

DRAFT
FISH PASSAGE FEASIBILITY EVALUATION
RAHWAY RIVER WATER SUPPLY DAM
RAHWAY, NEW JERSEY



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TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
EXECUTIVE SUMMARY		1
1. INTRODUCTION.....		2
1.1	OBJECTIVE.....	2
1.2	BACKGROUND.....	3
2. METHODOLOGY.....		4
2.1	DETAILED UTILITY SEARCH	4
2.2	FISHERIES SURVEY.....	5
2.3	COORDINATION WITH THE NJDEP OFFICE OF DAM SAFETY	6
2.4	STAKEHOLDER MEETING	6
2.5	LONG-TERM OWNER DETERMINATION.....	6
2.6	USGS GAGING STATION COORDINATION	6
2.7	PERMITTING PRE-APPLICATION MEETINGS.....	7
2.8	ENDANGERED AND THREATENED SPECIES SURVEY	7
2.9	CULTURAL RESOURCES SURVEY	7
2.10	FISH LADDER CONCEPTUAL DESIGN AND 30% COST ESTIMATE	7
3. RESULTS		8
3.1	DETAILED UTILITY SEARCH	8
3.2	FISHERIES SURVEY.....	8
3.3	COORDINATION WITH THE NJDEP OFFICE OF DAM SAFETY	9
3.4	STAKEHOLDER MEETING	9
3.5	LONG-TERM OWNER DETERMINATION.....	10
3.6	USGS GAGING STATION COORDINATION	10
3.7	PERMITTING PRE-APPLICATION MEETINGS.....	10
3.8	ENDANGERED AND THREATENED SPECIES SURVEY	11
3.9	CULTURAL RESOURCES SURVEY	11
3.10	FISH LADDER CONCEPTUAL DESIGN AND 30% COST ESTIMATE	12
4. EVALUATION AND APPLICABILITY OF RIVER HERRING STOCKING PROGRAMS.....		13
4.1	OPINIONS ON THE EFFECTIVENESS OF RIVER HERRING RESTOCKING	14
4.2	EXAMPLE RESTOCKING EFFORTS	15
4.2.1	<i>Project Name: Anacostia Tributary System River Herring monitoring/Reconnaissance Larval Stocking Project.....</i>	<i>15</i>
4.2.2	<i>Project Name: River Herring Restoration Project, Bronx River, NYC.....</i>	<i>17</i>
5. SUMMARY		18
6. RECOMMENDATIONS AND PATH FORWARD		19
7. REFERENCES.....		21

LIST OF TABLES

<u>Table</u>	<u>Title</u>
1	Fish Sampling Summary
2	Underground Utility Survey Summary
3	Fish Collection Summary
4	Ichthyoplankton Identification Summary
5	Bypass Channel Cost Estimate
6	Steeppass Channel Cost Estimate

LIST OF FIGURES

<u>Figure</u>	<u>Name</u>
1	Site Location Map
2	Fish/Ichthyoplanton Sampling Location Map
3	Detailed Utility Location Map

LIST OF APPENIDICES

<u>Appendix</u>	<u>Title</u>
A	Site Photographs
B	Conceptual Design Plans

LIST OF ATTACHMENTS

<u>Attachment</u>	<u>Title</u>
1	Scientific Collection Permit
2	Quality Assurance Project Plan
3	Underground Utility Survey Report
4	Dam Safety Permit Application
5	Union County Support Letter
6	USGS Concurrence Letter
7	NJDEP Permit Coordination and Env. Review Program Response
8	Natural Heritage Data Response Letter
9	Cultural Resources Survey Results
10	Cost Estimate Documentation
11	River Herring Stocking Programs Summary



EXECUTIVE SUMMARY

Under a grant provided in 2007 by the United States Environmental Protection Agency (USEPA) New York New Jersey Harbor Estuary Program (HEP), Weston Solutions Inc. (Weston®) has prepared this Fish Passage Feasibility Evaluation of the Rahway River Water Supply Dam in Rahway, New Jersey (NJ) focusing on recommendations and data gaps identified during the *Final Preliminary Fish Passage Feasibility Evaluation for the Rahway River Water Supply Dam, Rahway, New Jersey* completed in March 2006 (Weston, 2006). The dam is located on the Rahway River immediately south of the Union County Rahway River Park and encompasses HEP restoration sites AK3J and AK3K. These locations were previously identified by the HEP as high priority restoration sites. The dam is operated by United Water, Inc. who leases the facility from the City of Rahway.

The objective of this evaluation was to conduct continued assessment of the feasibility of anadromous and catadromous fish passage at the Rahway Water Supply Dam in Rahway, NJ. Specifically, this evaluation focused on the following recommendations from the 2006 Preliminary Feasibility Evaluation, including preparation of a Conceptual Design and 30 % Cost Estimate.

The study indicated that while there are hurdles to the potential installation of a fish ladder at the Water Supply Dam location, the project is generally feasible. Based on the previous investigations conducted by New Jersey Department of Environmental Protection (NJDEP), the United States Army Corps of Engineers (USACE), and the fishery survey conducted in the spring of 2008, the most important biological issue is the apparent lack of currently migrating anadromous fish to the proposed project river reach. This observation is consistent with what has been observed in recent years elsewhere within the Rahway River, as well as other urban rivers in the northern portion of the state (Shawn Crouse NJDEP Division of Fish and Wildlife, personal communication). Because of these trends, significant efforts in this region have been undertaken by numerous parties indicating that stocking and imprinting of fish may be a viable means of restoring runs of anadromous fish to the river. Section 4.0 of this report provides information regarding river herring stocking programs throughout the Northeast region.

Other specific obstacles that need to be overcome include potential alteration of the USGS gage station downstream of the Water Supply Dam, as well as construction issues related to the presence and location of buried underground utilities within the path of both proposed fish ladder design alternatives. If these concerns are sufficiently addressed, the project is likely to be successful and meet restoration based fish passage goals while allowing the dam to operate in its current capacity.

Following approval of this Feasibility Evaluation by regulatory agencies and stakeholders, a lead agency needs to be confirmed and construction funds raised in order to conduct the engineering, permitting, and construction activities presented in the conceptual design, cost estimate and recommendations (Section 6).

1. INTRODUCTION

The United States Environmental Protection Agency (USEPA) New York-New Jersey Harbor Estuary Program (HEP), in coordination with the New England Interstate Water Pollution Control Commission (NEIWPCC), has provided funding for Weston Solutions Inc. (Weston®) to conduct additional field studies, coordination activities, and conceptual restoration design services for potential fish passage improvements at the Rahway River Water Supply Dam, Rahway, New Jersey. The project is supported by the Rahway River Association (RRA), the County of Union, NJ, the City of Rahway, NJ, and United Water, Inc., the Water Supply Dam operator.

This project builds on work conducted with grant for \$15,000 from the New York-New Jersey Harbor Estuary Program (HEP) in 2005 for a preliminary evaluation of this HEP site as a potential fish ladder location. Weston provided a \$15,000 matching contribution for that effort, which included several elements including project planning, collection and review of existing data, a preliminary underground utility search, a topographic survey of the site, geotechnical borings and analysis, and a screening evaluation of fish passage alternatives. These efforts resulted in the *Final Preliminary Fish Passage Feasibility Evaluation for the Rahway River Water Supply Dam* (Weston, 2006). In 2007, Weston, on behalf of the Rahway River Association (RAA), was awarded a second HEP grant in the amount of \$60,000 to satisfy data gaps identified in the initial 2005 and 2006 study, and to prepare a conceptual design and 30% construction cost estimate. This report describes the results of the work conducted under the 2007 HEP grant.

1.1 OBJECTIVE

The objective of this evaluation was to further assess the feasibility and prepare a conceptual design plan for restoration of anadromous and catadromous fish passage at the Rahway River Water Supply Dam, Rahway, New Jersey. Specifically, in the *Final Preliminary Fish Passage Feasibility Evaluation* (Weston, 2006), Weston identified several additional steps necessary to further evaluate the proposed designs and develop a conceptual design plan:

- 1) Conduct a more detailed underground utility survey aimed at determining whether it is feasible to engineer fish passage by excavating around the eastern side of the dam;
- 2) Conduct a fish survey in the Rahway River to confirm reports that anadromous and catadromous fish species are present during expected spawning migration periods;
- 3) Coordination with the New Jersey Department of Environmental Protection (NJDEP) Office of Dam Safety regarding potential issues with the proposed fish ladder construction;
- 4) Determination of a long-term owner of the proposed fish ladder;
- 5) Coordination with the United States Geological Survey (USGS) regarding the gauging station located downstream of the Water Supply Dam;
- 6) Identify permitting requirements and conduct initial coordination with NJDEP Permit Coordination and Environmental Review Program regarding potential issues with the proposed fish ladder construction;
- 7) Conduct a threatened, endangered, and protected species search of the project site and surrounding habitats;

- 8) Conduct an archeological and historical assessment of the project area; and
- 9) Prepare a Conceptual Design and 30% Cost Estimate.

1.2 BACKGROUND

The Rahway River drains a watershed of roughly 41 square miles and includes portions of Middlesex, Union, and Essex counties. The river is 24 miles long, originating in Springfield, NJ and flowing to Linden, NJ where it drains into the Arthur Kill. The proposed fish ladder location is approximately 6 miles upstream from the Rahway River's confluence with the Arthur Kill and approximately one mile from the head of tide. Historically, the Rahway River was a spawning home river utilized by several anadromous fish species (Durkas 1992). There are now several dams that block the seasonal migration of these fish up the Rahway River. According to the Carl Alderson of the National Marine Fisheries Service (NMFS) (personal communication), the most downstream obstruction on the Rahway River, and the subject of this feasibility evaluation, is the Rahway Water Supply Dam. The dam is operated by United Water, Inc. who leases the property from Union County. As shown in Figure 1, the dam is located on the Rahway River at HEP restoration sites AK3J and AK3K, immediately south of the Union County Rahway River Park. These restoration sites were previously identified by the HEP as high priority restoration sites.

The Rahway Water Supply Dam (Appendix 1) is a weir-type design and consists of several linear "gates" which are raised or lowered according to water levels in the Rahway River. The dam is approximately 70 feet wide and constructed of concrete, steel, and wooden gates. Water behind the dam is used as a source of drinking water for the City of Rahway, New Jersey. The dam has a hydraulic head of approximately 2 feet. Photos of the dam and the surrounding area can be seen in Appendix 1, Photos 1 and 2. The dam has acted as an obstruction to upstream fish passage since the turn of the century.

Prior to this investigation, fish had previously been reported gathering at the dam during the time frame in which spawning anadromous fish would be expected to be ascending the river (James Lynch, Rahway River Association, personal communication). Based on the literature, the primary suspected species targeted for upstream passage at the Rahway River Water Supply Dam are alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), gizzard shad (*Dorosoma cepedianum*), white perch (*Morone Americana*) and American eel (*Anguilla rostrata*) (Able 1998; Durkas 1992). Alewife and blueback herring are collectively referred to as river herring due to their similarity in appearance, range, and life histories. River herring, gizzard shad, and white perch are all anadromous fish species (i.e., adults spawn in freshwater; juveniles migrate to marine environments where they grow to sexual maturity); whereas American eel are catadromous (adults spawn in the marine environment; the young migrate to freshwater habitats where they grow to sexual maturity) (Able, 1998).

River herring and gizzard shad are members of the family Clupeidae (herrings and shads). In New Jersey, adult herring migrate from the ocean to freshwater spawning areas from early spring through early summer (Able, 1998). After hatching, young-of-the-year fish typically remain in freshwater nursery habitats for several months prior to migrating to estuarine and eventually marine environments to grow and mature. After reaching sexual maturity, the adults return to their natal streams to spawn.

The ultimate purpose of this project is to allow native anadromous and catadromous fish populations to reach potential upstream spawning areas in the Rahway River which are currently inaccessible. Regionally, anadromous and catadromous fish populations have undergone dramatic decreases over the past several decades (Durkas, 1992). A significant reason identified by fisheries experts for historical population declines is the placement of dams or other obstructions that prohibit upstream passage to fresh water spawning grounds (ASMFC, 1999).

The installation of a fish ladder at the Rahway Water Supply Dam could be a first step in restoring the fishery in this section of the river and could lead to further efforts upstream. Additional impediments to fish passage are located 0.8 mile upstream of the Rahway Water Supply Dam at Jackson's Pond, followed by another 1.3 miles upstream at Bloodgoods Pond (Figure 1). A fish ladder was previously constructed by the Union County Parks Department at the Robinson Branch of the Rahway River.

In March 2006, Weston presented the results of the initial investigation in the *Final Preliminary Fish Passage Feasibility Evaluation for the Rahway River Water Supply Dam, Rahway, New Jersey*. The study indicated that two proposed fish passage alternatives (steep-pass, and bypass ramp) are potentially feasible and would meet the project's fish passage goals while allowing the dam to operate in its current capacity.

The remainder of this report details the work conducted under the HEP 2007 grant which includes the evaluation and assessment of recommendations previously provided in the Preliminary Feasibility Evaluation (Weston, 2006).

2. METHODOLOGY

In accordance with the project scope of work (SOW), a number of tasks were completed for this evaluation, to determine the feasibility of fish passage restoration at the site. These tasks, described in the following sections, include:

- Detailed utility search;
- Fisheries survey;
- Coordination with the NJDEP Office of Dam Safety;
- Stakeholder meeting;
- Long-term owner determination;
- USGS gauging station coordination;
- Permitting pre-application coordination;
- Endangered and threatened species survey;
- Cultural resources survey; and
- Preparation of a conceptual design and 30% cost estimate.

2.1 DETAILED UTILITY SEARCH

The preliminary investigation (Weston, 2006) indicated that in-stream attachment of a ladder to the dam was not feasible, since the dam is a weir-type dam that United Water is required to adjust in order to maintain minimum flows in the river during summer months. Therefore the only viable alternatives for ladder construction would involve bypassing the dam entirely, using

the adjacent eastern bank. A preliminary utility search was conducted in 2005 which indicated the presence of several buried utilities within the adjacent earthen bank proposed to be excavated. The presence of these utilities would complicate if not preclude installation of a fish ladder, so the size, type and vertical extent of the buried utilities required additional investigation in order to determine the ultimate feasibility of a ladder.

Building on the results of the initial utility location, Inframap, Corp. was contracted by Weston to perform a 'potholing' and magnetometer investigation in order to determine the exact horizontal and vertical location, depth, type and likely ownership of the existing underground utilities that may cause potential issues with the construction of the proposed fish ladder. Subsurface utility location was conducted June 2 - 4, 2008 by way of the air/vacuum test hole excavation (i.e., potholing) and magnetometry survey. A total of nine test holes were performed based on the previous (2005) identification of underground utilities. The results of the potholing were used in conjunction with the magnetometer survey results being performed concurrently to identify, map and flag the underground utility locations. Weston performed oversight of these activities to ensure quality, consistency and safety.

2.2 FISHERIES SURVEY

The objective of the fisheries survey was to establish whether suitable populations of anadromous fish are present in the area to warrant construction of a fish ladder, or whether reintroduction of fish stocks may be required. A secondary objective was to determine the upstream extent of any anadromous fish that may be presently negotiating the dam.

Prior to commencement of sampling activities, a Scientific Collection Permit Application was submitted to the NJ Division of Fish and Wildlife. The scientific collection permit was received on 2 May 2008 (Attachment 1).

A total of four fish collection sampling events were conducted (May 1, May 8, May 15, and May 29). One sampling event was conducted below each of the USGS gage station, Water Supply Dam, Jacksons Park Dam, and Bloodgoods Dam (Figure 2). An additional two visual inspections were conducted at the USGS gage station and Water Supply Dam prior to actual sampling activities (April 18 and April 26). A summary of these sampling events is provided in Table 1.

Each of the four sampling events was performed to monitor anadromous fish populations during the peak of the seasonal migration period (April – June). Backpack electrofishing and seining methods were employed during each of the sampling events. Sampling methods followed those detailed in the approved 30 April 2008 *Quality Assurance Project Plan* (Weston, 2008) which is provided as Attachment 2.

During electroshocking efforts, a portion of the river immediately downstream of each of the four sampled dams was sampled in sections consisting of a 15-minute run focusing on shoreline habitat. The collected specimens were placed in a live well and processed following completion of each run. All captured fish were identified by species and measured in length and weight. Additional information collected during each timed survey included the date, location, capture method, weather, crew members, and miscellaneous comments. Log books were completed during each survey. Seines were also used to trap fish by surrounding and concentrating them to



shoreline areas. The seine net used was 50 feet (ft) or 100 ft in length by 6 ft in depth with a collection bag in the middle.

During each sampling event, one ichthyoplankton sample was collected using a 90cm wide, 2.5m long, and a mesh size of 153microns net. The ichthyoplankton sample was then sent to a subcontracted laboratory (Normendeau Associates, Inc.) for taxonomy.

2.3 COORDINATION WITH THE NJDEP OFFICE OF DAM SAFETY

Weston conducted a review of the NJDEP Dam Safety Standards N.J.A.C. 7:20, as there is a potential of modifying the water flow at the Water Supply Dam if a fish ladder is constructed. Weston also conducted a telephone interview on July 25, 2008 with the NJDEP Bureau of Dam Safety & Flood Control representative, Jillian Lawrence, to inquire about permit requirements.

2.4 STAKEHOLDER MEETING

The goal of this task was to assemble the project stakeholders, review the project scope of work, discuss the anticipated schedule, and identify any significant issues or concerns that could affect implementation of the project. The meeting was held March 13, 2008 onsite and within the Rahway River Park maintenance building. Meeting attendees included:

- Jim Lynch - (Rahway River Association)
- Daniel Bernier - (Union County)
- Carl Alderson - (NOAA)
- David Bean - (NJDEP)
- Bryan Marsh - (USFWS)
- Mark Jaworski - (Weston)
- Russell Furnari - Corporate Wetlands Restoration Partnership (CWRP)
- Cindy Solomon - (City of Rahway)
- John Ludington - (United Water)

2.5 LONG-TERM OWNER DETERMINATION

A long-term owner and project sponsor for maintenance and operation of the fish ladder will need to be secured before proceeding to project construction. The property where the proposed fish ladder would be constructed is owned by Union County, and located adjacent to the Rahway River Park (owned and maintained by Union County). Weston facilitated discussions with Union County (Dan Bernier, Assistant Director of the Parks and Community Renewal) to determine whether the County would agree to serve as the long-term owner of any constructed fish ladder.

2.6 USGS GAGING STATION COORDINATION

A United States Geological Survey (USGS) gage station (# 01395000, Rahway River at Rahway) is located approximately 0.36 miles downstream of the Rahway River Water Supply Dam where the proposed fish ladder would be installed. Weston contacted Robert Reiser (Chief of the



USGS Hydrologic Data Assessment Program) to address any potential problems this project could cause to (or encounter) because of the gage station.

During initial fish collection activities, it was determined that fish passage at the actual gage station itself could be an obstacle to fish passage. As such, sampling below the gage station was incorporated into the fish survey by way of both observation and sampling.

2.7 PERMITTING PRE-APPLICATION MEETINGS

In order to determine the necessary permits and requirements for construction of a fish ladder at the site, Weston coordinated with the NJDEP. A Readiness Checklist was attained from the NJDEP Permit Coordination and Environmental Review Program. This checklist assists in making the determination of whether the proposed project will meet the NJDEP technical and policy requirements or if a more complicated review and/or modifications to the project would be considered necessary. Once a Readiness Checklist is reviewed by the NJDEP, a request can be made to establish a permit coordination and pre-application team by submitting a completed Permit Identification Form which includes site maps, wetland boundaries and development ideas. A Pre-application meeting would then be commenced.

A Readiness Checklist was completed by Weston and was reviewed by NJDEP.

2.8 ENDANGERED AND THREATENED SPECIES SURVEY

Weston contacted the NJDEP Office of Natural Lands Management and requested a determination of whether any endangered or threatened species are known or suspected to exist within the project area. A Natural Heritage Data Request Form was sent to this office along with a USGS topographic map delineating the area of interest.

