eradicate invasive species, stabilize banks, provide stormwater management, and address trash removal.

6. Cross Section Morphology
   Cross section sketches were made for each FEMA cross section within the project area.

7. River Bottom Characterization
   Pebble counts were completed for each cross section.

8. Photographic Record
   Pertinent features along the river corridor were photographed using a digital camera. Representative habitat conditions, stormwater outfalls, trash,

potential restoration locations, and negatively impacted habitats were some of the features recorded.

Appendix I contains a sample field sheet detailing the format in which information was collected for each of the categories listed above.

3.2.2 Data Analysis and Results

The data collected from each cross section were recorded and evaluated for the presence of potential restoration activities. Scores were recorded and placed into a Potential Restoration Development Worksheet. The total score for habitat assessment represented the overall rating of the site for restoration. Scores range from 0 to 8 out of a total of 8 points. Higher scores represent a greater benefit and potential for restoration. Cross-sections K, L, and M ranked the highest, with each site scoring 8. These cross sections are located directly adjacent to Scalzi Park (Figure 5). Due to the high quality of in-stream habitat and proximity to multiple schools and parks, this area is the primary area for habitat restoration. Mill River Park in downtown Stamford also ranked high with a score ranging between 6 and 7. See Appendix I for the detailed scoring of each cross section.

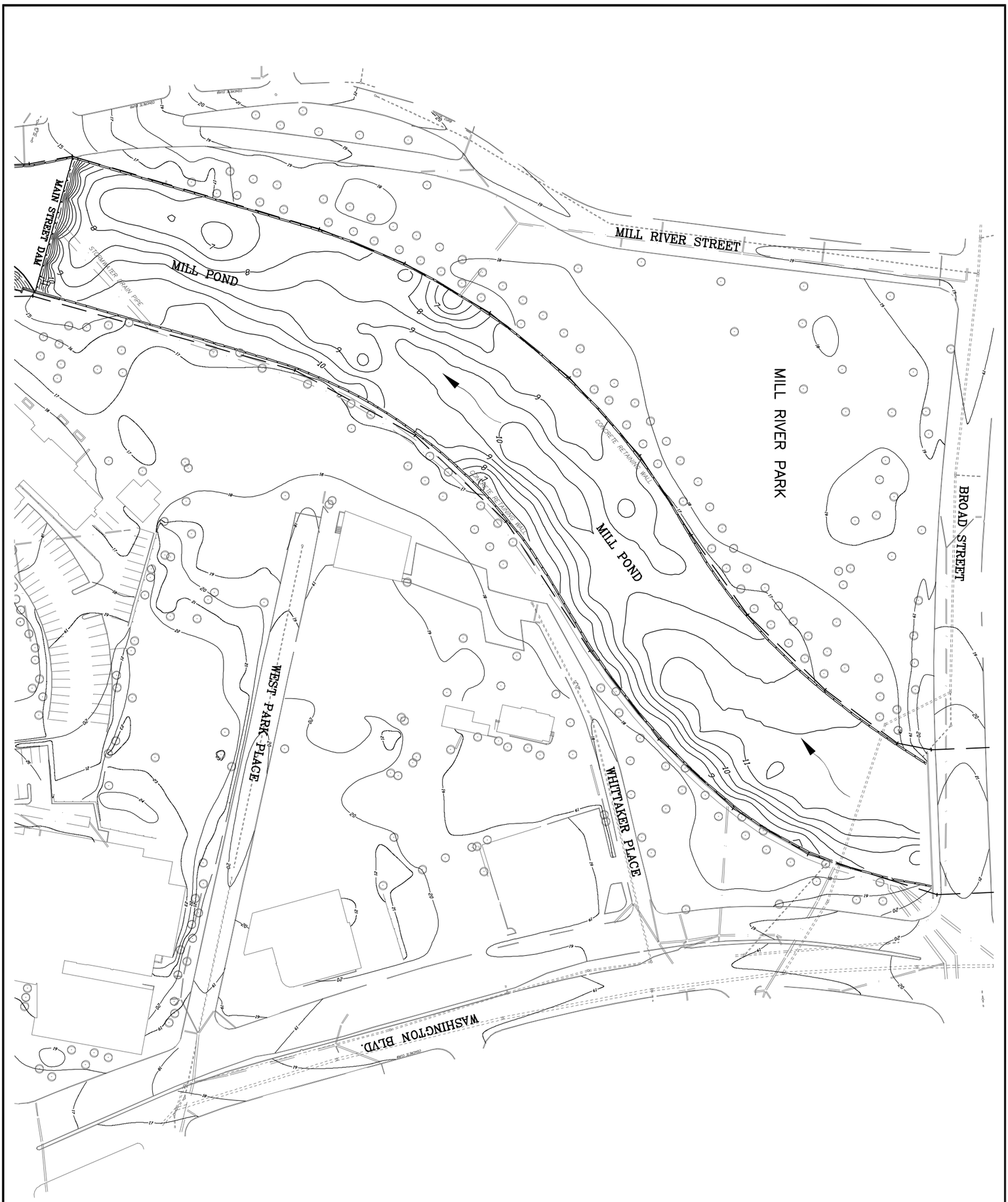
3.2.3 Hydrographic Survey and Site Mapping

