

Healthy Communities Grant Program Final Report

Name of Organization: The Children's Museum
950 Trout Brook Drive
West Hartford, CT 06119

Contact Person: Sue Carroll
860-231-2824

Project Title: Park River Assessment Program

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I. Project Purpose

A. Goals. The Park River Assessment Program is a community watershed enhancement program for the Park River Watershed. The original goals of the project were to: (1) promote community awareness of the river, (2) gather water quality data on all waterways in the project area, (3) identify and photograph areas where improvement projects or restoration are needed, and (4) engage families in collecting data.

B. How Goals Address Environmental/Public Health Protection.

To promote environmental/public health protection, project goals were intended to: (1) increase community awareness not only of the river, but also of the link between its water quality and local land use practices and (2) improve the environment of the Park River Watershed through river enhancement projects. By attending training workshops, conducting habitat surveys, collecting and identifying benthic macroinvertebrates, and interacting with program staff and workshop presenters, volunteers had the opportunity to see first hand the connection between the river, its water quality, and the impact of local land use practices and personal habits.

With the goal of improving the watershed environment, the project uses volunteer-gathered data to identify sites in each municipality for enhancement/restoration projects. Improvement projects may include river clean-ups, bank stabilization, wildlife enhancement, plantings to improve flood control and reduce storm water flow, and others. Pending approval and funding and depending on scope, projects may be implemented by program volunteers enabling the program to move from increasing awareness to promoting action.

C. Project Target Area. The project is located in three Connecticut urban areas within the Park River Watershed - Hartford, West Hartford, and New Britain. Volunteer recruitment efforts focused on residents and community networks in these areas.

II. Project Accomplishments

A. Accomplishments. Project accomplishments based on the original work plan are described below.

Objective 1: Recruit volunteers to conduct river assessment activities.

- Task 1: Meet with municipal officials and conservation commissions.

The project area consists of three municipalities – Hartford, West Hartford, and New Britain. The project coordinator and partner organization directors met with West Hartford and New Britain Conservation Commissions as well as the Hartford Planning and Zoning Commission. Program brochures were distributed to all commission members. Each of the three commissions expressed interest in the program and appreciated being informed.

- Task 2: Contact local businesses, youth organizations, colleges, and environmental organizations. Numerous organizations in the project area were contacted to solicit volunteers. Organizations included Boys & Girls Clubs, Hispanic youth centers, Nutmeg Big Brothers/ Big Sisters, Sierra Club's Inner City Outings, Riverfront Recapture, Sustainable West Hartford, Hartford Neighborhood Environmental Partnership, Knox Park Foundation, magnet schools, a local homeschooler's network, and others.
- Task 3: Post project announcements in local newspapers/libraries and on partner websites. To recruit volunteers, a press release was sent to area newspapers, program information was posted on the Museum website, notices were put on municipal list serves, and e-mails were sent to Museum members.

Objective 2: Conduct a stream walk training workshop.

- Task 1: Train volunteers to assess in-stream and riparian conditions. Training workshops were held on June 21, 2008 and June 12, 2009. Both workshops were held at Watkinson School in Hartford. The training was conducted by the USDA-Natural Resources Conservation Service (USDA-NRCS) and included both indoor and outdoor sessions. In Year 1, 16 teams of volunteers registered for the workshop. All but two teams attended. One of the missing teams could not attend the workshop, but was trained in a one-on-one session with the project coordinator on June 28, 2008. Both this and the other missing team chose to back out of the program. Of the 14 teams participating, two decided to pair up resulting in a total of 13 teams for the 2008 field season. In Year 2, 22 teams of volunteers registered for the workshop; 15 teams attended. Two of the missing teams were trained in Year 1 and chose not to repeat the workshop. Of the 15 teams trained, six withdrew from the program for various reasons. A seventh team was unable to schedule a stream walk, but participated in the second workshop. In all, 10 teams conducted stream walks in the 2009 field season.
- Task 2: Assign stream segments to families and youth groups. Volunteer teams chose a stream segment to survey. Segments were delineated based on a hydrogeomorphic study by the USDA-NRCS. Each team was given two maps of their stream walk area – one map to take into the field, the other to keep home.
- Task 3: Schedule site visits. Volunteer teams were asked to notify the project coordinator of their stream walk dates so that site visits could be scheduled and arrangements made to provide hip boots.

Objective 3: Conduct site visits and provide technical support to families and youth groups conducting stream walks.

- Task 1: Collect stream walk data. In Year 1, a total of seven stream walks were conducted. Volunteer teams were accompanied by either the project coordinator or a project partner on 86% of walks. Volunteers collected data on channel morphology, substrate composition, aquatic plants and algae, water conditions, canopy cover, riparian vegetation, surrounding land use, stream bank erosion, barriers to fish migration, storm water outfalls, channel modifications, and in-stream trash/debris. Volunteers were originally

required to submit data by September 5, 2008. However, due to frequent and heavy rains, the due date was extended to October 10, 2008. Also due, in large part, to the heavy rains and accompanying sewage overflows, six stream walks were not conducted.

In Year 2, a total of ten stream walks were conducted. Volunteer teams were accompanied by the project coordinator or a project partner on 70% of walks. Due to an injury sustained in an automobile accident in early August, the project coordinator was unable to accompany volunteers on a number of walks. Stream walk data collected by volunteers in Year 2 was as in Year 1. Volunteers were originally required to submit data by September 4, 2009. However, due to frequent and heavy rains through mid-summer, the due date was extended to October 1, 2009.

- Task 2: Photograph field sites.
Photographs were taken at many sites surveyed. Some photos were taken by the project coordinator/partner while others were taken by volunteers. Photos included images of volunteers at work and specific features (*e.g.*, dams, outfall pipes, eroded stream banks). Most photos taken by volunteers were submitted.

Objective 4: Conduct a water quality monitoring training workshop.

- Task 1: Train volunteers to conduct field sampling.
Training workshops were held on September 20, 2008 at Watkinson School in Hartford and on September 12, 2009 at St. Joseph's College in West Hartford. Eight teams of volunteers (=21 volunteers) attended in Year 1; nine teams (=19 volunteers) attended in Year 2. Each workshop began with a 15-minute presentation on the Park River Watershed by the Director of the Park River Watershed Revitalization Initiative, a project partner. Following the presentation, volunteers were trained how to conduct a rapid bioassessment of streams. The workshop was conducted by the Connecticut Department of Environmental Protection (CTDEP). After training, volunteers were assigned to one of six stream sites to conduct a bioassessment. Stream sites were pre-selected by the project coordinator based on accessibility and appropriateness for macroinvertebrate sampling. All sites were surveyed by volunteers prior to the workshop. When possible, volunteers were assigned to the stream segment they had surveyed.

In the field, all volunteers were visited by and received technical support from the workshop presenter. Some teams also received assistance from the project coordinator and a project partner. Volunteers were given approximately 2.5 hours to complete the bioassessment and return equipment and voucher specimens. Specimen identifications were verified and voucher specimens retained by the CTDEP. Bioassessment data was analyzed by the CTDEP and submitted to the project coordinator.

- Task 2: Loan monitoring equipment to volunteer teams.
Teams were provided with sampling equipment needed to conduct a rapid bioassessment at their assigned stream site. Equipment was provided by the CTDEP.

Objective 5: Review and interpret water quality and stream walk data.

In Year 1, water quality and some stream walk data was not submitted to the project coordinator until December 2008. All data was entered into an Access database created by the EPA. The project coordinator originally planned on using a template of an existing database for the program. The template was created by the Farmington River Watershed Association and based on the original USDA-NRCS stream walk data sheets. However, as significant changes were made to the data sheets for 2008, it was not possible to use the template. As the project coordinator and partners did not know how to create a new database, the EPA was contacted for assistance.

In Year 2, water quality was submitted to the project coordinator in December 2009.

Objective 6: Develop GIS maps of the watershed using volunteer data.

Two types of GIS maps were created using volunteer data. An overview map delineates all drainage basins surveyed. Individual basin maps indicate stream mileage, areas of concern and macroinvertebrate sampling locations. All maps were created in ArcGIS 9.3.1. All 2008 basin maps were overlaid on 2004 black and white aerial photographs obtained from the Center for Land Use Education and Research (CLEAR), a collaboration of the University of Connecticut Department of Extension and Connecticut Sea Grant. As these photographs were no longer available when 2009 maps were created, all 2009 maps were overlaid on 2008 color aerial photographs obtained from the National Agriculture Imagery Program (NAIP).

Objective 7: Identify areas for enhancement projects.

Project partners met in March 2010 to begin reviewing site data and identifying areas for enhancement projects. Partners reconvened in August 2010 to confirm recommended project sites.

Objective 8: Write annual assessment reports.

A Year 1 report was written and submitted in April 2010. The late submission date was due to delays in correcting errors on several GIS maps.

Objective 9: Present data and sites identified for enhancement projects to municipal officials.

Program findings were presented to the Hartford Planning & Zoning Commission and the New Britain and West Hartford Conservation Commissions in September 2010.

Objective 10: Host annual volunteer recognition events.

Instead of hosting volunteer recognition events after Year 1 and again after Year 2, it was decided to hold only one event, at the project's completion. However, in July 2009, the Program Coordinator's position at The Children's Museum was eliminated. As the Museum did not have staff available to take over the project, the Coordinator agreed to see the project through the second year of data collection, to present findings to each municipality, and to meet all EPA reporting requirements. As the Coordinator is currently working several part time jobs, planning for and hosting a volunteer event by the project end date was not feasible due to time constraints.

B. Objective Attainment. Objectives 1-4 outlined in the project work plan for 2008 were completed on schedule. Due to delays in data submission and review, the need for a new database, GIS map errors, and delays in creating 2009 GIS maps, objectives 5-9, originally scheduled for completion in December 2008, were completed by September 2010. Objective 10 was not completed within the project period.

C. Outcomes/Products. Volunteers conducted 17 stream walks surveying 24.9 miles of stream; 12 stream sites were assessed for water quality. Detailed descriptions of all streams surveyed and sites assessed are presented in the appendix. All descriptions include information on in-stream habitat and the stream corridor as well as any areas of concern. Some also include bioassessment data.

Stream Habitat Surveys

Stream walks were conducted following the USDA-NRCS methodology. Observations were made of in-stream and riparian conditions as well as surrounding land use. All observations were made facing downstream. Any areas of concern were identified and are summarized in Table I.

Stream survey areas were delineated by the USDA-NRCS and identified by drainage basin number. To accommodate volunteers, larger basins were divided into parts, which were then recombined for description purposes. Thus, although 17 stream walks were conducted, only 12 basins are indicated in Table I and Appendix I.

Each area surveyed includes up to three miles of stream classified by type – A, B, C, E, or F. In some basins, more than one stream type is identified. In such cases, separate descriptions are given for each type. Stream types are based on hydrogeomorphic assessments made by the USDA-NRCS. The criteria on which classifications are based are summarized below.

Stream Type A: Steep gradient, entrenched streams with low sinuosity and dominated by cascade or step/pool morphology. These streams are high energy with virtually no floodplain. Channel gradients range between 4% and 10%.

Stream Type B: Moderate gradient and moderately entrenched streams dominated by riffles with some irregularly placed pools. These streams have a limited floodplain. Channel gradients are between 2% and 4%.

Stream Type C: Moderate to low gradient, slightly entrenched streams with a meandering pool/riffle morphology and moderate sinuosity. These streams have well-developed floodplains. Channel gradients range between 0.1% and 2%.

Table I. Areas of concern by municipality, basin, and location. Areas of concern codes are as follows: DB = degraded buffer, ERO = erosion, FB = fish barrier, MC = modified channel, SWO/CSO/LO = storm water outfall/ combined sewer outfall/leak off, T/D = trash/debris, and VWC = visual water conditions and excess plants/algae.

| Basin/Location | DB | EROS | FB | MC | SWO/CSO/LO | T/D | VWC |
|--|----|------|----|----|------------|-----|-----|
| New Britain | | | | | | | |
| 4401-00-1-L2 Lower Pond New Britain Ave. to Village Square Dr. | x | | | | x | | |
| Village Square Dr. to Lower Pond | | | | x | x | | x |
| Rte. 9 to Lower Pond | x | | x | x | x | | |
| Bass Brook outlet | | | | x | | | |
| Batterson Park Pond outlet | | | x | | | | |
| 4401-00-2-R1 Bass Brook Ella Grasso Blvd. and along rte. 9 | x | x | | x | x | x | x |
| West Hartford | | | | | | | |
| 4403-00-2-R1 Trout Brook Mountain Rd. to Fern St. | x | x | x | x | x | | x |
| 4403-00-2-R2 South Branch Park River (part 1) White Ave. to Linbrook Rd. | x | | | x | x | | x |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (part 2) Brookside Dr. to Trout Brook | x | x | x | x | x | | x |
| 4403-06-1 Trout Brook (part 1) Pioneer Dr./Floyd Bugbee School | | | | | x | | |
| (part 2) Orchard Rd. | | | | | | | x |
| Wendy Lane area | x | | | | | | |
| Orchard Rd. to Mountain Rd. | x | | | | x | | |
| Borough Dr. area – Not Surveyed | | | | | | | |
| (part 3) Flagg Rd./Westmoor Park | x | | | | | | x |
| Flagg Rd. to Mountain Rd. | | | | | x | | |
| Old Oak Rd. area | | | x | x | x | | x |
| (part 4) Albany Ave. to Lovelace/Faxon Dr. | | x | | | | x | |
| Albany Ave. to Canal Rd. - Not Surveyed | | | | | | | |
| Lovelace/Faxon Dr. to Mountain Rd. – Not Surveyed | | | | | | | |
| 4403-07-1 South Branch Trout Brook (part 1) Rockledge Country Club to Trout Brook Dr. | x | x | x | x | x | | |
| (part 2) Burnham Dr. to Beechwood Rd. | x | | x | x | x | | x |
| Hartford | | | | | | | |
| 4400-00-4-R1 Gully Brook Keeney Park | x | | x | | x | x | |
| 4400-01-3-R1 South Branch Park River New Britain Ave. to Brookfield St. | | | x | x | x | x | x |
| 4400-02-1 Cemetery Brook New Britain Ave. to Chandler St. | | x | | x | x | x | |
| Jordan Lane to Maple Ave. to Cedar Hill Cemetery | x | | | | x | x | x |
| Jordan Lane/Cedar Hill Cemetery | | | | | | | |
| Cedar Hill Cemetery | x | | x | | x | | |
| S. of large lily pond in Cedar Hill Cemetery | | | | | | | |
| 4404-00-3-R4 North Branch Park River Livingstone Rd., Bloomfield to Hawk Dr., Hartford | | | | | x | | |
| 4404-00-3-R5/R6 North Branch Park River University of Hartford | x | | x | x | x | | |
| University of Hartford to Unitarian Church | | x | | | | | |
| Unitarian Church to S. of Albany Ave. | x | | | | x | | x |
| S. of Albany Ave. to Farmington Ave. | x | | x | x | x | | |

Stream Type E: Low gradient streams dominated by a pool/riffle morphology. These streams are more sinuous than stream type C and have a lower width/depth ratio. Type E streams have well-developed floodplains. Channel gradients are less than 2%.

Stream Type F: Entrenched streams with homogenous channels, a high width/depth ratio, and very low sinuosity. These streams have a limited floodplain. Channel gradients are less than 2%.

Water Quality Assessments

Water quality was assessed using the Connecticut Department of Environmental Protection's Rapid Bioassessment for Volunteers (RBV) methodology. Benthic macroinvertebrate voucher specimens were collected from six stream segments. Collections were made from riffle habitats and turned in to CTDEP staff for verification. A summary of macroinvertebrate collections based on indicator status is presented in Table II.

