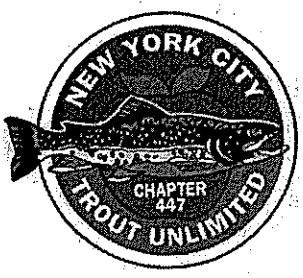
PHASE II REPORT
ALLEY CREEK TROUT HABITAT STUDY

NEW YORK CITY TROUT UNLIMITED



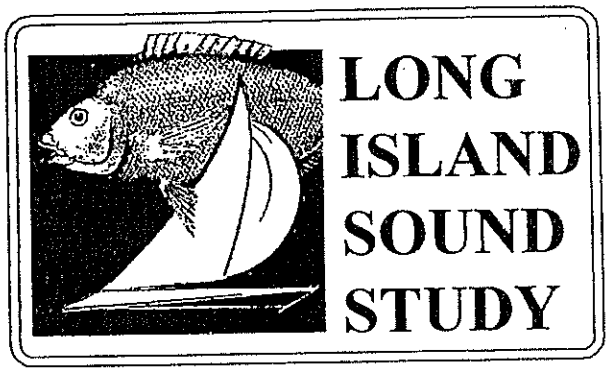
WITH FINANCIAL ASSISTANCE FROM
THE LONG ISLAND SOUND STUDY AND TROUT UNLIMITED

JULY 2002

ACKNOWLEDGMENTS

NYCTU would like to take this opportunity to thank the following individuals and organizations for supporting the second phase of the Alley Creek Habitat Study:

- Eric Thorner for identifying the potential Alley Creek project
- The Long Island Sound Study and Trout Unlimited for providing project financing
- The Alley Pond Environmental Center for providing continued encouragement.
- NYSDEC, NYCDEP and CSHFHA for making available talented and enthusiastic staff to assist in completing the field components of the study
- All of the members of the Advisory Board, especially Norman Soule and Chris VanMaaren, for their personal contributions to the project
- All of the NYCTU volunteers who participated in Phase II of the project



A Partnership To Restore and Protect The Sound

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ALLEY CREEK TROUT HABITAT STUDY

1.0 INTRODUCTION AND PURPOSE

Trout Unlimited is an approximately 100,000 member conservation organization whose mission is to conserve, protect and restore North America's coldwater fisheries and watersheds. With the assistance of volunteers in 450 local chapters, TU has organized hundreds of stream studies and habitat restoration projects over the past several decades. The New York City Chapter of Trout Unlimited (NYCTU), which has approximately 1,100 members in the five boroughs of New York City, has long supported conservation activities in the City and the metropolitan region.

Many of the creeks and streams in New York City, Long Island, Westchester and Connecticut originally were home to reproducing strains of brook trout. As the Long Island Sound watershed became increasingly urbanized, most of these trout populations suffered from the effects of human activities - such as point and non-point pollution, thermal stress, erosion and sedimentation, stream channelization, groundwater withdrawal and overfishing. While most of those ecosystems are no longer inhabited by trout, some of those streams support trout on a seasonal basis and several of the larger streams in Westchester and Long Island are nationally recognized trout fisheries with reproducing trout populations. There are also a large number of small coastal creeks in nearby Nassau and Suffolk Counties - some of which support naturally occurring trout populations.

Alley Creek is a small partially spring fed creek located in its entirety in Alley Pond Park in eastern Queens (see Figure 1) in New York City. Alley Creek, which begins at the southern end of the Park, consists of three sections - the "East Branch," which is a very short spring fed section, the "West Branch,"a longer section which drains Alley Pond and the "Main Stem," which is tidal and into which the two other sections flow. Alley Creek may have historically sustained trout and according to anecdotal information collected by staff of the Alley Pond Environmental Center (APEC), Alley Pond supported a fishery as late as the 1920's.

Some of the more recent data suggested that the Creek could be suitable as trout habitat. Stream flow data collected by the USGS from 1993 to 1999 from a gauging station on the West Branch indicated that minimum and monthly mean flow rates were reasonably consistent. Data collected by NYSDEC in the fall of 1998 indicated that in-stream water was of good quality. After observing the Creek, USGS and NYSDEC staff indicated that the habitat appeared potentially capable of supporting trout.

More importantly, Alley Creek is known to be potentially capable of supporting trout - at least during the critical summer months. In the spring of 1998, NYCTU stocked 200 hatchery raised two to three inch brook trout in the East Branch. This section of the Creek was electroshocked by New York State Department of Environmental Conservation (NYSDEC) personnel in the fall of 1998. Over fifty trout approximately six to eight inches in length were recovered. This section of the Creek was also electroshocked by NYCTU in the fall of 1999. No trout were recovered though much of the Creek including the spring pond was not accessible due to heavy vegetative growth.