Existing site mapping consisted of two-foot contour intervals of the Mill River Park provided by the city of Stamford, with orthophotographs and elevation contour mapping based on flight data collected in 1998. Half-foot contour intervals of bathymetry and sub-sediment of the Mill Pond were provided by CR Environmental, Inc. based on their survey work in 2001 (See Figure 6, and Appendix J)). Site investigations were carried out at locations of cross sections previously surveyed by the Federal Emergency Management Agency (FEMA) in November 1993 by Dewberry and Davis Inc. Dimensions of bridges on the river were taken by field staff to determine the hydraulic volume for the height, width, and breadth of structures. The city of Stamford Land Use Bureau provided GIS layers for the purpose of delineating watersheds according to two-foot contour intervals. See Appendix J for the complete bathymetric analysis and results.

3.2.4 Hydraulic Analyses

Hydraulic results for the existing conditions indicate that average daily streamflow velocities are insufficient to transport fine particles from behind the dam. Modeling results support the observations that considerable backwater influences occur for approximately 1,500 feet upstream of the dam. As much as 5.5 feet of sediment deposition has occurred in the impoundment. The total estimated volume of sediment behind the dam is 18,600 cubic yards based on analysis of bathymetry data and sub-sediment depth (Appendix J).

Figure 6. Bathymetric Survey of Mill Pond



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EXISTING BATHYMETRY
MILL POND
STAMFORD, CONNECTICUT

GRAPHIC SCALE
50 0 100
SCALE IN FEET

NORTH

Model results also show that modest flood discharges in the impoundment (discharges greater than approximately 1,100 cubic feet per second) are capable of transporting sediments that are sand-size and larger. This indicates that sediment, including some potentially contaminated sediment accumulated in the impoundment, may be transported to downstream reaches and Stamford Harbor during flood events.

3.2.5 Water Quality

The Mill River is rated by the State of Connecticut as Class B/A from the North Stamford Reservoir to Stamford Harbor (Hust, personal communication). Class B/A waters are considered suitable for fish and wildlife habitat, recreational uses, agricultural and industrial water supply, and possibly suitable for drinking water supply. Dissolved oxygen is not less than 5 mg/L at any time. Total coliforms are limited to a monthly mean of 100/100ml (Appendix K).

In 2002, the Rippowam River was added to the "Impaired Waters List" by the CT DEP according to the requirements of Section 303(d) of the Federal Clean Water Act (CT DEP 1998 and 2002b). The impairment was listed as 'inadequate aquatic life support' from Route 1 to West North Street and from West North Street to Route 15. The cause of this impairment is currently unknown. This will be a focus of further monitoring by the state.