The primary reason for collecting macroinvertebrate data is to compare a stream's community structure to biological criteria described in current water quality standards. This comparison allows for an

Table II. Benthic macroinvertebrates present in Park River Watershed voucher collections submitted to CTDEP in 2008-2009. Samples are identified first by municipality, basin number, stream name, and location and then by "Wanted" status. Only samples with 4 or more total most wanted organisms (= key indicator organisms) indicate that state water quality standards for aquatic life are supported.

| Basin/Location | Most Wanted | Moderately Wanted | Least Wanted | Other | State WQ Standards Supported? |
|---|-------------|-------------------|--------------|-------|-------------------------------|
| New Britain | | | | | |
| 4401-00-1-L2 Lower Pond Rte. 9 to Lower Pond | 1 | 3 | 1 | 2 | No |
| 4401-00-2-R1 Bass Brook Ella Grasso Blvd. & along rte. 9 | 0 | 3 | 1 | 2 | No |
| West Hartford | | | | | |
| 4403-00-2-R1 Trout Brook Mountain Rd. to Fern St. | 0 | 4 | 2 | 3 | No |
| 4403-00-2-R2 South Branch Park River (part 1) White Ave. to Linbrook Rd. | 0 | 2 | 2 | 5 | No |
| 4403-06-1 Trout Brook (part 1) Pioneer Dr./Floyd Bugbee School | 0 | 4 | 1 | 1 | No |
| (part 2) Burnham Dr. to Beechwood Rd. | 0 | 1 | 3 | 1 | No |
| (part 3) Flagg Rd. to Mountain Rd. | 1 | 3 | 3 | 2 | No |
| (part 4) Albany Ave. to Lovelace/Faxon Dr. | 2 | 4 | 2 | 2 | No |
| 4403-07-1 South Branch Trout Brook (part 1) Rockledge Country Club to Trout Brook Dr. | 0 | 1 | 3 | 3 | No |
| Hartford | | | | | |
| 4400-02-1 Cemetery Brook New Britain Ave. to Chandler St. | 0 | 0 | 5 | 3 | No |
| 4404-00-3-R5/R6 North Branch Park River University of Hartford to Unitarian Church | 0 | 2 | 4 | 2 | No |
| S. of Albany Ave. to Farmington Ave. | 0 | 4 | 5 | 4 | No |

assessment of the degree to which water quality is impaired and water quality standards are supported.

Data collected using the RBV protocol can be used to identify stream segments with very high or very low water quality. Voucher collections provide a record of the benthic community for a specific date and time. Collections are examined for key indicator organisms (= “most wanted” organisms in the RBV program). While other organisms can thrive under many environmental conditions, indicator organisms thrive only under conditions of low environmental stress. Collections with four or more indicator organisms indicate that state water quality standards for aquatic life are fully supported at the collection site. Collections with three or fewer indicator organisms do not, however, definitively indicate water quality impairment, but rather that further information is needed. If bioassessments indicate degraded water quality, additional review of the species present as well as upstream land use and the potential for sampling error is warranted.

Recommended Enhancement Project Sites

Ten sites were identified as potential areas for restoration/improvement projects (Table III). Three sites are located in New Britain, two in West Hartford, and four in Hartford. Project sites were chosen based on several criteria including areas of concern, the abundance of least wanted macroinvertebrates, project feasibility, the potential for project partners, and the proximity of similar projects already in process. Project sites were not chosen in areas where a positive outcome was seen as highly unlikely. At some sites, the recommended action is secondary to conducting educational outreach to one or more property owners. Where outreach is needed, the input of a watershed association or other river advocacy group is suggested.

Table III. Recommended enhancement projects. Project sites are identified by municipality and basin number. Project descriptions include recommended actions and reason for recommendation. Potential project partners are identified where possible.

| Site | Brief Project Description |
|---|--|
| New Britain | |
| 4401-00-1-L2 Lower Pond | Recommended Action: <ul style="list-style-type: none"> • Educational outreach to Brittany Farms Condominium Association and New Britain Parks Department to install/increase stream buffer in condominium development and Stanley Park Reason for Action: Reduce storm water runoff from lawn areas |
| 4401-00-2-R1 Bass Brook | Recommended Action: <ul style="list-style-type: none"> • Clean up from Rte. 9 entrance ramp downstream to beyond French Model Council Club, Inc., 1375 East St. • Install fencing and “No Dumping” sign behind French Model Council Club Reason for Action: Remove trash and reduce opportunity for illegal dumping |
| 4401-00-2-R1 Bass Brook | Recommended Action: <ul style="list-style-type: none"> • Install bioswale or other green infrastructure in commuter lot on Rte. 175 near Rte. 9 Reason for Action: Reduce storm water runoff from parking lot Potential Partners: <ul style="list-style-type: none"> • Park River Watershed Revitalization Initiative • Central Connecticut State University • New Britain Department of Public Works • Connecticut Department of Transportation |
| West Hartford | |
| 4403-00-2-R2 South Branch Park River | Recommended Action: <ul style="list-style-type: none"> • Install native plant buffer around pond on western end of American School for the Deaf campus • Install bioswale or other green infrastructure to reduce parking lot runoff into pond Reason for Action: Reduce storm water runoff into pond that feeds Trout Brook |

| | |
|--|--|
| <p>4403-07-1 South Branch Trout Brook</p> | <p>Recommended Action:</p> <ul style="list-style-type: none"> Educational outreach to Wolcott Townhouses Condominium Association and the owner of a shopping center at the corner of South Main St. and Sedgewick Dr. to remove leak-offs and install green infrastructure <p>Reason for Action: Reduce storm water runoff from parking lots</p> |
| <p>Hartford</p> | |
| <p>4400-00-4-R1 Gully Brook</p> | <p>Recommended Action:</p> <ul style="list-style-type: none"> Clean up day-lighted portion of brook Outline ways to reduce trash that flows to the Westland St. culvert Analyze soil conditions near Westland St. culvert Remove invasive plant species between Westland St. and Love La. and replant with native species Investigate source of waters flowing intermittently from SWO1 <p>Reason for Action:</p> <ul style="list-style-type: none"> Remove trash and reduce trash inflow Address quicksand-like sediment near the Westland St. culvert <p>Potential Partners:</p> <ul style="list-style-type: none"> Friends of Keeney Park Park River Watershed Revitalization Initiative City of Hartford Metropolitan District Commission Connecticut Department of Environmental Protection |
| <p>4400-02-1 Cemetery Brook</p> | <p>Recommended Action:</p> <p>Recommended Action:</p> <ul style="list-style-type: none"> Stream bank restoration from New Britain Ave. to east of Chandler St. Efforts to include erosion control, removal of invasive plant species, and replanting with native species <p>Reason for Action: Reduce erosion. Recommended action would extend restoration efforts further upstream (west of Chandler St.) to address serious bank erosion.</p> <p>Potential Partners:</p> <ul style="list-style-type: none"> Park River Watershed Revitalization Initiative Hooker Environmental Studies Magnet School Trinity College Community Services Knox Park Foundation Metropolitan District Commission |
| <p>4404-00-3-R5 North Branch Park River</p> | <p>Recommended Action:</p> <ul style="list-style-type: none"> Educational outreach to University of Hartford to install bioswales between campus parking lots and the North Branch Park River <p>Reason for Action: Reduce storm water runoff from parking lots</p> |
| <p>4404-00-3-R6 North Branch Park River</p> | <p>Recommended Action:</p> <ul style="list-style-type: none"> Educational outreach to Knox Park Foundation to prevent future stream bank tree/shrub removal and branch hewing at Knox community garden Develop community garden compost area to discourage disposal of garden waste along the banks of the North Branch Park River Install green infrastructure at SWO1-3 and DB2 <p>Reason for Action:</p> <ul style="list-style-type: none"> Increase canopy cover and decrease excess submerged aquatic plants Capture/slow storm water runoff from parking lots and roads <p>Potential Partners:</p> <ul style="list-style-type: none"> Knox Park Foundation Unitarian Universalist Church Park River Watershed Revitalization Initiative |

III. Project Challenges and Lessons Learned

A. Significant Challenges/Barriers to Achieving Project Goals

The primary challenges to achieving project goals by the project schedule dates were (1) rainfall, (2) late data submission, (3) lack of an appropriate database, (4) late GIS map submission and map errors, and (5) Museum downsizing leading to job loss for the Program Coordinator. During both the 2008

and 2009 field seasons, heavy rainstorms were frequent and rainfall amounts were excessive. Volunteers were instructed not to conduct stream walks for at least 24 hours after a significant storm due to sewage overflows from combined sewer outfalls. Due to the rainy weather, the due date for stream walk data was extended. This was helpful to some, but not all, volunteers. Some volunteers were not available once the school year began. Others were available only in early summer when heavy rains were most frequent. As a result, fewer stream walks were conducted than were originally planned for. Due, in part, to the revised due date, data from some volunteers were submitted late. So too were bioassessment data from the CT Department of Environmental Protection and GIS maps from a project partner.

The elimination of the Program Coordinator's position at The Children's Museum presented a major challenge as the Museum did not have a staff person available to assume project oversight. As a result, the Coordinator agreed to see the project through and meet as many objectives as possible. Due to time constraints associated with job searching and working several part-time jobs, however, it was not feasible to carry out the last objective – hosting a volunteer recognition event – by the project end date.

B. Lessons Learned

1. Unlike other projects of The Children's Museum, this project relied on state and federal agencies to conduct training workshops. Collaboration with these agencies enhanced the scientific value of the data and the entire project.
2. A unique aspect of this project was the assistance given volunteers while conducting field work. Most volunteers were accompanied by the project coordinator or a partner on stream walks. Having assistance in the field was seen as a "big plus." Training workshops were held in June and covered a lot of terminology. By the time stream walks were conducted, between July and October, some of the survey process as well as the terms were forgotten. Having staff along "provided clarification" and enabled volunteers to feel more confident in their work.
3. If this project is continued in the future, there are several changes that are recommended.
 - Project coordination and creation of GIS maps took far more hours than anticipated. The number of hours budgeted for each of these should be increased substantially.
 - More hip boots should be purchased and sizes appropriate for younger children need to be located.
 - Collaboration with NRCS should be reconsidered. Although the training provided by them was excellent, the numerous data sheets they used were cumbersome to volunteers. Paring down the number of data sheets is suggested. Prior to 2008, NRCS used fewer data sheets. Discussions with NRCS about the data sheets is recommended.
 - If the project is reviewed by an outside evaluator, greater attention is needed to ensure timely submission of reports.

IV. Project Evaluation

1. Measuring Project Effectiveness. Project evaluation was conducted by Dr. Todd Rofuth, chairperson of the Social Work Department at Southern Connecticut State University. The evaluation design relied mainly on qualitative methods of data collection and included statistics on recruitment, number of participating families/youth groups, attendance at training workshops, level of participation, and responses to evaluation surveys sent to volunteers. A sample evaluation survey is given in Appendix II. In Year 1, eleven volunteers completed and returned surveys; in Year 2, only five surveys were returned.

Training Workshops. The evaluation summary concluded that both indoor and field portions of training workshops "provided [volunteers] with an excellent understanding of the causes and negative

impacts of water pollution. [Volunteers] found the instruction on how to conduct stream walks and how to employ monitoring protocols and sampling techniques as most beneficial and professional. [Volunteers] also developed a better understanding of how to assess water quality. [Volunteers] increased their awareness of what lives in the water and how difficult it is to find and identify these organisms.”

Conducting Stream Walks and Water Quality Assessments. In conducting a stream walk, volunteers were able to see first hand the land use practices along the stream. They could see where stream banks had eroded or buffers were degraded. They walked over fish barriers, saw areas with excessive plant growth and illegal dumping, noted storm water outfalls, and walked through stretches where the stream channel was armored with concrete, rip rap or other materials. The experience of conducting a stream walk impacted volunteers in numerous ways. “It altered my thinking about urban waterways and the risks to them that exist,” said one volunteer. “Hard work and a bit sad to see the condition of things up close”, said another. A third volunteer found the stream walk “very productive personally” and thought “it was nice to contribute. It’s good work to be doing.” Stream walks enabled a fourth volunteer to see “the waterways as an environment from the viewpoint of the stream and the buffer, not from the buildings and roadways surrounding them.” A fifth volunteer stated that, “although there were some technical difficulties, I thought [conducting a stream walk] was a very worthwhile and educational experience. I had never walked that length of stream before. I was amazed at how much beauty was there despite the problems caused by human beings. It inspired me to do more for waterways.”

Bioassessments to evaluate water quality were conducted immediately following the indoor training workshop. This went over well with volunteers. They liked that they “went right out to do it, [while] the information was fresh.” The experience of conducting a bioassessment was reported as enjoyable, interesting, and gratifying. Volunteers clearly understood the connection between macroinvertebrates and water quality. “Various species act as ‘canaries in the mine’. “If these small components of the food chain are not sustainable, then larger life forms would not have food sources. And, “certain kinds of macroinvertebrates are found in certain types of water. The right kind and quantity of macroinvertebrates mean better water quality.” If no macroinvertebrates were found when sampling a stream, most volunteers understood that this did not necessarily indicate poor water quality, but could reflect improper sampling procedures or an inappropriate sampling site. “It could simply be a case of an improper survey,” reported one volunteer. “Bad water quality or incorrect screening techniques,” reported another. “You are looking in the wrong place or the stream conditions are too hostile to the animals,” reported a third.

By conducting stream surveys and bioassessments, volunteers gained an understanding of “the connection between land use in an area and its impact on streams. “Volunteers indicated that land use can both positively and negatively impact what lives in the stream. According to one volunteer, “Dumping things in the water is the worst...[P]aving that is too close to the water [and] allows runoff of chemicals from autos and the roadway is bad as well. And the runoff from fertilizers is also bad.” From another volunteer, “Increased runoff caus[es] a more drastic change in water temperature and carr[ies] contaminants from roads, lawns, lots, dumps, and commercial lands.” Yet another stated “Everything we build has an effect on our watershed! People need to be educated about everything from the importance of waterways and how they function to how our traditional building practices damage waterways to sustainable alternatives.” Two volunteers summed it up by saying “The more pollution, the poorer quality of water, the less [aquatic] life.” and “People need to know that you can have both [development and good water quality,] but only with best [management] practices.”

Technical Support. Most volunteer respondents rated the technical support as “perfect, sufficient, or excellent.” All found the Program Coordinator to be “most helpful; she was skilled, professional, accessible, and supportive.” Volunteers had only a few suggestions on how technical support could be

improved. “Maps could be a little larger, with some larger white margins for making notes. It was extremely difficult to mark information on the map,” reported one volunteer. Another recommended providing “hip boots that are the correct sizes ... and yard sticks.”

2. Using Evaluation Data to Strengthen Project. As the Year 1 evaluation was submitted after the stream walk training workshop for Year 2 was completed, it was not possible to implement workshop improvement recommendations made by volunteers. Recommendations for future stream walk workshops include more breaks, more quick quiz sessions, a handout of definitions, more engaging activities for children, a completed example of the data sheets filled out, and a modified copy of the presenters’ Power Point presentation which volunteers could review before conducting their stream walk. No recommendations were given for water quality training workshops.

In both Years 1 and 2, several volunteers had difficulties completing the stream assessment data sheets. Stream walks were conducted following the USDA-NRCS methodology. Starting in 2008, the NRCS changed the stream assessment data sheets from 2 pages to many paged. Some volunteers found the layout problematic. Some thought it should be “simplified,” found it “unclear as to what information was needed,” or thought a glossary would be helpful due to the number of terms. Only one volunteer reported difficulties filling out the Rapid Bioassessment data sheet. Others found the data sheet easy to understand.

V. Project Sustainability.

A. Future Application.

1. Project Continuation. Due to Museum downsizing and elimination of the Project Coordinator’s position, The Children’s Museum has no current plans to continue the project. The Museum is not closing the door to project continuation, but will not actively seek funding. Project continuation and expansion would require the Project Coordinator to (1) seek funding on her own time or (2) secure a position and establish the project at another organization.

2. Project Value. The value in continuing the project is twofold. First, training workshops, field work, and interaction with project staff are highly educational and serve to increase awareness of watersheds and the link between water quality and personal habits. Second, in identifying sites for enhancement projects and presenting project findings to municipal officials, the project sheds light on problem areas and may lead to required remedial action by property owners of identified sites should they seek property changes.

B. Healthy Communities.

This project has contributed to the creation of healthier communities primarily by increasing awareness of the link between human activities and water quality. As the project identified areas in need of remedial action, and notified municipal officials of those areas, the project also laid the groundwork for further contributions. If remedial actions are undertaken, storm water runoff, erosion, and illegal dumping will be reduced in portions of the watershed. Implementing remedial actions will require educational outreach to various parties and thus further increase awareness of the watershed and the impacts of human activities on water quality. If remedial actions are not undertaken, the project may still make further contributions. At least one municipality has stated that they will require the recommended remediation if property owners of identified sites seek to make changes on their property.