2.9 CULTURAL RESOURCES SURVEY

In order to determine if the Rahway River Water Supply Dam fish ladder project footprint has any known cultural or archaeological concerns Weston contacted the NJDEP Historical Preservation Office (HPO) to review their files, if any, for the area of interest. The NJDEP HPO then reviewed the project area against their files and topographic maps of the locations of known historic properties. Each of the properties identified on the HPO maps has an individual file containing specific information about each property. Many files contain HPO office opinions about the property, report information, property information, photographs, and maps.

2.10 FISH LADDER CONCEPTUAL DESIGN AND 30% COST ESTIMATE

Based on the field data collected and reviewed by our engineers and fisheries biologists, Weston engaged, Interfluve Inc., an expert in fish ladder design and construction firm, to prepare a conceptual design and initial cost estimate. This conceptual design was developed based on the two ladder designs proposed in the Preliminary Feasibility Evaluation and provided both plan and cross-section views.

Included in the conceptual design is a 30% cost estimate for the work. This estimate was developed based upon the data gathered during the field and desk-top activities of this

investigation and will provide the basis for establishing future construction funding sources. The cost estimate includes the following elements: plans, engineering design and specifications, mobilization/demobilization, erosion and sediment controls, construction, relocation of underground utilities, permitting, and project management.

3. RESULTS

3.1 DETAILED UTILITY SEARCH

Complete results of the June 2008 subsurface utility survey performed by Inframap Inc. are provided in Attachment 3. Figure 3 illustrates the locations and results of the 9 test holes. The survey indicated that a number of underground utilities cross beneath the proposed fish ladder pathway. Table 2 presents a summary of each of the underground utilities identified.

Based on the preliminary designs for the proposed fish ladder (see Section 3.10) seven underground utilities may need to be eliminated or moved. These utilities include five electrical conduits and two electrical ducts that run to, or around the eastern end of the Water Supply Dam, and one 15-inch storm drain that drains to the Rahway River approximately 30 feet south of the dam. The five electrical conduits are each approximately 2 to 3 inches in diameter. Each electrical duct is each approximately 8 inches square in extent. It is highly likely that since these electrical ducts and conduits are less than 3 feet below ground surface that they will need to be relocated. They could be moved to another underground location beyond the extent of the ladder, or could potentially be raised above grade with approval from the utility provider. The storm drain, may be able to be altered to drain directly into the fish ladder depending on the ultimate construction design of the ladder.

The three water utilities (e.g., the 36-inch water main upstream of the dam, the 6-inch water pipe, and the 10-inch water pipe) are not expected to impact the proposed project due to their depth below ground surface, and in the case of the 6- and 10-inch water lines, their distance downstream from the proposed fish ladder installation. As a result they would not need to be relocated.

Based on the analysis of the utilities and the path of the proposed excavation area, Weston has concluded that while the subsurface electrical and storm water utilities will most likely have to be relocated, the more significant water underground utility lines are not likely to constrain or preclude the construction of the proposed fish ladder.

3.2 FISHERIES SURVEY

Weston was granted a Scientific Collection permit from the NJDEP Division of Fish and Wildlife to sample the waters below the Rahway River USGS gage station, Rahway Water Supply Dam, Jacksons Park Dam, and Bloodgoods Pond Dam using electrofishing, seining, and ichthyoplankton sampling to collect blueback herring, alewife, and gizzard shad (Figure 2).

Weston conducted one sampling event at each of the selected locations (Table 1). Table 3 presents a summary of the fish collection results. During the four sampling events, there were no visual observations of river herring, nor were any collected. Fish collected were representative of

typical fish communities within the Rahway River. Below the USGS gage station as well as below the Water Supply Dam, the community was dominated by American eel (*Anguilla rostrata*), white sucker (*Catostomus commersoni*), and pumpkinseed (*Lepomis gibbosus*). These three species were also present below Bloodgoods Dam and the Jackson Park Dam, however, tessellated darters (*Etheostoma olmstedi*) were the dominant species in these two areas.

A two-minute haul with the ichthyoplankton net was done at the USGS gage station, the Water Supply Dam, Jackson Park Pond and Bloodgoods Pond Dam. The samples were identified, enumerated and classified on their life stage by Normandeau Associates, Inc. Table 4 provides the summary of the results for each of the sampling locations. River herring were found at both the Water Supply Dam (egg stage) and the Bloodgoods Pond Dam (both egg and juvenile stage). While it is conceivable that river herring eggs could be found below the Water Supply Dam, it is highly unlikely that any river herring eggs or juveniles were found below Bloodgoods Pond Dam unless they were from stocking or other non-native spawning activities. Regardless, the presence of fish eggs and juveniles below these dams are promising in regards to the likelihood of favorable spawning conditions.

Based on the lack of positive identification of adult river herring during sampling activities, the project stakeholders agreed that stocking the Rahway River with adult, juvenile, or larval river herring may be a feasible and recommended step in restoring migratory fish runs to this portion of the river. As such, research and personal interviews were held with numerous fisheries experts with respect to their migratory fish stocking experience. Section 4 provides a summary of this research.

3.3 COORDINATION WITH THE NJDEP OFFICE OF DAM SAFETY

Based on the conversation with an NJDEP Office of Dam Safety representative, Jillian Lawrence, it is unlikely that the proposed ladder design would pose a threat to the Water Supply Dam. However, in order to move the project forward, a NJDEP Dam Safety Permit would be required if there were to be any form of modifications to the dam structure. Since there would be a probable modification of the concrete retaining wall along the northern bank, a NJDEP Dam Safety Permit would be required for this project. The application would be reviewed by the NJDEP Office of Dam Safety along with any documentation pertinent to the dam. The dam information is retained by the Bureau. Following the Bureau review of the application, the permit is then forwarded to the United States Fish and Wildlife Service (USFWS) for final review and approval. A facsimile from the NJDEP Office of Dam Safety was transmitted on July 25, 2008, summarizing the requirements for the application and contact information for the USFWS. A copy of the facsimile is provided in Attachment 4.

3.4 STAKEHOLDER MEETING

The goals of the meeting (e.g., assembling the project stakeholders, reviewing the project scope of work, and discussing the anticipated schedule) was met and no significant project implementation issues were identified. One additional matter discussed included the potential use of money collected by the State of New Jersey in Natural Resources Damages (NRD) claims to help fund the future construction of the Rahway River fish ladder.

3.5 LONG-TERM OWNER DETERMINATION

Dan Bernier (Assistant Director of the Park Planning and Environmental Conservation Division for Union County) reported to Weston that Union County, specifically the Park Planning and Environmental Conservation Division, would be willing to take ownership of and maintain a fish ladder structure if constructed. A letter indicating Union County's support is provided in Attachment 5. Coordination with the Park Planning and Environmental Conservation Division would be required throughout the planning and construction phase. Post-construction operation and maintenance plans (as applicable) would need to be prepared as part of the project.

3.6 USGS GAGING STATION COORDINATION

There is a USGS gaging station located approximately 1,000 feet south of the proposed fish ladder. USGS determined that the proposed fish ladder would not affect the operation of the gage station # 01395000. The USGS does not have any objections to the project, and Robert Reiser, Chief of the USGS Hydrologic Data Assessment Program, provided a letter in support of it (Attachment 6). Mr. Reiser also noted (personal communication) that the gage station is no longer an operating station and should the station pose an obstacle to anadromous fish passage, he would work with the project team to find a suitable solution for all restoration efforts.

Mr. Reiser did express concern over the current deteriorating state of the gage. Specifically, he noted the possibility of erosion from where the gage contacts the banks contributing to sedimentation issues which in turn may be affecting spawning habitats in the river. USGS has offered their assistance with the repair of the stream banks should it be needed in the restoration of the river.

3.7 PERMITTING PRE-APPLICATION MEETINGS

The Office of Permit Coordination and Environmental Review (PCER) of the NJDEP reviewed the Readiness Checklist that Weston submitted. The following requirements were detailed in the NJDEP review of the project Readiness Checklist:

- The NJDEP Division of Fish, Game and Wildlife has no impending issues with the project.
- Recommendations for the proposed project made by the NJ Historic Preservation Office include:
 - All plans for materials and design are made compatible with the Union County Park Systems Historic District;
 - Consultation to be made with the Landscape Architect for the Union County; and,
 - The State of New Jersey review of the project under Section 106 of the National Historic Preservation Act, facilitated by the involvement of a historic preservation consultant in the project planning process.
- Requirements for the proposed project made by the NJDEP Department of Land Use Regulation include:
 - Freshwater Wetlands permit N.J.A.C. 7:7A-5.16 if applicable or an individual permit or transition area waiver; and

- Flood Hazard permit N.J.A.C. 7:13-7.2(a)7 or an individual permit.

Based on the review and comments provided by NJDEP (Attachment 7), it was determined that a Pre-Application meeting is not required at the current time. When the actual project is proposed for construction, the NJDEP PCER recommends that a Permit Identification Form be completed and a pre-application meeting with a permit coordination and pre-application team be requested. The meeting would provide the determination of the required permits, develop a permit schedule, and facilitate the permit process. Subsequent to this meeting, the permits would be issued.

3.8 ENDANGERED AND THREATENED SPECIES SURVEY

In February of 2008, Weston received a response from the NJDEP Office of Natural Lands Management (ONLM) in regards to the search of the Nature Heritage Database in relation to the proposed project area (Attachment 8). The search was completed based on the boundaries of the project site provided to NDJEP ONLM.

There was no record for occurrences of any rare wildlife on or within a ¼ mile of the site based on information within the Nature Heritage Database and the Landscape Project. NJDEP ONLM also performed a search for any rare plant species or ecological communities. The database does not have any records of documented rare plant species or ecological communities on or within a ¼ mile of the site. A list of rare species and ecological communities that have been found in Union County was provided with the intent that if suitable habitat is present at the site, these species may be present (Attachment 8).

3.9 CULTURAL RESOURCES SURVEY

The Rahway River fish ladder project is located in the Perth Amboy Quadrangle 7.5 Minute Topographic map (Attachment 9). Review of cultural and historic sites on this quadrangle by NJDEP HPO personnel identified two historical properties within the proposed project footprint. These properties are the Rahway River Park (ID# 2713) and Rahway River Parkway Historic District (ID# 4079). A copy of the property files that correspond to these cultural/historic sites is provided in Attachment 9.

The Rahway River Park was designed in 1929 by Olmstead Brothers and included the first public outdoor bathing complex in the county. Its inclusion in the National Register for Historic Places was based on its significance in Community Planning and Social/Humanitarian movements in the state. The Rahway River Park file contained a consultation from the NJDEP HPO (14 October 1980) regarding renovation/restoration of the Rahway River Pool and Bath House located approximately 750 to the northeast of the Water Supply Dam. The consultation indicated that the proposed project would not have an adverse affect on the Rahway River Park. Additionally, this consultation noted that no subterranean cultural resources were identified in association with this project.

The Rahway River Parkway is a historic greenway system following the Rahway River through a considerable portion within Union County. This parkway provided a cross link between the entire Union County Park system and included the actual Rahway River Park itself (noted above). The parkway had numerous purposes including restoring the Rahway River as a natural aquifer (which is used for drinking water today), preserving fish and wildlife, providing

recreation to county residents as well as the ecological link between numerous other county parks. The Historic District file contained a report completed by Richard Grubb and Associates, Inc. in June 2002, which investigated the cultural resources of the area related to the Route 82 bridge replacement (located approximately 6 miles upstream of the Water Supply Dam). The report states that “no significant archaeological resources were recovered during the archaeological survey.”

These two properties were the only two cultural or historical sites identified by the HPO that are located in the proposed project footprint. Based on this information, there are no anticipated cultural or historical resource issues at the Rahway River Water Supply Dam fish ladder project area that will be affected.

3.10 FISH LADDER CONCEPTUAL DESIGN AND 30% COST ESTIMATE

Appendix B provides conceptual design plans for the two feasible fish ladder alternatives for the project as identified in the Preliminary Feasibility Study (Weston, 2006). Drawings 2, 3 and 5 provide the overall plan, detail, and cross sections views, respectively, of the bypass channel alternative. Drawings 4 and 6 provide the plan and detail/cross section views of the concrete channel based steppass alternative.

In order to successfully pass fish, the ladder must meet a few critical criteria. The most important aspect of a fish ladder is its entrance. This is because the barrier that is blocking the upstream migration pathway imposes an entirely new stress on the fish (Clay 1995). As such, the entrance should be as easy to find as possible. Therefore, the proposed ladder entrance has been shown as close to the dam face as reasonably feasible. The effect of this is to decrease the amount of area the migrating fish need to search in order to locate a passable flow. Secondly, the ladder slope, or grade, should be low enough to allow passage by the target migratory species, in this case primarily river herring.

Generally, bypass channel alternatives are aesthetically pleasing and when constructed correctly can require little or no maintenance. As can be seen in drawings 2 and 3, some cut back of the ladder is required in the bypass channel scenario since the slope at the proposed site is too steep to allow the fish to ascend. Several grade scenarios have been presented in drawing 2. Generally the lower grades (green and blue colored paths) allow the easiest fish passage, while the higher grades may be slightly more difficult for the fish to pass. As such, drawing 3 presents a plan view of one option of bypass channel configuration. However, in this configuration, the overall length of the ladder is constrained by the presence of the water storage structure (seen to the North of the Water Supply Dam) as well as underground utilities in the area. Therefore, higher grade scenarios (3.8% or 3.9%, colored yellow and magenta, respectively) may be the more suitable scenario for this location. This would be determined during actual fish ladder engineering design.

Drawings 4 and 6 present the more conventional steppass fish ladder design. In this case the steppass ladder would be placed within a constructed concrete channel. The individual baffles within the steppass ladder allow for higher grade changes (up to 20%) than a bypass channel scenario. Steppass models have been shown to effectively pass migratory fish such as river herring and are typically easier to install with lower flow requirements.

Cost estimates for both alternatives were prepared and are currently estimated at \$300,000 for bypass channel alternative and \$408,000 for the steepass alternative (Tables 5 and 6). These costs include plans, engineering design and specifications, mobilization/demobilization, erosion and sediment controls, construction, relocation of underground utilities, permitting, and project management. Detailed cost estimation back-up is provided in Attachment 10. Post-construction monitoring of fish populations is not included and would cost an additional \$30,000 - \$60,000 over a 3-year period.

4. EVALUATION AND APPLICABILITY OF RIVER HERRING STOCKING PROGRAMS

River Herring stocks occupy East Coast rivers and coastal waters and are a multi-state resource playing a significant role in the sustainability of our ecological food chain. In August 2008, the Atlantic State Marine Fisheries Commission (ASMFC) issued Draft Amendment 2 to the Interstate Fishery Management Plan (FMP) for River Herring for public review and comment. This Amendment describes proposed requirements for population and bycatch monitoring and presents numerous potential commercial and recreational management measures. According the ASMFC, the Draft Amendment has been developed in response to widespread concern regarding the decline of river herring stocks. ACMF reported that over a twenty year period, commercial landings of river herring dropped by 90% from 13.6 million pounds in 1985 to 1.33 million pounds in 2004. In 2007, declines continued with Commission member States reporting river herring landings of approximately 1.1 million pounds.

In response to the declining stocks, four states - Massachusetts, Rhode Island, Connecticut, and North Carolina - acted independently and closed their river herring fisheries. The Draft Amendment proposes several management measures to address these concerns and ensure the survival and enhancement of depressed stocks or the maintenance of presently stable stocks. According to the ASMFC, "The Draft Amendment proposes mandatory data and bycatch monitoring provisions, as well as options to close fisheries by river system or establish a coastwide moratorium on the river herring fishery. Specific *commercial* measures include area closures, escapement provisions, and landings reductions by river systems, as well as limited access. *Recreational* measures include recreational license/permit, limiting recreational harvest by the days of the week, coastwide creel limit, gear restrictions, and area or seasonal closures by river system."

These measures illustrate the importance of applying standardized management techniques for the restoration of this important fishery. Restocking of river herring in urban rivers such as the Rahway River may represent one component to increasing their populations in coastal waters, and to be effective would require that other elements affecting the population be addressed including sediment and water quality in New Jersey's urban rivers.

4.1 OPINIONS ON THE EFFECTIVENESS OF RIVER HERRING RESTOCKING

To better understand how fisheries professionals view the effectiveness of River Herring restocking to restore historic populations, Weston contact several professionals who are actively involved with river herring and other anadromous fish restocking efforts including:

- Steve Gephard - Supervising Fisheries Biologist, Connecticut Department of Environmental Protection (CTDEP) – 860.447.4316
- Jim Cummins - Interstate Commission on the Potomac River Basin (ICPRB) - 301.984.1908
- Mark Boriek - Principal Fisheries Biologist, New Jersey Department of Environmental Protection, Northern New Jersey Section – 908.236.2118
- Chris Smith - Fisheries Biologist, New Jersey Department of Environmental Protection (NJDEP) – 856.629.4950
- Marit Larson, Senior Project Manager Natural Resources Group, City of New York Department of Parks & Recreation – 212.360.1415

These discussions indicated that most parties have experienced varying degrees of success with river herring restocking efforts. The general consensus was that inconsistent monitoring of post river herring restocking efforts has resulted on data gaps on the quantities of fish that have re-populated targeted river systems. The most obvious success stories reported were the projects where no, or very minimal runs existed pre-stocking and where river herring populations were restored or dramatically rebounded. An example of this level of success was experienced during the Latimer Brook River Herring Restoration Project in East Lyme, CT where (according to Steve Gephard of CTDEP) river herring populations were totally restored by restocking. Other projects like the Batsto River in New Jersey have not seen such dramatic improvements despite the transplantation of several hundred river herring from the Mullica River to the Batsto River. According to Chris Smith of the NJDEP, the runs have not improved and have actually declined over the past few years.

New Jersey's efforts to date have primarily been limited to southern New Jersey and have included the Great Egg Harbor River, the Batsto River, and the Cooper River. Although large populations of river herring have been documented in the Great Egg Harbor River, these runs are considered "pioneer" runs that have existed for an extended period of time, and were enhanced by fish passage improvements as compared to restocking efforts (personal communication, Chris Smith, NJDEP). The results of restocking efforts on the Cooper River have reportedly been inconclusive although river herring populations have improved at the first of three fish passages installed along the river. River herring from the Maurice River were used for the Cooper River restocking.

Also, some State-led restocking programs are much more aggressive than others. Steve Gephard of the CTDEP described numerous restocking projects, both past and current, that his group has successfully performed. Some projects extend back to the 1980's while others (including the Bronx River Project in NY where the CTDEP provided the river herring used in their restocking

program) occurred within the past few years. In their April 2008 Fishery Bulletin, CTDEP described three alewife restocking projects currently ongoing in Connecticut.

The techniques for restocking river herring have also varied. A large majority of Connecticut's efforts have included the capturing of 200 to 400 river herring during early spring migrations in March and April and transporting them via truck for release in the targeted river system. According to the Steve Gephard of CTDEP, the benefits of this technique is that the fish larvae are fertilized and hatched within the targeted river, perhaps improving their acclimation and "imprinting" the juveniles so they know where to return in 3-5 years to spawn themselves.

Techniques used in the attempt to restore river herring populations in the Anacostia River (Maryland) focused primarily on the incubation and hatching of river herring in a State-run fish hatchery. This technique included the capture of broodstock (group of sexually mature individuals for breeding purposes), the fertilization of eggs, the incubation to the larval stage, and transportation for release into the Anacostia River. According to Jim Cummins of the ICPRB, one of the benefits of this restocking technique is that it releases millions of larval staged river herring into the target river system during each restocking effort.

4.2 EXAMPLE RESTOCKING EFFORTS

Many State and Local agencies along the Atlantic Coast have initiated river herring restocking projects. Attachment 11 includes a listing and brief description of river herring restocking projects throughout the northeastern United States. It was assembled in 2004 by the City of New York, Parks and Recreation, Natural Resource Group and published in document entitled *Phase 1 Final Report, Fish Passage Needs and Feasibility Assessment, March 2004*. Additional updated river herring repopulation project summaries, obtained through literary review, journal articles, and internet searches are provided below.