Water quality has been tested in the Mill River upstream of the Mill Pond. Water quality tests were performed by the USGS in 1994 (USGS 2002). The CT DEP collected samples in July and September of 1998, and in October 2000 (Pizzuto, personal communication). In addition, several water quality parameters have been monitored since 1994 by students at Westhill High School as part of Project SEARCH (Sullivan, personal communication). Project SEARCH is a statewide water quality monitoring and aquatic studies program for high schools. A more in-depth discussion of these results is provided in the Environmental Assessment of this report, and results are available in Appendix K.

The North Stamford Reservoir discharges into the river following the minimum discharge requirements of the state of Connecticut. Under normal circumstances, the required discharge for the North Stamford Reservoir is about 4 cubic feet per second (Gilmore, personal communication). During heavy storm flow events, the reservoir may discharge at higher levels. Aquarion manages the water behind the reservoir so as to minimize the amount of water lost during storms. This has the effect of dampening streamflow variation in the Mill River. In addition to the North Stamford Reservoir, four tributaries provide additional base flow and stormwater flow.

The Mill River watershed is moderately urban. Much of the land surface is covered with impervious materials for roads, parking lots and buildings. Stormwater outfalls are particularly dense in the downstream reach, which is more heavily urbanized. The stormwater systems convey water from the street but provide very little opportunity for

water to infiltrate the soil. Aquifers fail to recharge to sufficient levels, and the river consequently has low base flows during drier weather periods. When large rain events occur, storm sewers reduce the time of concentration of runoff in the watershed and the river reaches bank capacity in a shorter time. Rapid peak discharge, with high energy flows, results in bank erosion and flooding downstream. High sediment loads and pollutants from overland flows may affect water quality during storm events. Pollutants may include hydrocarbons and heavy metals from streets, and pesticides, fertilizers, and fecal coliform from residential gardens and urban parks.

Infringement upon riparian buffers by development reduces the ecological benefits that these areas provide, including infiltrating runoff, capturing sediment, and remediating pollutants. The lack of tree cover in some parts of the riparian corridor reduces shading and increases water temperatures, an important consideration for fish habitat. Problems have been noted with sand and salt from winter road de-icing. Refuse and evidence of intentional dumping are commonly encountered.

Water quality has been noted as best in the upstream reach, while deteriorating downstream. Sediment loading, household refuse and leaf litter affect water quality in the Mill Pond. Site investigators noted evidence of leaves being dumped into the upstream reaches of the river. The pond supports water milfoil, hydrilla, and algae, which are indicative of high nutrient loading and high biochemical oxygen demand (BOD). Resident Canada geese contribute fecal coliform to the pond and downstream areas.

3.2.6 Sediment Quality

Sediment quality characterization was based on existing sediment data that was collected in spring 2002. A total of six (6) grab sediment samples were collected from Mill Pond on March 20, 2002, between West Broad Street (to the north) and Main Street Dam (to the south). The sampling was performed to help evaluate sediment disposal options should the material be dredged. Each sample was collected approximately 120 ft to 160 ft apart, moving in an upstream to downstream direction. Sample SB-01 represents the furthest sample point upstream and SB-06 represents the furthest sample point downstream.

Premier Laboratory analyzed the samples using EPA recommended methodologies. The following constituents were measured: reactive sulfide, hexavalent chromium, semivolatile organic compounds, polychlorinated biphenyls, volatile organic compounds, extractable total petroleum hydrocarbons, phenolics, metals (arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, selenium, silver, and zinc), and total organic carbon. Data results displayed undetectable concentrations for most constituents, with the exception of those constituents shown in Table 1.