APPENDIX I

Stream Segment Descriptions

Descriptions of all streams surveyed and assessed in 2008/2009 are presented below. Stream survey areas were delineated by the USDA-NRCS and identified by drainage basin number. Each area includes up to three miles of stream classified by type – A, B, C, E, or F. In some basins, more than one stream type is identified. In such cases, separate descriptions are given for each type. Stream types are based on hydrogeomorphic assessments made by the USDA-NRCS.

Stream segment maps are of two types. An overview map delineates all drainage basins surveyed. Individual basin maps indicate stream mileage, areas of concern, and macroinvertebrate sampling locations. All maps were created in ArcGIS 9.3.1. All 2008 basin maps are overlaid on 2004 black and white aerial photographs obtained from the Center for Land Use Education and Research (CLEAR), a collaboration of the University of Connecticut Department of Extension and Connecticut Sea Grant. As these photographs were not available for later use, all 2009 maps are overlaid on 2008 color aerial photographs obtained from the National Agriculture Imagery Program (NAIP).

Stream habitat surveys were conducted following the USDA-NRCS methodology. Survey observations were made of in-stream and riparian conditions as well as surrounding land use. All observations were made facing downstream. All descriptions include information on in-stream habitat and the stream corridor, as well as any areas of concern. Some also include bioassessment data. Water quality assessments were made using the CTDEP's Rapid Bioassessment for Volunteers (RBV) methodology. Macroinvertebrates were collected from riffle habitats.

New Britain

Basin 4401-00-1-L2 Lower Pond

Total Length: 2.2 miles

Total Length Surveyed: 2.2 miles

Location: New Britain Avenue to Village Square Drive

Length: 0.24 miles

Stream Corridor: The stream flows from a wooded wetland west of New Britain Avenue to Village Square Drive. Riparian vegetation within 35 ft. of the stream is predominantly deciduous trees, shrubs, and grass. On both banks, the density of deciduous trees is high; grass density is moderate. Shrub density is high on the left bank and low on the right. Land use within .25 miles of the stream is forest, suburban residential, and commercial. Land use greater than .25 miles from the stream is suburban residential and commercial.

In-Stream Habitat: The stream is classified as type E. The stream has pool-riffle morphology, although this was not evident due to extremely low flow. The active channel width is 20 ft. Bank height averages 3 ft. on the right and 1 ft. on the left. The substrate is nearly all silt with composition >75%. The water is clear. No aquatic plants or algae are evident. The stream is shaded >75% by a tree canopy.

Areas of Concern

- **Degraded Buffer (DB):** The riparian buffer is degraded for approximately 300 ft. along the right bank. Buffer width is minimal - 15-35 ft. - and compromised by roadway grading and condominium development. Dominant land cover on the right bank is pavement and a band of grasses, shrubs and trees that line Village Square Drive. Invasive plants, especially Oriental Bittersweet (*Celastrus orbiculatus*), are abundant. On the left bank, shrubs and deciduous trees dominate a wooded wetland.

- Storm Water Outfalls (SWO): Three 4-ft. x 30 inch corrugated metal outfall pipes are located at Village Square Drive. Two pipes are located on the right bank, one on the left bank. The pipes are at stream level and drain Village Square Road. Rip rap lines the banks and surrounds the pipes from the storm drains to the pipe outlets. Stone leak off swales extend approximately 15 ft. from the pipes to the stream. No odor, deposits, stains, or benthic growth are evident at the outfall sites.

Location: Village Square Drive to Lower Pond

Length: 0.14 miles

Stream Corridor: The stream flows from Village Square Drive southwest to Lower Pond in Stanley Park. Riparian vegetation within 35 ft. of the stream is predominantly deciduous trees and shrubs. On both banks, deciduous tree and shrub density is high; grass density is moderate. Land use within .25 miles of the stream is forest and urban and suburban residential. Land use greater than .25 miles from the stream is urban and suburban residential and commercial.

In-Stream Habitat: The stream is classified as type F. The stream has glide morphology. The active channel width is 50 ft. Bank height averages 4 ft. on the right and 2 ft. on the left. The substrate is predominantly silt. Composition is >75% silt and 5-25% each of sand and gravel. The water is clear. Rooted aquatic plants occur in excess. No floating-leaved aquatic plants or algae are evident. The stream is shaded 25-50% by a tree canopy.

Areas of Concern

- Modified Channel (MC): At the downstream terminus, where the stream enters Lower Pond, both banks and the channel bottom are modified for approximately 30 ft. Wooden beam baffles in the stream bed and both banks route the water in a zigzag pattern and pose a potential barrier to objects flowing downstream. The baffles also appear to limit backflow into the slow-moving stream. Land use adjacent to the modified section is forested and recreational. Riparian buffer width is >100 ft. The width of the active channel is greater in the modified section. There is no evidence of sediment deposition in the channel.
- Storm Water Outfalls (SWO): Three 4-ft. diameter corrugated metal outfall pipes are located at Village Square Drive. Two pipes are located on the right bank, one on the left bank. The pipes are perched 3 ft. above the stream bed and drain a road. An earthen channel directs water from the left outfall to the stream. Sand deposits are evident in the channel and in the stream directly beneath the channel. No odor was evident, but sediment deltas and green benthic growth were observed at the outfall sites.
- Visual Water Conditions (VWC): Extending approximately 400 ft. downstream of Village Square the growth of submerged aquatic plants is excessive. Excess growth is associated with storm water outfalls and minimal canopy cover. There is much sand and silt near the outfall and the stream is slow moving. Land use adjacent to the affected area is forested and recreational (walking trail set back from stream edge). Canopy cover in the area is <25%.

Location: Rte. 9 to Lower Pond

Length: 0.93 miles

Stream Corridor: The stream flows from under Rte. 9 to Lower Pond in Stanley Park. With the exception of the Brittany Farms condominium development, riparian vegetation within 35 ft. of the stream is predominantly deciduous trees, shrubs, and grasses. On both banks, deciduous tree and shrub density is high; grass density is low. Land use within .25 miles of the stream is forest, urban and suburban residential, and recreational. Land use greater than .25 miles from the stream is forest, suburban residential, and recreational.

In-Stream Habitat: The stream is classified as type C. The stream has pool-riffle morphology. The active channel width is 30 ft. Bank height averages 6 ft. on the right and 3 ft. on the left. The substrate is predominantly gravel and cobble. Composition is 25-50% each of gravel and cobble and 5-25% sand. The water is clear. No aquatic plants or algae are evident. The stream is shaded 50-75% by a tree canopy.

Areas of Concern

- Degraded Buffer (DB): The riparian buffer is degraded at two locations along the stream.

DB1: Along Brittany Farms Road, the riparian buffer is degraded for approximately 800 ft. along both banks. On the right bank, buffer width is minimal with <15 ft. of vegetation. On the left bank, buffer width is 35-50 ft. Dominant land cover on the right bank is residential turf/lawn. On the left bank, shrubs and deciduous trees dominate.

DB2: In Stanley Park, the riparian buffer is degraded for approximately 900 ft along the right bank. The area of degradation parallels Stanley Street. On the right bank, buffer width is minimal with 15-35 ft. of vegetation. On the left bank, buffer width is 50-100 ft. Dominant land cover on the right bank is turf/lawn associated with a public park. On the left bank, shrubs and deciduous trees dominate.

- Fish Barrier (FB): At Lower Pond, a sloping concrete spillway may prevent upstream fish passage by acting as a velocity barrier. The spillway is 150 ft. in length and 30 ft. wide. Incline is greater than 12%. Water flow across the spillway is uniform and measured 2-3 inches in depth.
- Modified Channel (MC): At the downstream terminus, where the stream enters Lower Pond, both banks and the channel bottom are modified for approximately 250 ft. The stream bottom is lined with concrete; banks are lined with 15 ft. high stone/concrete walls. Land use adjacent to the modified section is recreational. Buffer width is minimal with <15 ft. of vegetation. The width of the active channel increases from an average of 30 ft. upstream to 50 ft. in the modified section. There is no evidence of sediment deposition in the channel.
- Storm Water Outfalls (SWO): Five storm water outfall pipes are located along the reach.

SWO1-4: Four 1-ft. diameter concrete outfall pipes are located emerging from turf/lawns behind a row of apartment/condominium buildings on Brittany Farms Road. Three pipes are at stream level; one pipe is perched 3 ft. above the stream bed. All pipes appear to drain parking lots and a road. No odor, deposits, stains, or benthic growth are evident at the outfall site.

SWO5: A 2.5-ft. diameter concrete outfall pipe is located downstream of SWO1-4 near Stanley Park. The pipe is perched 5 ft. above the stream bed and drains a parking lot. A 15 ft. long x 6 ft. wide concrete channel directs outfall from the pipe to the stream. No odor, deposits, stains, or benthic growth are evident at the outfall site.

Location: Bass Brook Outlet

Length: 0.03 miles

Stream Corridor: The stream flows from a concrete pipe into a stream that flows into Lower Pond. The entire stream length is approximately 300 ft. Riparian vegetation within 35 ft. of the stream is predominantly turf/lawn. On both banks, turf/lawn density is high. The density of shrubs and deciduous trees is low. Land use within .25 miles of the stream is forest, suburban residential, and recreational. Land use greater than .25 miles from the stream is suburban residential.

In-Stream Habitat: The stream is classified as type F. Bass Brook flows into a stream that feeds Lower Pond via a 30- ft. concrete pipe. Water flowing from the pipe is clear. No aquatic plants or algae are evident.

Areas of Concern

- Modified Channel (MC): The stream is completely encased in a concrete pipe. Buffer width is minimal with <15 ft of vegetation. There is no evidence of sediment deposition where the stream exits the pipe and no change in active channel width due to the modification.

Location: Batterson Park Pond outlet

Length: 0.86 miles

Stream Corridor: The stream flows from Batterson Park Pond to a stream that flows into Lower Pond. Riparian vegetation within 35 ft. of the stream is predominantly deciduous trees, shrubs, and grasses. On both banks, deciduous tree and shrub density is moderate; grass density is low. Land use within .25 miles of the stream is forest, urban and suburban residential, and commercial. Land use greater than .25 miles from the stream is forest, urban and suburban residential, and recreational.

In-Stream Habitat: The stream is classified as type B. The stream has pool-riffle morphology. The active channel width is 12 ft. Bank height averages 5 ft. on the right and 3 ft. on the left. The substrate is predominantly cobble. Composition is 5-25% each of silt, sand, and gravel and 50-75% cobble. The water is clear. No aquatic plants or algae are evident. The stream is shaded >75% by a tree canopy.

Areas of Concern

- Fish Barrier (FB): A 25 ft. high crescent-shaped concrete dam is located at the upstream terminus at Batterson Park Pond. The spillway is 75 ft. in length and located at the far right side of the dam. Rip rap and concrete occur at the base of the spillway. Pond waters flow into the stream via a 2.5 ft.-diameter concrete culvert. The culvert is 100 ft. in length and perched 4 ft. above stream level.

Basin 4401-00-2-R1 Bass Brook

Location: Ella Grasso Boulevard and along Rte. 9

Total Length: 0.9 miles

Total Length Surveyed: 0.9 miles

Stream Corridor: The stream flows from Ella Grasso Boulevard east to Rte. 9 and south to Wells Street and beyond. Riparian vegetation within 35 ft. of the stream is predominantly deciduous trees, shrubs, and grasses. On both banks tree, shrub, and grass density is moderate. Land use within .25 miles of the stream is forest, commercial, and recreational (Central Connecticut State University athletic fields). Land use greater than .25 miles from the stream is urban and suburban residential and commercial.

In-Stream Habitat: The stream is classified as type C. The stream has pool-riffle morphology. The active channel width averages 15 ft. Bank height ranges from 3-20 ft. on the right and 2-3 ft. on the left. The substrate is predominantly silt, sand, and cobble. Composition is 25-50% each of silt, sand, and cobble and 5-25% each of gravel and boulder. The water is clear. Filamentous algae is found in spots. No aquatic plants or planktonic algae are evident. The stream is shaded 50-75% by a tree canopy. Bioassessment data indicates moderately impaired water quality. Macroinvertebrates collected have moderate to high pollution tolerance and include common net spinners, orange head caddisflies, water penny beetle larvae, small minnow mayflies, flatworms, and leeches.

Areas of Concern

- Degraded Buffer (DB): South of the Rte. 9 entrance ramp, behind a commercial strip on Rte. 175, the buffer is degraded for approximately 600 ft. Buffer width on the right bank is minimal with < 15 ft. of vegetation. On the left bank, buffer width averages 35-50 ft. Invasive plants are abundant on both banks.
- Erosion (EROS): Two areas of erosion are located along the reach.

EROS1: The left bank is eroded for approximately 100 ft. along Fenn Road across from a commercial strip. Bank height at the erosion site averages 35 ft. with a 75-85% angle. The riparian buffer in the area is < 15 ft. in width.

EROS2: South of the Rte. 9 entrance ramp, the right bank is eroded along a meander bend. Bank height averages 20 ft. with a 45-80 degree angle. Land use adjacent to the site is commercial. The proximity of the site to buildings and parking lots is 15-30 ft. Land ownership in the area is both private and public (Rte. 9 right-of-way).

- Modified Channel (MC): The stream channel is modified in two sections along the reach.

MC1: South of Ella Grasso Boulevard across from Volpe Road, both stream banks are armored for about 300 ft. The left bank is armored with a concrete wall, the right with rip rap. Bank height on both sides is 8 ft. Land use adjacent to the modified section is commercial and recreational. A storage area for park maintenance vehicles (Iwo Jimo Memorial Park) borders the concrete wall on the left bank. University athletic fields are found near the right bank. Riparian buffer width on both sides of the stream is <15 ft. There is no change in active channel width due to the modification, however, extensive sediment deposition in the channel is evident.

MC2: North of Rte. 175, the left bank is armored with rip rap at a meander bend for approximately 1000 ft. Bank height averages 35 ft. Adjacent to the modified bank is Rte. 9S. Riparian buffer width on the left side of the stream is <15 ft. There is no evidence of sediment deposition in the channel and no change in active channel width due to the modification.

- Storm Water Outfalls (SWO): Seven storm water outfall pipes are located along the reach.

SWO1: A 2.5-ft. diameter concrete outfall pipe is located on the left bank immediately downstream of the Rte. 175 crossing. The pipe is perched 1.5 ft. above the stream bed and drains a road. No odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO2: A 1-ft. diameter concrete outfall pipe is located on the left bank immediately downstream of the Rte. 175 crossing. The pipe is perched 4.5 ft. above the stream bed and drains a road. No odor, deposits, or benthic growth were evident at the outfall site, however, a black stain was observed.

SWO3: A 4-inch diameter plastic outfall pipe is located on the left bank immediately downstream of the Rte. 175 crossing. The pipe is perched 1.0 ft. above the stream bed and drains a road. No odor, deposits, or benthic growth were evident at the outfall site, however, a tan stain was observed.

SWO4: A 1.0-ft. diameter corrugated metal outfall pipe is located on the left bank immediately downstream of the Rte. 175 crossing. The pipe is at ground level, set back approximately 50 ft. from the stream. A concrete-asphalt-earthen channel extends from the outfall pipe to the stream. Channel width is 5 ft. Contributing sources to the pipe are unknown. No odor, deposits, stains, or benthic growth were evident at the outfall site or in the channel.

SWO5: A 2.5-ft. diameter concrete outfall pipe is located on the right bank immediately downstream of the Rte. 175 crossing. The pipe is perched 4 ft. above the stream bed and drains a road. No odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO6-7: Two 4-inch diameter plastic outfall pipes are located on the right bank immediately downstream of the Rte. 175 crossing. The pipes are perched 1 ft. above the stream bed and drain a road. No odor, deposits, stains, or benthic growth were evident at the outfall sites.

- Trash/Debris (T/D): South of the Rte. 9S entrance ramp, extensive trash is seen in the stream, along both banks, and in the riparian area. Trash is heaviest in the stream and along the right bank behind a commercial strip on Rte. 175. Trash is both residential and commercial and includes plastic, paper, yard waste, tires, construction materials, cement posts and slabs, metal, automobiles, and a toilet. Some trash was likely blown in or carried downstream during high flow times. However, much of the trash appears to have been illegally dumped. A metal fence behind the commercial strip has been nearly pushed over in some areas and a “No Dumping” sign has been damaged. Aside from the trash, extensive debris from fallen trees and branches occurs at the downstream end of the reach.
- Visual Water Conditions (VWC): South of Ella Grasso Boulevard across from Volpe Road, the growth of rooted aquatic plants and filamentous algae is excessive in spots. Excess growth is associated with increased sun exposure. Whereas much of the stream is shaded 50-75% by tree cover, the affected area has <25 % canopy cover.