4.2.1 Project Name: Anacostia Tributary System River Herring monitoring/Reconnaissance Larval Stocking Project

Duration of Restocking Program: 5 years (2000 through 2004)

Project Overview: To compensate for impacts to wetlands and submerged aquatic vegetation in the replacement of the Woodrow Wilson Bridge in Maryland, one of the mitigation projects included restoration of migratory river herring to historical spawning areas in the Anacostia watershed. In 2000 a larval river herring stocking program was initiated through the Anacostia Fish Passage Working Group (AFPWG). According to a report entitled *Spring 2004 Anacostia Tributary System River Herring Monitoring/Reconnaissance and Larval Stocking Project*, over the 5 year program, approximately 13.5 million larval river herring were reared and stocked in the Anacostia River.

Restocking Methodology: The assemblage of Alewife and Blueback broodstock involved the yearly collection of approximately 100 ripe females from Maryland Rivers over a 4-6-week period. According to the report entitled *Spring 2004 Anacostia Tributary System River Herring Monitoring/Reconnaissance and Larval Stocking Project* prepared by the ICPRB, "At all broodstock collections, ripe females were collected and stripped of eggs into shaded bowls containing ambient stream water temperature. Eggs from alewife herring were kept separate

from blueback herring and each set of eggs was fertilized by milt from males of the appropriate species. A minimum of 0.15 L of fertilized eggs per sampling event was required for incubation. Fertilized eggs were allowed to sit in darkened buckets for approximately 45 minutes, then packaged with battery powered aerators at ambient stream temperature, and delivered promptly to the Maryland Department of Natural Resource's (MDDNR's) Joseph H. Manning Fish Hatchery located approximately 40 miles away in Charles County, Maryland. Through a cooperative agreement with MDDNR, the fertilized eggs were incubated to yolk sac-stage larvae before they were released."



According to the same report "In preparation for incubation, the eggs were separated by adding 20 grams of salt (NaCl) and 0.375 grams of tannic acid into 5 liters of water. A few drops of de-foamer were added and the mixture agitated and aerated for 6-7 minutes. To clear the eggs, they were extracted from the above mixture, rinsed with well-water and then were added to another solution of 20 grams of Salt (NaCl), 15 grams of Urea, and 5 liters of water. De-foamer was added, and the mixture agitated/aerated for 6-7 minutes more. The eggs were then rinsed and transferred to incubation containers, which are constantly refreshed with cool fresh well water. Over an approximately 5 to 10 day period, the eggs were incubated and hatched to a larval stage, after which approximate counts of viable eggs and pre-stock larvae survival rates. After eggs had hatched, the larvae were transported in covered, black, 5-gallon containers from the hatchery back to the Anacostia five stocking sites. The Anacostia stocking locations included five major Anacostia tributary sites".



Restocking Results: According to 2009 personal communications with Jim Cummins of the ICPRB, the restocking results were inconclusive as river herring populations varied and fluctuated from year to year, depending on the sampling location. Also, the ICPRB project ended in 2004 and river herring population reconnaissance studies ceased. Recently, only limited ichthyoplankton studies have been reportedly conducted by others to comply with State regulatory requirements stipulated in the Woodrow Wilson Bridge project permits. However, Mr. Cummins reported that he believes that the recent coast-wide declines in river herring populations have likely negatively impacted their restocking efforts.

For More Information:

Interstate Commission on the Potomac River Basin
6110 Executive Blvd Suite 300
Rockville, M.D. 20852
www.potomacriver.org
Contact: Jim Cummins
301.984.1908

4.2.2 Project Name: River Herring Restoration Project, Bronx River, NYC

Duration Of Stocking Program: 2 years (2006 and 2007)

Project Overview: In the Spring of 2003, the New York City's Department of Parks and Recreation, Natural Resources Group (NRG) and Lehman College began work under a National Oceanic and Atmospheric Administration (NOAA) Regional Partnership Grant to study the feasibility of restoring diadromous fish to the Bronx River in New York City. According to a report entitled *Phase 1 Final Report, Fish Passage Needs and the Feasibility Assessment March 2004*, prepared by the City of New York, Parks and Recreation, for the project, "The approach was to investigate historical fisheries and river conditions, assess existing fish conditions, and evaluate existing environmental factors." River herring were the focus of the study and based on information collected, the study team concluded "that river herring could survive, reproduce, provide recruitment of a river population, and help increase faunal diversity in the river". To pursue their reintroduction, several steps were recommended in the 2004 Report including the implementation of a fish stocking program to "jump start" river herring establishment in the river.

Based on discussions in 2009 with the City of New York, Parks and Recreation and with the CTDEP, alewife, a species of river herring, were first reintroduced to the Bronx River (at the Bronx Zoo) on March 21, 2006. A second release occurred in April 2007 using river herring captured from Bride's Brook in East Lyme, CT. Monitoring to determine if adult Alewife are returning to the Bronx River and document the initial success of the program are scheduled for spring 2009.

Restocking Methodology: In March 2006 and April 2007 approximately 200 and 400 Alewife, respectively were captured and transported via truck by the Connecticut DEP's Inland Fisheries Division to the Bronx River for release. The river herring reportedly came from Bride's Brook in Connecticut where strong river herring runs remain. Reportedly, spawning of the river herring in the Bronx River began in April 2006 following the first release. The fertilized eggs eventually hatched into larvae and then shortly into juveniles. At approximately 2" in length, the juveniles began "popping" through the water surface and could be seen in August and September feeding (NYC Dept. of Parks). Based on factors including water temperature and day length, the juvenile fish began their migration from the River to the sea in the fall of each respective year.



According to the NYC Parks and Recreation, the Alewife seen in 2006 will return between 2009 and 2011 as adults to spawn and continue the cycle.

Restocking Results: According to Marit Larson of NYC Parks and Recreation, the Alewife restocking results are inconclusive but additional data will be obtained shortly. Extensive monitoring will be conducted in the spring 2009 to document the potential return of Alewife to the Bronx River. Recently, due to new regulations adopted by New York State Division of Environmental Conservation that restrict out-of-state importations and release of fish into NY



State waters, no restocking efforts could be conducted in 2008 or will likely be conducted in 2009.

For More Information:

Marit Larson
Project Manager
City of New York Parks and Recreation
Natural Resources Group
212-360-1415

5. SUMMARY

This evaluation addressed the following objectives, mentioned as outlined in the Preliminary Feasibility Evaluation (Weston, 2006).

- 1) Conduct a detailed underground utility survey aimed at determining whether it is feasible to engineer fish passage by excavating around the eastern side of the dam;

A detailed underground utility survey was conducted, and while several utilities were detected in the vicinity of the proposed ladder, Weston concludes that a fish ladder can be successfully engineered and constructed at the Water Supply Dam.

- 2) Conduct a fish survey in the Rahway River to confirm reports that anadromous and catadromous fish species are present during expected spawning migration periods;

A fish survey was conducted in Spring 2008 using seining and electroshocking methods and results indicated American eel are present during migration. While no river herring were detected, ichthyoplankton from resident fish as well as potential river herring were detected at the Water Supply Dam and upstream of the dam.

- 3) Coordinate with the New Jersey Department of Environmental Protection (NJDEP) Office of Dam Safety regarding potential issues with the proposed fish ladder construction;

Weston coordinated with the NJDEP dam safety personnel and determined that the fish ladder could be constructed and would not interfere with dam safety. However, NJDEP Freshwater Wetlands and Flood Hazard Area permits will be required.

- 4) Determine long-term owner of the proposed fish ladder;

The suggested long term owner of the fish ladder is the Union County Parks Department, which owns the adjacent land. Coordination with the Park Planning and Environmental Conservation Division would be required throughout the planning and construction phase. Post-construction operation and maintenance plans (as applicable) would need to be prepared and adhered to as part of the project.

- 5) Coordinate with the United States Geological Survey (USGS) regarding the gaging station located downstream of the Water Supply Dam;

According to USGS, the gaging station is located 1,000 feet downstream of the proposed ladder, but it is no longer being used to actively collect data. As such the USGS has no objection to the proposed project. During subsequent fish collection activities, it was determined that the gage station may act as an impediment to fish passage itself. The USGS indicated they would support gage modifications that support overall restoration goals for the river.

- 6) Identify permitting requirements and conduct initial coordination with the NJDEP Permit Coordination and Environmental Review Program regarding potential issues with the proposed fish ladder construction;

Weston contacted NJDEP and found that Freshwater Wetlands and Flood Hazard Area permits are required for construction of the fish ladder. Based on the review and comments provided by NJDEP (Attachment 7), it was determined that a Pre-Application meeting is not required at the current time.

- 7) Conduct a threatened, endangered, and protected species search of the project site and surrounding habitats;

Weston contacted the Natural Heritage Program who indicated that there are no records of State or Federally threatened or endangered species that would be impacted from construction of a fish ladder.

- 8) Conduct an archeological and historical assessment of the project area;

Weston contacted the State Historic Preservation Office who found no records or historical, archaeological or submerged archaeological structures that would be affected by construction of a fish ladder.

- 9) Prepare a Conceptual Design and 30% Cost Estimate.

The conceptual design and 30% cost estimate are attached; total project cost is estimated at between \$300,000 for a bypass channel design up to an estimated \$408,000 for a steepass design.

6. RECOMMENDATIONS AND PATH FORWARD

In order to take this project the next step towards construction, the following tasks should be conducted:

Identification of Additional Funding Sources – Preliminary funding sources have already begun to be identified through the NOAA, Damage Assessment and Restoration Program, however, based on the cost estimate (Section 3.10), additional funds will need to be identified.

Hydrologic Modeling – In order to assess potential impacts that construction of the proposed fish ladder may cause to the flow characteristics on the Rahway River system, hydraulic and hydrologic analysis and modeling will need to be performed. To assist in the study, it is recommended that the Federal Emergency Management Agency (FEMA) be contacted for the backup information for the City of Rahway Flood Insurance Study (FIS). The information would be used to construct a hydraulic model (i.e., HEC-RAS) for the river reach that includes the Water Supply Dam. A HEC-RAS model is designed to perform one-dimensional hydraulic calculations for a full network of natural and constructed channels. This model could be modified to include the fish passage and re-analyzed to evaluate any impact on flooding caused by the project. Importantly, the HEC-RAS model could be used to compare existing and future conditions.

Permitting – Based on the results obtained in Sections 3.3 and 3.7, the following three NJDEP permits will be needed for the proposed project:

- Freshwater Wetlands permit N.J.A.C. 7:7A-5.16 if applicable or an individual permit or transition area waiver; and
- Flood Hazard permit N.J.A.C. 7:13-7.2(a)7 or an individual permit.

Design Drawings and Specifications - An important scope of work needed to bring the subject project to construction would be the preparation of design drawings and specifications describing construction details and requirements. In this task, engineers would work with project biologists to design a fish ladder that will accommodate target fish species while conforming to site constraints. It is anticipated that almost all of the information collected to date including river hydraulics, geotechnical conditions, biological data, and regulatory requirements would be synthesized and translated into project drawings and written specifications needed for construction.

It is likely that drawings, specifications, and cost estimates for construction would be prepared at progressing level of completeness and will include submittals at the 60%, 90% and 100% stages. The design would be based on the conceptual plans developed in this evaluation (Section 3.10). The drawings and specifications may be reviewed by USEPA or other delegated authority. Once the 100% design is completed and construction funding secured, a bidding package would be assembled and bids solicited from qualified contractors. The project owner (as identified in Section 3.5) would be responsible for entering into the construction agreement with the contractor. Engineering oversight would likely be a key component to ensure the project is built to specification.

7. REFERENCES

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Personal Communications:

Steve Gephard - Supervising Fisheries Biologist, Connecticut Department of Environmental Protection (CTDEP) – 860.447.4316

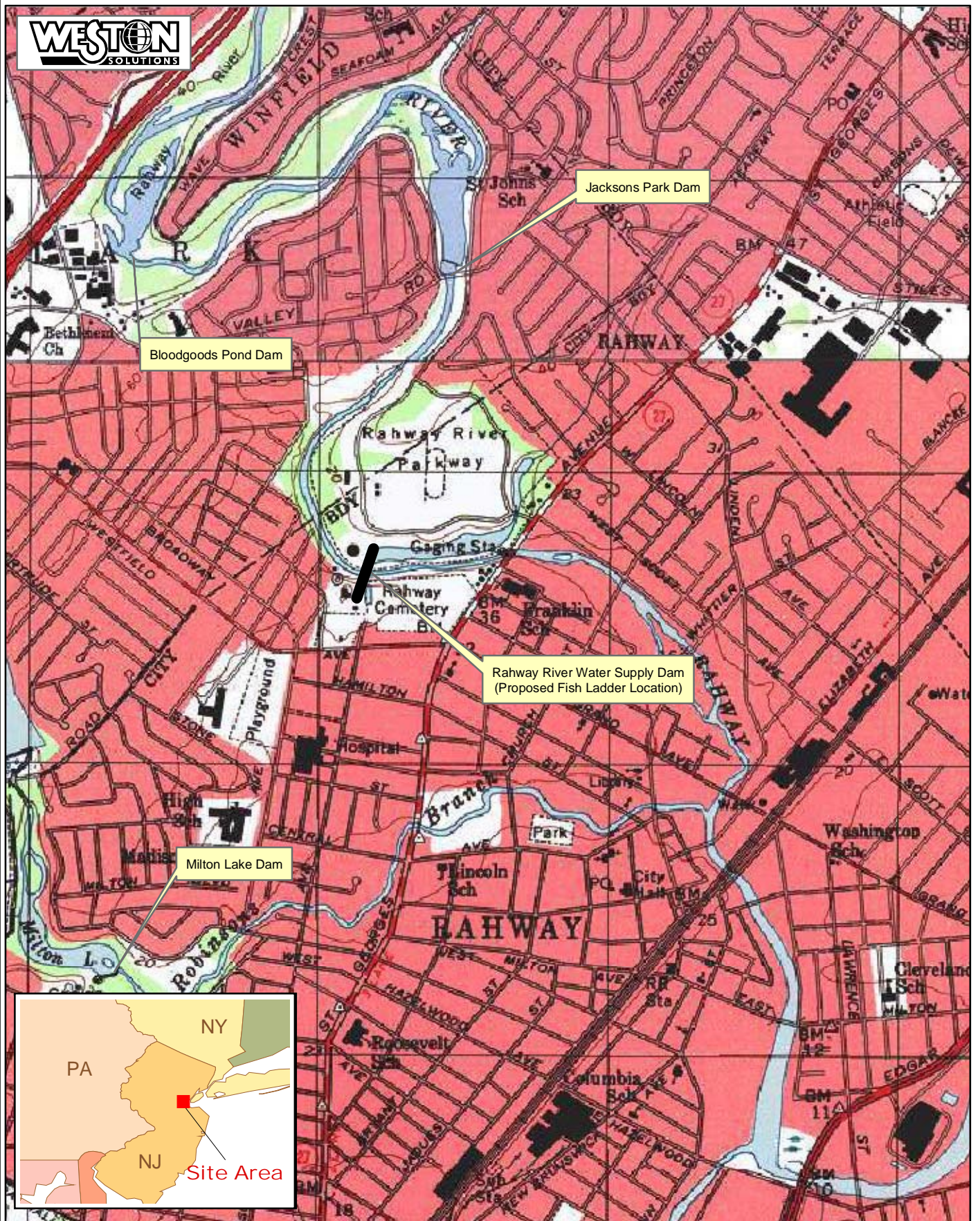
Jim Cummins - Interstate Commission on the Potomac River Basin (ICPRB) - 301.984.1908

Mark Boriek - Principal Fisheries Biologist, New Jersey Department of Environmental Protection, Northern New Jersey Section – 908.236.2118

Chris Smith - Fisheries Biologist, New Jersey Department of Environmental Protection (NJDEP) – 856.629.4950

Marit Larson, Senior Project Manager Natural Resources Group, City of New York Department of Parks & Recreation – 212.360.1415

FIGURES



SOURCE: USGS 7.5 Minute Series
(Topographic) Quadrangles:
Perth Amboy NJ, 1956, photorevised 1981

DATE: 12/06/05

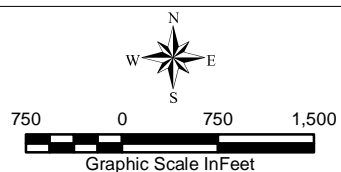
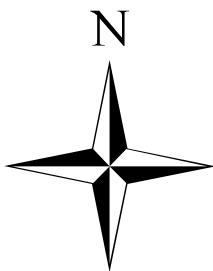


Figure 1
Site Location Map
Rahway River Fish Ladder
Rahway, New Jersey



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REPORT DATE:
December 2008

DRAWING: 06286_Samp_Loc.mxd
PATH: P:\Rahway_Fish_ladder\GIS\IMXD\1208_Maps\

REVISION No.
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WORK ORDER No.
14178.001.001.0001

PROJECT MANAGER:
R. Brown

CHECKED BY:
D. Krumich

CONTRACT No.
DELIVERY ORDER NO.

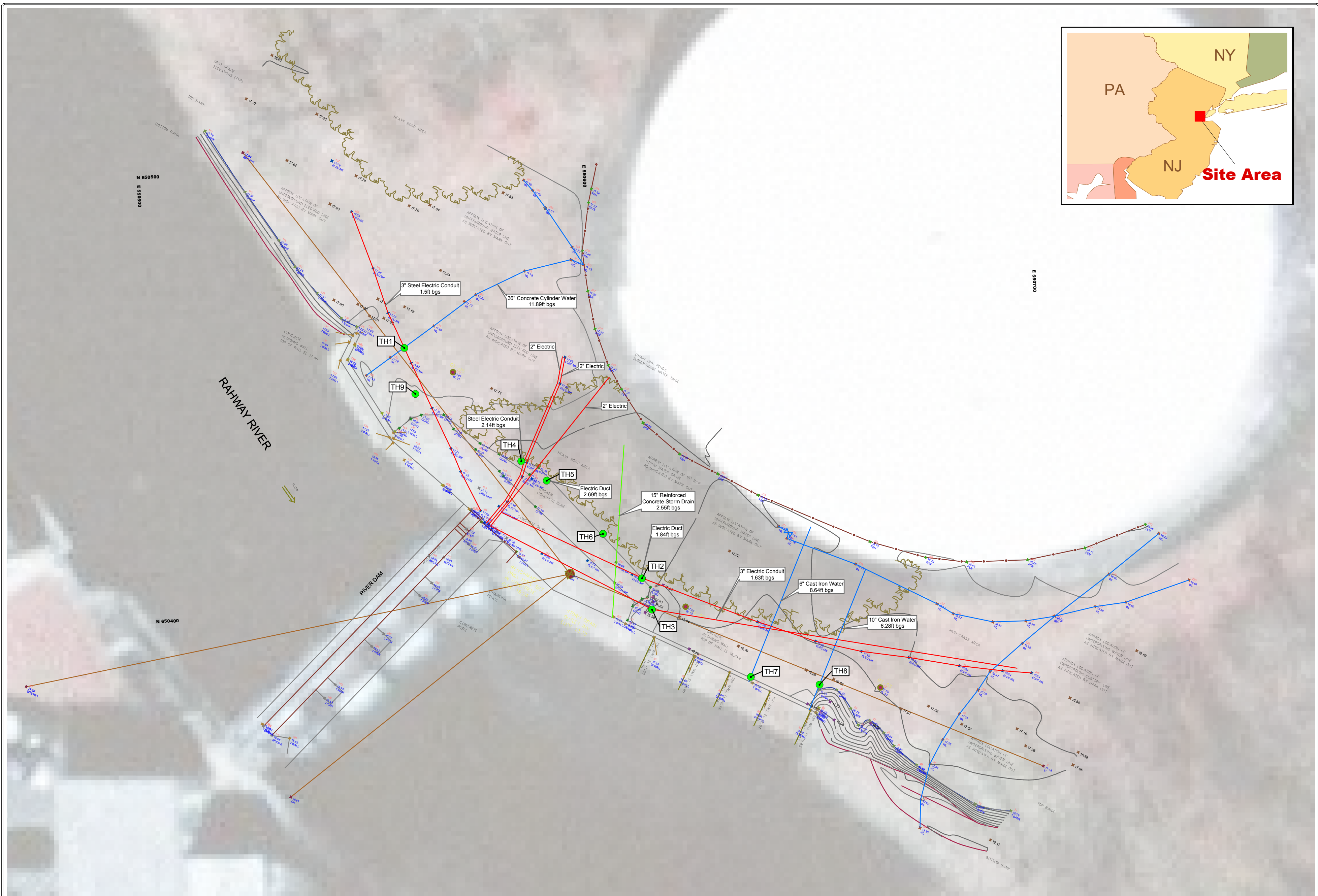
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S. Poultney
DATE CREATED:
12-10-08