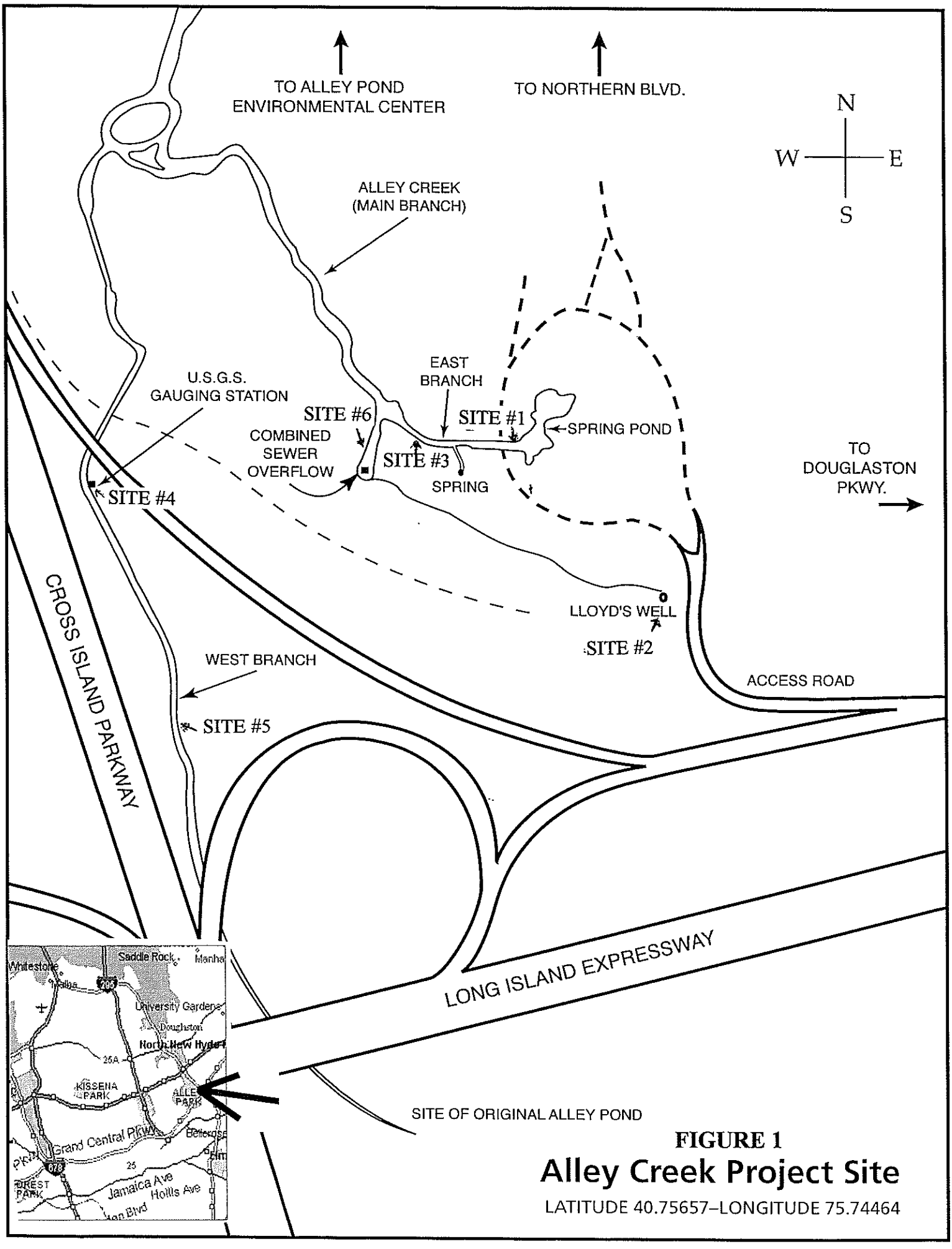

FIGURE 1

Alley Creek Project Site

LATITUDE 40.75657–LONGITUDE 75.74464

Notwithstanding the fact that trout survived in the Creek for at least six months over the summer of 1988, the Alley Creek ecosystem is very small (6" to 2' in depth, 2' to 15' in width, approximately1000' in length) and is likely to be very sensitive to environmental factors. While trout are surprising resilient, a wide variety of factors, such as point sources of pollution, stormwater runoff, pesticide spraying, drought, avian predation, salt water intrusion and angling, can have very significant impacts on the viability of any water body for trout reproduction and survival. Consequently, in the fall of 1999 NYCTU submitted grant applications to the Long Island Sound Study (LISS) and Trout Unlimited (TU) to complete a year long scientific study to determine if the Creek could be restored as trout habitat. LISS is a United States Environmental Protection Agency (USEPA) sponsored program focusing on the restoration of Long Island Sound. TU's Embrace-A-Stream program is focused on protecting and restoring trout habitat. Both LISS and TU responded positively and NYCTU completed a year long scientific study of Alley Creek beginning in the spring of 2000 and extending through the spring of 2001.

The results of the Phase I study indicated that water quality was generally good but that insufficient data was available to assess the extent to which water temperatures were within the acceptable range. Consequently, at the conclusion of the Phase I field data gathering effort, NYCTU submitted grant applications to the Long Island Sound Study (LISS) and Trout Unlimited (TU) to extend the duration of the study through the summer of 2001. Both organizations provided additional funding and the Trout Habitat Study was expanded to include a second phase. The second phase would largely consist of an additional four months of water quality monitoring, the installation of continuous water temperature monitors in selected locations, a second trial brook trout fingerling stocking and a final electroshocking event.