West Hartford

Basin 4403-00-2-R1 Trout Brook

Location: Mountain Road to Fern Street

Total Length: 1.4 miles

Total Length Surveyed: 1.4 miles

Stream Corridor: The stream flows from south of Spicebush Swamp on Mountain Road to Fern Street and beyond. Riparian vegetation within 35 ft. of the stream varies with location. North of Braeburn Road, vegetation is predominantly turf/lawn, grass, and shrubs. On the left bank are numerous residences. Turf density is high. On the right bank, grasses and shrubs are seen in moderate density. South of Braeburn Road, vegetation is predominantly deciduous trees and shrubs with density being moderate to high, respectively. Grass density is low. Land use within .25 miles of the stream is suburban residential and forested. An elementary school and church border the stream near Braeburn Road. Land use greater than .25 miles from the stream is suburban residential.

In-Stream Habitat: The stream is classified as type C. The stream has pool-riffle morphology. The active channel width averages 30 ft. Bank height averages 3 ft. on both sides. North of Braeburn Road stream banks are less defined as the stream widens and meanders through a flood plain. Riffle are further apart and numerous sandbars, some vegetated, are evident. The substrate is predominantly cobble and boulder. Composition varies with location. North of Braeburn Road, composition is 25-50% cobble, 50-75% boulder, and less than 5% silt and sand. South of Braeburn Road, composition is 25-50% each of cobble and boulder, 5-25% each of silt and sand, and less than 5% gravel. The water is clear. Filamentous algae is found in spots. No aquatic plants or planktonic algae are evident. The stream is shaded >75% by a tree canopy. Bioassessment data indicates moderately impaired water quality. Macroinvertebrates collected at the Whitman Avenue crossing have moderate to high pollution tolerance and include flat-headed mayflies, orange head caddisflies, common net spinners, dragonflies, damselflies, craneflies, flatworms, aquatic earthworms, amphipods, and crayfish.

Areas of Concern

- Degraded Buffer (DB): North of Braeburn Road, much of the riparian buffer is degraded along the left bank. Buffer width is minimal with <15 ft. of vegetation. On the right bank, buffer width is 15-35 ft. Dominant land cover on the left bank is turf/lawn behind residences. On the right bank, shrubs and deciduous trees dominate.
- Erosion (EROS): The right bank is eroded along a meander bend for approximately 600 ft. Bank height in the area is 3-4 ft. The riparian buffer averages 35-50 ft. in width. Land use immediately adjacent to the area is forested. A cemetery lies within 15 ft. of the southern end of the erosion site.
- Fish Barrier (FB): A dam of fallen trees, branches, and trash prevents upstream fish passage approximately 1000 ft. north of Braeburn Road. The dam is 0.5-1.0 ft. in height.
- Modified Channel (MC): The stream channel is modified in two sections along the reach.

MC1: At Spice Bush Swamp, the stream channel is modified approximately 150 ft. before a pond and again for about 80 ft. downstream of the pond. The stream bottom is lined with concrete and both banks are armored with concrete slabs piled atop each other. Upstream of the pond, land use adjacent to the modified section is forested on the left bank and forested and recreational on the right bank. Immediately downstream of the pond, land use is recreational on both banks. The riparian buffer is <15 ft. along most of the modified section. There is no evidence of sediment deposition in the channel and no change in active channel width due to the modification.

MC2: The right bank is armored with concrete blocks for about 700 ft. behind residences on Gloucester Lane. Block dimensions are 8 ft. x 2 ft. x 4 ft. Bank height in the modified section is 2 ft. Riparian buffer width is <15 ft. due to residential lawns that extend to the stream bank. There is no change in active channel width due to the modification, however, extensive sediment deposition in the channel is evident.

- Storm Water Outfalls (SWO): Seven storm water outfall pipes are located along the reach.

SWO1-2: Two concrete outfall pipes are located behind residences on Gloucester Lane. A 2-ft. diameter pipe is perched 1 ft. above the stream bed. A second 1.5-ft. diameter pipe is at stream level. Both pipes drain unknown sources. No odor, deposits, stains, or benthic growth were evident at the outfall sites.

SWO3-4: Two 3-inch plastic corrugated outfall pipes are located behind a green house on Gloucester Lane. Both pipes are perched above stream level and extend from beneath the lawn. No odor, deposits, stains, or benthic growth were evident at the outfall sites.

SWO5: A 1-ft. diameter concrete outfall pipe is located approximately 20 ft. from the left bank immediately south of Braeburn Road. Although set back from the stream bank, the pipe is below stream level and drains an unknown source. No odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO6: A 2.5-ft. diameter concrete outfall pipe is located on the left bank north of Braeburn Road. The pipe is perched 8 inches above the stream bed and drains a road. No odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO7: A 6-inch corrugated plastic outfall pipe is located on the left bank north of Braeburn Road. The pipe is perched 1 ft. above the stream bed and drains an unknown source (possibly a yard drain or drain from a sump pump). No odor, deposits, stains, or benthic growth were evident at the outfall site.

- Visual Water Conditions (VWC): Rooted aquatic plants and filamentous algae are found in excess behind residences along Gloucester Lane. Excessive growth is associated with a change in canopy cover. Whereas most of the stream is shaded >75%, the affected area has full sun exposure. Canopy cover is reduced to 25% due to residential lawns along the right bank. The water is clear. No free-floating aquatic plants or planktonic algae were evident.

Basin 4403-00-2-R2 South Branch Park River

Total Length: 4.0 miles

Total Length Surveyed: 2.7 miles

Location: (Part 1) White Avenue to Linbrook Road

Length: 1.7 miles

Stream Corridor: The stream flows along Trout Brook Drive from just north of Linbrook Road south to White Avenue and beyond. At Farmington Avenue the stream is routed underground and resurfaces at Memorial Drive. Riparian vegetation within 35 ft. of the stream is predominantly grass and turf/lawn. On both banks, grass density is moderate. On the left bank, turf density is also moderate whereas on the right bank turf density is low. Shrubs and deciduous and coniferous trees are seen on both banks in low density. Land use within .25 miles of the stream is urban residential. A ball field (recreational land use) borders the stream on the left bank near the southern terminus. Beyond .25 miles, land use is urban residential and commercial.

In-Stream Habitat: The stream is classified as type F. The stream has a manipulated channel. Active channel is 40 ft. wide. Bank height averages 25 ft. on the right, 10 ft. on the left. The substrate is >75% silt and rip rap with <5% each of sand and gravel. The water is clear. Rooted aquatic vegetation and filamentous algae are found in spots. No free-floating plants or planktonic algae are evident. The stream is shaded <25% by a tree canopy. Bioassessment data indicates moderately impaired water quality. Macroinvertebrates collected near the ball field have moderate to high pollution tolerance and include aquatic earthworms, flatworms, leeches, freshwater clams, crane flies, dragonflies, flat-headed mayflies, and riffle beetles.

Areas of Concern

- Degraded Buffer (DB): The riparian buffer is degraded along both banks of the entire reach or 1.7 miles. Buffer width is minimal, with <15 ft. of vegetation on the left bank, 15-35 ft. on the right bank. Both banks have extensive areas of invasive plants, especially Japanese knotweed (*Polygonum cuspidatum*). Dominant land cover is turf/lawn, grasses, and deciduous trees on the left bank, deciduous trees on the right bank.
- Modified Channel (MC): The stream channel is modified along much of the reach. At the Fern Street bridge, both banks and the channel bottom are lined with concrete. Riparian buffer width is minimal with <15 ft. of vegetation. At Farmington Avenue, the channel is routed underground in a concrete tunnel and surfaces again immediately south of Memorial Drive. From Memorial Drive to Trout Brook Terrace, both banks and the channel bottom are again lined with concrete. Modified banks are approximately 21-24 ft. in height. Rip rap covers the channel bottom. Riparian buffer width along the modified section ranges from <15 ft. to 50 ft wide. Channel modifications do not alter the width of the active channel nor is there evidence of sediment deposition in the channel.

- Storm Water Outfalls (SWO): Twenty-one storm water outfall pipes and leak offs are located along the reach.

SWO1-4: Two 2 ft.-diameter outfall pipes are located on each side of the stream just north of the Park Road bridge. The pipes are corrugated metal lined with plastic and perched 7 ft. above the stream bed. All pipes drain Park Road. At each outfall site, a brown benthic growth was observed. No odor, deposits, or stains were evident.

SWO5: A concrete outfall pipe is located on the right bank under the Boulevard bridge. The pipe is 2.5 ft. in diameter and drains the Boulevard. At the outfall site, a green benthic growth was observed. No odor, deposits, or stains were evident.

SWO6: A concrete outfall pipe is located on the right bank just south of the Memorial Drive bridge. The pipe is 2.5 ft. in diameter and perched 10 ft. above the stream bed. At the outfall site, a brown benthic growth was observed. No odor, deposits, or stains were evident.

SWO7-11: Five concrete and stone leak offs are located on the right bank just north of Farmington Avenue below a parking lot. The leak offs are 2 ft. wide and drain the parking lot and a road. No odor, deposits, stains, or benthic growth were evident at the outfall sites.

SWO12-15: Four concrete outfall pipes are located on the left bank south of Fern Street. SWO12-14 are 1 ft. in diameter; SWO15 is 1.25 ft. in diameter. All pipe outlets are at stream level and drain unknown sources. At SWO13 and SWO14, a brown benthic growth was observed at the outfall site. No odor, deposits, or stains were evident.

SWO16: A plastic outfall pipe is located on the right bank by the Loomis Drive apartment building. The pipe is 1.25 ft. in diameter and drains an unknown source. At the outfall site, a brown benthic growth was observed. No odor, deposits, or stains were evident.

SWO17: A PVC outfall pipe from a residential yard drain leads into a leak off on the left bank just south of Fern Street. The pipe is .25 ft. in diameter with an outlet at stream level. No odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO18-19: A 2.5 ft.-diameter concrete outfall pipe is located on each bank under the Fern Street bridge. The pipes are perched and drain Fern Street. At each outfall site, a brown benthic growth was observed. No odor, deposits, or stains were evident.

SWO20-21: Two concrete outfall pipes are located on the right bank just north of Fern Street. The pipes are 2.25 ft. in diameter and drain an unknown source. No odor, deposits, stains, or benthic growth were evident at the outfall sites.

- Visual Water Conditions (VWC1, VWC2): Submerged aquatic plant growth is excessive at two locations - near Loomis Drive, adjacent to a large apartment complex with turf bordering the stream, and immediately north of the Farmington Avenue. At Loomis Drive, excessive plant growth is located near a storm water outfall and associated with an increase in channel depth. At Farmington Avenue, excess growth is associated with an increase in channel width. At both locations, the water is clear. No algae or free-floating plants were evident.

Location: (Part 2) Brookside Drive to Trout Brook

Length: 1.0 mile

Stream Corridor: The stream flows from a pond southwest of Brookside Drive to Trout Brook. Riparian vegetation within 35 ft. of the stream is predominantly turf/lawn, but varies somewhat with location. East of North Main Street, numerous residences abut the stream. Turf density is high. The density of deciduous trees is moderate; grasses and shrubs are seen in low density. West of North Main Street, the density of grasses, shrubs and deciduous trees is greater in certain areas. Land use adjacent to and beyond .25 miles from the stream is suburban residential

In-Stream Habitat: The stream is classified as type C. The stream has pool-riffle morphology. The active channel width ranges from 35-75 ft. Bank height averages 5 ft. on both sides. West of North Main Street, bank height on the right reaches 25 ft. in some areas. The substrate is predominantly clay and sand, gravel, cobble, or bedrock depending location. East of North Main Street, composition is 25-50% clay and sand, 5-25% cobble and boulder, less than 5% gravel, and, in spots, 50-75% bedrock. Between North Main Street and Brookside Drive, composition is 50-75% clay, 25-50% gravel and boulder, and 5-25% sand. No aquatic plants or algae are evident. The stream is shaded 50-75% by a tree canopy. The water was mostly clear, with some rust-colored areas indicating the presence of iron reducing bacteria.

Areas of Concern

- **Degraded Buffer (DB):** The riparian buffer is degraded along the entire reach. Downstream of North Main Street, buffer width on both banks averages <15 ft. Dominant land cover is turf/lawn behind residences. Lawn areas extend to the stream bank. Upstream of North Main Street, buffer width varies from <15 ft. to 100 ft. depending on the proximity of residences and property owner decisions and activities. Dominant land cover on both banks is turf/lawn, tall grass, shrubs, and trees.
- **Erosion (EROS):** Areas of erosion can be seen at various locations especially at meander bends and where bank slopes are steep. Land use immediately adjacent to the stream is suburban residential. Buffer width is minimal with <15 ft. of vegetation. Many residential lawns extend to the stream edge and property owners have armored banks with cement, large stones, and other materials to reduce erosion. One erosion site is especially noteworthy. At a dam just west of North Main Street, the left bank is eroded for approximately 40 ft. Bank height averages 35 ft. with a 70-degree angle. Vegetation in the area is minimal. Although some trees are standing, shrubs and ground cover are nearly absent due to scouring.
- **Fish Barrier (FB):** Four barriers to upstream fish passage are located along the reach.

FB1: A stone and concrete dam is located at the confluence with Trout Brook. The dam is 4-6 ft. in height.

FB2: A series of waterfalls over trap rock is located near Hammick Road. The step-like falls are 6-8 ft. in height and approximately 30 ft. wide. Downstream of the falls, the stream bottom is flat, smooth bedrock for approximately 20 ft.

FB3: Three arched stone culverts are located at the North Main Street crossing. The culverts are ramped and may prevent upstream passage during low flow periods. Each culvert is 60 ft. in height, 15 ft. in width, and 50 ft. in length

FB4: A concrete dam is located at Wyndwood Pond and regulates water height in the pond. The dam is associated with an old mill. The dam is 12 ft. in height and has a 75 ft. long straight spillway.

- Modified Channel (MC): Upstream of the North Main Street crossing, just below FB4, both stream banks are armored with concrete, rip rap, and gabions for approximately 100 ft. Bank height is approximately 30 ft. Riparian buffer width averages <15 ft. The modification has altered the active channel width to 70 ft. There is no evidence of sediment deposition in the stream channel.
- Storm Water Outfalls (SWO): There are 12 storm water outfall pipes located along the reach.

SWO1: A 1-ft diameter concrete outfall pipe is located on the right bank. The pipe is perched 4 ft. above the stream bed and drains a road. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO2: A 1.5-ft diameter concrete outfall pipe is located on the left bank. The pipe is perched 3 ft. above the stream bed and drains an unknown source. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO3-5: Three 5-inch diameter plastic outfall pipes are located on the left bank behind residences. The pipes are perched above the stream bed and drain residential properties. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall sites.

SWO6: A 2-inch diameter concrete outfall pipe is located near the waterfalls at FB2. The pipe is perched 3.5 ft. above the stream bed and drains an unknown source. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO7: A 1.5-ft diameter concrete outfall pipe is located at North Main Street. The pipe is at stream level and drains a road. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO8: A concrete outfall pipe is located on the right bank in a culvert at North Main Street. The pipe is perched 3 ft. above the stream bed and drains a road. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO9: A 3-ft diameter concrete outfall pipe is located in a culvert at North Main Street. The pipe is perched 2 ft. above the stream bed and drains a road. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO10: A 1.5-ft diameter concrete outfall pipe is located on the right bank downstream of a dam at FB4. The pipe is at stream level and drains a road. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO11: A 1.5-ft diameter concrete outfall pipe is located on the right bank at Brookside Drive. The pipe is perched 20 ft. above the stream bed and drains a road. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO12: A plastic pipe is located on the right bank behind a residence near the Brookside Drive crossing. The pipe may drain residential property or serve as an intake for lawn watering. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

Basin 4403-06-1 Trout Brook**Total Length: 6.7 miles****Total Length Surveyed: 5.0 miles****Location: (Part 1) Pioneer Drive/Floyd Bugbee School****Length: 1.9 miles**

Stream Corridor: The stream flows from a wetland on the eastern end of the reach through wooded areas and residential backyards, traveling under Asylum Avenue to Brookside Drive. Riparian vegetation within 35 ft. of the stream is predominantly deciduous trees and shrubs. Land use adjacent to and up to .25 mile from the stream is suburban residential. An elementary school is located uphill of the stream south of Asylum Avenue.