CLIENT NAME:
Hudson River Foundation

PROJECT NAME:
Rahway Fish Ladder

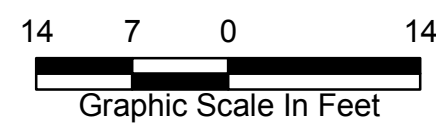
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Fish Survey Sample Location Map
Rahway River Fish Ladder
Rahway, New Jersey

FIGURE: 2 SCALE: 1" = 500' DATE: 12-10-08



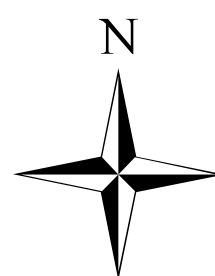
Legend

- GPS Location
- Electric Utility
- Storm Sewer Utility
- Water Utility



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REPORT DATE: December 2008	PROJECT MANAGER: R. Brown	CLIENT NAME: Hudson River Foundation	DRAWING TITLE: Subsurface Utility Location Map Rahway River Fish Ladder Rahway, New Jersey
DRAWING: 06288_GPS Locs.mxd PATH: P:\Rahway_Fish_Ladder\ GIS\MXD\1208_Maps\	CHECKED BY: D. Krumich	PROJECT NAME: Rahway Fish Ladder	FIGURE: 3
REVISION No. 0	CONTRACT No. DELIVERY ORDER NO.		SCALE: 1" = 14'
WORK ORDER No. 14178.001.001.0001	DRAWN/MODIFIED BY: S. Poultney DATE CREATED: 12-10-08		DATE: 12-16-08

TABLES

Table 1
Fish Sampling Summary
Fish Passage Feasibility Study
Rahway River, Rahway, New Jersey

Date	Location	Sampling Methods	Comments
April 18, 2008	- USGS Gage Station - Water Supply Dam	Visual Inspection	No anadromous fish observed.
April 26, 2008	- USGS Gage Station - Water Supply Dam	Visual Inspection	No anadromous fish observed.
May 1, 2008	- USGS Gage Station	Ichthyoplankton Sample Collection Seining Electrofishing	No anadromous fish observed.
May 8, 2008	- Water Supply Dam	Ichthyoplankton Sample Collection Seining Electrofishing	No anadromous fish observed.
	- USGS Gage Station	Visual Inspection	
May 15, 2008	- Jackson Park Dam	Ichthyoplankton Sample Collection Seining Electrofishing	No anadromous fish observed.
	- USGS Gage Station	Visual Inspection	
	- Water Supply Dam		
May 29, 2008	-Bloodgoods Pond Dam	Ichthyoplankton Sample Collection Seining Electrofishing	No anadromous fish observed.
	- USGS Gage Station	Visual Inspection	
	- Water Supply Dam		

Table 2
Underground Utility Survey Summary
Fish Passage Feasibility Study
Rahway River, Rahway, New Jersey

Type of Utility	Description	Depth (ft) Below Ground Surface	Direction	Comments
Electric Conduit	3-inch diameter steel conduit	1.50	North northwest from the east end of the Water Supply Dam	Will likely need to be moved/replaced due to shallow location of the utility.
Electric Conduit	3-inch diameter steel conduit	1.63	East southeast from the east end of the Water Supply Dam	
Electric Duct	8.5-inch concrete duct	1.84	East southeast from the east end of the Water Supply Dam	
Electric Conduit	3, 2-inch diameter steel conduits	2.14	Northeast from the east end of the Water Supply Dam	
Storm Drain	15 inch diameter reinforced concrete	2.55	North-south, approximately 30 feet southeast of Water Supply Dam	
Electric Duct	6.5-inch concrete duct	2.69	Northwest approximately 15 feet to the east end of the Water Supply Dam	
Water	10-inch diameter cast iron pipe	6.28	Northeast, approximately 60 feet southeast of Water Supply Dam	Should not be a cause for concern.
Water	6-inch diameter cast iron pipe	8.64	Northeast, approximately 75 feet southeast of Water Supply Dam	
Water	36-inch diameter concrete cylinder	11.89	Northeast, approximately 50 feet northwest of Water Supply Dam	

Table 3
Fish Collection Summary
Fish Passage Feasibility Study
Rahway River, Rahway, New Jersey

Collection Location	Genus	Species	Common Name	Number Captured	Comments
USGS Gage Station - Below					
	Catostomus	commersoni	White sucker	7	In addition, numerous American eels were shocked but not collected.
	Anguilla	rostrata	American eel	2	
	Lepomis	gibbosus	Pumpkinseed	2	
	Anguilla	rostrata	American eel	2	
	Lepomis	gulosus	Warmouth	1	
Water Supply Dam - Below					
	Catostomus	commersoni	White sucker	3	In addition, approximately 40 American eels, 5 Sunfish, and a Brook trout were shocked but not collected.
	Lepomis	gibbosus	Pumpkinseed	3	
Jackson Park Pond - Below					
	Etheostoma	olmstedii	Tessellated darter	33	In addition, approximately 40 American eels were observed while shocking but not collected.
	Anguilla	rostrata	American eel	10	
	Lepomis	gibbosus	Pumpkinseed	3	
	Catostomus	commersoni	White sucker	1	
	Lepomis	macrochirus	Bluegill	1	
Bloodgoods Pond Dam - Below					
	Etheostoma	olmstedii	Tessellated darter	55	In addition, approximately 60 American eels, ranging from elver to 2 ft. in length, were observed while shocking but were not collected
	Lepomis	macrochirus	Bluegill	10	
	Anguilla	rostrata	American eel	5	
	Lepomis	gibbosus	Pumpkinseed	4	
	Notropis	pronce	Swallowtail shiner	3	
	Catostomus	commersoni	White sucker	3	
	Fundulus	diaphanus	Banded killifish	2	
	Notropis	pronce	Swallotail shiner	1	
	Fundulus	diaphanus	Banded killifish	1	
	Lepomis	gulosus	Warmouth	1	

Table 4
Icthyoplankton Identification Summary
Fish Passage Feasibility Study
Rahway River, Rahway, New Jersey

Collection Location	Genus	Species	Common Name	Quantity	Comments
USGS Gage Station - Below					
	<i>Catostomus</i>	<i>commersoni</i>	White sucker	4	Larvae; 16-17mm
	<i>Pseudopleuronectes</i>	<i>americanus</i>	Winter flounder	1	Larvae; 3.6mm; Normandeau Associates, Inc. 2nd stage
Water Supply Dam - Below					
	<i>Alosa</i>	<i>sp.</i>	River herring	3	Egg
	<i>Morone</i>	<i>americana</i>	White perch	2	Egg
Jackson Park Pond - Below					
			Unknown egg cluster	9	Egg
	<i>Morone</i>	<i>americana</i>	White perch	1	Egg
Bloodgoods Pond Dam - Below					
	<i>Alosa</i>	<i>sp.</i>	River herring	5	Normandeau Associates, Inc. third stage
				3	Egg
	<i>Pomoxis</i>	<i>sp.</i>	Crappie	2	Larvae; 4.5, 5.5mm

Table 5
Bypass Channel Cost Estimate
Fish Passage Feasibility Study
Rahway River, Rahway, New Jersey

Task	Description	QTY	Units	Total
1 Plans				\$ 112,600
01. . .0010.0	Health & Safety Plan	1	LS	\$ 8,958
01. . .0040.0	QA/QC Plan	1	LS	\$ 9,702
01. . .0050.0	Coordination and Meetings	1	LS	\$ 11,160
01. . .0060.0	Engineering Design and Specifications	1	LS	\$ 40,000
01. . .0070.0	Hydrologic Modeling	1	LS	\$ 20,000
01. . .0080.0	Final Report	1	LS	\$ 22,780
2 Mobilization/Demobilization				\$ 13,835
02. . .0070.0	Mobilization & Demobilization	1	LS	\$ 9,435
02. . .0080.0	Survey and Stake-out	1	LS	\$ 4,400
3 E & S Controls				\$ 26,235
03. . .0005.0	Clear & Grub	1	LS	\$ 8,096
03. . .0110.0	E & S Controls	1	LS	\$ 11,660
03. . .0120.0	Stabilized Construction Entrance	1	LS	\$ 6,479
4 Construction				\$ 54,168
04. . .0130.0	Excavation	540	cy	\$ 15,579
04. . .0135.0	Place Controlled Base	415	cy	\$ 14,147
04. . .0137.0	Place Boulders and Cobbles	65	cy	\$ 13,442
04. . .0140.0	Plantings (Allowance)	1	LS	\$ 11,000
5 Relocate Utilities (Allowance)				\$ 25,000
05. . .0010.0	Relocate Utilities (Allowance)	1	LS	\$ 25,000
6 Permitting				\$ 20,000
06. . .0150.0	Permitting	1	LS	\$ 20,000
7 Project Management				\$ 48,440
07. . .0150.0	Field Office	15	DY	\$ 20,550
07. . .0160.0	Home Office	5	wk	\$ 27,890
			Total	\$ 300,278

Table 6
Steeppass Channel Cost Estimate
Fish Passage Feasibility Study
Rahway River, Rahway, New Jersey

Task	Description	QTY	Units	Total
20	Plans			\$ 132,600
20. . .0010.0	Health & Safety Plan	1	LS	\$ 8,958
20. . .0040.0	QA/QC Plan	1	LS	\$ 9,702
20. . .0050.0	Coordination and Meetings	1	LS	\$ 11,160
01. . .0060.0	Engineering Design and Specifications	1	LS	\$ 60,000
01. . .0070.0	Hydrologic Modeling	1	LS	\$ 20,000
20. . .0080.0	Final Report	1	LS	\$ 22,780
21	Mobilization/Demobilization			\$ 13,835
21. . .0010.0	Mobilization & Demobilization	1	LS	\$ 9,435
21. . .0020.0	Survey and Stake-out	1	LS	\$ 4,400
22	E & S Controls			\$ 25,955
22. . .0010.0	Clear & Grub	1	LS	\$ 8,096
22. . .0020.0	E & S Controls	1	LS	\$ 11,380
22. . .0030.0	Stabilized Construction Entrance	1	LS	\$ 6,479
23	Construction			\$ 142,423
23. . .0020.0	Excavation	225	cy	\$ 10,386
23. . .0030.0	Concrete Channel	100	LF	\$ 113,100
23. . .0035.0	Backfill	75	cy	\$ 10,688
23. . .0050.0	Plantings (Allowance)	1	LS	\$ 8,250
24	Relocate Utilities (Allowance)			\$ 25,000
24. . .0010.0	Relocate Utilities (Allowance)	1	LS	\$ 25,000
25	Permitting			\$ 20,000
25. . .0150.0	Permitting	1	LS	\$ 20,000
26	Project Management			\$ 48,035
26. . .0010.0	Field Office	15	DY	\$ 20,145
26. . .0020.0	Home Office	5	wk	\$ 27,890
			Total	\$ 407,848

APPENDIX A

Site Photograph Log



Photo 1 – Fish sampling by electrofishing below the USGS gaging station.



Photo 2 – Fish sampling by seining below the USGS gaging station.



Photo 3 – Ichthyoplankton sampling below the USGS gaging station.



Photo 4 – Ichthyoplankton sampling net.



Photo 5 – Equipment used in the fishing sampling procedure.



Photo 6– Subsurface utility locating by Air/Vacuum test hole.



Photo 7 – Test Hole 1 - Water line and electrical line.



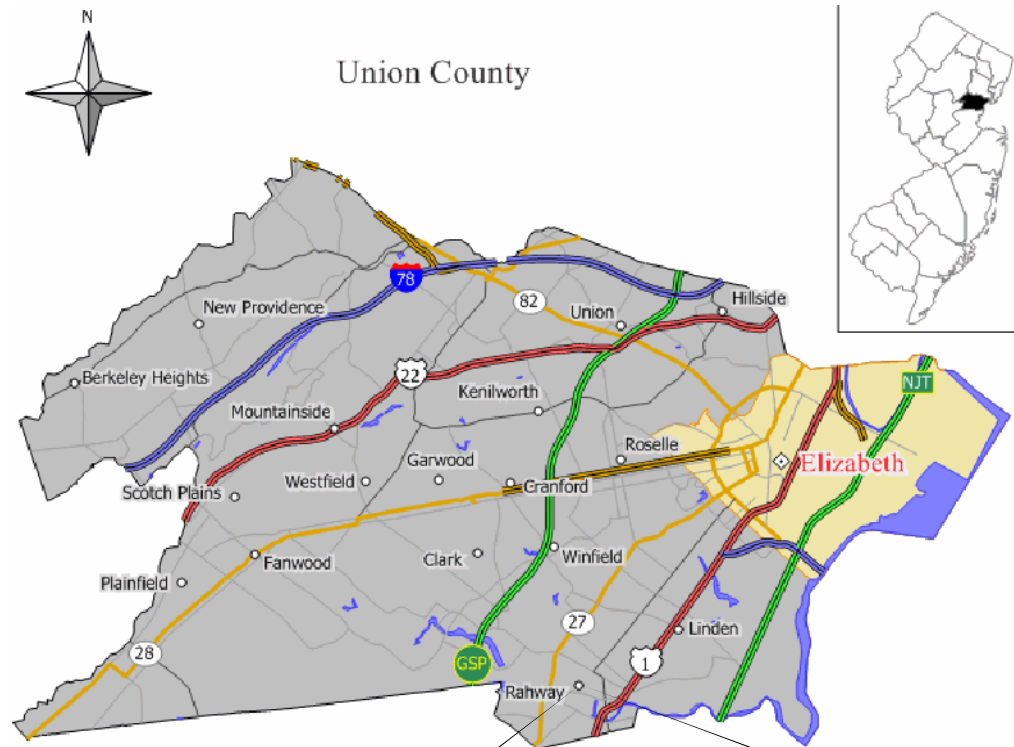
Photo 8 – Air/vacuum test hole to a water line.