2.0 SUMMARY OF THE PHASE I HABITAT STUDY

2.1 Phase I Scope of Work

The scope of work for the Alley Creek Trout Habitat Study included the implementation of the following tasks:

- Collecting and evaluating historical background information on local land uses, point and nonpoint sources of pollution, sanitary and storm sewer systems, etc.
- Gathering potentially relevant information on trout ecology and stream restoration techniques
- Establishing an Advisory Committee of representatives from appropriate local and state organizations to facilitate the coalition building which would potentially be required to implement a stream restoration program
- Soliciting and training a volunteer group consisting of approximately ten NYCTU members to assist in the collection of field data
- Assessing the water quality characteristics of the Creek by implementing monthly stream water quality surveys at several locations in Alley Creek over a period of one year, including monitoring for temperature, maximum temperature, pH, dissolved oxygen, conductivity, total dissolved solids, oxidation reduction potential and turbidity utilizing portable electronic

devices, as well as measuring total nitrate, phosphate and iron concentrations utilizing Hach Stream Survey Kits

- Evaluating the biological characteristics of the Alley Creek ecosystem by implementing approximately quarterly vegetative surveys, electroshocking surveys and macroinvertebrate surveys at selected locations over the course of one year.
- Preparing photographic documentation of the Alley Creek environment (See Appendix A of the Phase I report)
- Preparing and meeting the requirements of an United States Environmental Protection Agency (USEPA) approved Quality Assurance Project Plan (QAAP) for implementing the data gathering tasks (See Appendix B of the Phase I report)
- Implementing a public relations program consisting of the preparation and distribution of approximately eighty press releases which resulted in the publication of several articles in the local and national media, including the Queens Courier, the Queens Chronicle, the Mid-Atlantic Fly Fishing Guide, Trout Magazine, the Daily News and the New York Times. The Habitat Study was also extensively covered in NYCTU's newsletter, "New York City Trout Unlimited" (See Appendix C of the Phase I report).
- Utilizing the available information to prepare a Phase I report describing the project purpose, scope of work and findings relating to the potential suitability of Alley Creek as trout habitat.

2.2 Study Participants

NYCTU was able to draw upon a diverse array of resources and technical expertise to complete Phase I of the Alley Creek Trout Habitat Study. In addition to the fiscal support of the Long Island Sound Study and Trout Unlimited, the following groups and/or individuals actively participated in the study:

2.2.1 NYCTU Project Management

Fred Thorner, NYCTU Board Member and Program Chair, served as the Project Director and Wayne Tusa, NYCTU Board Member and Conservation Chair, served as the Project Manager/QAAP Manager. Several NYCTU Board members, including Susanne Weiser, Eric Newman, Gerald Hoffnagle and Michael Parks provided management support.

2.2.2 Alley Creek Advisory Committee

NYCTU approached most of the local and state agencies that were perceived to have some jurisdiction over or potential interest in the project. Almost without exception, the response was positive with many individuals expressing interest in providing support. To avail the project of this expertise and to foster a cooperative team building effort, NYCTU extended invitations to the following individuals to participate as members of an Alley Creek Advisory Committee. Many of these individuals attended a project orientation meeting and participated in a site tour in May of 2000.

Name	Title	Affiliation
William Neiter	President	Alley Pond Environmental Center
	Director, Environmental Studies	St. John's University
Irene Schied	Director	Alley Pond Environmental Center
Dave Lipsky	Deputy Chief, Watershed Operations	NYCDEP
Chris VanMaaren	Urban Fisheries Biologist	Region 2, NYSDEC
Dana Gumb	Director, Staten Island Bluebelt	Region 2, NYSDEC
Greg Koslowski	Fisheries Biologist	Region 1, NYSDEC
Dick Cartwright	Water Resources	United States Geological Survey
Patricia Martinkovic	Refuge Manager	US Fish and Wildlife Service
Mark Matsil	Director, Natural Resources Group	NYC Parks Department
Dave Thompson	President	TU Art Flick Chapter
Ed Vallerie	President	TU Mianus Chapter
Norman Soule	Director	Cold Spring Harbor Fish Hatchery and Aquarium

2.2.3 External Technical Support

Several environmental organizations and government agencies provided staff support for various field data gathering activities. These included the following organizations and participating staff:

Organization	Participants	Technical Support
Cold Spring Harbor Fish Hatchery and Aquarium	Norman Soule, Keith Holley	Implemented the electroshocking surveys, supported the water quality sampling efforts
NYCDEP	Charles Olson, Martin Rosenfeld	Implemented the macrobiotic surveys
NYSDEC	Chris VanMaaren	Served as Field Manager for most of the water quality sampling efforts

2.2.4 NYCTU Volunteers

A team of NYCTU volunteers actively participated in the study by attending the project orientation meeting/site tour, as well as by gathering background information; providing field assistance in completing the water quality, macrobiotic, vegetation and/or electroshocking surveys; implementing the public relations program and/or photodocumenting the site. These individuals included Seymour Algus, Owen Beglane Jr., Mike Blasco, Richard Comerford, Lisa Daniels, Mike Franek, Kevin Gerrard, Marvin Glass, Gerald Hoffnagle and JD Struckman.

2.3 Phase I Findings

The following sections provide a summary of the results of the implementation of the Phase I tasks. More detailed information was provided in the Phase I Appendices or retained in the project files.