In-Stream Habitat: The stream is classified as type E. The stream has a pool-riffle morphology. Riffles averaged 0.25 ft. in depth; pool depth averaged 1.5 ft. The substrate is predominately silt-sand-gravel. Composition is 5-25% silt, 5-25% sand, 25-50% gravel, and less than 5% cobble, boulder, and bedrock. The water is clear. Rooted aquatic vegetation and filamentous algae are found in spots. No free-floating plants or planktonic algae are evident. The stream is shaded 25-50% by a tree canopy. Bioassessment data indicates moderately impaired water quality. Macroinvertebrates collected have moderate to high pollution tolerance and include aquatic earthworms, craneflies, dragonflies, flat-headed mayflies, orange head caddisflies, and common net spinners.

Areas of Concern

- Storm Water Outfalls (SWO): Three concrete storm water outfall pipes (SWO1, 2, 3) are located on the right bank near Pioneer Drive. Pipes are 2 ft. in diameter, with outlets at stream level. Contributing sources are unknown. A brown benthic growth was observed at the outfall sites. No odors, deposits, or stains were evident at the outfall site.

Location: (Part 2) Orchard Road**Length: 0.26 miles**

Stream Corridor: The stream flows from a pond on Orchard Road through a wooded wetland. Riparian vegetation within 35 ft. of the stream is predominantly grass and deciduous trees and shrubs. Tree and shrub density on both banks is high; grass density is moderate. Land use adjacent to and over .25 mile from the stream is suburban residential.

In-Stream Habitat: The stream is classified as type B. Based on its hydrogeomorphic classification, the stream has a pool-riffle morphology, however this was not observed due to low water levels. Bank height is 6 inches on both sides. The substrate is predominately sand and gravel. Composition is 50-75% sand, 25-50% gravel, and less than 5% each of silt, cobble, and boulder. The water was mostly clear, with some rust-colored areas indicating the presence of iron reducing bacteria. Rooted and free-floating aquatic plants and planktonic algae are found in spots. No filamentous algae is evident. The stream is shaded 50-75% by a tree/shrub canopy

Areas of Concern

- Visual Water Conditions (VWC): Although not in the stream itself, the growth of free-floating aquatic plants is excessive in the pond from which the stream originates. Excess growth appears associated with residential lawns that are uphill from and surround the pond.

Location: (Part 2) Wendy Lane area

Length: 0.16 miles

Stream Corridor: The stream flows from a wetland to Orchard Road. Riparian vegetation within 35 ft. of the stream is predominantly deciduous trees and shrubs. Shrub density on both banks is high; tree density is moderate. Land use adjacent to and over .25 mile from the stream is suburban residential.

In-Stream Habitat: The stream is classified as type A. Based on its hydrogeomorphic classification, the stream has a step-pool morphology, however this was not observed. Due to dense shrub growth, part of the stream was inaccessible and therefore not surveyed. Near Orchard Road, the stream has a pool-riffle morphology. Riffles averaged 3.5 inches in depth. Bank height averages 1 ft. on the right, 5 ft. on the left. The substrate is predominantly sand and gravel. Composition is 50-75% sand, 25-50% gravel, 5-25% cobble, and <5% boulder. The water is clear. No aquatic plants or algae are evident. The stream is shaded over 75% by a tree/shrub canopy.

Areas of Concern

- **Degraded Buffer (DB)**: The riparian buffer is degraded just before the first house on the left side of Orchard Road, about 100 yards from the pillars at the road entrance. Buffer width on both banks averages 15-35 ft. Dominant land cover on the left bank is tall grass and shrub. On the right bank, shrubs dominate.

Location: (Part 2) Orchard Road to Mountain Road

Length: 0.25 miles

Stream Corridor: The stream flows from just west of the Orchard Road-Mountain Road intersection where it is channeled underground through a concrete tunnel. The stream resurfaces east of Mountain Road and continues to a wetland. Riparian vegetation within 35 ft. of the stream is predominantly deciduous trees and shrubs. On the right bank, tree and shrub density is moderate; on the left bank tree/shrub density is low. Grasses and turf/lawn are also seen on the left bank in low density. Land use adjacent to and over .25 mile from the stream is suburban residential.

In-Stream Habitat: The stream is classified as type B. The stream has a pool-riffle morphology, however, at the time of the survey, the stream bed east of Mountain Road was dry. Bank height averages 2.5 ft. on the right side, 1.5 ft. on the left. The substrate is predominately sand-gravel-cobble. Composition is 25-50% each of sand and gravel and 5-25% cobble. Shortly beyond Mountain Road the stream enters a wetland and was not accessible. No aquatic plants or algae are evident near Mountain Road. The stream is shaded over 75% by a tree canopy.

Areas of Concern

- **Degraded Buffer (DB)**: The riparian buffer is degraded along a straight section for about 100 ft. along both banks just east of Mountain Road. Buffer width on both banks averages 15-35 ft. Dominant land cover on the left bank is turf/lawn. On the right bank, shrubs dominate.
- **Storm Water Outfalls (SWO)**: A concrete outfall pipe is located at stream level just east of Mountain Road. The pipe carries water from a low lying area at the base of a sloping lawn on the west side of Mountain Road. No odor, deposits, stains, or benthic growth were evident at the outfall site.

Location: (Part 2) Borough Drive area

Length: 0.38 miles

Stream Corridor: The stream flows through a wetland and was inaccessible at the time of the survey. Land use adjacent to and over .25 mile from the stream is suburban residential.

In-Stream Habitat: The stream is classified as type C. Based on its hydrogeomorphic classification, the stream has a pool-riffle morphology, however this was not observed as the stream was not surveyed.

Areas of Concern: No areas of concern were observed as the stream was not surveyed.

Location: (Part 3) Flagg Road/Westmoor Park

Length: 0.5 miles

Stream Corridor: The stream flows from a wetland through a ponded area to Flagg Road. Riparian vegetation within 35 feet of the stream is predominantly deciduous trees and shrubs with moderate to high densities of both. Turf/lawn is found on the eastern edge of the pond on the Westmoor Park property. Land use adjacent to and up to .25 mile from the stream is forested and recreational. Beyond .25 miles, land use is suburban residential.

In-Stream Habitat: The stream is classified as type C. The stream has a pool-riffle morphology. Bank height averages 0.5 ft. on the right, 2.25 ft. on the left. The substrate is over 75% silt, with less than 5% cobble and boulder. The water is clear. Planktonic and filamentous algae are found in spots. Free-floating aquatic plants grow throughout. Submerged aquatic plants are found in excess in the pond. The stream is shaded <25% by a tree canopy.

Areas of Concern

- Degraded Buffer (DB): The riparian buffer is degraded for approximately 700 ft. along the left bank of the pond. Buffer width is minimal with <15 ft. of vegetation. On the opposite bank, buffer width is >100 ft. Dominant land cover is turf/lawn maintained by park personnel.
- Visual Water Conditions (VWC): Excessive free-floating and submerged aquatic plant growth is evident in the ponded area. Excess growth is associated with a change in channel width and full sun exposure.

Location: (Part 3) Flagg Road to Mountain Road

Length: 0.9 miles

Stream Corridor: The stream flows from a pond just south of Flagg Road through a wetland where it splits into two branches. One branch flows west to Mountain Road near the Albany Avenue (Rte. 44) intersection. The other branch flows north behind Gledhill Nursery to the Plainfield Road area. Riparian vegetation within 35 ft. of the stream is predominantly grasses and deciduous shrubs and trees. Shrub density on both banks is high; tree and grass density is moderate. Land use immediately adjacent to the stream is forested. One-quarter mile from the stream and beyond, land use is suburban residential.

In-Stream Habitat: The stream is classified as type F. The stream has a pool-riffle morphology. Riffles averaged 1 inch in depth; pool depth averaged 1.0 ft. The active channel is 11.5–25.5 ft. wide. Bank height averages 1.5–3.0 ft. on the right, 0.5 ft. on the left. The substrate is predominantly gravel and cobble. Composition is 50–75% each of gravel and cobble and 5–25% sand. A few sand bars are located near Mountain Road. The water is clear. Free-floating aquatic plants are found in spots. No rooted aquatic plants or planktonic or filamentous algae were evident. The stream is shaded >75% by a tree canopy. Bioassessment data indicates some degree of water quality impairment. Most macroinvertebrates collected

just east of the Mountain Road crossing have moderate to high pollution tolerance, however one key indicator organism (saddle case maker) was identified. Macroinvertebrates collected include aquatic earthworms, snails, crane flies, dragonflies, small minnow mayflies, blackflies, orange head caddisflies, common net spinners, and saddle case makers.

Areas of Concern

- Storm Water Outfalls (SWO): Two concrete storm water outfall pipes are located at stream level on the left bank. The pipes are 1.5 ft. in diameter and drain nearby roads. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall sites.

Location: (Part 3) Old Oak Road area

Length: 0.4 miles

Stream Corridor: The stream flows from southwest of the Old Oak Road crossing to Mountain Road. Riparian vegetation within 35 ft. of the stream is predominantly turf/lawn on the right bank and deciduous trees and shrubs on the left. Tree/shrub density is moderate to high. Land use immediately adjacent to and beyond .25 miles from the stream is suburban residential.

In-Stream Habitat: The stream is classified as type B. The stream has a pool-riffle morphology. Riffles averaged 0.25 ft. in depth; pool depth averaged 1.5 ft. The active channel is 12.75 ft. wide. Bank height averages 4.0 ft. on both sides. The substrate is predominantly sand-gravel-cobble. Composition is 50-75% sand and 25-50% each of gravel and cobble. Free-floating aquatic plants and filamentous algae are found in spots. No rooted aquatic plants or planktonic algae are evident. The stream is shaded 50-75% by a tree canopy.

Areas of Concern

- Fish Barrier (FB): A concrete step-like dam is located just west of Mountain Road. The dam is 5 ft. in height and has an 11 ft. straight spillway. In addition to the dam, several large concrete blocks used to armor the banks have fallen into the stream blocking the channel.
- Modified Channel (MC): Just west of Mountain Road, both banks are armored with large concrete blocks for approximately 1000 ft. Bank walls are deteriorating in sections with several blocks lying in the stream channel. Block dimensions are 8 ft. x 2.5 ft. x 2.5 ft. Bank height in the modified section is 4 ft. Riparian buffer width is <15 ft. There is no evidence of sediment deposition in the channel and no change in active channel width due to the modification.
- Storm Water Outfalls (SWO): A concrete storm water outfall pipe is located on the left bank at the Old Oak Road crossing. The pipe is 1.5 ft. in diameter and perched 4 ft. above stream level. No flow was observed and no odors, deposits, stains, or benthic growth were evident at the outfall site.
- Visual Water Conditions (VWC): Excessive emergent plant growth is evident immediately upstream of the Old Oak Road crossing. The area is adjacent to a residence and receives full sun exposure.

Location: (Part 4) Albany Avenue (Rte. 44) to Lovelace/Faxon Drive

Length: 0.6 miles

Stream Corridor: The stream flows from under Albany Avenue (Rte. 44) to Lovelace Drive. Riparian vegetation within 35 ft. of the stream is predominantly deciduous trees with density being moderate on both banks. Land use adjacent to the stream is forested and suburban residential. Beyond the stream, land use is forested, suburban residential, and recreational (Rennbrook School athletic fields).

In-Stream Habitat: The stream is classified as type A. The stream has step-pool morphology. The substrate is predominantly gravel and cobble. Composition is 50-75% of each. The water is clear. Planktonic algae occur in spots. No aquatic plants or filamentous algae are evident. The stream is shaded 50-75% by a tree canopy. Bioassessment data indicates some degree of water quality impairment. Most macroinvertebrates collected at the Winchester Road crossing have moderate to high pollution tolerance, however two key indicator organisms (common stonefly and Michelin man caddisfly) were identified. Macroinvertebrates collected include flat headed mayflies, common net spinners, orange head caddisflies, midges, riffle beetles, water penny beetle larvae, aquatic earthworms, common stoneflies, and Michelin man caddisflies.

Areas of Concern

- Erosion (EROS): Downstream of Ferncliff Drive, the right bank is eroded at the first major meander bend. A second and more substantial area of erosion occurs on the left bank at the second meander bend. There is much debris and construction waste as well as a rusted metal fence at the erosions sites. Land use immediately adjacent to the sites is suburban residential.
- Trash/Debris (T/D): Just north of Albany Avenue (Rte. 44), substantial residential trash occurs on both banks. The trash includes plastic, metal, and propane tanks for gas grills.

Location: (Part 4) Albany Avenue (Rte. 44) to and along Canal Road

Length: 1.1 miles

Stream Corridor: The stream flows from under Albany Avenue (Rte. 44) to and along Canal Road. Due to volunteer time constraints, the stream was not surveyed.

In-Stream Habitat: The stream is classified as type F. No further description is here given as the stream was not surveyed.

Areas of Concern: No areas of concern were observed as the stream was not surveyed.

Location: (Part 4) Lovelace/Faxon Drive to Mountain Road

Length: 0.2 miles

Stream Corridor: The stream flows from Lovelace/Faxon Drive to Mountain Road. Near and along Mountain Road, the stream is bordered by metal fencing making it inaccessible at the time of the survey.

In-Stream Habitat: The stream is classified as type B. Based on its hydrogeomorphic classification, the stream has a pool-riffle morphology, however this was not observed as the stream was not surveyed.

Areas of Concern: No areas of concern were observed as the stream was not surveyed.

Basin 4403-07-1 South Branch Trout Brook

Total Length: 3.4 miles

Total Length Surveyed: 3.4 miles

Location: (Part 1) Rockledge Country Club to Trout Brook Drive

Length: 1.8 miles

Stream Corridor: The stream flows from an underground concrete tunnel and becomes day lighted at the south end of the Rockledge Country Club golf course. The stream continues to Thompson Road where it is

again channeled underground only to reemerge at Park Road. From here, the stream flows under I-84 and into Trout Brook. At the golf course, riparian vegetation within 35 feet of the stream is predominantly grasses, shrubs and turf/lawn. Immediately adjacent to the stream is a narrow vegetated buffer. Here, shrub density on both banks is moderate; grass/wildflower density is low. North of the golf course extending approximately 2000 ft., riparian vegetation is predominantly deciduous trees and turf/lawn with moderate densities of both on each bank. Beyond this, vegetation is predominantly deciduous trees, shrubs, and grasses. The density of deciduous trees on both banks is moderate to high; shrub and grass density is moderate. Land use adjacent to and up to .25 mile from the stream is urban residential, commercial, and, at the country club, recreational. Beyond .25 miles, land use is urban and suburban residential.

In-Stream Habitat: The stream is classified as type F. At the golf course, the stream has a glide morphology. The active channel is 10 ft. wide. Bank height averages 15 ft. on the right, 15-20 ft. on the left. The substrate is predominantly silt-sand-gravel. Composition is 25-50% each of silt, sand, and gravel and less than 5% boulder. The water is clear. Rooted aquatic plants and filamentous algae are found in spots. No free-floating plants or planktonic algae are evident. The stream has full sun exposure as there is no tree canopy. Bioassessment data indicates moderately to severely impaired water quality. Macroinvertebrates collected at the Sedgewick Road crossing have moderate to high pollution tolerance and include common net spinner, blackflies, craneflies, small minnow mayflies, midges, riffle beetles, and leeches.

North of the golf course, the stream has a pool-riffle morphology. The active channel width is 15-30 ft. wide. Bank height averages 10 ft. on both sides. The substrate varies with proximity to the golf course. Near the course and extending north approximately 2000 ft., the substrate is predominantly silt and gravel. Composition is 50-75% each of silt and gravel and 25-50% cobble. Beyond this, the substrate changes to predominantly gravel and cobble. Composition is 25-50% each of gravel and cobble and less than 5% each of boulder and clay. The water is clear. Rooted aquatic plants and filamentous algae are found in spots. No free-floating or planktonic algae are evident. Much of the stream is shaded 50-75% by a tree canopy; nearest Trout Brook shading decreases to <25%.