APPENDIX B

Conceptual Design Plans

RAHWAY RIVER WATER SUPPLY DAM

FISH BYPASS CONEPTS
JANUARY 2, 2009



LOCATION MAP
STATE OF NEW JERSEY



PROJECT AREA

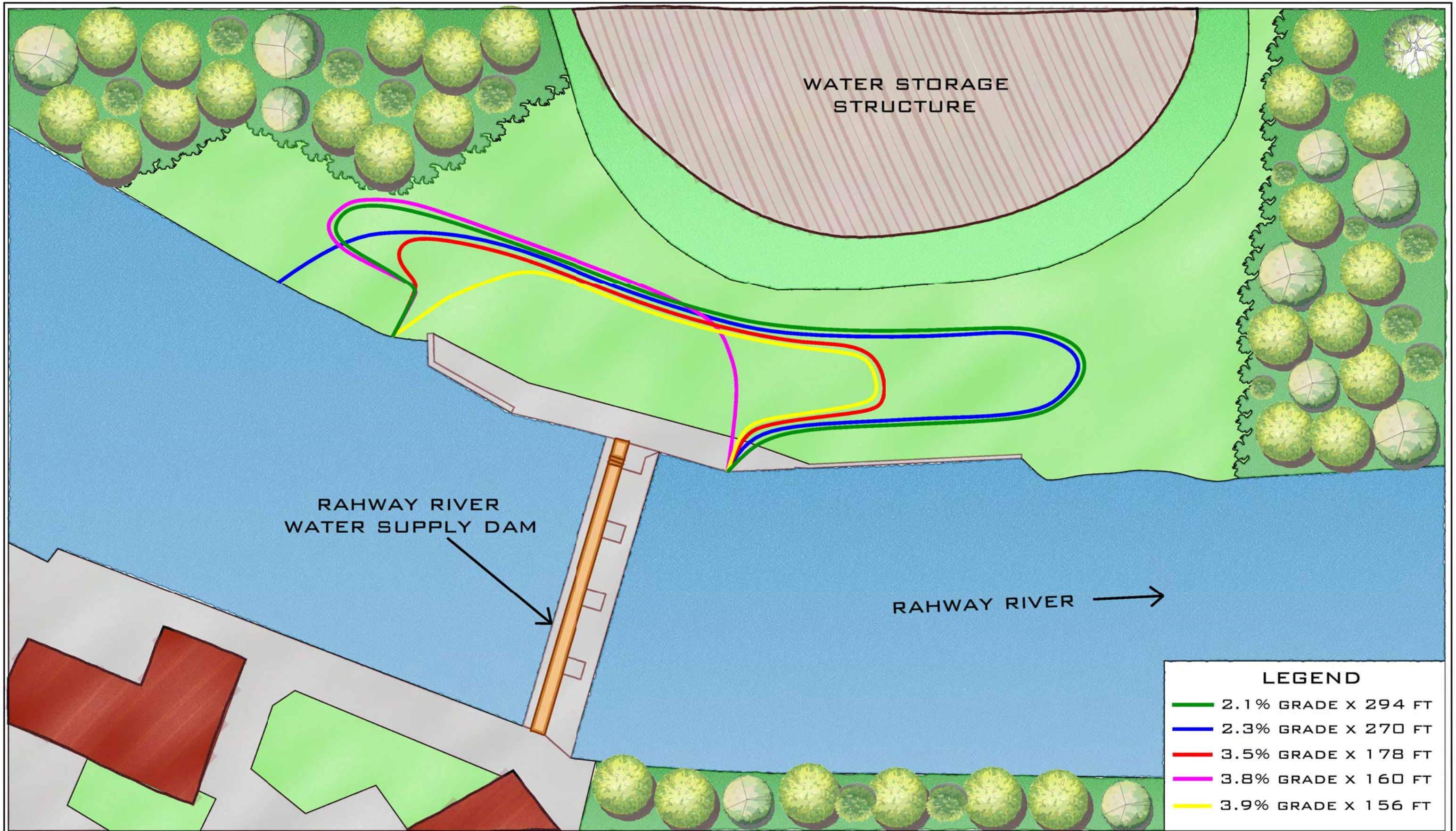


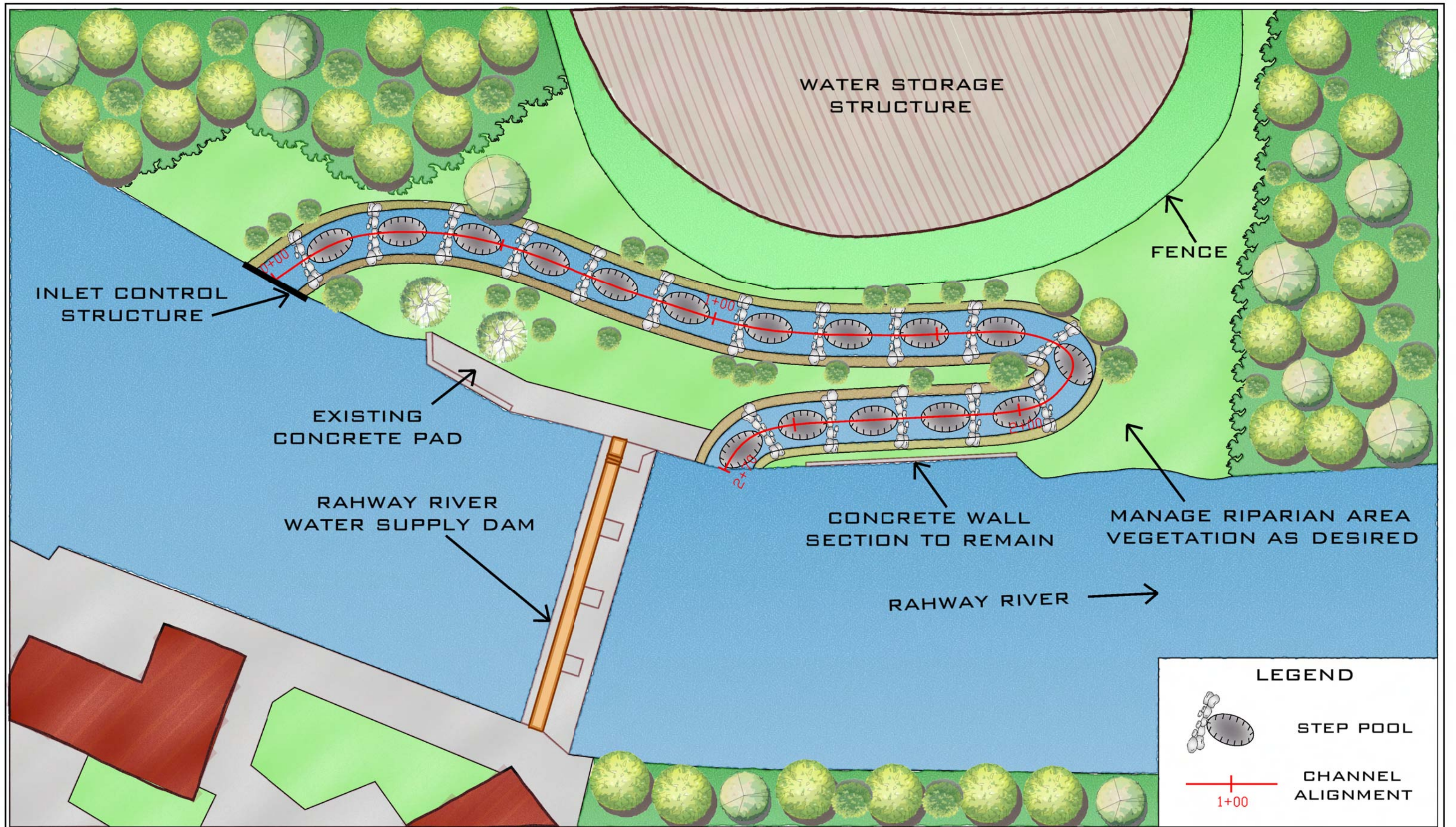
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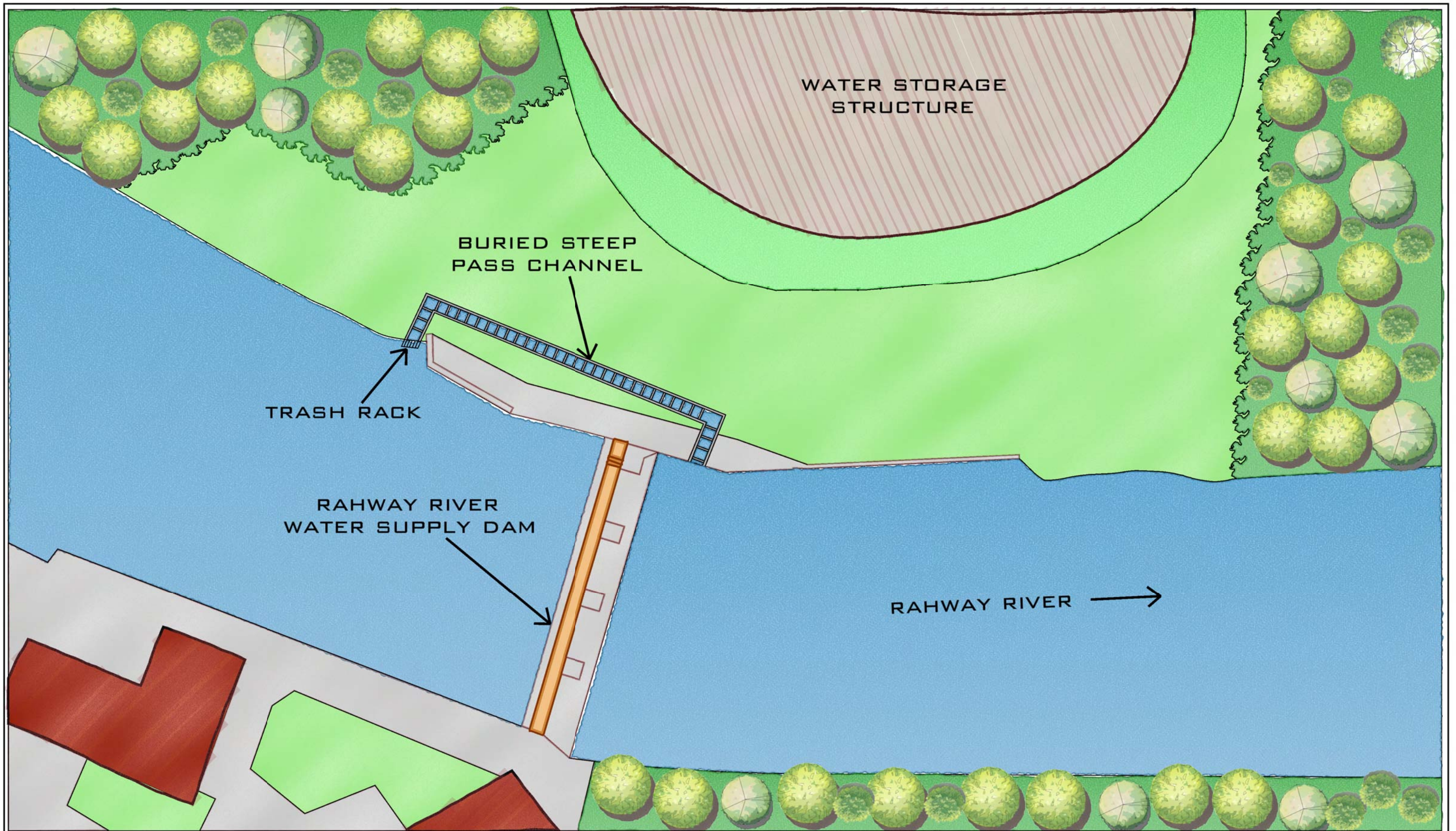
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For Construction

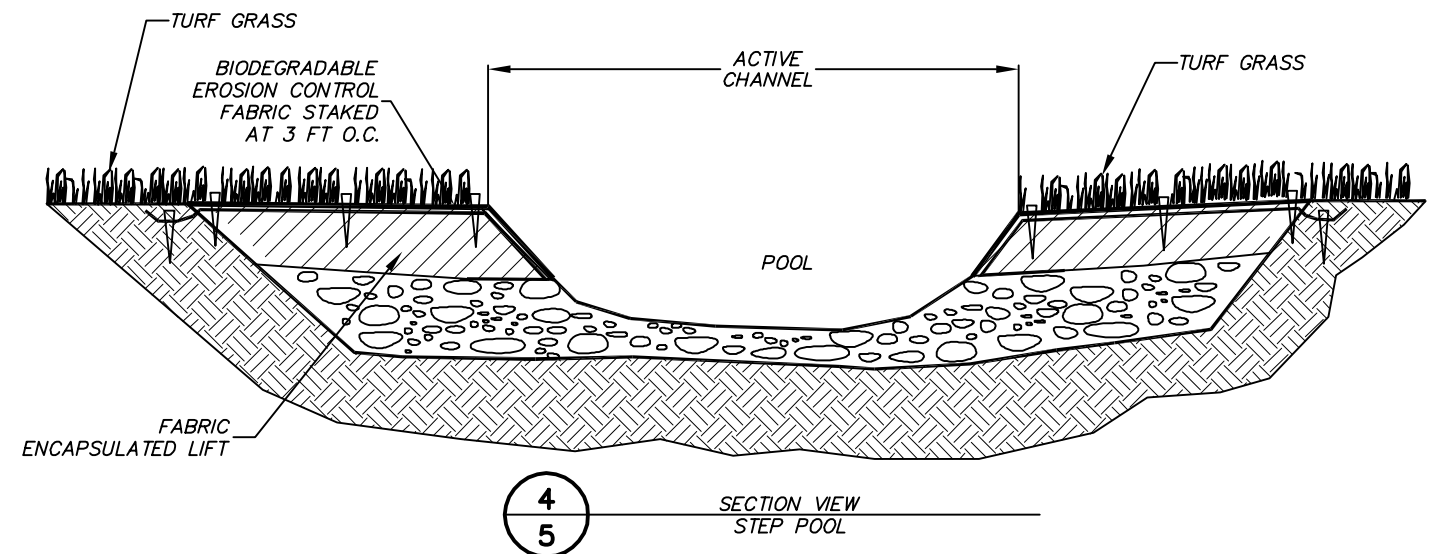
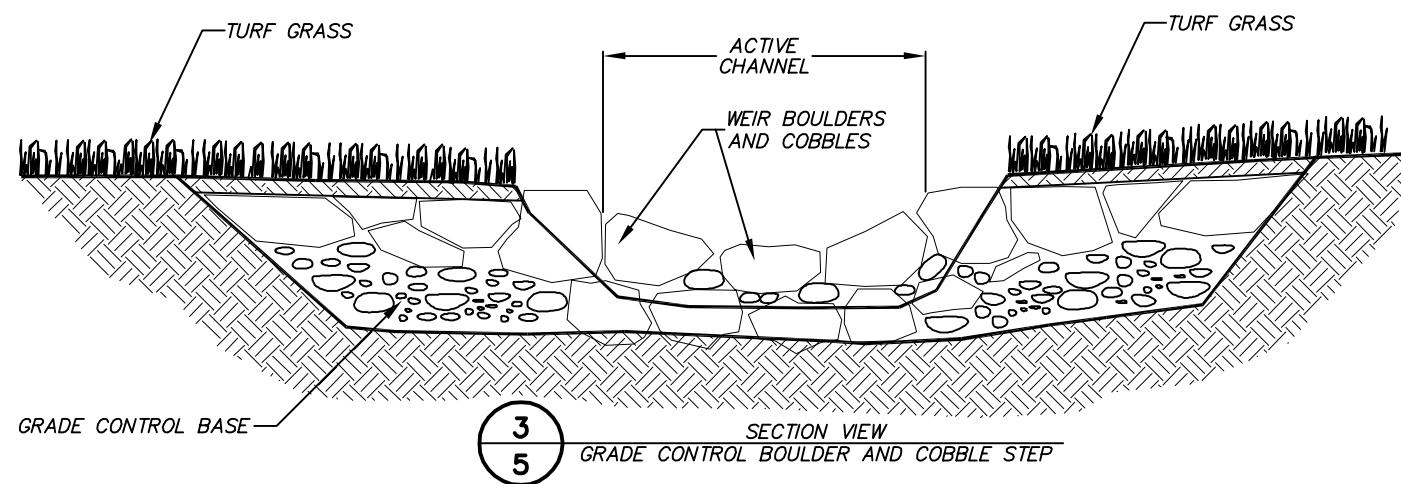
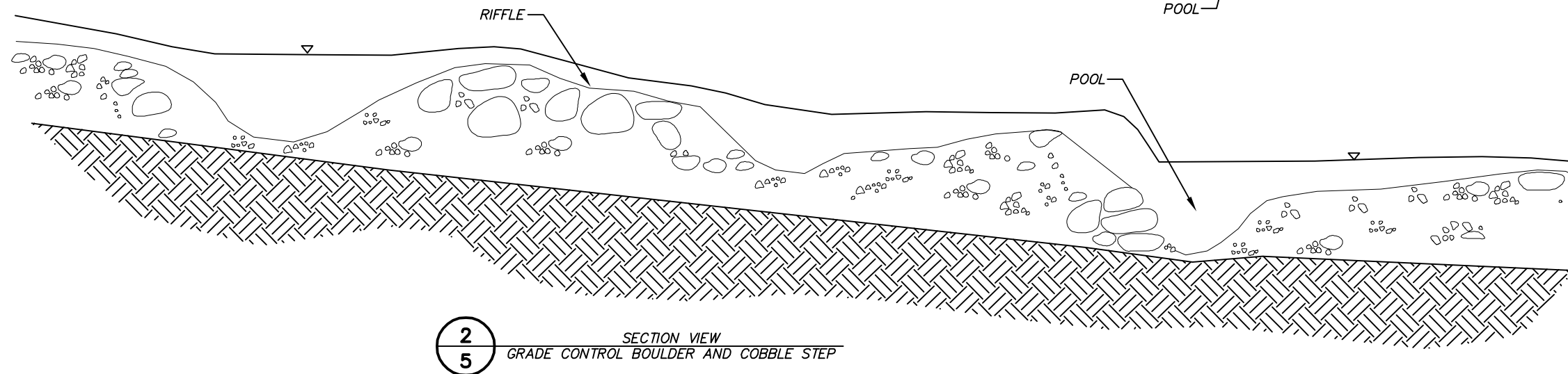
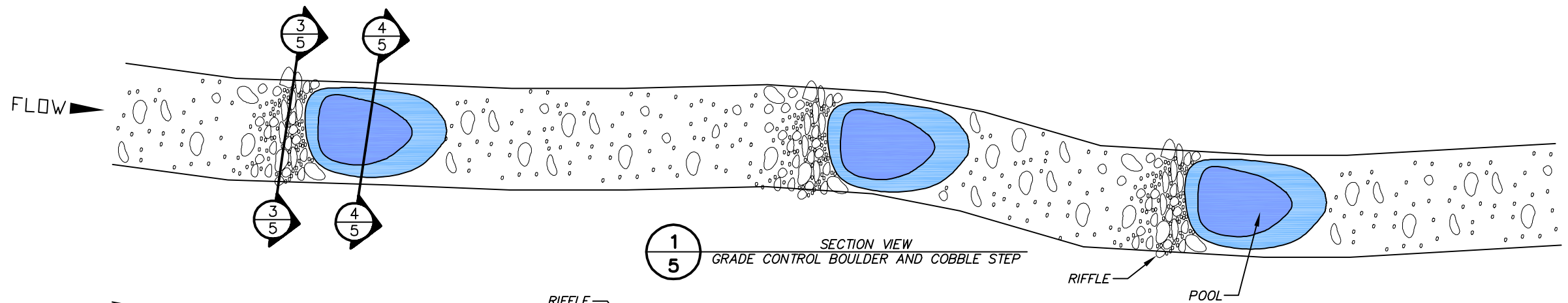


SITE LOCATION
RAHWAY RIVER WATER SUPPLY DAM
RAHWAY, NJ









ATTACHMENT 1

Scientific Collection Permit



STATE OF NEW JERSEY
Department of Environmental Protection
DIVISION OF FISH AND WILDLIFE

P.O. Box 400
Trenton, New Jersey 08625

Dave Chanda, Director
Tel: (609) 292-2965 Fax: (609) 984-1414



SCIENTIFIC COLLECTION PERMIT

Permit No. 08-024	Effective Date: May 02, 2008	Expiration Date: June 02, 2008	Statute: NJSA 23:4-52
-----------------------------	----------------------------------------	------------------------------------------	---------------------------------

The New Jersey Department of Environmental Protection Division of Fish and Wildlife grants this permit in accordance with your application, attachments accompanying same application and applicable laws and regulations. This permit is subject to further conditions and stipulations enumerated in the supporting documents, which are agreed to by the permittee upon acceptance of the permit.

Weston Solutions

205 Campus Drive
Edison, NJ 07704

Researcher: Ryan H. Brown

Is permitted to sample the freshwaters of United Water Dam (above and below), Rahway Water Supply Dam, Jacksons Park Dam, Bloodgrounds Pond Dam, Rahway River (above and below) US Geological Survey Gage Station using electrofishing, seining, gillnetting, Ichthyoplankton sampling to collect blueback herring, alewife, gizzard shad. This permit is to determine whether suitable populations of anadromous fish are present in the Rahway River.

PERMIT CONDITIONS:

The person/s named herein must be in possession of this permit during collection so that it can be shown to the Division of Fish and Wildlife Conservation Officers upon request.

Permittee shall notify the nearest Regional Law Enforcement Office when collecting in non-tidal waters, for tidal waters also contact Marine Police Station.

This permit does not convey the right to trespass. When collecting on public lands, permission must be obtained from the agency that administers these lands before collecting is initiated.

Permittee must comply with all reporting requirements.

Others operating under this permit must have a copy of this permit with their signature and the signature of designated permit researcher on their person when collecting.

Fish samples may be retained for further analysis

Additional collectors covered under this permit:

Paul Bovitz, Dan Gaughan, Eric Schrading, Dyna Krumich, Shawn Crouse, Mark Jaworski, James Lynch

May 01, 2008

Date

Dave Chanda, Director

ATTACHMENT 2

Quality Assurance Project Plan

**FINAL
QUALITY ASSURANCE PROJECT PLAN
FOR THE IMPLEMENTATION OF THE EPA REGION 2
HARBOR ESTUARY PROGRAM
RAHWAY RIVER FISH LADDER
CONCEPTUAL RESTORATION PLAN**

April 30 2008

Prepared by

WESTON SOLUTIONS, INC.
205 Campus Drive
Edison, New Jersey 08837

**FINAL
QUALITY ASSURANCE PROJECT PLAN
FOR THE IMPLEMENTATION OF THE EPA REGION 2
HARBOR ESTUARY PROGRAM
RAHWAY RIVER FISH LADDER
CONCEPTUAL RESTORATION PLAN**

April 30 2008

Prepared by

WESTON SOLUTIONS, INC.

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Client Service Manager (Date)

 4/28/08

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**New England Interstate Water Pollution
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Susannah King
Project Manager (Date)

Michael Jennings
QA Program Manager (Date)

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standard
FedEx

TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
SECTION 1.0 INTRODUCTION.....		1-1
SECTION 2.0 PROJECT DESCRIPTION		2-1
SECTION 3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES		3-1
3.1	INTERNAL RESPONSIBILITIES.....	3-1
3.2	EXTERNAL RESPONSIBILITIES	3-3
3.3	SPECIAL TRAINING REQUIREMENTS/CERTIFICATIONS	3-4
SECTION 4.0 QA OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA.....		4-1
4.1	QA OBJECTIVES	4-1
SECTION 5.0 SAMPLING PROCEDURES		5-1
SECTION 6.0 SAMPLE CUSTODY		6-1
SECTION 7.0 EQUIPMENT		7-1
SECTION 8.0 ANALYTICAL PROCEDURES		8-1
SECTION 9.0 DATA ACQUISITION, COLLECTION, REPORTING AND MANAGEMENT		9-1
9.1	DATA ACQUISITION REQUIREMENTS	9-1
9.2	DATA COLLECTION.....	9-1
9.3	DATA REPORTING	9-2
9.4	DATA QUALITY MANAGEMENT	9-2
SECTION 10.0 INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY.....		10-1
SECTION 11.0 QA PERFORMANCE AUDITS, SYSTEM AUDITS, AND FREQUENCY		11-1
SECTION 12.0 CORRECTIVE ACTION		12-1
SECTION 13.0 QA REPORTS TO MANAGEMENT.....		13-1
SECTION 14.0 RECORDS MANAGEMENT SYSTEM		14-1
14.1	PROJECT RECORDS	14-1
14.2	AUDIT FILES.....	14-1
14.3	FILE CLOSURE PROCEDURE	14-1
14.4	PERIODIC REVISIONS OF THE QAPP	14-1
SECTION 15.0 QUALITY-RELATED DOCUMENTS		15-1
SECTION 16.0 PROCUREMENT PROCEDURES AND INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES, CONSUMABLES AND SERVICES		16-1

16.1	SUPPLIES AND CONSUMABLES	16-1
16.2	SERVICES.....	16-1
16.2.1	<i>Field Equipment</i>	16-1
16.2.2	<i>Subcontracting</i>	16-2
16.2.3	<i>Analytical Services</i>	16-2

LIST OF FIGURES

<u>Figure</u>	<u>Title</u>	<u>Page</u>
2-1	Revised Project Schedule	2-3
2-2	Fish Survey Sample Locations	2-4
3-1	Project Organization and Reporting Relationships	3-2
5-1	Sample Labels	5-6
5-2	Example of Custody Seal	5-6
6-1	Example of Chain-of-Custody Form	6-2
9-1	Logbook Control Sheet	9-4
14-1	File Checklist	14-3

LIST OF APPENDICES

<u>Appendix</u>	<u>Title</u>
A	Fish Collection by Seining or Electrofishing SOP

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SECTION 1.0 INTRODUCTION

Weston Solutions, Inc. (Weston®) has established a quality assurance (QA) program as an essential part of corporate policy with the objectives of ensuring the technical soundness, statistical accuracy, and proper documentation of all information and measurement data for every project. Elements of the corporate program, along with proven QA provisions of the Quality Assurance Project Plan (QAPP) from the Superfund Technical Assessment and Response Team III (START) program have been combined with the project-specific needs related to the Statement Of Work (SOW) for the Region 2 Harbor Estuary Program (HEP) Fish Ladder Grant to provide for quality services and deliverables to the U.S. Environmental Protection Agency (EPA) and the New England Interstate Water Pollution Control Commission (NEIWPCC).