2.3.1 Current Alley Creek Setting

Alley Pond Park is a New York City public park consisting of 635 acres of woodlands, meadows and fresh and salt water marshes. The Park is surrounded by densely developed residential and commercial areas, except for Little Neck Bay to the north. Several highways, including the Long Island Expressway, the Cross Island Parkway and Northern Boulevard, transect or are adjacent to the Park.

A key feature of the Park is the Alley Pond Environmental Center (APEC). APEC is a not for profit organization whose mission is to provide family oriented environmental education utilizing the Alley Pond Park environs as a learning center, to build public support for the preservation of parks and open space and to advocate for progressive environmental policies and environmentally sound lifestyles. The Center, which incorporates an array of nature exhibits, is located at 228-06 Northern Boulevard at the north end of the Park.

Alley Creek, consists of three sections - the "East Branch," a very short spring fed section, the "West Branch," which drains Alley Pond and the "Main Stem," which is tidal. The East Branch begins at what appears to be a small played out spring pond located just to the north of an access road for the Long Island Expressway. The spring pond appears to be shallow and is heavily vegetated in the summer months. Stream flow in the East Branch originates from the spring pond and appears to be largely spring fed given the presence of an artesian spring in the streambed about halfway to the Main Stem to the west. The East Branch is five to fifteen feet wide and six inches to one foot deep. The East Branch has a sandy bottom and flows along the edge of a phragmite marsh.

The West Branch begins at the outlet of Alley Pond just south of the Long Island Expressway, is routed beneath the intersection of the Expressway and the Parkway and finally drains to the south to the Main Stem along the east side of the Parkway. Stream flow in the West Branch appears to be a combination of outflow from Alley Pond, runoff from the Cross Island Expressway and possibly spring flow. The West Branch is five to fifteen feet wide and six inches to two feet deep. The West Branch has a mucky bottom and is largely shaded. Some of the stream bottom exhibits an orangish discoloration which would be consistent with high levels of iron. The surrounding habitat consists of a wide variety of native and non-native shrubs and trees.

The Main Stem begins at a large stormwater outflow device located to the north of the access road noted above. The flow in the Main Stem is comprised primarily of stormwater runoff from the surrounding highway system, flow from an uncapped artesian well located approximately 200 feet to the west and flow from the East and West Branches. Except for a small pool located at the stormwater outflow, the Main Stem has a mucky bottom, is tidally influenced, is surrounded by a phragmite marsh and discharges to Little Neck Bay and ultimately the Long Island Sound.

Alley Pond, which is now a phragmite marsh, was reduced in size by the construction of the Long Island Expressway in the mid 1950's. The Pond is scheduled to be restored as part of the planned upgrading of the Cross Island Parkway. Restoration is to consist of dredging the pond, removing the phragmites, rebuilding the outflow weir and reestablishing emergent vegetation.

2.3.2 Historical Setting

Alley Pond Park was never intensively developed apparently due to the presence of tidal wetlands. However, a blacksmith shop, grist mill, post office and general store were reportedly constructed at varying times within the park boundaries. By the twentieth century, the surrounding area had been extensively developed for a broad array of residential, commercial industrial and transportation uses. The Park itself was substantively impacted by the construction of the Long Island Expressway and the Cross Island Parkway - which reportedly included the placement of large quantities of road construction fill in the southern portion of the Park.

To provide additional information on the historical development of the Park, historical topographic maps (see Appendix D of the Phase I report) and aerial photos (see Appendix E of the Phase I report) were procured for the Park and surrounding area. An 1897 topographic map depicts the surrounding area as largely undeveloped and the Park as wetland. A 1954 topographic map shows the original configuration of Alley Pond and what appear to be manmade drainage channels in the middle and northern portions of the wetlands in the Park. A 1968 topographic map depicts the Park after the Long Island Expressway was constructed.

Historical aerial photos were available at a scale of 1" equals 750 feet or 1" equals 833 feet for 1954, 1966, 1876, 1980 and 1994. The 1954 photo shows the original configuration of Alley Pond, the original location of the West Branch and what may be the spring pond and the East Branch. A 1966 photo shows what appears to be a vegetated Alley Pond, the new location of the West Branch and what appears to be a southward flowing creek from the spring pond. A 1976 photo shows the stormwater overflow structure at the head of the Main Stem, the East Branch flowing to the west and the junction of the both branches with the Main Stem further to the north. A 1980 photo show the East Branch discharging to the Main Stem approximately where it is at the present time. A 1990 photo is consistent with the current configuration of the East and West Branches and the Main Stem.