Table 1. Data Results Summary for Mill Pond Sediment Sampling

Sample	SB-01	SB-02	SB-03	SB-04	SB-05	SB-06
Sulfide (mg/l)	12	22	4.8	32	21	ND
Phenolics (mg/kg)	ND	ND	ND	ND	20	ND
CT ETPH (mg/kg)	620	1,700	830	1,500	750	940

Metals (mg/l):	SB-01	SB-02	SB-03	SB-04	SB-05	SB-06
Arsenic	ND	ND	ND	ND	0.36	ND
Barium	0.86	0.90	1.2	1.2	1.2	1.2
Iron	1.1	0.92	15	37	46	2.3
Manganese	2.9	2.4	7.4	1.9	8.0	8.0
Zinc	1.0	0.95	1.6	0.62	0.57	2.6

Trace Metals (mg/kg):	SB-01	SB-02	SB-03	SB-04	SB-05	SB-06
Arsenic	ND	ND	ND	1.6	1.4	ND
Barium	62	90	97	100	100	130
Cadmium	0.38	0.74	0.58	0.74	0.71	0.64
Chromium	12	18	20	21	36	25
Copper	27	44	44	53	49	51
Iron	6,700	9,000	9,000	9,500	10,000	12,000
Lead	33	52	59	68	70	73
Manganese	180	260	330	180	380	430
Mercury	0.028	ND	0.046	0.051	0.076	0.068
Selenium	ND	ND	ND	ND	1.7	ND
Silver	ND	ND	0.40	0.64	0.64	0.50
Zinc	120	190	190	220	200	220

Semivolatiles (mg/kg)	SB-01	SB-02	SB-03	SB-04	SB-05	SB-06
Benzo[a]anthracene	0.96	1.6	1.5	1.6	2.0	2.7
Benzo[a]pyrene	1.3	2.3	2.2	2.3	2.8	3.8
Benzo[b]fluoranthene	1.8	3.6	2.8	2.8	3.5	4.6
Benzo[g,h,i]perylene	0.67	ND	1.0	1.8	1.4	1.8
Benzo[k]fluoranthene	1.5	2.8	2.7	2.4	2.7	4.0
Bis(2-ethylhexyl)phthalate	1.4	2.5	1.9	1.9	2.1	2.5
Chrysene	1.7	2.9	2.7	2.8	3.3	4.5
Dibenz[a,h]anthracene	ND	ND	0.46	0.66	0.61	0.82
Fluoranthene	3.4	6.0	5.3	5.6	6.6	9.5
Indeno[1,2,3-cd]pyrene	0.68	ND	1.0	1.6	1.4	1.9
Phenanthrene	1.4	2.3	2.0	2.2	2.4	3.9
Pyrene	2.4	4.1	3.8	4.0	4.7	6.6

Polychlorinated biphenyls (mg/kg)	SB-01	SB-02	SB-03	SB-04	SB-05	SB-06
Aroclor 1254	ND	0.57	0.35	0.24	0.099	0.57

ND = not detected
Dark shaded box = Exceeds CT DEP regulatory threshold for disposal of polluted soil in residential areas (see results for semivolatiles)
Light shaded box = Exceeds CT DEP regulatory threshold for disposal of polluted soil in industrial/commercial areas (see results for semivolatiles)

Sediment quality issues in Mill Pond and Mill River are primarily associated with pollutant runoff and sedimentation. Over the years, pollutant-laden material has accumulated in Mill Pond, upriver of the Main Street Dam. Sediment analysis to date has shown that the pollutants in the pond do not reach hazardous waste levels. At present, however, limited tests indicate that some sediments exceed the CT DEP thresholds for certain semivolatiles for disposal in residential and/or industrial/commercial areas. If dredging were to occur, the city of Stamford would be required to secure appropriate permits for disposing material that exceeds these thresholds. Dredging and sediment removal would be needed to prepare the site for restoration actions and dam removal. Alternatively, removal of the Main Street Dam would eliminate sedimentation, the potential for island formation and invasive plant species colonization, and the need for dredging (other than a one-time dredging event) within the pond. For a more complete discussion of sediment quality see Section 6.3.3 of the Environmental Assessment.