In order to provide data, information, and/or services that will fulfill their intended use and are adequately documented, Weston has established this QAPP, which includes:

- QA objectives and goals.
- An organizational structure to implement the QA objectives.
- Mechanisms to establish standards for performance.
- Audit mechanisms to evaluate performance and corrective action mechanisms to address identified problems.
- Documentation protocols to demonstrate level of performance.

This QAPP is consistent with the Uniform Federal Policy for Implementing Environmental Quality Systems: Evaluating, Assessing and Documenting environmental Data Collection/Use and Technology Programs, Final, Version 2, 4 March 2005; Uniform Federal Policy for Quality Assurance Project Plans, Part 1: UFP - QAPP Manual, Final, Version 1, March 2005; Workbook for Uniform Federal Policy for Quality Assurance Project Plans, Part 2A: UFP - QAPP Workbook, Final, Version 1, March 2005; Uniform Federal Policy for Quality Assurance Project Plans, Part 2B: Quality Assurance/Quality Control Compendium: Minimum QA/QC Activities, Final, Version 1, March 2005; and was developed in accordance with the EPA Quality Assurance Guideline as outlined in EPA QA/R-5, EPA Requirements for Quality Assurance Project Plans, March 2001.

SECTION 2.0 PROJECT DESCRIPTION

The project purpose is to allow anadromous fish populations including blueblack herring (*Alosa aestivalis*) and alewife (*Alosa pseudoharengus*), collectively known as river herring, and gizzard shad (*Dorosoma cepedianum*) to reach historical upstream spawning grounds in the Rahway River that are currently inaccessible due to the presence of dams and other water control structures. This project would also support spawning migrations of catadromous American eel (*Anguilla rostrata*) populations.

Weston and the Rahway River Association (RRA) were originally awarded a grant for \$15,000 from the New York-New Jersey Harbor Estuary Program (HEP) in 2005 for a preliminary evaluation of this HEP site as a potential fish ladder location. The Hudson River Foundation administered the grant. Weston provided a \$15,000 matching contribution for that effort, which included several elements including project planning, collection and review of existing data, a preliminary underground utility search, a topographic survey of the site, geotechnical borings and analysis, and a screening evaluation of fish passage alternatives.

Results were presented to reviewing agencies in March 2006 in the *Final Preliminary Fish Passage Feasibility Evaluation for the Rahway River Water Supply Dam, Rahway, New Jersey*.

A summary of the work completed to date is provided in an article from *The Tidal Exchange*, Autumn 2006, the newsletter of the New York-New Jersey Harbor Estuary Program.

The study indicated that two proposed fish passage alternatives (steep-pass, and bypass ramp) are potentially feasible and would meet the project's fish passage goals while allowing the dam to operate in its current capacity. Weston identified several future steps in order to further evaluate these designs and develop a conceptual design plan:

1. Conduct a more detailed underground utility survey aimed at determining the depth of buried pipes and electrical lines in order to evaluate whether it is feasible to engineer fish passage by excavating around the eastern side of the dam.
2. Conduct a fish survey in the immediate upstream and downstream portions of the Rahway River to confirm reports that anadromous and catadromous fish species are present during expected spawning migration periods.
3. Survey for the presence of suitable habitat available upstream of the dam for spawning and rearing juvenile fish, and/or determine whether habitat enhancements are necessary or are appropriate. This work was conducted by U.S. Fish and Wildlife Service (USFWS) in July 2006.
4. Conduct a threatened, endangered, and protected species search of the project site and surrounding habitats.
5. Conduct flow measurements and hydraulic modeling at sites upstream and downstream of the dam to model impacts to fish ladder designs at different flow regimes.
6. Conduct an archeological and historical assessment of the project area.

A subsequent grant for \$60,000 issued May 21, 2007, addressed all of these steps except for #5. Step # 5 above will be the subject of future engineering design studies should the subsurface

utility survey and fisheries studies confirm project implementability. This QAPP covers activities to be performed under that grant, and future activities under the project. However, the only environmental data to be collected under the current grant includes that which is obtained during the fisheries survey (Task 2 below).

Project Approach

The project approach includes technical elements and recommendations identified in the *Final Preliminary Fish Passage Feasibility Evaluation for the Rahway River Water Supply Dam, Rahway, New Jersey*, as well as comments on the report from stakeholders such as National Oceanic & Atmospheric Association (NOAA). The following tasks would be completed as part of the Scope of Work of this grant application. Figure 2-1 provides a tentative schedule for the following tasks.

Task 1 - Detailed Utility Search - The objective of this task is to identify the exact location, depth, and ownership of utilities potentially in the path of potential fish ladder. The initial investigation indicated that in-stream attachment of a ladder to the dam was not feasible, and that viable alternatives for ladder construction would involve bypassing the dam entirely. The preliminary utility search indicated the presence of some utilities within the area proposed to be excavated. Information on the vertical extent of utilities is still required in order to determine the ultimate feasibility of a ladder. The deliverable will be a CAD drawing (not certified) showing the location of any buried utilities, and their width and depth.

Task 2 - Fisheries Survey - The objective of the fisheries survey is to ascertain whether suitable populations of anadromous fish are present in the area to warrant construction of a fish ladder, or whether reintroduction of fish stocks may be required. A secondary objective is to determine the upstream extent of any anadromous fish presently negotiating the dam.

After completion of Weston's initial fish ladder investigation, the USFWS conducted a Habitat Suitability Index (HSI) survey immediately upstream of the dam in July 2006. The HSI indicated that suitable spawning habitat for anadromous fish is present.

However, data are still needed on the actual number and species of fish present above and below the dam during the spring anadromous fish run, including data regarding the impact of two dams located upstream (Jacksons Park Dam and Bloodgoods Pond Dam) of the United Water Dam. Fish, including ichthyoplankton, will be sampled in the vicinity of all three dams. The technical approach will be to conduct fish sampling at six locations (one location above and below each of the dams located on the Rahway River, twice during the spawning season [early and late]) (Figure 2-2). Each sampling event is estimated to consist of a maximum of one day's worth of effort. While the primary goal is simple presence/absence monitoring, this survey has been designed so that it can also serve as a baseline from which future fish monitoring data can be compared.

Task 3- NJDEP Office of Dam Safety Coordination - Dam safety is not anticipated to be a significant issue since the currently proposed design avoids impacting the dam itself. However, because there is a potential for construction of a fish ladder to modify water flow at the United Water dam, approval from New Jersey Department of Environmental Protection (NJDEP) will likely be required.



SOURCE: NJGIN-NJ Image Warehouse
2002 Ortho Photos

● - Fish/Ichthyoplankton Collection Sample Location

DATE: 3/21/2008

P:\Rahway_Fish_ladder\GIS\MXD\05608_Samp_Loc.mxd

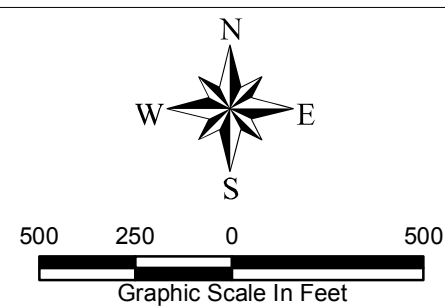


Figure 2-2
Fish Survey Sample Location Map
Rahway River Fish Ladder
Rahway, New Jersey

Task 4- Stakeholder Meeting - The goal of the stakeholder meeting will be to identify any remaining concerns before applying for future fish ladder design and construction funding. Weston proposes to organize and conduct one stakeholder meeting designed to ensure cooperation from stakeholders regarding the project. The meeting will be informative in nature; Weston will provide a brief PowerPoint presentation explaining the project to interested stakeholders.

Task 5- Long-term Owner Determination - A long-term owner and project sponsor for maintenance and operation of the fish ladder will need to be secured before proceeding to project construction. The property is owned by the City of Rahway, and located adjacent to the Rahway River Park (owned and maintained by Union County). Weston will assist with negotiations with both the City of Rahway and Union County to determine whether they will sign agreements for potential long-term ownership.

Task 6 - USGS Gauging Station Coordination - It will be necessary to coordinate with U.S. Geological Survey (USGS) to ensure that implementation of a fish ladder at the United Water dam would not impact measurements of velocity or flow at the nearest USGS gauging station (#01395000) located 0.35 mile downstream of the dam. Since data have been collected there for decades, any impact on velocity or flow could affect the ability of the agency to ascertain long-term trends in hydrological data.

Task 7 - Permitting Pre-application Meetings - It will be necessary to coordinate with NJDEP and other agencies to ascertain the permits required for implementation of a fish ladder at the Water Supply dam, and to confirm that regulatory requirements can be met.

Task 8 - Endangered and Threatened Species Survey - Two forms of endangered/threatened species data will be collected. First, Weston will place a Natural Heritage Survey with NJDEP, who will conduct a records search of the area.

Task 9 - Initial Cultural Resources Survey - Weston will place a request for a Cultural Resources Natural Heritage Survey with the State Historic Preservation Office (SHPO) to determine if there are any known cultural or archaeological resources within the proposed project footprint. Should cultural or archaeological resources be present, a Phase I Cultural Resources Survey would have to be conducted, which is outside of the scope of this grant.

Task 10 - Feasibility Analysis Report – Based on the information collected, Weston will update the *Final Preliminary Fish Passage Feasibility Evaluation for the Rahway River Water Supply Dam, Rahway, New Jersey*, into a Draft document for stakeholder review. The report will include results of this investigation and coordination activities.

Task 11 - Conceptual Design Preparation and 30% Cost Estimate - Once the field data have been collected and reviewed by our engineers and fisheries biologists, RRA and Weston will prepare the conceptual design. We will then prepare up to two design drawings depicting the conceptual design in plan and cross-section views. The conceptual design will also include a 30% cost estimate for the work and a summary of any remaining data gaps needed to finalize the cost estimate. This estimate would provide the bases for establishing future construction funding sources. The cost estimate will include the following elements: hydrological studies, soil

excavation and testing, transportation and disposal costs, permitting and approvals, and final engineering design.

Future Tasks Necessary to Reach Construction (not included in the current grant)

Task 12 – Hydrologic Modeling – In order to assess potential impacts that construction of the proposed fish ladder may cause to the flow characteristics on the Rahway River system, Weston will perform hydraulic and hydrologic analysis and modeling. To assist in the study, Weston will contact Federal Emergency Management Agency (FEMA) and request the backup information for the City of Rahway Flood Insurance Study (FIS). Weston will then reconstruct the hydraulic model for the reach containing the dam using the hydraulic model, HEC-RAS. This model is designed to perform one-dimensional hydraulic calculations for a full network of natural and constructed channels. The model will be modified to include the fish passage and re-analyzed to evaluate any impact on flooding caused by the project. The HEC-RAS model will be used to compare existing and future conditions.

Task 13 – Permitting - Using the results obtained in Task 7, Weston will prepare and submit permit applications to the appropriate regulatory agencies. Based on discussions with NJDEP's Bureau of Land Use and NJDEP's Bureau of Dam Safety and Flood Control, it is currently anticipated that at a minimum, the following two major state permits will be needed for the proposed project:

- NJDEP Stream Encroachment Permit (N.J.A.C. 7:13) - There are two types of stream encroachment permits - minor and major. If the flooding impact of an activity is easy to assess, and the activity will have only minor impacts on flooding, the activity will require a minor permit. An activity whose flooding impact cannot be assessed without complex calculations, and which may have a substantial impact on flooding, will require a major permit.
- NJDEP Freshwater Wetlands Permit 7:7A-5.16 General Permit 16 - Habitat creation and enhancement activities. General permit 16 authorizes habitat creation and enhancement activities in freshwater wetlands, transition areas, and State open waters, necessary to implement a plan for the restoration, creation or enhancement of the habitat and water quality functions and values of wetlands, which is sponsored or substantially funded by a Federal or State agency or other entity and may include fish habitat enhancement devices or fish habitat improvement structures. An application for authorization under general permit 16 does not require an application fee under N.J.A.C. 7:7A-11.

Task 14 – Design Drawings and Specifications - An important scope of work needed to bring the subject project to construction will be the preparation of design drawings and specifications describing construction details and requirements. In this task, engineers will work with project biologists to design a fish ladder that will accommodate target fish species while conforming to site constraints. It is anticipated that almost all of the information collected to date including river hydraulics, geotechnical conditions, biological data, and regulatory requirements will be synthesized and translated into project drawings and written specifications needed for construction.

It is likely that drawings, specifications, and cost estimates for construction will be prepared at progressing level of completeness and will include submittals at the 60%, 90% and 100% stages. The design will be based on the conceptual plans developed under Task 11. The drawings and specifications may be reviewed by EPA and NEIWPCC or other delegated authority. Once the 100% design is completed and construction funding secured, a bidding package would be assembled and bids solicited from qualified contractors. The project owner (as determined in Task 5) would be responsible for entering in the construction agreement with the contractor. Engineering oversight would likely be a key component to ensure the project is built to specification.

Quality Assurance Project Plan

The 2007 HEP grant requirements include a provision that any field data collected or secondary data used under the grant be subject to an EPA-approved Quality Assurance Project Plan (QAPP). Data collection at this phase of the project will be minimal, and limited to the review of existing data and to biological data collected during the fisheries sampling (i.e., enumeration and meristics of fish caught, taxonomic identification of fish species and ichthyoplankton) under Task 2. To address the QAPP requirement, Weston has edited our approved EPA QAPP for the Region 2 Site Assessment Team (SAT) contract. We have spoken with and gained preliminary approval from Mr. Marcus Kantz (Team Leader of EPA Region 2 Air and Water Quality Assurance Team) regarding our proposed approach. All data collection procedures will follow the approved QAPP once EPA and NEIWPCC approve the revised sections pertinent to biological sampling.

SECTION 3.0

PROJECT ORGANIZATION AND RESPONSIBILITIES

The project organization and reporting relationships of the office in Edison, NJ are presented in Figure 3-1. Due to the size and complexity of the Project, the Quality Assurance Officer (QAO) has reporting responsibilities assigned to Division QAOs as established in the Corporate QA Process Description.

3.1 INTERNAL RESPONSIBILITIES

QAO — The primary function of the QAO is to ensure the quality of services and deliverables through implementation of an effective QA program for the project. This function begins with the development and implementation of the QAPP. Following its implementation, the QAO must ensure compliance by conducting periodic management and system audits. Tracking the development and implementation of QA deliverables and SOPs are other roles for the QAO. The QAO's other responsibilities may include overseeing laboratory procurement (subcontract and CLP); submitting monthly QA reports to EPA and NEIWPCC; participating in developing Data Quality Objectives (DQOs) or QA objectives for sampling projects; approving field sampling plans; performing data review and validation; reporting on data quality to EPA; conducting field audits; evaluating and responding to corporate-generated audit reports; and reviewing the QAPP (annually at a minimum) and revising it as necessary.

The QAO reports to the PM on technical and daily administrative issues to facilitate the integration of quality in all assignments. The QAO also has direct and independent reporting requirements to the corporate QA Manager on nonconformance, performance, and corrective action issues.

The QAO is responsible for encouraging and achieving continual improvement by implementing new policies based on audit observations and issues identified by field personnel. The QAO will update or develop new SOPs in response to an observed need or request of the project staff. The QAO will perform the annual review of the QAPP, and provide comments for revision and approval to the Program Manager.

Project Manager (PM) — The PM provides overall management of the project. The PM has overall responsibility for the assignment and direction of tasks received from the EPA Project Officer (PO) and NEIWPCC PM. The PM ensures the project is staffed with qualified/appropriate personnel. The PM's quality-related responsibilities include direct supervision of team members; hiring qualified and appropriate staff; management of contract budgets; final review and approval of deliverables; ensuring quality in the performance and timely completion of specified tasks; providing for program reporting requirements [i.e., monthly progress reports, program reports]; coordinating activities with the EPA PO and NEIWPCC PM; and ensuring the implementation of corrective actions in response to functional audits.

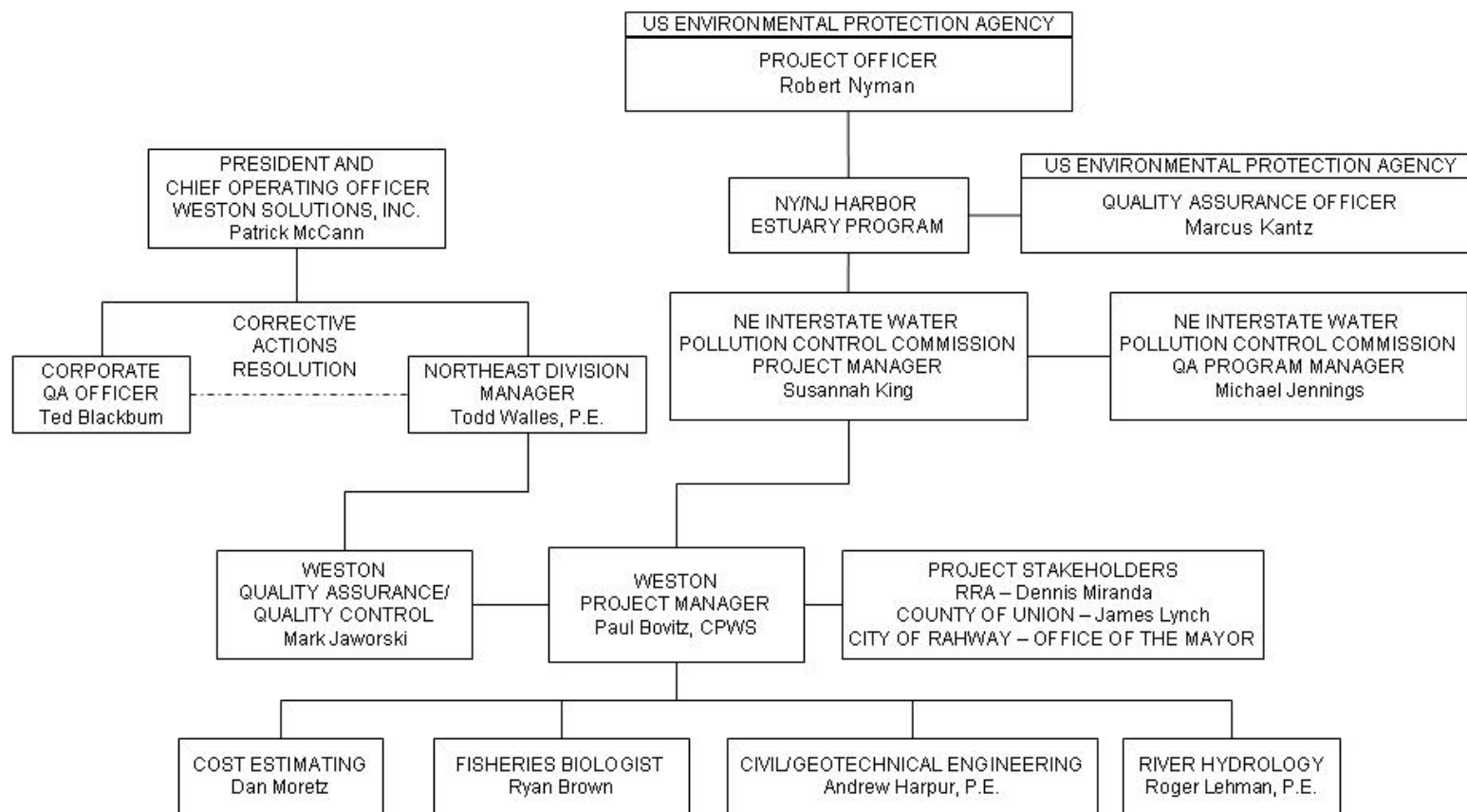


FIGURE 3-1: PROJECT ORGANIZATION AND REPORTING RELATIONSHIPS

Team Members — Team members provide technical assistance to EPA and NEIWPC. Their quality-related functions include knowing and applying the QAPP; following the appropriate field practices and applicable established procedures and methods; documenting all deviations from standard procedures or methods; helping develop sampling plans that reflect methods, techniques, and procedures being used; submitting all final reports for peer review validation; and reporting major quality problems and progress to the QAO. Team members report to the PM.