2.3.3 Local Water and Sewer Systems

NYSDEC provided a partial set of water and sewer plans for the Alley Creek area. Historically, large areas of New York City were sewered with combined sewers, which transport sanitary wastes and stormwater runoff. Over time, the City installed separate storm and sanitary sewer systems. The available plans indicate that some of the stormwater generated in areas immediately adjacent to the Park is discharged directly into wetlands or surface waters in the Park. The plans also show a very large storm sewer, apparently constructed between 1955 and 1959, which discharges to the west from the vicinity of a sanitary wastewater pump station located approximately 200 feet uphill of the East Branch spring pond. Presumably this sewer routes runoff from the Expressway to the stormwater

outlet located at the head of the Main Stem. The available plans also indicate that a "temporary" grit chamber and stormwater outlet were constructed prior to 1955 at approximately the same location as the sanitary pump station. The outlet appears to have been routed to Alley Creek somewhere in close proximity to the current location of the spring pond. The available plans indicate that sanitary wastewater in the vicinity of the southeastern portion of Alley Pond Park is routed to the above pump station. A 1945 plan also depicts a "tide gate/dam" on Alley Creek at the northern end of the Park. And finally, the plans indicate the presence of an eight inch water main running inside the easterly boundary of Alley Pond Park and potentially crossing beneath the East Branch in the vicinity of the spring pond. These plans were retained in the project files.

2.3.4 Potential Sources of Pollutants to Alley Creek

Water quality in Alley Creek is potentially impacted by a variety of point and non-point sources of pollutants. Water quality in the West Branch and the Main Stem is directly influenced by surface runoff from the highway system. Water quality in the Main Stem is also significantly impacted by tidal influences. Given the presence of a number of natural springs in the Alley Pond area, water quality in the East Branch, and to some extent the West Branch, is likely impacted by groundwater quality.

To assess the potential impact of point sources of pollutants on Alley Creek, on behalf of NYCTU Environmental Data Resources, Inc. (EDR) completed a computerized database search for Alley Pond Park and the immediately surrounding area utilizing standard ASTM search distances (ranging from one eighth to two miles depending on the database). This search accessed a variety of federal and state regulatory databases to identify potential environmental contaminant sources (i.e., known spills and leaks, underground tanks, hazardous waste disposal sites, solid waste landfills, environmental permits, etc.) in the Park or in close proximity to the Park. The Executive Summary of the database search was provided in Appendix F of the Phase I report. The full report was retained in the project files.

Alley Pond Park was not identified in any of the databases. However, as is the case in most urban areas, numerous other locations were identified in one or more of the databases. For example, within the search distances, the database search identified three large quantity hazardous waste generators, four small quantity hazardous waste generators, two hazardous waste disposal sites, seventeen leaking underground tanks and twenty two properties with underground storage tanks. While these databases do not provide sufficient information to determine to what extent soil and/or groundwater may have been impacted at any of these locations, at almost all of the identified sites where releases are known to have occurred, the releases consisted of relatively small quantities of materials and/or corrective action was undertaken. In addition, none of the locations identified in the database search were within one quarter mile of the East or West Branches and the majority of the identified locations were to the north of the Park along Northern Boulevard - which is topographically downgradient of the fresh water portion of Alley Creek.

2.3.5 Water Quality Surveys

The Phase I Study included water quality monitoring at approximately monthly intervals at selected locations in Alley Creek starting in June of 2000 and ending in May of 2001. A staff person from either NYSDEC or the Cold Spring Harbor Fish Hatchery and Aquarium (CSHFHA) served as Field Manager for each monitoring event. With the assistance of NYCTU volunteers, portable water quality monitors or Hach Test Kits were utilized at selected locations in the Alley Creek system to evaluate water quality for indicator parameters as follows:

Parameter	Model	Precision	Accuracy	Measurement Range
Temperature	Orion 106	0.1 C	1 C	-50 to 150 C
Max. Temperature	Davis T7600	1.8 F	1.8 F	30 to 220 F
pH	pH Tester 2	0.1 pH	0.1 pH	-1.0 to 15.0 pH
Conductivity	Orion 116	10 uS/cm	2%	1990 uS/cm
TDS	Orion 112	10 ppm	2%	1990 ppm
ORP	Orion 108	1 mV	5 mV	999 mV
Dissolved Oxygen	HI 9142	0.1 ppm	1.5%	0.0 to 19.9 ppm
Turbidity	Model 800	0.05 NTU	2%	0 to 199.9 NTU
Nitrate	Hach Kit	0.02 mg/l	10%	0 to 10 mg/l
Phosphates	Hach Kit	0.02 mg/l	10%	0 to 50 mg/l
Iron	Hach Kit	0.01	10%	0 to 10 mg/l

With the exception of the TDS meter (which failed and was replaced), the DO meter (which indicated incorrect dissolved oxygen measurements during the colder winter months) and the maximum temperature recording thermometers (which were not recovered after the first major storm event), the above equipment performed as expected.

Water quality was surprisingly good in all three sections of the Creek except for the discharges from the stormwater outflow to the Main Stem and the occasional presence of visible oil sheens on the West Branch - most likely due to the Cross Island Parkway reconstruction project which began in the summer of 2000. The monitored levels of conductivity, TDS, ORP and turbidity levels were low to acceptable, as were the concentrations of nitrates, phosphates and iron. The pH levels were neutral. Dissolved oxygen levels ranged from a low of 4.4 ppm to a high of 13.6 ppm - with DO concentrations ranging from 6.0 to 9.0 ppm during the summer months. The preferred range is greater than 5.0 ppm.