Areas of Concern

- Degraded Buffer (DB): The buffer is degraded on both banks along the entire reach. At the golf course, a narrow strip of wildflowers and grasses border the stream. The strip is <15 ft. wide and lacks trees that would shade the stream. North of the golf course, near Sedgewick Road, buffer width is minimal with <15 ft. of vegetation and the presence of invasive plants. Sections of both banks are paved parking lots. Dominant land cover in the area is 75% shrub, 25% deciduous trees, and 25% turf/lawn. At the downstream terminus, the riparian buffer is degraded by the presence of invasive plants, especially Japanese knotweed (*Polygonum cuspidatum*), for approximately 20 ft. along both banks. Riparian vegetation in the area averages 35-50 ft. in width. Dominant land cover is shrub.
- Erosion (EROS): The right bank is eroded along a straight section at the northern end of the golf course. The area of erosion is approximately 250-350 ft. in length. Bank height is 20-25 ft. with a 45 degree angle. Land ownership in the area is public. The riparian buffer averages 15-35 ft. in width.
- Fish Barrier (FB): Three barriers to upstream fish passage are located along the reach.

FB1: At Park Road, where the stream emerges from the Thompson Road tunnel, two 10-ft. diameter concrete culverts prevent upstream fish passage. The culverts are perched 5 ft. above the stream bed, requiring water flowing from the culverts to fall.

FB2: At the entrance to the tunnel at Sedgewick Road, fish passage is restricted due to sloped culvert bottoms and minimal water depth.

FB3: A twin culvert at Pheasant Hill Drive may prevent fish passage during times of drought. The concrete double culverts are 8-10 ft. high and 12 ft. wide. Flow is restricted to the left chamber as the right is filled with approximately 5 ft. of silt.

- Modified Channel (MC): North of the golf course, both stream banks are armored with stacked concrete slabs and blocks for at least 350 ft. The modified banks range from 7 ft. to over 10 ft. in height. Riparian buffer width is minimal with <15 ft. of vegetation. South of Sedgewick Road, both banks are armored with sloping concrete slabs for approximately 75 ft. Bank height in the area is 5-10 ft. Riparian buffer width averages 35-50 ft. There is no evidence of sediment deposition in the stream channel and no change in active channel width due to the modification.
- Storm Water Outfalls (SWO): More than six storm water outfalls are located along the reach.

SWO1: A 10-ft. wide stone outfall channel is located south of Park Road at the edge of the I-84 ramp. The channel drains a road. No flow was observed. No deposits or stains were evident at the outfall site, however a sewage odor was detected and brown benthic growth was observed.

SWO2-3: Two storm water outfall pipes are located at the Park Road culverts.

SWO4: A 1 ft. diameter concrete outfall pipe is located behind a commercial strip mall on South Main Street near the Sedgewick Road intersection. The pipe is perched and drains a parking lot. No flow was observed and no odors, deposits, stains, or benthic growth were evident at the outfall site.

SWO5: More than three corrugated plastic outfall pipes are located behind residences along South Main Street south of Sedgewick Road. The pipes are 6-8 inches in diameter. Contributing sources are unknown, but likely to be sump pumps. No flow was observed and no odors, deposits, stains, or benthic growth were evident at the outfall site.

SWO6: A 3-ft. diameter concrete storm water outfall pipe is located on the left bank north of Pheasant Drive. The pipe is perched 5-6 ft. above the stream bed. Contributing sources are unknown.. Flow from the pipe was moderate. No odor deposits, stains, or benthic growth were evident at the outfall site. A pool beneath the pipe had numerous snails, crayfish, and small fish.

Location: (Part 2) Burnham Drive to Beechwood Road

Length: 1.6 miles

Stream Corridor: The stream flows from a concrete culvert at Burnham Drive and flows behind residences to Beechwood Road where it is again channeled underground in a concrete tunnel. Riparian vegetation within 35 ft. of the stream is predominantly grass and deciduous trees and shrubs. Vegetation density on both banks is moderate. Land use adjacent to and within .25 miles from the stream is urban residential. Greater than .25 miles from the stream, land use is urban residential, commercial, and recreational (high school athletic fields).

In-Stream Habitat: The stream is classified as type F. The stream has a pool-riffle morphology in some areas and a glide morphology in others. The active channel is 15 ft. wide. Riffle depth averaged 2 inches. Glide depth ranged from 4 inches to 1 ft. Bank height averages 2.5 ft. on the right, 4-12 ft. on the left. The substrate is predominately sand. Composition is >75% sand with only 5-25% each of gravel and cobble. The water is clear. Rooted aquatic plants (*Potamogeton crispus* and *Elodea* sp.) and filamentous algae are found in spots. No free-floating plants or planktonic algae are evident. Stream shading varies throughout the reach. In some areas, tree cover is <25%, in others the canopy is >75%. Bioassessment data indicates moderately to severely impaired water quality. Macroinvertebrates collected at the Elmfield Street crossing

have moderate to high pollution tolerance and include common net spinners, midges, riffle beetles, leeches, and aquatic earthworms.

Areas of Concern

- Degraded Buffer (DB): The buffer is degraded on both banks along the entire reach. Buffer width is minimal, with 15-35 ft. of vegetation. Invasive plant species are common.
- Fish Barrier (FB): Immediately upstream of the Beechwood Road tunnel, a dam of fallen trees and branches appears to prevent upstream fish passage. Adjacent to the dam on the right bank is a residence. All trees and shrubs bordering the stream on the residential property have been cleared.
- Modified Channel (MC): South of New Britain Avenue, both banks are armored with concrete, asphalt, and rip rap along a straight section of stream. Adjacent to the modified banks are residences. Riparian buffer width on both sides of the stream is minimal, with <15 ft. of vegetation. There is no change in active channel width due to the modification, however, sediment deposition in the channel is evident.
- Storm Water Outfalls (SWO)/Leak offs (LO): Forty-four storm water outfalls and four leak offs are located along the reach.

SWO1: A 3-inch diameter metal outfall pipe is located on the right bank just south of Beechwood Road. The pipe is perched 2 ft. above the stream bed and drains an unknown source. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO2: A 2.5-ft diameter concrete outfall pipe is located on the left bank in a tunnel beneath I-84. The pipe is perched 6 ft. above the stream bed and drains an unknown source. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO3-4: Two 4-inch diameter plastic outfall pipes are located on the left bank just south of I-84 by an apartment complex on Shadow Lane. The pipes are perched 4.5 ft. and 6 ft. above the stream bed and drain the apartment complex parking lot. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

LO1-3: Three leak-offs are located on the right bank between I-84 and New Britain Avenue. Swales are 4 ft. in width and 45 ft., 30 ft., and 30 ft. in length. Swales are either earthen or earthen and rip rap. All drain unknown sources.

SWO5: A 1-ft. diameter plastic outfall pipe is located on the left bank just south of I-84 by an apartment complex on Shadow Lane. The pipes are perched 1.5 ft. above the stream bed and drain unknown sources. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO 6-7: Two 2-ft. diameter concrete outfall pipes are located on the right bank in the New Britain Avenue culvert. The pipes are perched 2 and 3 ft. above the stream bed and drain a road. Observed flow was a trickle in one pipe, absent in the other. No odor, deposits, or benthic growth were evident at the outfall sites. A dark stain was evident at the outfall site of the 3-ft. perched pipe.

SWO8: A 1.5-ft. diameter concrete outfall pipe is located on the left bank between New Britain Avenue and Thorne Road. The pipe is perched 1.5 ft. above the stream bed and drains a condominium parking lot. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO9-10: Two 5-inch plastic outfall pipes are located on the right bank between New Britain Avenue and Thorne Road. The pipes are perched 2 ft. above the stream bed and drain unknown sources. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall sites.

LO4: A leak-off is located on the right bank between New Britain Avenue and Thorne Road. The asphalt swale is 25 ft. in length, 5 ft. in width, and drains an apartment/condominium parking lot.

SWO11-12: Two 1.5-ft. diameter concrete outfall pipes are located on the right bank in the Thorne Road culvert. The pipes are perched 1.5 ft. above the stream bed and drain a road. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall sites.

SWO13: A 1.5-ft. diameter plastic outfall pipe is located on the right bank between Thorne Road and Elmfield Street. The pipe is perched 1.5 ft. above the stream bed and drain an unknown source. Observed flow was a trickle. No odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO14-15: Two 4-inch diameter plastic outfall pipes are located between Thorne Road and Elmfield Street. One pipe is located on each bank. The pipes are perched 3.5 ft. and 4 ft. above the stream bed and drain unknown sources. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall sites.

SWO16: A 1.5-ft. diameter concrete outfall pipe is located on the left bank in the Elmfield Street culvert. The pipe is perched 1.5 ft. above the stream bed and drains a road. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO17: A 1-ft. diameter concrete outfall pipe is located on the right bank in the Elmfield Street culvert. The pipe is perched 2 ft. above the stream bed and drains road. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO18: A 3-ft. diameter ramped concrete outfall pipe is located on the left bank just south of Elmfield Street. The pipe drains a road. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO19-20: Two 4-inch diameter plastic outfall pipes are located on the right bank along Davenport Road just south of Elmfield Street. The pipe is perched 3.5 ft. above the stream bed and drains an unknown source. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO21: A 1.5-ft. diameter concrete outfall pipe is located on the right bank along Davenport Road south of Elmfield Street. The pipe is perched 1.5 ft. above the stream bed and drains an unknown source. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO22: A 4-inch diameter plastic outfall pipe is located on the left bank along Davenport Road near Wolcott School. The pipe is perched 3 ft. above the stream bed and drains an unknown source. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO23-24: Two 1-ft. diameter concrete outfall pipes are located in the Davenport Road culverts. One pipe is located on each bank. The pipes are perched 2.5 ft. above the stream bed and drain a road. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall sites.

SWO25: A 1.5-ft. diameter concrete outfall pipe is located on the left bank between Davenport Road and Barton Street. The pipe is perched 1 ft. above the stream bed and drain a road. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO26-27: Two 1-ft. diameter concrete outfall pipe is located on the right bank in the Barton Street culvert. The pipes are perched 3.5 ft. above the stream bed and drain a road. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall sites.

SWO28-29: Two 4-inch diameter plastic outfall pipes are located between Barton Street and Chestnut Lane. One pipe is located on the right bank just south of Barton Road. The other is located on the left bank where the stream makes a 90-degree bend. The pipes are perched 3 ft. and 5 inches above the stream bed and drain unknown sources. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall sites.

SWO30-31: Two 1.5-ft. diameter concrete outfall pipes are located on the right bank between Barton Street and Chestnut Lane. Both pipes are located near where the stream makes a 90-degree bend. One pipe is perched 3 ft. above the stream bed, the other is ramped. Both pipes drain unknown sources. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall sites.

SWO32: A 1-ft. diameter concrete outfall pipe is located on the left just east of the Chestnut Lane culvert. The pipe is perched 2 ft. above the stream bed and drains an unknown source. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO33-35: Three 1.5-ft. diameter concrete outfall pipes are located on the left bank - two in the Chestnut Lane culvert, one in the Huckleberry Lane culvert. The pipes are perched 1 ft. above the stream bed and drain unknown sources. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall sites.

SWO36: A 1.5-ft. diameter ramped concrete outfall pipe is located on the left bank just west of Huckleberry Lane. The pipe is perched 1.5 ft. above the stream bed and drains an unknown source. Observed flow was moderate. No odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO37: A 3-inch diameter plastic outfall pipe is located on the left bank west of Huckleberry Lane. The pipe is perched 4.5 ft. above the stream bed and drains an unknown source. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO38: A 1-ft. diameter concrete outfall pipe is located on the right bank west of Huckleberry Lane. The pipe is perched 1.5 ft. above the stream bed and drains an unknown source. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO39: A 4-inch diameter plastic outfall pipe is located on the left bank west of Huckleberry Lane. The pipe is perched 1.5 ft. above the stream bed and drains an unknown source. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO40-41: Two 2-ft. diameter outfall pipes are located on the left along Red Top Drive. One pipe is concrete and ramped; the other is corrugated metal and perched 1 ft. above the stream bed. Both pipes drain unknown sources. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall sites.

SWO42: A 1-ft. diameter plastic outfall pipe is located on the left bank along Red Top Drive. The pipe is perched 6 ft. above the stream bed and drains an unknown source. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO43-44: Two 8-inch diameter plastic outfall pipes are located on the right bank along Shepard Road. The pipes are perched 2.5 ft. above the stream bed and drain unknown sources. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

- Visual Water Conditions (VWC): Immediately upstream of the New Britain Avenue crossing, the growth of rooted aquatic plants (*Potamogeton crispus* and *Elodea* sp.) and filamentous algae is excessive. Canopy cover at the site is <25%. Excessive growth is not associated with impoundments or changes in channel dimensions, but appears to be associated with storm water outfalls and leak-offs coupled with decreased canopy cover.

Hartford

Basin 4400-00-4-R1 Gully Brook

Location: Keeney Park

Total Length: 0.7 miles

Total Length Surveyed: 0.7 miles

Stream Corridor: The stream flows from a submerged culvert at Coventry Street through woodlands of a public park and residential and commercial areas before disappearing into a second culvert at Westland Street. Riparian vegetation within 35 ft. of the stream is predominantly grass and deciduous trees and shrubs. Grass density on the right bank is moderate; density on the left bank is low. Tree and shrub density on both banks is moderate. Land use adjacent to and greater than .25 miles from the stream is urban residential and commercial.

In-Stream Habitat: The stream is classified as type C. Based on its hydrogeomorphic classification, the stream has a pool-riffle morphology, however, at the time of the survey, this was not observed. The active channel is 2.5 ft. wide. Water depth averaged 1.5 ft. Bank height averages 4 ft. on the right, 6 ft. on the left. The substrate is predominately gravel. Composition is 5-25% silt, 5-25% sand, 50-75% gravel, and <5% cobble. The water is clear but stained. An odor of raw sewage emanates from the downstream culvert as the culvert feeds into the MDC Storm Water and Sewage System. Natural stream flow is impeded at the deteriorating brownstone/brick culvert resulting in flooding. Stream water appears to flow into the declining culvert through submerged cracks and holes. Aquatic plants and algae are absent from the stream. The stream is shaded 50-75% by a tree canopy.

Areas of Concern

- Degraded Buffer (DB): At Coventry Street, near a hospital and parking lots, approximately 1000 ft. of stream buffer is degraded. Buffer width is minimal with only 15-35 ft. of riparian vegetation. The right bank is predominantly paved areas and turf/lawn; the left bank is dominated by deciduous trees. Land use immediately adjacent to the degraded right bank is commercial.
- Fish Barrier (FB): At Westland Street, the culvert opening is covered with a metal and mortared grate that blocks fish movement upstream. The 6-ft. diameter culvert is 20 ft. in length and perched 6 ft. above stream level.
- Storm Water Outfalls (SWO): Six storm water outfalls are located along the reach.

SWO1: A 2-ft. diameter concrete outfall pipe is located on the left bank 1200-1500 ft. upstream of the culvert at Westland Street. The nearest structure is Simpson Waverly School. The pipe is perched 3 ft. above stream level. Moderate flow from the pipe abruptly changed at 2:15 pm to a heavy sudsy flow. No odor, stains, or benthic growth were evident at the outfall site, however, a sediment delta was observed.

SWO2: A 1.5-ft. diameter concrete outfall pipe is located on the right bank 1700-1800 ft. upstream of the culvert at Westland Street. The nearest structures are hospital/clinic buildings on Coventry Street. The pipe, perched 3 ft. above stream level, had moderate flow. No odors, deposits, stains, or benthic growth were evident at the outfall site.

SWO3: A 1.5-ft. diameter concrete outfall pipe is located on the right bank approximately 500 ft. from the upstream culvert. The nearest structures are hospital/clinic buildings on Coventry Street. Perched 3 ft. above stream level, the pipe drains a parking lot. Light shining into the parking lot storm drain is visible from inside the pipe. Observed flow was moderate. No odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO4: A 4-ft. diameter concrete boxed culvert is located on the right bank approximately 500 ft. from the upstream end of the reach. The nearest structures are hospital/clinic buildings on Coventry Street. Perched 3 ft. above stream level, the culvert drains an unknown source. An 8 ft. broken grate made up of metal strips 6 inches apart lies in the water tiled away from the culvert opening. Observed flow was only a trickle. No odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO5: A 1-ft. diameter corrugated metal outfall pipe is located on the left bank at Coventry Street. Perched 4 ft. above stream level, the pipe drains a road. No flow, odor, deposits, stains or benthic growth were evident at the outfall site.

SWO6: A 4-ft. diameter concrete outfall pipe is located on the left bank at Coventry Street. Submerged 2 ft. below stream level, the pipe drains a road. No odor, deposits, stains, or benthic growth were evident at the outfall site.