Continued improvement begins with the performance of Team members, not just correcting problems identified in audits. Technology transfer, training, employee incentives, and awareness programs will be used to improve the quality of everyday activities and deliverables. The following core team of individuals will be implementing this project.

Mr. Mark Jaworski will act as Weston's QAO and Corporate Sponsor. He has been a long-time advocate of ecological restoration projects within the New York/New Jersey Harbor and has been an active member of the HEP Habitat Work Group since 1999. His principal responsibility will be to ensure good overall project communications and to engage Weston's corporate resources. He will also monitor project milestones and ensure satisfaction with the project deliverables. Mr. Jaworski is an ecologist with over 17 years of experience in the environmental restoration field.

Mr. Paul Bovitz (M.S. Ecology) will serve as the Weston Project Manager. He will be responsible for the implementation of the scope of work, schedule, and cost control. Mr. Bovitz is a certified wetland scientist with extensive experience in the management of ecological studies/restoration designs. He has in-depth Rahway River restoration experience, having managed the first phase of this project, and prior projects for the U.S. Army Corps of Engineers (USACE) in Rahway and at Medwick Park. Mr. Bovitz has over 20 years experience in ecological investigations and has been with Weston for over 17 years.

Mr. Ryan Brown (M.S. Fisheries) will serve as Weston's fisheries biologist responsible for evaluating fisheries data collected from the field and selecting the type of fish ladder most appropriate for the conditions at the site. He has been the lead fisheries biologist on numerous fisheries and aquatic habitat investigations involving hydroelectric and water storage projects in the Northeast and Midwest. Mr. Brown has over 10 years of experience in the field of aquatic ecology with representative projects including: dam removal for native trout recolonization, aquatic habitat assessments for Federal Energy Regulatory Commission (FERC) dam re-licensing projects, as well as riparian habitat restoration projects within the Rahway River.

3.2 EXTERNAL RESPONSIBILITIES

Northeast Division (NED) Manager — The NED Manager's primary quality-related responsibility is to introduce and support total quality management (TQM) principles into all Federal projects. The NED Manager is the focal point to resolve technical nonconformance issues with the team members, firm Principals, and other Weston Divisions. The NED Manager is also the corrective actions contact for the corporate QA Manager. The NED Manager reports to the corporate President and Chief Operating Officer as indicated in the QMP.

Corporate QA Manager — The corporate QA Manager's primary quality-related responsibility is to formulate, track, and evaluate corrective action measures based on input and reporting from the Weston NED project QAO. The corporate QA Manager is also responsible for the development and implementation of corporate QA operating procedures. The corporate QA Manager will work with the NED Manager to implement corrective actions as necessary. The corporate QA Manager reports directly to the President and Chief Operating Officer.

3.3 SPECIAL TRAINING REQUIREMENTS/CERTIFICATIONS

Ryan Brown will be responsible for field taxonomic identification of fish that are collected during the fisheries survey (Task 2). Mr. Brown will also be in charge of the fish survey collection methods. Mr. Brown has a Masters Degree in Fisheries from the University of Minnesota and has extensive fisheries collection and taxonomic identification experience.

Mr. Michael Scherer Ph.D. of Normendeau Associates, Inc. will be responsible for taxonomic identification of ichthyoplankton samples collected during the fisheries survey.

SECTION 4.0

QA OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The Uniform Federal Policy for Implementing Environmental Quality Systems: Evaluating, Assessing and Documenting environmental Data Collection/Use and Technology Programs, Final, Version 2, EPA-505-F-03-001, 4 March 2005 outlines essential elements of a Quality Systems for management of environmental data collection and use and environmental technology programs. Additional guidance is provided in the Uniform Federal Policy for Quality Assurance Project Plans, Part 1: UFP - QAPP Manual, Final, Version 1, EPA-505-B-04-900A, March 2005; Workbook for Uniform Federal Policy for Quality Assurance Project Plans, Part 2A: UFP - QAPP Workbook, Final, Version 1, EPA-505-B-04-900C, March 2005; Uniform Federal Policy for Quality Assurance Project Plans, Part 2B: Quality Assurance/Quality Control Compendium: Minimum QA/QC Activities, Final, Version 1, EPA-505-B-04-900B, March 2005; the EPA Quality Assurance Guideline as outlined in EPA QA/R-5, EPA Requirements for Quality Assurance Project Plans, March 2001.

All tasks that require measurement data will define the quantitative limits that the data are expected to meet in specific sampling plans. These limits are established as part of the DQO process as detailed in EPA QA/G-4, Guidance for the Data Quality Objectives Process, EPA/600/R-96/05, August 2000. The DQO process requires decision-specific acceptable data quality goals. This approach encourages optimal data usability across EPA program lines and reduces the need for repetitive sampling. The DQO approach includes defined steps, including: 1) stating the site problem (source/location of contamination); 2) identifying the decision (which may require additional data); 3) identifying the needed inputs for the decision (data needed for the decision); 4) defining the site boundaries (area and time- frame for study); 5) developing a decision rule (logical "if...then" statement); and 6) specifying limits on decision errors (acceptable error limits). The sampling design is optimized for obtaining data to support this process in the most resource-effective manner. As delineated in the subsequent Uniform Federal Policy for Quality Assurance Project Plans, Part 1: UFP - QAPP Manual, Final, Version 1, EPA-505-B-04-900A, March 2005; the PM will more typically implement a "Graded Approach" for data collection activities that are either exploratory or small in nature or where specific decisions cannot be identified, the formal DQO process is not necessary.

4.1 QA OBJECTIVES

The data objectives and the means for determining acceptance can vary greatly, depending on the collection system, the number of measurements, the detection limits of the analytical method, and the ability to use QA/QC samples. The data generated will be used in support of evaluating the feasibility of a fish ladder on the Rahway River; the river and adjacent area, including biological inventories. The overall objective is to provide sufficient quality data to evaluate the feasibility of the proposed engineering project.

SECTION 5.0 SAMPLING PROCEDURES

The accuracy of a data-generating activity begins with well planned and executed sampling procedures. This site-specific QAPP has been developed for the proposed sampling and field data collection activities. This plan includes the rationale for the sampling design, field procedures, standard operating procedures (SOPs), documentation, data objectives, and, if samples should be taken for analysis, analytical requirements, sample container preparation, and sample volume, collection, preservation, holding times, chain-of-custody and shipping requirements. The plan also details the locations, types, number, and frequency of samples to be collected, and provides a schedule for all activities, including field sampling.

Sample Collection and Preservation — Field SOPs are established to facilitate general field-sampling or collection activities for routine site investigations. This includes the methods used to collect, label, store, preserve, and ship samples; the methods used to maintain sample chain-of-custody during shipment; and equipment operation and maintenance. Deviations from the SOP should be pre-approved by the QAO and documented. Weston will generally follow the Fish Collection by Seining or Electrofishing SOP (Appendix A) as well as the organism collection procedures presented below for this project.

Objective and Background

A recommendation of the Preliminary Fish Passage Feasibility Evaluation for the Rahway River Water Supply Dam (Weston 2006) was to confirm reports that anadromous and catadromous fish species are present in the Rahway River. As such, fish survey activities are proposed in the immediate upstream and downstream portions of the Rahway River Water Supply Dam during expected spawning migration periods. One sampling event is to take place at the early peak of the expected spawning run and the second event is to take place at the late peak of the expected spawning run.

The objective of the fish survey is to determine fish species populations that are present and also to create a baseline from which future fish monitoring data can be compared. While the primary goal is simple presence/absence monitoring, this survey has been designed so that it can also serve as a baseline from which future fish monitoring data can be compared.

Fish have been observed gathering at the dam during the time frame in which spawning anadromous fish would be expected to ascending the river (James Lynch, Rahway River Association, personal communication). Based on the literature, the primary suspected species targeted for upstream passage at the Rahway River Water Supply Dam are alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), gizzard shad (*Dorosoma cepedianum*), white perch (*Morone Americana*) and American eel (*Anguilla rostrata*) (Able 1998; Durkas 1992)). Alewife and blueback herring are collectively referred to as river herring due to their similarity in appearance, range, and life histories. River herring, gizzard shad, and white perch are all anadromous fish species (i.e., adults spawn in freshwater; juveniles migrate to marine environments where they grow to sexual maturity); whereas American eel are catadromous (adults spawn in the marine environment; the young migrate to freshwater habitats where they grow to sexual maturity) (Able 1998).

River herring and gizzard shad are members of the family Clupeidae (herrings and shads). In New Jersey, adult herring migrate from the ocean to freshwater spawning areas from early spring through early summer (Able 1998). After hatching, young-of-the-year fish typically remain in freshwater nursery habitats for several months prior to migrating to estuarine and eventually marine environments to grow and mature. After reaching sexual maturity, the adults return to their natal streams to spawn.

Fish Collection

Two non-lethal collection techniques will be used to obtain a sufficient number of fish for a baseline population census. The preference is to use boat electroshocking (or backpack electroshocking, where applicable) due to its effectiveness in shallow water bodies such as are found across the Rahway River. However, electroshocking may not be feasible in certain areas. As a backup, seining may be employed. Both sampling techniques will be conducted according to a measurable unit effort so that capture success can be compared for each technique between sampling locations. All fish collection activities will adhere to the Health and Safety Plan (HASP) for the investigation. Field sampling personnel have been trained in the proper and safe use of all fish sampling equipment, including the safe use of electrofishing equipment.

Scientific collecting permits will be obtained from the New Jersey Bureau of Freshwater Fisheries before any fish are collected. The names of all personnel involved in the collection activities will be listed on the permit. Permit conditions will be strictly followed during sampling activities.

Electroshocking

When feasible, electroshocking will be conducted primarily during twilight and daylight hours using a backpack, bank, or boat-mounted electroshocking unit. The bank or boat-mounted unit consists of a Coffelt Mark)”XX”(variable voltage pulsator shocker powered by a Honda 3-horsepower generator fitted with a boom-mounted sphere anode or a hand-held wand, an 18-inch dual hoop anode, and a trailing stainless-steel cable cathode, and with a potential output of 600 volts and 15 amps. Alternatively, individual backpack electroshocking units may be utilized in smaller wadeable locations where boat electroshocking is not possible. Backpack electroshocking will be performed by a two-or three-person crew equipped with a Smith-Root Model 12 backpack electroshocking unit (or equivalent) applying DC current.

Selected water will be sampled by conducting three timed runs along available shoreline habitat. Each run, regardless of electroshocking technique, will consist of a 10-minute run focusing primarily on shoreline habitat. Results will be presented in terms of catch per hour. This will ensure uniform sampling effort between the sampling locations and that the fish caught are representative of similar habitat types. During each specific run, collected fish will be placed in a live well and will be processed following completion of the run. Following each run, all captured fish will be identified by species, enumerated, measured, weighed and inspected by a fisheries biologist. Additional information collected during each timed survey will include date, location, capture method, weather, crew members, and miscellaneous comments. Data forms will be completed during each survey. All collected fish will be returned live to the water body from which they were collected.

Seining

Seining may be used if necessary to supplement electroshocking surveys, or when electroshocking is not feasible. Seines will be used to encircle or trap fish by surrounding and concentrating them to shoreline areas. Seining is a relatively simple and effective technique to employ if water depths are wadeable. In addition, fish are captured live with minimal trauma. Seine nets proposed for use will be 50 feet (ft) or 100 ft in length (as determined by the stream characteristics) by 6 ft in depth with a collection bag in the middle.

Selected water will be sampled by conducting three distance-measured seine hauls along available shoreline habitat. Each haul, will consist of a 100 foot linear haul primarily focusing on shoreline habitat. Results will be presented in terms of catch per foot of haul. This will ensure uniform sampling effort between the sampling locations and that the fish caught are representative of similar habitat types. During each specific haul, collected fish will be placed in a live well and will be processed following completion of the haul. Following each haul, all captured fish will be identified by species, enumerated, measured, weighed and inspected by a fisheries biologist. Additional information collected during each survey will include date, location, capture method, weather, crew members, and miscellaneous comments. Data forms will be completed during each survey. All collected fish will be returned live to the water body from which they were collected.

The following metrics will be recorded for each individual fish included in any sample:

- Total Length (cm) The greatest dimension of a fish from its anterior-most extremity to the end of the tail fin. For fish with a forked tail, the two lobes should be pressed together, and length of the longest lobe should be recorded.
- Total Weight (g) Fish will be placed in a pre-weighed decontaminated tray and weighed to the nearest gram.
- Physical Exam Gross pathological examination of all fish will be conducted and documented.

Taxonomic identification will utilize the most current and geographically relevant keys and references. 10% of all ichthyoplankton taxonomic identifications will be QA checked by a separate taxonomist. An 80% agreement is necessary or a recount of each sample will be conducted.

Ichthyoplankton Collection

Ichthyoplankton samples will be collected using a 30 cm diameter conical plankton net. The plankton nets are 90 cm in length and constructed of a maximum 500 micron mesh. The fabric of each net should be inspected prior to each use for wear holes and immediately replaced or mended as required.

Ichthyoplankton collection will be made by horizontal hauls using hand over hand with a steady, unhurried motion at a rate of 0.5 m/s for 10 seconds. Two timed hauls will be made at each location on the same day as the fish survey (although in advance of the fish surveys). When

net haul speed is more, a static cone of water develops thus diverting water outside the net and consequently reducing the effective filtration. Once the net is at the surface, wash the net by raising and lowering the net body below the net mouth in the water. De-ionized water will be used against the outside of the netting and from top downward. This washes any adhered ichthyoplankton down into the cod-end. Cod end will be disconnected, water decanted and sample placed into a pre-labeled bottle. The net will be washed by rinsing (pulling it through the water with out cod-end). Samples will be preserved with 70% ethanol and placed in a cooler. Additional information collected during each timed survey will include date, location, capture method, weather, crew members, and miscellaneous comments. Data forms will be completed during each survey.

Mr. Michael Scherer Ph.D. of Normendeau Associates, Inc. will be responsible for taxonomic identification of ichthyoplankton samples collected during the fisheries survey. Taxonomic identification will utilize the most current and geographically relevant keys and references. 10% of all ichthyoplankton taxonomic identifications will be QA checked by a separate taxonomist. An 80% agreement is necessary or a recount of each sample will be conducted.

Sample Identification System – A sample identification system will include: Each sample will be designated by a code which will identify the site.

WSU – Water Supply Dam – Upstream
WSD – Water Supply Dam - Downstream
JPU – Jackson Park Dam - Upstream
JPD – Jackson Park Dam - Downstream
BPU – Bloodgoods Pond Dam - Upstream
BPD – Bloodgoods Pond Dam - Downstream

The media type will follow the site code. A hyphen will separate the site code and media type. Specific media types are as follows:

IC - Ichthyoplankton

After the media type, the sequential sample numbers will be listed; sample numbers will begin with 01 and increase accordingly. For example, two surface water samples collected from a site may be designated as Sample Nos. WSU-IC-01 and WSU-IC-02.

A duplicate sample will be identified in the same manner as other samples and will be distinguished in the field logbook.

Sample Packaging and Shipping – Sampling containers and preservation will be selected in accordance with applicable EPA sampling guidance. Preservatives, ice, or fixing agents will be added, or used, as soon as possible after collection. Sample bottles will be placed in polyethylene bags inside high density polyethylene coolers. All samples will be accompanied by a properly completed chain of custody form and be labeled and packaged for shipment in accordance with U.S. Department of Transportation (DOT) HM-181 requirements. These regulations require field personnel to be trained and certified by a qualified instructor in the requirements of HM-181. All samples will either be hand-delivered or shipped via common carrier to the laboratory within 24 hours of collection. Sample shipment will conform to Weston Solutions, Inc., *Manual*

and Procedures for Shipping and Transporting Dangerous Goods and the most current International Air Transport Association (IATA) Dangerous Goods Regulations.

Sample Documentation - The sampling team or individual performing a particular sampling activity is required to maintain a field logbook. The bound, numbered, paginated, and weatherproof logbook shall be filled out at the location of sample collection immediately after sampling. The logbook shall contain sampling information, including: sample number, sample collection time, sample location, sample descriptions, sampling methods, weather conditions, field measurements, name of sampler, site-specific observations, and any deviations from protocol. All entries will be entered legibly in permanent ink. If errors are made when completing this logbook, the error will be crossed out with a single line, initialed, and dated by the sampler.

Sample Labels - Sample labels will clearly identify the particular sample, and should include the following:

1. Site/project number.
2. Sample identification number.
3. Sample collection date and time.
4. Designation of sample (grab or composite).
5. Sample preservation.
6. Analytical parameters.
7. Name of sampler.

Sample labels will be written in indelible ink and securely affixed to the sample container. Tie-on labels can be used if properly secured. Sample labels should be covered with clear waterproof tape to protect the label from water and solvent attack. Figure 5-1 illustrates a sample label.

Custody Seals - Custody seals demonstrate that a sample container has not been tampered with, or opened. The individual in possession of the sample(s) will sign and date the seal, affixing it in such a manner that the container cannot be opened without breaking the seal. The name of this individual, along with a description of the sample packaging, will be noted in the field logbook. Sample shipping containers will be sealed with a custody seal prior to shipping to assure sample integrity. Figure 5-2 illustrates a sample custody seal.

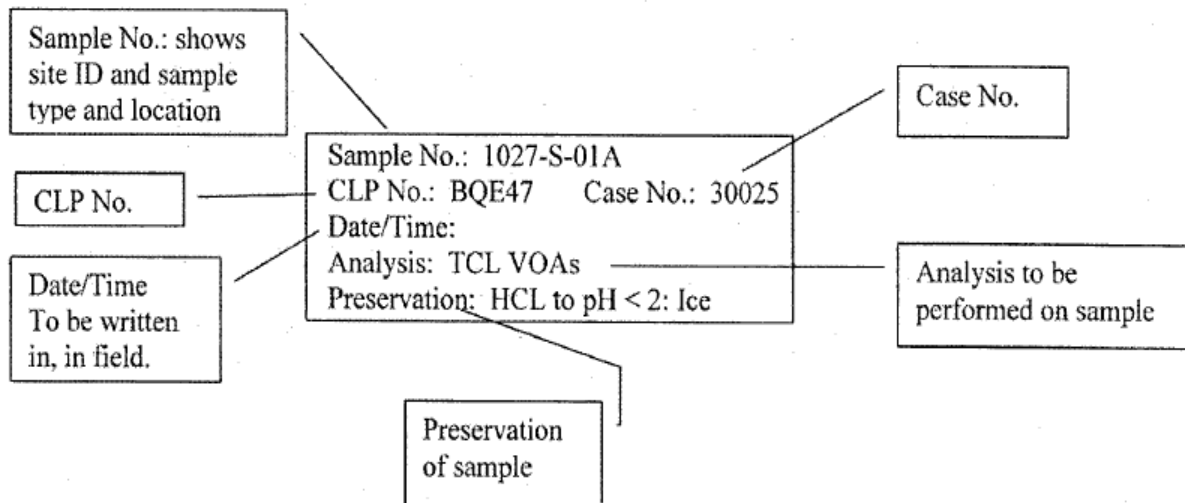


FIGURE 5-1: SAMPLE LABELS


 <p>WESTON MANAGERS DESIGNERS/CONSULTANTS</p> <p>OFFICIAL CUSTODY SEAL</p> <p>WCS 1</p>	Name _____
	Date _____
	W.O. # _____

FIGURE 5-2 EXAMPLE OF A CUSTODY SEAL

SECTION 6.0 SAMPLE CUSTODY

Sample custody is maintained when a sample is in a secure area, or in view of, or under the control of, a particular individual.