Water temperature during the Phase I sampling events was generally within the acceptable range (60's and low 70's) in all three Creek sections during the summer sampling events. However, the maximum temperature thermometers indicated maximum temperatures in the low 80's in August of 2000. While trout can survive higher temperatures for short periods of time, trout require temperatures under 70 to 75 degrees Fahrenheit to sustain growth. Since maximum recording thermometers do not provide information on temperature variation with time, it was unclear what the actual temperature profiles were in the Creek were during the month of August. A summary of the field data was provided in Appendix G of the Phase I report. The original field data sheets were retained in the project files.

2.3.6 Creek Habitat Surveys

During each Phase I water quality monitoring event, NYCTU volunteers completed physical surveys at each monitoring location. Pertinent data on the type of stream habitat (riffle, pool, glide), adjacent vegetation, the extent of the overhead canopy, relative stream flow rates, streambed composition, etc. were recorded on Physical Survey Field Sheets. A representative sample from one of the monitoring events was provided in Appendix H of the Phase I report. The original field data sheets were retained in the project files.

2.3.7 Macroinvertebrate Surveys

An additional approach that can be utilized to evaluate aquatic habitat and water quality is to sample macroinvertebrate populations. Better habitat and water quality are typically associated with the greater abundance and diversity of benthic organisms. NYCDEP staff, with the assistance of NYCTU volunteers, completed macroinvertebrate surveys at four locations, the East Branch spring pond, East Branch, West Branch and Main Stem, in June, September and December of 2000 and March of 2001. Two meter kick samples were collected from three creek locations and a sweep net sample was collected from the swing pond. A sample was not collected from the Main Stem in September due to tidal flooding. The samples were preserved in ethyl alcohol and returned to NYCDEP's laboratory for sorting and identification.

The macroinvertebrate survey (see Appendix J of the Phase I report) indicated that the spring pond harbors a fairly diverse invertebrate community dominated at different times by Amphipods (scuds), Chironomids (midges), Gastropods (snails), Odonata (damselflies), Lepidoptera (moths) and Oligochaeta (bristle worms). A small population of Ephemeroptera (mayflies) was present in the spring pond in June. The East Branch invertebrate population was less diverse than the spring pond and was dominated at different times by Chironomids (midges), Amphipods (scuds), Oligochaeta (bristle worms) and Gastropods (snails). A small population of Trichoptera (caddisflies) was present in September. The West Branch invertebrate population consisted almost entirely of Oligochaeta (bristle worms) and Chironomids (midges). The Main Stem invertebrate community was even less diverse, consisting almost entirely of Oligochaeta (bristle worms).

The survey indicated that the available invertebrate biomass in the Alley Creek system was the highest in the spring pond and the East Branch. The available biomass was substantively lower in the West Branch. At all locations, relative abundance was highest in June with substantially less biomass available in December and March.

2.3.8 Electroshocking Surveys

Staff from the CSHFHA, assisted by NYCTU volunteers, completed electroshocking surveys (see Appendix K of the Phase I report) in selected portions of the East Branch spring pond, East Branch, West Branch and Main Stem in June, September and December of 2000 and March of 2001. In summary, the sampled aquatic life consisted primarily of elvers, eels and killies in the spring pond;

elvers, eels, killies and 9 spined sticklebacks in the East Branch, elvers, eels and killies in the West Branch and elvers, eels, killies and green frogs in the Main Stem. A small number of aquatic worms, leeches and turtles were also identified. The bulk of the sampled aquatic life consisted of elvers, eels and killies. Sticklebacks are normally found in clean cool stream habitats.

2.3.9 Vegetative Surveys

Vegetation surveys (see Appendix J of the Phase I report) were completed by NYCTU volunteers in June and December of 2000 and March of 2001 in close proximity to all three sections of Alley Creek. In summary, the vegetation that was present along each Creek section is largely dependant on two factors - relative elevation and the extent to which human intervention has impacted the native vegetation. The East Branch and the Main Stem are both located at slightly higher elevations than that of the tidal estuary into which the Main Stem discharges. While neither of these sections appears to be within the zone of salt water inundation that affects most of the estuary, except under extreme weather conditions, the immediate environs of the East Branch and the Main Stem are dominated by phragmite populations. As a consequence, plant diversity is limited and overhead cover, except at the head of the Main Stem, is limited. Nearby areas are at a slightly higher elevations, potentially as a consequence of historical filling activities, and the plant communities consisted of overgrown meadows with a mix of indigenous and introduced vegetation.

The West Branch is located at a higher elevation than the East Branch. While there apparently has been extensive filling and regrading along the of the West Branch largely due to the construction of the Cross Island Parkway, most of this Creek section is bordered by a mix of native and non-native deciduous scrubs and trees. As a consequence, overhead cover was reasonably dense during the summer months.

2.4 Phase I Conclusions and Recommendations

The results of the Phase I Habitat Study were very encouraging. Water quality was surprisingly good except for the discharges from the stormwater overflow at the head of the Main Stem and the oil sheens on the West Branch. Dissolved oxygen levels were good with in-stream concentrations of six to nine ppm during the summer months. A moderately diverse macrobiotic community exists in the East Branch. Water temperature was well within the acceptable range during the Phase I sampling events. However, the maximum temperature thermometers (which record the highest temperature reached between sampling events) indicated maximum temperatures in the low 80's in August in the East Branch. While trout can survive higher temperatures for short periods of time, trout require temperatures under 75 degrees Fahrenheit to sustain growth. With respect to this issue, perhaps the most relevant information is the fact that trout not only survived but appeared to thrive in the East Branch in the summer of 1998. The most obvious explanation is that areas of cooler water may exist in the Creek due to spring seeps. Along those lines, water temperature in the adjacent artesian well (Site #2) was consistently at 55 degrees Farenheit.