- Trash/Debris (T/D): Much organic debris is piled up at the foot of the grated downstream culvert.

Basin 4400-01-3-R1 South Branch Park River

Location: New Britain Avenue (behind Pepboys) to Brookfield Street

Total Length: 1.8 miles

Total Length Surveyed: 1.8 miles

Stream Corridor: The stream flows from behind Pepboys in the Elmwood section of West Hartford northeast under Newfield Avenue and Flatbush Avenue to across from Pulaski Drive. Riparian vegetation within 35 feet of the stream is predominantly shrubs and deciduous and coniferous trees. Shrub density on both banks is high; tree density is low. Land use immediately adjacent to the stream is forested (shrubs). Within .25 mile from the stream, land use is commercial. Beyond that, land use is urban and suburban residential.

In-Stream Habitat: The stream is classified as type F. The stream has a glide morphology. The active channel is 2.5 ft. wide. Glide depth averages 1.5 ft. Bank height averages 12 ft. on both sides. The substrate is predominately cobble. Composition is >75% cobble and 5-25% each of sand, gravel, and boulder. The water is clear for the first half of the reach. Near Overlook Drive, the water is orange colored and oily. Rooted aquatic plants and filamentous algae are found in spots. No free-floating plants or planktonic algae are evident. The stream is shaded <25% by a tree canopy.

Areas of Concern

- Fish Barrier (FB): At Flatbush Avenue, a dam of trees, branches, and trash appears to prevent upstream fish passage in the underpass. “Dam” height ranges from 2-4 ft.
- Modified Channel (MC): Downstream of Newfield Street, the right bank is armored with rocks in two areas – the upstream site stretching about .25 miles, the downstream site extending about 50 ft. Bank height in both modified sections is 15-20 ft. Riparian buffer width is 15-35 ft. There is no evidence of sediment deposition in the channel and no change to the active channel width due to the modification. Immediately north of Flatbush Avenue, both banks and the channel bottom are lined with concrete for approximately 100 ft. along a meander bend. Bank height in the area averages 15 ft. Riparian buffer width is minimal with <15 ft. of vegetation. Land use adjacent to the modified section is urban residential and commercial. There is evidence of sediment deposition in the channel, but the modification has not altered the width of the active channel.
- Storm Water Outfalls (SWO): Based on volunteer observations, thirty-six storm water outfall pipes are located along the reach. According to the MDC, only 13 SWOs and two combined sewer outfalls (CSO) occur. As indicated on an MDC map, one CSO is located near the upstream terminus. The second is located midpoint along the reach. It is unclear from volunteer data which two of the 36 SWOs here described are actually CSOs.

SWO1: A 2 ft.-diameter corrugated metal outfall pipe is located on the left bank near New Britain Avenue behind a white building adjacent to PepBoys Automotive. The pipe is ramped and drains an unknown source. Observed flow was moderate. No deposits or stains were evident at the outfall site, but a oily odor was detected and brown benthic growth was observed.

SWO2: Downstream of SWO1, a 1.5 ft.-diameter concrete pipe is located on the left bank by a chain link fence and street light with camera. The pipe is perched 2 ft. above stream level and drains a parking lot. Observed flow was moderate. No odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO3: A 2 ft.-diameter corrugated metal pipe is located on the right bank by a Bonanza on New Britain Avenue. The pipe is perched 2 ft. above stream level and appears to drain a parking lot. Observed flow was a trickle yet the day was sunny and dry. No deposits or stains were observed at the outfall site, but a sewage odor and brown and orange-colored benthic growth were evident.

SWO4-9: Five outfall pipes are located near Newfield Street. A 1 ft.-diameter corrugated metal pipe is located on the left bank. The pipe is perched 1 ft. above stream level and drains an unknown source. No odor, deposits, or stains were evident at the outfall site, but an orange-colored benthic growth was observed. A 2.5 ft.-diameter concrete pipe is located on the right bank by a riffle and large tree. The pipe is perched 2.5 ft. above stream level and appears to drain a road. Observed flow was moderate. No odor, deposits, or stains, were evident at the outfall site, but an orange-colored benthic growth was observed. A 2 ft.-diameter concrete pipe is located on the left bank near a billboard sign. The pipe is ramped and appears to drain a road. Observed flow was a trickle. No odor, deposits, or stains, were evident at the outfall site, but an orange-colored benthic growth was observed. A 1.5 ft.-diameter concrete pipe is located on the right bank near a billboard sign. The pipe is perched and drains an unknown source. No odor was evident at the outfall site, but black deposits/stains and orange-colored benthic growth were observed. A 3.5 ft.-diameter concrete pipe is located in the left bank near a billboard sign. The pipe is ramped and drains an unknown source. Observed flow was moderate. A rancid/sour odor, black deposits/stains, a sediment delta, and thick, orange-colored benthic growth were evident at the outfall site.

SWO10-17: Eight outfalls are located between SWO4-9 and Flatbush Avenue. A 12 ft.-diameter flat-bottomed concrete pipe is located on the right bank. The pipe is perched 10 ft. above stream level and drains an unknown source. No odor or benthic growth were evident at the outfall site, but black deposits/stains were observed. A .5 ft.-diameter plastic pipe is located on the right bank in a modified section of stream where the bank is armored with rocks. The pipe is at stream level and filled with soil. No odor, deposits, stains, or benthic growth were evident at the outfall site. A 1.5 ft.-diameter oval-shaped concrete pipe is located on the left bank near a red/cream brick building and a fallen tree overhanging the stream. The pipe is perched 1.5 ft. above stream level and drains an unknown source. Observed flow was a trickle. No odor, deposits, or stains were evident at the outfall site, but an orange benthic growth was observed. A 1.5 ft.-diameter concrete pipe is located on the right bank by a fallen tree overhanging the stream. The pipe is perched 3 ft. above stream level and drains a road. Observed flow was a trickle. No odor, deposits or stains were evident at the outfall site, but red-colored benthic growth was observed. A 2.5 ft.-diameter concrete pipe is located on the right bank by a treehouse. The pipe is perched 1 ft. above stream level and drains an unknown source. Observed flow was a trickle. No odor, deposits, or stains were evident at the outfall site, but orange-colored benthic growth was observed. A 2.5 ft.-diameter concrete pipe is located on the left bank near Flatbush Avenue. The pipe is perched 3 ft. above stream level and drains an unknown source. Observed flow was a trickle. No odor was evident at the outfall site, but a sediment delta and brown and green benthic growth were observed. A 2 ft.-diameter corrugated metal pipe is located on the left bank near Flatbush Avenue. The pipe is perched 6 ft. above stream level and drains an unknown source. Observed flow was a trickle. No benthic growth was observed at the outfall site, but a rancid/sour odor and rust-colored stains were evident. A 1 ft.-diameter corrugated metal pipe is located on the right bank near Flatbush Avenue. The pipe is at stream level and overgrown with plants. Observed flow was a trickle. No odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO18-34: Seventeen outfall pipes are located under the Flatbush Avenue overpass. A 1.5 ft.-diameter corrugated metal pipe is located on the right bank. The pipe is perched 25 ft. above stream level and drains a road. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site. A 1 ft.-diameter concrete pipe is located on the right bank. The pipe is perched 30 ft. above stream level and drains a road. No flow was observed. No odor or benthic growth were evident at the outfall site, but black and orange deposits/stains were observed. A 2 ft.-diameter concrete pipe is located on the left bank. The pipe is perched 20 ft. above stream level and drains a road. Observed flow was a trickle. No odor or benthic growth was evident at the outfall site, but a sediment delta was observed. A 12 ft.-diameter concrete pipe is located on the left bank. The pipe is perched 30 ft. above stream level and drains a road. No flow was observed. No odor or benthic growth were evident at the outfall site, but a sediment delta was observed. Five 6 inch-diameter concrete pipes are located on the left bank. The pipes are perched 5-10 ft. Above stream level and drain a road. No flow was observed. No odor or benthic growth were evident at the outfall site, but black and orange deposits/stains were observed. Eight 8 inch-diameter concrete pipes are located on the right bank. The pipes are perched 10-20 ft. above stream level and drain a road. No flow was observed and no odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO35: A 1.5 ft.-diameter concrete outfall pipe is located on the right bank immediately downstream of Flatbush Avenue. The pipe is perched 20 ft. above stream level and drains a road. No odor, deposits, stains, or benthic growth were evident at the outfall site.

SWO36: A 1.5 ft.-diameter corrugated metal outfall pipe is located on the left bank immediately downstream of Flatbush Avenue. The pipe is perched 20 ft. above stream level and drains a road. No odor, deposits, stains, or benthic growth were evident at the outfall site.

- Trash/Debris (T/D): From approximately .25 miles of upstream of Newfield Avenue to Flatbush Avenue, trash is extensive in the stream, along both banks, and in the riparian area. Trash is both

residential and commercial and includes plastic, paper, yard waste, numerous tires, construction materials, metal pipes and grates, bicycles, shopping carts, wire fencing, a door frame, a tent, and an automobile. Some trash was likely blown in or carried downstream during high flow times. However, much of the trash appears to have been illegally dumped.

- Visual Water Conditions (VWC):

VWC1: Approximately .25 miles upstream of Newfield Street the growth of filamentous algae is excessive. Excess growth is associated with a storm water outfall. Land use adjacent to the affected area is commercial. Canopy cover in the area is <25%.

VWC2: South of Flatbush Avenue, the water is oily and filamentous algae growth is excessive. Excess growth is not associated with a change in channel dimensions or storm water outfalls. Land use adjacent to the affected area is residential on the left bank. On the right bank is a field. Canopy cover in the area is <25%.

Basin 4400-02-1 Cemetery Brook

Total Length: 1.8 miles

Total Length Surveyed: 1.8 miles

Location: New Britain Avenue to Chandler Street

Length: 0.4 miles

Stream Corridor: The stream flows from an underground concrete tunnel and becomes day lighted at New Britain Avenue on the eastern end of the reach. The stream continues under two road crossings and is again channeled underground at Chandler Street. Riparian vegetation within 35 feet of the stream is predominantly grass and deciduous trees and shrubs. Vegetation density on both banks is moderate. Land use immediately adjacent to the stream is forest and urban residential. Within .25 mile from the stream is a school with recreational fields. Land use greater than .25 miles from the stream is urban residential.

In-Stream Habitat: The stream is classified as type F. The stream has a pool-riffle morphology. Riffles averaged 2.5 inches in depth; pool depth averaged 1.5 ft. Bank height averages 4 ft on the right, 8 ft. on the left. The substrate is predominately sand-gravel-cobble. Composition is 25-50% sand, 25-50% gravel, 25-50% cobble, and 5-25% boulder. The water is clear. Free-floating aquatic plants are found in spots. No rooted plants or planktonic or filamentous algae are evident. The stream is shaded >75% by a tree canopy. Bioassessment data indicates severely impaired water quality. Macroinvertebrates collected near Chandler Street have high pollution tolerance and include aquatic earthworms, flat worms, amphipods, aquatic sowbugs, midges, small minnow mayflies, blackflies, and riffle beetles.

Areas of Concern

- Erosion (EROS): Along the stream, the left bank is strongly undercut at various locations. Serious erosion is evident at SWO2.
- Modified Channel (MC): The stream channel is modified at the eastern and western ends of the reach where the stream flows from and into buried concrete tunnels. Just before the western end of the reach, the stream banks are armored with asphalt for approximately 250 ft. There is no evidence of sediment deposition in the stream channel and no change in active channel width due to the modification.
- Storm Water Outfalls (SWO): Two storm water outfall pipes are located on the left bank.

SWO1: A clay pipe badly broken up into several pieces. Contributing sources for SWO1 are unknown. No odors, deposits, stains, or benthic growth were evident at the outfall site.

SWO2: A concrete outfall pipe with a perched outlet. SWO2 drains a nearby road. No odors, deposits, stains, or benthic growth were evident at the outfall site.

- Trash/Debris (T/D): Scattered along the entire reach is residential trash including tires, plastic, metal, and a dirt bike. The trash has been carried in by floodwaters as well as illegally dumped. Where fallen trees and branches have created partial dams, trash has accumulated.

Location: Jordan Lane to Maple Avenue to Cedar Hill Cemetery

Length: 0.4 miles

Stream Corridor: The stream flows from Jordan Lane and travels under Maple Avenue to the north end of a small pond at the cemetery entrance. Riparian vegetation within 35 ft. of the stream is predominantly deciduous trees and shrubs. Shrub density on both banks is moderate; tree density is high. Land use immediately adjacent to the stream is suburban residential, commercial, and forest. Within .25 mile from the stream is a cemetery. Land use greater than .25 miles from the stream is suburban residential and commercial.

In-Stream Habitat: The stream is classified as type F. Based on its hydrogeomorphic classification, the stream has a pool-riffle morphology, however, at the time of the survey, the water level was low and flow was minimal. No riffles were observed. The active channel is 7 ft. wide. Right and left banks average 5 ft. in height. The substrate is over 75% silt with only 5-25% gravel. The site has an unpleasant odor. When disturbed, the sediment emits a sulfur smell, indicating aerobic conditions. Beneath the surface, the sediment is black. Rooted aquatic vegetation is found in spots. No free-floating plants or planktonic or filamentous algae are evident. The stream is shaded >75% by a tree canopy.

Areas of Concern

- Degraded Buffer (DB): From Jordan Lane to Maple Avenue (approximately 1800 ft.) the buffer is degraded on both banks. Buffer width is minimal with <15 ft. of riparian vegetation. Much of the left bank is bare ground; most of the right bank is a paved parking lot associated with a condominium complex. Dominant land cover in the area is turf/lawn.
- Storm Water Outfalls (SWO): A 3-ft. diameter concrete storm water outfall pipe is located on the right bank at Maple Avenue. The pipe outlet is at stream level. The pipe drains water from Maple Avenue. No odor or benthic growth were evident, however, a sediment delta was observed at the outfall site.
- Trash/Debris (T/D): Trash is scattered along the entire reach both on the banks and within the stream. Trash is residential and commercial and includes plastic, tires, yard waste, bricks, and cinder blocks. The bricks and cinder blocks originate from a commercial establishment (Wethersfield Building Supply) on the left bank at Maple Avenue.
- Visual Water Conditions (VWC): Throughout much of the reach water is not flowing, but stagnant. Stream water is clear and malodorous. The sediment is predominantly silt and anaerobic, emitting a sulfur smell when disturbed. Water/sediment conditions are not associated with excessive plant or algae growth or impoundment.

Location: Jordan Lane/Cedar Hill Cemetery

Length: 0.5 miles

Stream Corridor: The stream flows from a wetland and heavily wooded area on the south side of Jordan Lane through a culvert and enters a small cemetery pond through a 4-ft. stone archway. The stream exits the pond via several pipes that carry stream waters under the cemetery lawn. Riparian vegetation within 35 ft. of the stream is predominantly deciduous trees and shrubs. Vegetation density on both banks is high. Land use immediately adjacent to the stream is predominantly forest. Within .25 mile from the stream is a cemetery. Land use greater than .25 miles from the stream is suburban residential and commercial.

In-Stream Habitat: The stream is classified as type C. The stream has a pool-riffle morphology, however, at the time of the survey, most of the streambed was dry. The active channel is 21 ft. wide. Bank height averages 10 ft. on the right, 4 ft. on the left. The substrate is over 75% silt with less than 5% gravel and cobble. Rooted aquatic vegetation and filamentous algae are found in spots. No free-floating plants or planktonic algae are evident as most of the streambed was dry. The stream is shaded >75% by a tree canopy.

Areas of Concern: No areas of concern were observed.

Location: Cedar Hill Cemetery

Length: 0.2 miles

Stream Corridor: The stream flows west to east down a rocky slope. Riparian vegetation within 35 ft. of the stream is predominantly deciduous trees and shrubs. On the right bank, tree density is high; shrub density is moderate. On the left bank, tree density is moderate; shrub density is low. Land use immediately adjacent to the stream is predominantly forest. Within .25 mile from the stream is a cemetery. Land use greater than .25 miles from the stream is suburban residential and commercial.

In-Stream Habitat: The stream is classified as type A. The stream has a pool-riffle morphology, however, at the time of the survey, most of the streambed was dry. The active channel is 21 ft. wide. Bank height averages 2 ft. on the right, 3 ft. on the left. The substrate is predominantly cobble and boulder. Composition is 50-75% cobble, 50-75% boulder, and less than 5% bedrock. No aquatic vegetation or algae are evident. The stream is shaded >75% by a tree canopy.