3.2.7 Benthic Environment

Between 1995 and 2000 the macroinvertebrate community in the Mill River upstream of the Mill Pond was sampled in independent studies by the CT DEP and Westhill High School, Stamford, CT. No samples were taken within or downstream of the Mill Pond. The CT DEP concluded that the low percentage of intolerant species indicated that benthic (riverbed) habitats were degraded. The Westhill High School data indicated that the riverbed habitat of the Mill River within the study period was overall in good condition, with the exception of some organic pollution. For detailed information on the existing macroinvertebrate community and riverbed habitat quality, see Section 6.3.4 of the Environmental Assessment.

3.2.8 Fisheries, Shellfish, and Threatened and Endangered Species

The Main Street Dam divides the Mill River into two reaches. The reach upstream of the dam is primarily a warm-water freshwater fishery stocked with trout. The reach downstream of the dam is an estuarine fishery composed of marine and warm-water fish species.

The New England Fisheries Management Council and the NMFS have designated Long Island Sound as Essential Fish Habitat for several fish species. As Stamford Harbor is part of Long Island Sound, it is necessary to identify those species that use the harbor, the tidal mouth of the Mill River, and the freshwater reach of the Mill River at any point during their life cycles. These fish species include pollock (*Pollachius virens*), cobia (*Rachycentron canadum*), winter flounder (*Pleuronectes americanus*), windowpane flounder (*Scophthalmus aquosus*), bluefish (*Pomatomus saltatrix*), summer flounder (*Paralichthys dentatus*), black sea bass (*Centropristis striata*), king mackerel (*Scomberomorous cavalla*), Spanish mackerel (*Scomberomorous maculates*), striped bass (*Morone saxatilis),* alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), and Atlantic salmon (*Salmo salmar*). Section 6.3.5 of the Environmental Assessment contains a detailed inventory of the existing estuarine fishery downstream of the Main Street Dam.

Upstream of the Main Street Dam, the Mill River is primarily a warm-water, freshwater fishery composed mainly of shiners (*Notropis* spp.), dace (*Rhinichthys* spp.), and bass (*Micropterus* spp.), and supplemented with annual trout stockings by CT DEP. Section 6.4.3 of the Environmental Assessment contains a detailed inventory of the existing warm-water, freshwater fishery.

As discussed in Section 1, the Main Street Dam is the major barrier to anadromous fish passage in the Mill River. The dam prevents the passage of fish upstream to their spawning habitat. The dam also affects the quality of habitat in the Mill Pond by trapping sediment and concentrating pollutants and nutrients, creating an environment of high biochemical oxygen demand (BOD). A restored Mill River, including dam removal, would restore access to five miles of valuable spawning habitat for anadromous species.

3.3 FUTURE WITHOUT-PROJECT CONDITIONS

The without-project conditions are forecasted based on continuation of a trend of worsening aquatic ecosystem conditions. Fish passage will continue to be blocked, and the dam will eventually require major repairs. CT DEP may attempt to transport fish above the dam, but such efforts are expensive and generally not very effective.

The Mill Pond walls will eventually deteriorate to some degree and the pond will continue to accumulate sediment, organics, refuse, and pollutants. Infrequent dredging of the pond has occurred, leaving the pond partially to mostly full of sediments. The local sponsor may pursue limited periodic dredging of the pond. The city had been pursuing state permits in 2002 to dredge up to 9,000 cubic yards of sediment from the pond as a maintenance effort. However, regular maintenance dredging cannot be assumed due to the high cost and associated disruptions to the park and surrounding area. Therefore, the pond will probably remain partially to mostly full of sediments, and the aquatic habitat of the pond will remain degraded.

The riparian area along the pond will remain highly degraded due to the existence of the walls and fill along the channel. The deterioration of habitat quality along the Mill River will continue unabated with the potential erosion of banks and the domination of a few invasive and pollution-tolerant species.