Given the above, the Phase I report concluded that Alley Creek appears to have potential as trout habitat. However, additional data is needed to assess the temperature issue. Therefore NYCTU proposed to extend the duration of this study to through the summer of 2001. The scope of this additional effort would include implementing the existing water quality monitoring program for an additional four months as well as installing continuous temperature monitoring recorders at selected locations in the East and West Branches. This additional information would provide a much better assessment of the extent to which dissolved oxygen and temperature might be limiting factors and the extent to which these factors need to be addressed in any forthcoming stream restoration program. In addition, NYCTU proposed to complete an additional trial stocking of trout fingerlings in the late spring to be followed by an electroshocking survey in the late summer. The stocking would hopefully provide empirical verification of the scientific conclusions to be drawn from the Phase II water quality and temperature monitoring effort.

3.0 PHASE II SCOPE OF WORK

As noted, NYCTU submitted grant applications to the Long Island Sound Study (LISS) and Trout Unlimited (TU) to extend the duration of the habitat study through the summer of 2001. Both organizations provided additional funding and the scope of the resulting Phase II effort included:

- Implementing the water quality monitoring program for an additional four months
- Installing continuous temperature monitors at selected locations in the East and West Branch
- Completing an additional trial stocking of trout fingerlings in the East Branch in concert with TGF's Trout-in-the-Classroom Program (See Appendix A for photo documentation)
- Implementing an electroshocking survey of the East Branch at the end of the summer
- Continuing the public relations program (See Appendix B)
- Utilizing the resulting information to prepare a Phase II report describing the project purpose, the Phase I and Phase II findings and conclusions and recommendations relating to the potential suitability of Alley Creek as trout habitat.

With the exception of the substitution of continuous water temperature monitors for the maximum recording thermometers, essentially the same resources and procedures that were utilized in Phase I to gather data were utilized in Phase II.

4.0 PHASE II STUDY FINDINGS

The following sections provide a summary of the results of the implementation of the Phase II tasks. As appropriate, more detailed information is provided in the Appendices or retained in the project files.

4.1 Changes in Alley Creek Setting

During the summer of 2000, the New York State Department of Transportation began a substantive construction project to improve the Cross Island Parkway in the vicinity of the Parkway's intersection with the Long Island Expressway. This resulted not only in apparent impacts on water quality in the

West Branch (the oil slicks reported in the Phase I report) - but also a direct physical impact on the West Branch since the portion of the West Branch in close proximity to the above intersection (approximately 200 to 300 feet of stream bed) was channelized as part of the construction program. In addition, an upland area just north of the access road to the Expressway which is topographically upgradient of the Main Stem and the East Branch was used for heavy equipment staging. The above activities may have resulted in additional stream sedimentation and/or minor changes in surface runoff patterns. As a consequence of the construction activities and the difficulties physically accessing the upper portion of the West Branch, water quality monitoring was only completed in the lower portion of the West Branch during Phase II.

4.2 Water Quality Surveys

The Phase II Habitat Study included water quality monitoring at approximately monthly intervals at selected locations in Alley Creek starting from June to September of 2001. A staff person from NYSDEC served as Field Manager for each monitoring event. With the assistance of NYCTU volunteers, portable water quality monitors or Hach Test Kits were utilized at selected locations in the Alley Creek system to evaluate water quality for indicator parameters. A summary of the field data is provided in Appendix C. The original field data sheets, including Physical Survey Field Sheets, have been retained in the project files.

Water quality continued to be surprisingly good in all three sections of the Creek. The monitored levels of conductivity, TDS, ORP and turbidity levels were low to acceptable, as were in stream concentrations of nitrates, phosphates and iron. The pH levels were slightly below neutral to neutral. Dissolved oxygen levels ranged from a low of 4.8 ppm to a high of 9.9 ppm - with DO concentrations typically in the 6.0 to 8.0 ppm range. The preferred range is greater than 5.0 ppm. Water temperatures were excellent - ranging from 55 to 69 degrees Farenheit in all three Creek sections during the summer sampling events.

4.3 Continuous Water Temperature Monitoring

To more accurately assess the range of water temperatures in Alley Creek, continuous temperature data loggers (Onset StowAway Tidbits) were securely installed on the stream bottom at four locations in Alley Creek. These locations included the East Branch spring pond, the East Branch just upgradient of the in stream artesian spring, the East Branch just above the intersection with the Main Stem and the USGS gauging station at the lower end of the West Branch. The data loggers were installed on 6/26/01 and removed on 9/20/01. The data loggers were set to record temperature every 30 minutes during the intervening period. At the end of the sampling period, the data from each datalogger was downloaded utilizing Boxcar Version 3.6 software. This data is provided graphically in Appendix D.