Areas of Concern

- Degraded Buffer (DB): In the area of the outfall pipe the buffer is degraded with <15 ft. of riparian vegetation. Dominant land cover in the area is turf/lawn.
- Fish Barrier (FB): At the start of the reach, just downstream of a small cemetery pond, are five culverts that prevent upstream fish passage. Culverts are 58 ft. in length and perched 3-8 ft. above the stream bed. Two culverts are concrete; three are plastic. Concrete culverts are 2.5 ft. in diameter; plastic culverts are 1 ft. in diameter.
- Storm Water Outfalls (SWO): A 2 ft.-diameter concrete outfall pipe is located just south of the culverts on the left bank. The pipe is perched 0.75 ft. above the stream bed and drains a cemetery road. No odor, deposits, stains, or benthic growth were evident at the outfall site.

Location: S. of large lily pond in Cedar Hill Cemetery

Length: 0.3 miles

Stream Corridor: The stream flows through a wetland thick with herbaceous plants and shrubs before entering the north end of a large lily pond near the cemetery entrance. Riparian vegetation within 35 ft. of the stream is grass and deciduous trees and shrubs. Grass density on both banks is high. Shrub and tree density is moderate. Land use immediately adjacent to the stream is forest. Within .25 mile from the stream is a cemetery and commercial establishment. Land use greater than .25 miles from the stream is commercial.

In-Stream Habitat: The stream is classified as type C. The stream has a pool-riffle morphology, however, at the time of the survey, much of the streambed was dry. Standing water was seen nearer the lily pond, but no riffles were observed. The active channel is 8 ft. wide. Bank height averages 1.6 ft. on the right, 1 ft. on the left. The substrate is over 75% silt. Rooted aquatic vegetation is found in spots. No free-floating plants or planktonic or filamentous algae are evident. The stream is shaded 50-75% by a tree canopy.

Areas of Concern: No areas of concern were observed.

Basin 4404-00-3-R4 North Branch Park River

Location: Livingstone Road, Bloomfield to Hawk Drive, Hartford

Total Length: 1.5 miles

Total Length Surveyed: 0.9 miles

Stream Corridor: The stream flows from a stream confluence northeast of Livingstone Road in Bloomfield to Hawk Drive on the western edge of the University of Hartford campus. The section of stream from Livingstone Road south to Croydon Drive was not surveyed. From Croydon Drive south, riparian vegetation within 35 ft. of the stream is predominantly deciduous trees and shrubs. On both banks tree density is high and shrub density moderate. Land use within .25 miles from the stream is forest and suburban residential. Land use greater than .25 miles from the river is suburban residential.

In-Stream Habitat: The stream is classified as type C. The stream has a pool-riffle morphology. Riffle depth averaged 5 inches; pool depth averaged 16 inches. The active channel is 27 ft. wide. Bank height averages 15 ft. on the right, 5 ft. on the left. The substrate is predominantly bedrock. Composition is >75% bedrock and 5-25% each of boulder and cobble. The water is clear. No aquatic vegetation or algae are evident. The stream is shaded 50-75% by a tree canopy.

Areas of Concern

- Storm Water Outfalls (SWO): Two 2-ft. diameter concrete outfall pipes are located near the intersection of Rte. 189 (Bloomfield Avenue) and Sunny Reach Drive. The pipes are perched 6 ft. above the stream bed. No odor, deposits, stains, or benthic growth are evident at the outfall sites.

Basin 4404-00-3-R5/R6 North Branch Park River

Total Length: 4.1 miles

Total Length Surveyed: 4.1 miles

Location: University of Hartford

Length: 0.8 miles

Stream Corridor: The river flows through a gorge on the western edge of University Drive on the University of Hartford campus to the southeastern edge of campus. Riparian vegetation within 35 feet of the river varies. On both banks, shrub and deciduous tree density is moderate to high. On the right bank,

bordering parts of the university campus, turf/lawn density is moderate while grass density is low. On the left bank, grass density is moderate. No turf/lawn occurs on the left bank. Land use within .25 miles of the river is forest and commercial (a university). Land use greater than .25 miles from the river is suburban residential and forest.

In-Stream Habitat: The river is classified as type C. The river has a pool-riffle morphology. Riffle depth averaged 1.0 ft.; pool depth averaged 3.0 ft. The active channel is 45 ft. wide. Bank height averages 3 ft. on both sides. The substrate is predominantly silt-sand-gravel. Composition is 25-50% silt, 5-25% sand, 5-25% gravel, and <5% cobble. The water is clear. Rooted aquatic vegetation and filamentous algae are found in spots. No free-floating plants or planktonic algae are evident. The stream is shaded 50-75% by a tree canopy.

Areas of Concern

- **Degraded Buffer (DB):** On both banks, the buffer is degraded from north of the bridge/dam at the University Drive crossing to the southern terminus. Buffer width and existing vegetation are minimal. On the right bank, approximately 2600 ft. of buffer is degraded, with riparian vegetation averaging 15-35 ft. Dominant land covers are turf/lawn, shrub and paved areas. On the left bank, approximately 1500 ft. of buffer is degraded, with riparian vegetation averaging 35-50 ft. Dominant land covers are turf/lawn and shrub.
- **Fish Barrier (FB):** A dam and eight flood control culverts prevent fish passage at the University Drive bridge crossing. The dam is concrete with a crescent shaped spillway 60 ft. in length. Culvert pipes are 5 ft. in diameter and 60 ft. in length. Pipes are corrugated metal within concrete and ramped. At the upstream side, the lower lips of the culverts are 4.5 ft. above the water surface. A 150 ft. concrete apron acts as a velocity barrier to fish. The approximate vertical rise at the barrier is 1.5 ft.
- **Modified Channel (MC):** On the left bank, just north of storm water outfalls 1 & 2, the bank is armored with 90% concrete slabs and 10% boulders for approximately 120 ft. Armoring extends 4 ft. in height. Riparian vegetation on the left side of the stream averages 15-35 ft. in width. There is no evidence of sediment deposition in the stream channel and no change in active channel width due to the modification.
- **Storm Water Outfalls (SWO):** Four storm water outfall pipes are located along the reach. SWO1 is located on the left bank approximately 350 ft. upstream of an oxbow in the river near the southern terminus. SWO2 and SWO3 are located on the right bank just east of parking lots off of University Drive. SWO4 is located on the left bank, approximately 400 ft. downstream of the University Drive bridge crossing. All outfall pipes are concrete and drain either roads (SWO1 and SWO4 appear to drain Mark Twain Drive, a service road) or parking lots (SWO2 and SWO3). SWO4 is 2.5 ft. in diameter and perched 1.0 ft. above stream level. Other outfall pipes are 1.5 ft. in diameter and at stream level. A channel extending from SWO3 is earthen and stone. No odor, deposits, stains, or benthic growth are evident at the outfall sites.

Location: University of Hartford to Unitarian Church

Length: 0.2 miles

Stream Corridor: The stream flows from the University of Hartford campus behind the Science & Technology Magnet School and Watkinson School to just north of the Unitarian Church. Riparian vegetation within 35 ft. of the stream varies. On both banks, grass and shrub density is moderate while deciduous tree density is high. On the right bank, bordering parts of the university campus, turf/lawn and coniferous tree density is moderate. Land use immediately adjacent to the stream is forest, commercial (university and private school, and church). Within .25 mile from the stream suburban residences are

found. Land use greater than .25 miles from the stream is urban residential, suburban residential, and commercial.

In-Stream Habitat: The stream is classified as type E. The stream has a pool-riffle morphology. Riffle depth averaged 0.5 ft.; pool depth averaged 2.5 ft. The active channel is 45 ft. wide. Bank height averages 3.5 ft. on the right, 3.5 ft. on the left. The substrate is predominantly clay-sand-gravel. Composition is 25-50% clay, 25-50% sand, 5-25% gravel, and <5% cobble. The water is clear. Rooted aquatic vegetation and filamentous algae are found in spots. No free-floating plants or planktonic algae are evident. The stream is shaded 50-75% by a tree canopy. Bioassessment data indicates moderately impaired water quality. Macroinvertebrates collected behind the magnet school have moderate to high pollution tolerance and include aquatic earthworms, leeches, amphipods, snails, freshwater clams, flat-headed mayflies, water penny beetles, and riffle beetles.

Areas of Concern

- Erosion (EROS): The left bank is eroded at a meander bend approximately 300 ft. upstream of the southern terminus. The area of erosion is approximately 100 ft. in length. Bank height is 6 ft. with a 90 degree angle. Land ownership in the area is private. The erosion site is 45-60 ft. from infrastructure. The riparian buffer averages 35-50 ft. in width.
- Storm Water Outfalls (SWO)/Combined Sewer Outfalls (CSO): According to the MDC, one SWO and one CSO are located along the reach. Neither outfall was observed.

Location: Unitarian Church to S. of Albany Avenue

Length: 0.7 miles

Stream Corridor: The stream flows from behind the Unitarian Universalist Church and Knox Community Gardens to the first major meander bend downstream of Albany Avenue. Riparian vegetation within 35 ft. of the stream is predominantly deciduous trees and shrubs. On the right bank, tree and shrub density is high; on the left bank, density is moderate to high. On both banks grasses are seen in low density. Land use immediately adjacent to the stream is forest. Within .25 mile from the stream, a community garden and commercial establishments (church, private school) are found. Land use greater than .25 miles from the stream is urban and suburban residential.

In-Stream Habitat: The stream is classified as type F. The stream has a pool-riffle morphology. Riffle depth averaged 1.0 ft.; pool depth averaged 2.0 ft. The active channel is 42 ft. wide. Bank height averages 5.5 ft. on the right, 4.0 ft. on the left. The substrate is predominantly clay with some sand and gravel. Composition is 25-50% clay and 5-25% each of sand and gravel. The water is clear. Rooted aquatic vegetation and filamentous algae are found in spots. No free-floating plants or planktonic algae are evident. The stream is shaded 25-50% by a tree canopy.

Areas of Concern

- Degraded Buffer (DB): Approximately 200 ft. downstream of the northern end of the reach, behind Knox Community Gardens, the right bank is degraded for approximately 100 ft. along a steep slope. Dominant land cover at the site is shrub while up and downstream deciduous trees also dominate. Most trees at the site have been cleared. Those standing have had lower branches hewn. The riparian buffer averages 50-100 ft. at the site while on the opposite bank the buffer averages over 100 ft. Degradation of the buffer is due to tree clearing associated with the community garden.
- Storm Water Outfalls (SWO)/Combined Sewer Outfalls (CSO): According to the MDC, two SWOs and one CSO are located along the reach. Only the CSO was observed. One SWO, located at a road

crossing, was not seen due to extensive vegetation growth covering the outfall pipe. A 2 ft.-diameter concrete CSO pipe is located near where Mark Twain Drive and Dillon Road run close to the river. The pipe is slightly perched with the outfall lip covered by a thick mat of roots from nearby shrubs and trees. The pipe drains a road. Flow from the pipe was a trickle. No odor, deposits, stains, or benthic growth are evident at the outfall site.

- Visual Water Conditions (VWC): Approximately 300 ft. downstream of the northern end of the reach, behind Knox Community Gardens, the growth of rooted aquatic plants and filamentous algae is excessive. Canopy cover at the site is <25%. The area of excessive growth extends approximately 500 ft. and is not associated with storm water outfalls, impoundments, or changes in channel dimensions. Growth may be associated with decreased canopy cover coupled with the leaching of fertilizers from the community garden.

Location: S. of Albany Avenue to Farmington Avenue

Length: 2.2 miles

Stream Corridor: The stream flows from the first major meander bend south of Albany Avenue to Farmington Avenue. Riparian vegetation within 35 ft. of the stream is predominantly deciduous trees and shrubs. On the right bank tree/shrub density is moderate to high. On the left bank, tree density is moderate while shrub density is low. Land use immediately adjacent to and beyond .25 miles from the stream is urban residential and commercial.

In-Stream Habitat: The stream is classified as type C. Based on its hydrogeomorphic classification, the stream has a run morphology, however, at the time of the survey, no riffles were observed. The stream was slow moving with a glide-like morphology. Water depth averaged 1.5 to 4.5 ft. The active channel is 45 ft. wide and connected to a floodplain. Bank height averages 4.0 ft. on the right, 5.0 ft. on the left. The substrate is predominantly cobble-boulder-sand. Composition is 25-50% cobble, 5-25% boulder and sand, and <5% gravel and bedrock. The water is clear. Rooted aquatic vegetation and filamentous algae are found in spots. No free-floating plants or planktonic algae are evident. The stream is shaded 50-75% by a tree canopy. Bioassessment data indicates moderately impaired water quality. Macroinvertebrates collected near the Farmington Avenue culvert have moderate to high pollution tolerance and include flat worms, leeches, freshwater clams, snails, crayfish, amphipods, aquatic sowbugs, midges, dragonflies, flat-headed mayflies, orange head caddisflies, common net spinners, and riffle beetles.

Areas of Concern

- Degraded Buffer (DB & DB2): From Farmington Avenue to approximately 0.5 miles north of Asylum Avenue, the riparian buffer is seriously degraded for approximately 6000 ft. along the left bank. Buffer width is minimal with <15 ft. of vegetation. Along the right bank, buffer width averages 50-100 ft. with deciduous trees and shrubs as the dominant land cover. Along the affected left bank, land cover is primarily paved parking lots, three (DB2) of which have runoff channels or pipes leading to the river. Land use in the immediate area is urban residential and forested on the right bank, urban residential and commercial on the left bank.
- Fish Barrier (FB): At Farmington Avenue, a concrete dam crosses the entrance to a boxed flood control culvert that channels the river underground and through the central city district. The dam is 60 ft. in height with a 60 ft. straight spillway. Five concrete pillars rise from the dam and connect to a concrete arch at the top of the culvert. The culvert is concrete, 30 ft. in diameter, and ramped.
- Modified Channel (MC): At Farmington Avenue, both banks exhibit extensive flood control modifications near the culvert. Approximately 100 ft. of bank is armored with rip rap, concrete, and gabions. Modified banks are approximately 40 ft. in height. Riparian buffer width adjacent to the

modified section averages 15-35 ft. There is no evidence of sediment deposition in the channel and no change in active channel width due to the modification.

- Storm Water Outfalls (SWO)/Combined Sewer Outfalls (CSO)/Sewer Siphons (SS): According to the MDC, nine SWOs, one CSO, and three sewer siphons (SS) are located along the reach. Sewer siphons direct storm water beneath and away from the stream. They do not discharge to the stream. Three SWOs, one CSO, and three SSs were observed. Five SWOs are located away from the stream channel in adjacent wetlands and were not seen. Another SWO, located at a road crossing, was not seen due to extensive vegetation covering the outfall pipe.

CSO5: MDC combined sewer outfall #5 is located near the right bank just south of Asylum Avenue. The pipe is boxed in concrete with a manhole cover. No flow was observed, however, after heavy rains the sealed outfall leaks sewage and rain run off from cracks at its base.

SS1-3: Two MDC sewer siphons are located on the left bank behind a condominium building at 31 Woodland Street and behind the Classical Magnet School on Woodland Street. A third sewer siphon is located on the right bank behind the former Capitol Community College building on Woodland Street.

SWO1: A concrete storm water outfall pipe is located on the left bank near where Ashley Street meets Woodland Street. The pipe is 4.75 ft. in diameter and has an associated channel 8 ft. wide and 40 ft. long extending to the river. The channel is lined with rip rap. Sources contributing to the outfall are unknown but appear to be associated with St. Francis Hospital.

SWO2: A concrete storm water outfall is located on the left bank near Homestead Avenue. The pipe is 3.5 ft. in diameter and perched. An associated earthen channel extending to the river is 6-12 ft. wide and 60-75 ft. long. Sources contributing to the outfall are unknown.

SWO3: Approximately 500 ft. upstream of outfall pipe SWO2, is a sealed concrete outfall structure associated with the MDC municipal management system. An earthen channel associated with the outfall structure is 3 ft. wide and 60 ft. long.

APPENDIX II

In this appendix are the following:

- Project Brochure
- Welcome Letter to volunteers
- Miscellaneous handouts to volunteers at first training workshop
- Stream Survey Data Sheet Packet
- Rapid Bioassessment Data Sheet and Field Sampling Guide
- Project Evaluation Survey