The available data indicates that water temperatures in Alley Creek are generally suitable for trout habitat. Water temperatures in the spring pond ranged from 55 to 63 degrees Farenheit over the entire sampling period. Water temperatures in the East Branch just upgradient of the in stream artesian spring ranged from55 to 70 degrees over the entire sampling period. Water temperatures in the East

Branch just above the intersection with the Main Stem generally ranged from 55 to 75 degrees, however there were three or four short duration periods during which water temperatures ranged from 75 to 79 degrees. Water temperatures in the West Branch ranged from 57 to 70 degrees, however there were one or two events where water temperatures ranged from 75 to 80 degrees. These higher temperature events appear to have occurred as a consequence of storm events.

4.4 Brook Trout Fingerling Stocking

In late April of 2001, approximately 200 two to three inch brook trout fingerlings were released in the East Branch. These trout were raised in cold water aquariums by teachers and students from the John Bowne High School in Flushing, Queens. The school was participating in the Theodore Gordon Flyfishers' Trout-In-A-Classroom program in which participating classes raise trout from fertilized eggs for release in local streams. The purpose of releasing trout fingerlings into Alley Creek was to further assess the viability of the Creek as trout habitat. As previously noted, Appendix A includes photographs of the stocking event.

4.5 Electroshocking Survey

To assess fingerling survival, on September 23, 2001 staff from the CSHFHA, assisted by an NYCTU volunteer, completed an electroshocking survey of the entire East Branch with the exception of most of the spring pond and the Main Stem adjacent to the stormwater outfall. In summary, the sampled aquatic life consisted primarily of eels and killies in the East Branch and eels, killies and green frogs in the Main Stem. No brook trout were recovered. The electroshocking results are provided in Appendix E.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The implementation of a stream restoration program which resulted in restored trout populations in a stream in the City of New York would be considered an enormous success and the methods and procedures developed therein would have applicability to similar settings throughout the Long Island Sound watershed. Consequently, the results of the Phase II study were very encouraging - particularly for the East Branch. While the Main Stem will clearly never be suitable trout habitat and the West Branch is currently not suitable as trout habitat due to the highway construction, the impact of stormwater runoff on water quality and the limited macroinvertebrate community, the conditions in the East Branch are much more consistent with trout habitat. Water quality and dissolved oxygen levels are within the acceptable range. Water temperatures are excellent with the possible exception of large storm events. A moderately diverse macrobiotic community also exists. While that community is atypical of many trout habitats, as a community it is probably not that distinct from the benthic communities in the small creeks inhabited by trout in similar ecosystems on Long Island. However, the East Branch ecosystem is very small, there is very little in stream cover and predation levels are likely to be high. As a consequence, it is clear that the East Branch is currently marginal trout habitat. This likely explains why the 1998 stocking was so successful while the stocking in 2001 was not - since even relatively minor changes in such a habitat could affect its ability to sustain trout.

Given the above, NYCTU has reevaluated its objectives for the Alley Creek project. As originally envisioned, NYCTU's objective was to restore Alley Creek such that a self reproducing population of trout would be established. However, NYCTU has realized that a non-sustaining trout population, one in which periodic stockings might be required, would also have significant value given the setting in which Alley Creek is situated. More specifically, through the efforts of the Alley Pond Environmental Center, Alley Pond Park serves as a nature learning center for a large number of children and adults - few of whom have had the opportunity to view a trout or a trout habitat up close. As a consequence, NYCTU's objectives now include not only restoring the East Branch as self reproducing trout habitat - but as an interim objective - restoring the East Branch for use as a "trout in the field" learning facility - to be utilized in concert with APEC's other educational initiatives.

Fortunately, given that water quality, dissolved oxygen content and temperature levels are generally acceptable, most of the other factors which limit the capacity of the East Branch to function as viable trout habitat can likely be mitigated via the implementation of an appropriate stream restoration program. A large number of restoration approaches are commonly utilized in cold water stream restoration ranging from minor modifications to the stream environment to complete reconstruction of the stream channel and the adjacent stream banks. Depending on the restoration objectives, various approaches can be used to increase stream depth or current velocity, stabilize stream banks, promote the growth of native vegetation, provide in stream cover, maximize available shade and minimize the impact of stormwater runoff. Implementation of an appropriate set of restoration approaches can result in reduced water temperatures, increased dissolved oxygen levels, improved water quality, increased food supply and improved protection from predation - all of which would significantly contribute to the viability of the East Branch as a "trout in the field" learning facility and as a self sustaining trout habitat.

To achieve the above objectives, NYCTU proposes to complete a preliminary engineering assessment of the stream restoration approaches that might be utilized to restore the East Branch. The scope of this effort would likely include:

- Identifying potential stream restoration approaches - ranging from minor modifications to the current stream environment to complete reconstruction of the stream channel and the adjacent stream banks - including potential approaches for implementing a "trout-in-the-field" educational facility, such as habitat viewing areas, stream viewing stations, descriptive signage and indoor exhibits at APEC.
- Detailed evaluation of the above approaches with respect to anticipated results and likely costs.
- Development of recommended stream restoration plans for both the "trout-in-the-field" educational objective and the self reproducing trout population objective - including projected costs
- Preparation of a recommended implementation plan, including identification of potential funding strategies and sources and a proposed schedule

Given the technical complexity of these issues, NYCTU anticipates supplementing the expertise of the NYCTU volunteer team with the services of an expert in coastal stream restoration.