CHAIN-OF-CUSTODY RECORD - Chain-of-custody records (Figure 6-1) will be prepared to accompany the ichthyoplankton samples from the time of collection and throughout the shipping and taxonomic process in accordance with U.S. EPA *Region 2 CERCLA Quality Assurance Manual*, Revision 1, October 1989. Each individual in possession of the samples must sign and date the sample chain-of-custody document. The chain-of-custody record will be considered completed upon receipt at the taxonomy laboratory. Every transfer of custody must be noted and signed for. When samples (or groups of samples) are not under direct control of the individual responsible for them, they must be stored in a locked container sealed with a custody seal. Specific information regarding custody of the samples projected to be collected on the weekend will be noted in the field logbook.

The chain-of-custody form must address all samples in a sample cooler/container, but not address samples in any other cooler. This practice maintains the chain-of-custody for all samples in case of mis-shipment.

Within the taxonomic laboratory, the person responsible for sample receipt must sign and date the chain of custody form; verify that the chain of custody procedure was followed accordingly; examine all samples for possible shipping damage and/or improper sample preservation; note any observations on the chain of custody record; notify sampling personnel as soon as possible so that appropriate samples may be regenerated; maintain laboratory chain of custody documentation; and place the samples in the appropriate laboratory storage.

USEPA Contract Laboratory Program Organic Traffic Report & Chain of Custody Record								Case No: 99999 LAB No: L RDO No:																								
Date Shipped: 04/09/2001 Carrier Name: FedEx Airbill #: 4103427144 Shipped to: Organic Lab 908 Route 123 Arlington, VA 22204 (888) 955-5555		Chain of Custody Record <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>Relinquished By</th> <th>(Date / Time)</th> <th>Sample Signature</th> <th>Received By</th> <th>(Date / Time)</th> </tr> <tr><td>1</td><td></td><td></td><td></td><td></td></tr> <tr><td>2</td><td></td><td></td><td></td><td></td></tr> <tr><td>3</td><td></td><td></td><td></td><td></td></tr> <tr><td>4</td><td></td><td></td><td></td><td></td></tr> </table>			Relinquished By	(Date / Time)	Sample Signature	Received By	(Date / Time)	1					2					3					4					For Lab Use Only Lab Contract No: _____ Unit Price: _____ Transfer To: _____ Lab Contract No: _____ Unit Price: _____		
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00101	DAN SAMPLER Surface SW (0°-6°)	IS	Arachnids (7)	32 (Use Only) (1)	2	04/06/2001 11:50																										
00102	DAN SAMPLER Surface SW (0°-6°)	IS	Arachnids (7)	33 (Use Only) (1)	3	04/06/2001 11:50																										
00103	DAN SAMPLER Sediment	IS	Arachnids (7)	34 (Use Only) (1)	4	04/06/2001 11:45																										
00104	DAN SAMPLER Sediment	IS	Arachnids (7)	35 (Use Only) (1)	5	04/06/2001 11:55																										
00107	Surface Water DAN SAMPLER	IS	Arachnids (7)	3133 (Use Only), 3134 (Use Only) (2)	1	04/06/2001 10:52																										
00108	Sediment JOE SAMPLER	IS	Arachnids (7)	3135 (Use Only) (1)	3	04/06/2001 10:51																										
Shipments for Case Complete? <input type="checkbox"/>		Sample(s) to be used for laboratory GC: 00100 Concentration: L = Low, M = Medium, H = High		Additional Sampler Signature(s): Type/Designator/Composite = C, Grab = G		Cooler Temperature Upon Receipt: _____ Chain of Custody Seal Number: _____		Custody Seal Intact? <input type="checkbox"/> Shipments Kept? <input type="checkbox"/>																								
Analysis Key: Arachnids = Arachnids, BGA = BGA, TGL = TGL, Sedimentation = SOA = TGL, Volatiles																																
TR Number: 3-235781339-040901-0002 <small>EO provides preliminary results. Requests for preliminary results will increase analytical costs. Send Copy to: Contract Laboratory Analysis Services Support, 2000 Edmund Highway D., Boston, VA 20191-3434 Phone 703/264-3345 Fax 703/264-8222</small>																																

FIGURE 6-1 AN EXAMPLE OF A CHAIN-OF-CUSTODY FORM

SECTION 7.0 EQUIPMENT

All field equipment will be acquired as needed from Weston's corporate inventory, Equipment Solutions, or from equipment vendors. Maintenance and most repairs are conducted by Weston's factory-trained equipment technicians (some repairs can only be done by the equipment manufacturers). Between Equipment Solutions and Weston's pre-qualified local and regional equipment vendors, Weston has the ability to quickly acquire equipment or replace faulty equipment, usually within 24 hours. As with any field equipment there is always the possibility failure while in use. Weston will minimize the impact of equipment failure during field operations by providing redundancy of critical field equipment. Section 16 of this QAPP details procedures for acquiring field equipment.

SECTION 8.0
ANALYTICAL PROCEDURES

No analytical work is required to complete the grant SOW.

SECTION 9.0

DATA ACQUISITION, COLLECTION, REPORTING AND MANAGEMENT

9.1 DATA ACQUISITION REQUIREMENTS

Weston's primary responsibility under this grant, is to provide professional and technical services evaluation of the feasibility of a candidate site on the Rahway River for implantation of a fish ladder. Because the results of such assessment eventually lead to the decision of whether the location is suitable, it is extremely important that all of the data gathered in various stages of the process are appropriate for such purposes.

Any data needed for project implementation or decision making that are obtained from non-measurement sources such as maps, literature files (e.g., regulatory agency inspection, past activity, permit history, etc.) and historical data will be compared to the DQO for the project to determine the acceptability of the data. Professional judgment is exercised to determine the usability of the literature files.

For example, data from historical surveys may be evaluated to determine whether they satisfy the acceptance criteria for the project. If the data are not deemed acceptable by EPA and NEIWPCC, then a decision to require additional data gathering may be necessary.

9.2 DATA COLLECTION

The primary objective of the fish survey is to determine which fish species populations are present at the sampling locations. Specifically, the objective is to identify whether anadromous fish species are present below the Water Supply Dam, indicating an existing run of anadromous fish that are blocked by the dam. The locations upstream of the Water Supply Dam intend to determine if any anadromous species may be passing the obstructions, and also to determine the native assemblage upstream of the dam. While the primary goal is simple presence/absence monitoring, this survey has been designed so that it can also serve as a baseline from which future fish monitoring data can be compared. As such, quantitative sampling schemes have been proposed so that future sampling events can replicate the effort in order to allow comparison between sampling events. The primary determinant in the feasibility study from the fish survey is whether anadromous fish are actually found within the North Branch of the Rahway River and blocked to upstream spawning locations by the dams. Otherwise, in order to make the project feasible, stocking of anadromous fish would be necessary.

There is some research that indicates different fish ladder designs are preferable for different species. This survey should help to identify which, if any, species are present and hence which fish ladder design is most appropriate.

To achieve data quality objectives, the following types of data and specific quality criteria will be required:

- Enumeration (counts) for each species in each replicate sample — Counts must be made and recorded accurately. Accurate counts are readily achievable in the field.

- Total length (cm) for each fish in each of the target species collected — Total length must be measured accurately in the field using a fish board to ensure that consistent length measurements are taken and recorded.
- Biomass (total weight) for each fish — Total weight must be determined accurately and recorded to 1 g using a calibrated balance designed and intended by the manufacturer to be capable of accurately measuring masses of this magnitude.
- Physical exam of all fish — Gross pathologies for each fish collected must be accurately recorded.

9.3 DATA REPORTING

Data reporting includes the format used for presentation and the review mechanism imposed to verify that reported results correspond to the data analysis. All data reports must be stand-alone and include: identification of the work assignment; sample identification numbers; chemical parameters analyzed; reported values; and units of measurement. Note: Data will be reported with constant significant figures for all samples (if any analyses are done); the detection limits of the analytical procedure if the reported value is less than the detection limit; the results of the QC sample analyses (if any); and the data qualifiers referenced to specific data, if required to explain the reported values.

All data will be verified to determine whether the data have been collected/generated in accordance with the specification of the site-specific data gathering plan.

Data verification will be done by personnel who are familiar with the procedures of a particular activity and rely on proper documentation such as chain-of-custody forms, logbooks, instrument printouts, etc.

9.4 DATA QUALITY MANAGEMENT

Data, whether generated in the field or by a laboratory, are tabulated and reviewed by the PM. A hard copy of all data are maintained in field and site logbooks, and in interim and final reports and memoranda.

LOG BOOK DOCUMENT CONTROL SYSTEM

NUMBER	ISSUED TO/SITE	DATE ISSUED	DATE COMPLETED	DISPOSITION

FIGURE 9-1: LOGBOOK CONTROL SHEET

SECTION 10.0
INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

No analytical work is required to complete the grant SOW.

SECTION 11.0

QA PERFORMANCE AUDITS, SYSTEM AUDITS, AND FREQUENCY

Audits are of five specific types: 1) performance audits; 2) system audits; 3) administrative audits; 4) project audits; and 5) field audits. Each of these plays a significant role in ensuring quality at the regional level.

Performance Audits – Performance audits consist of monitoring the actual sample analysis task to check for compliance with established QC procedures that are documented either in a laboratory's SOPs or in the actual analytical methods. The QAO is responsible for conducting performance audits of Weston field analytical operations and subcontracted laboratories as established in a project work plan or following the generation of data outside predicted QC limits. Associated audit reports and corrective actions are sent to the corporate QA Manager, PM, associated laboratory manager, EPA PO, and NEIWPCC PM. The PM will be responsible for implementation of corrective actions. A follow-up audit will be conducted by the QAO, with copies of the assessment report going to the same people.

System Audits – System audits consist of a review of the QC system to ensure that a comprehensive set of QC methods, procedures, reviews, and sign-off approvals is established for a fixed or mobile laboratory. The primary goal of the system audit is to ensure that a new laboratory subcontractor or new mobile analytical unit has the proper procedures in place to ensure quality analytical data. The QAO or his/her designee will conduct system audits in accordance with the project work plan. The associated audit reports and corrective actions will be sent to the corporate QA Manager, the PM, associated laboratory manager, EPA PO, and NEIWPCC PM.

Administrative Audits – Administrative audits consist of a review of administrative procedures to ensure they are consistent with established EPA, NEIWPCC, and Weston requirements. Specific areas to be audited include: processing; file organization; conflict-of-interest (COI) prevention; procurement procedures and records; expense reporting records; time reporting records; logbook program; and general deliverables quality, review, and tracking. The QAO or his/her designee will conduct administrative audits. An audit report with corrective actions will be issued to the PM and the corporate QA Manager. An external project administrative audit is conducted annually by the corporate QA Manager or their trained representative. The PM is responsible for implementing corrective actions.

Project Audits – Project audits will be conducted to evaluate the quality, completeness, and timeliness of the project. All nonconformance issues will be brought to the attention of the PM. These audits are conducted by the QAO or his/her trained representative. The audit reports and corrective actions are sent to the PM and corporate QA Manager.

Field Audits – Field audits will be conducted to ensure Weston field personnel are adhering to proper sampling, administrative, and health and safety SOPs. Field audit considerations should include: sample documentation; sampling plan adherence; equipment operation, maintenance, and calibration; proper handling of standards, calibration gases, and preservatives; sampling techniques; decontamination; data management and review; sample custody; packing and shipment procedures; and health and safety practices. Field audits will be conducted by the

QAO or the QAO designee on a random basis and in response to reports or findings of poor performance or noncompliance with the QAPP, SOPs, or sound engineering practices. The associated reports and corrective actions are sent to the PM, EPA, and NEIWPCC, as appropriate.

NEIWPCC may implement, at their discretion, various audits or reviews of this project to assess conformance and compliance to the quality assurance project plan in accordance with the NEIWPCC Quality Management Plan.

SECTION 12.0 CORRECTIVE ACTION

Corrective action can result from nonconformance to QAPP requirements as observed by personnel during the course of work audits. Corrective action may be required due to malfunctioning equipment systems and instruments, or equipment systems and instruments that fail calibration or generate data that exceed stated acceptance limits. Non-conformance to SOPs and site-specific sampling plan will also result in corrective action if they have a negative impact on data quality, usability, or established detection limits. It is the responsibility of the PM to assure that corrective action be initiated as soon as possible. Non-conformance and corrective actions will be documented in the trip report with correspondence to the QAO.

If non-conformance is observed during the field activities such as sample collection or field analytical measurements, the corrective action such as refresher training may be required. For malfunctioning equipment or instrument, the site-specific sampling plan may simply require a contingency plan for such incident. Since items that may need corrective action are variable and hence the corrective action protocols must be flexible.

As appropriate, non-conformance resulting in corrective action will be documented and the resolution evaluated by the QAO. If corrective action is not satisfactorily implemented, resulting in an ongoing non-conformance, the corporate QA Manager will be notified and action taken.

The EPA PO and NEIWPCC PM will be informed of the non-conformance and any corrective action needed or taken as soon as possible.

Corrective action and non-conformance frequency or history will be reviewed as one indicator in determining the efficiency of the continual improvement program.

Any changes and/or deviations from the site-specific QAPP made during field activities will be documented in the ensuing report. Changes in field activities requested by the EPA PO and NEIWPCC PM will be documented in writing from the EPA PO and NEIWPCC PM with acceptance by the PM, as per the SOW.

SECTION 13.0

QA REPORTS TO MANAGEMENT

The QAO will include continual improvement initiatives, achievements, and goals in the quarterly reports to the corporate QA Manager.

SECTION 14.0 RECORDS MANAGEMENT SYSTEM

14.1 PROJECT RECORDS

Weston has established and maintains a records management system to collect, maintain, and retrieve records.

Overall project records will include: copies of the QMP, QAPP, SOPs, and distribution lists for these documents; progress reports; correspondence; audit reports; purchasing records and documentation.

At the end of the contract all pertinent information may be copied, or electronically recorded as directed by the EPA PO. The PO will also provide direction for the final disposition of the original files.

14.2 AUDIT FILES

The QAO will maintain a QA audit filing system with the contents organized into categories that are event-specific (i.e., logbook, file) and task-specific (i.e., administrative, health and safety, and field audits). Each file should contain items as they pertain to a specific audit event, including dated checklists that were used to execute the audit; a copy of the audit report; verification and acknowledgment of corrective action, if any; and the QAO's audit closure statement.

14.3 FILE CLOSURE PROCEDURE

File completeness is the responsibility of the Weston PM. To ensure that the project file is complete at the time of closure the following procedure must be implemented:

1. Upon completion of the project, the project file will be reviewed by the PM for completeness. The file checklist should be referred to for a list of items necessary for file completeness. Figure 14-1 illustrates the File Checklist.
2. If the file is found to be incomplete in any way, it is the PM's responsibility to obtain any missing articles and enter them into the file.
3. The PM is required to submit the file checklist to the QAO for a final verification of completion.

14.4 PERIODIC REVISIONS OF THE QAPP

This QAPP may be revised during the life of the grant project. To ensure appropriate personnel have the most current version copies of the approved, revised QAPP will be distributed according to the Distribution List presented on page "ii" of this document. The revised QAPP will have the appropriate revision number and will be signed and dated by the appropriate Weston, EPA, and NEIWPCC personnel.

FILE CHECKLIST

PROJECT NAME: _____ PROJECT #: _____

PROJECT MANAGER: _____ TASK #: _____

Required (Y,N)	Item	Date entered
Y	Form	
Y	Amendments	
Y	Close-Out	
Y	H & S Plan/Waiver	
	Trip Report	
	Logbook Copies	
	Sampling Plan	
	Analytical Data	
	Site Photographs/Video	
	Maps/Diagrams	
	Other: _____	
	Other: _____	
	Other: _____	
	Other: _____	
	Other: _____	
	Other: _____	

Comments: _____

FIGURE 14-1: FILE CHECKLIST

SECTION 15.0 QUALITY-RELATED DOCUMENTS

The following documents provide Weston with directions for implementing and fulfilling QA requirements:

Able, K. W., and M.P. Fahay.1998. *The First Year in the Life of Estuarine Fishes in the Middle Atlantic Bight*, New Brunswick, NJ, Rutgers University Press.

Durkas, S. J., 1992. *Impediments to the spawning success of anadromous fish in tributaries of the NY/NJ harbor watershed*. American Littoral Society, Highlands, NJ

Quality Assurance Management Plan (QMP) — The Weston QMP provides overall policy statements, procedures, and responsibilities to implement quality throughout the corporation.

QA Project Plan (QAPP) — The QAPP provides specific direction to implement QA principles for quality-related activities within the Edison office, and describes the duties and responsibilities of individuals in the region related to QA.

QA Work Plan (QAWP) — The QAWP provides the blueprint for completing complex or multiphased projects, and includes project schedules, resources, personnel responsibilities, and deliverables required to complete the project.

EPA Order 5360.1A2, Policy and Program Requirements for the Mandatory Agency-Wide Quality System; 5 May 2000. Quality specifications for the U.S. EPA organizations that produce or use environmental data.

EPA Manual 5360 A1, EPA Quality Manual for Environmental Programs; May 2000. Specifications for satisfying the mandatory system defined in EPA Order 5360.1.

Intergovernmental Data Quality Task Force, Uniform Federal Policy for Implementing Environmental Quality Systems: Evaluating, Assessing, and Documenting Environmental Data Collection/Use and Technology Programs, EPA-505-F-03-001, Final Version 2, March 2005. Outlines essential elements of a Quality System for management of environmental data and provides a framework to ensure that essential elements are addressed.

Intergovernmental Data Quality Task Force, Uniform Federal Policy for Quality Assurance Project Plans, Part 1: UFP - QAPP Manual, Final, Version 1, EPA-505-B-04-900A, March 2005. The UFP – QAPP Manual is intended to provide instruction for QAPP preparation in accordance with Section 6 (Part B) of ANSI/ASQ E4.

Intergovernmental Data Quality Task Force, Workbook for Uniform Federal Policy for Quality Assurance Project Plans, Part 2A: UFP - QAPP Workbook, Final, Version 1, EPA-505-B-04-900C, March 2005. This workbook may be used by the EPA and Weston to assist with the preparation of QAPPs for environmental data gathering activities.

Intergovernmental Data Quality Task Force, Uniform Federal Policy for Quality Assurance Project Plans, Part 2B: Quality Assurance/Quality Control Compendium: Minimum QA/QC Activities, Final, Version 1, EPA-505-B-04-900B, March 2005. The purpose of the QA/QC Compendium is to establish minimum specifications for data quality activities for all phases and data uses in the CERCLA process.

U.S.EPA, Region 2 CERCLA Quality Assurance Manual, Revision 1, October 1989 and Compendium of ERT Standard Operating Procedures (SOPs) — SOPs provide a uniform approach to topics such as sampling, equipment use, and analytical procedures that will be consistently employed by Weston personnel. These SOPs are referenced or attached to site-specific QAPPs to ensure technically consistent methodology among Team members.

U.S. EPA Region 2, Standard Operating Procedure for Implementing the National Strategy for Procuring Analytical Services for All OSWER Programs, SOP No. HW-32, Revision 5, 17 March 2005. The SOP provides guidance to Weston personnel on how to implement Superfund's Field and Analytical Services Teaming Advisory Committee (FASTAC) analytical services strategy as it applies to project activities.

U.S. EPA Region 2, Quality Management Plan Fiscal Years 2002 - 2007 QMP, February 2002, intended to document the ongoing QA policies, procedures, responsibilities and management systems that are in place to comprise the Region 2 QA program.

EPA QA/R-2, Requirements for Quality Management Plans, EPA/240/B-01/002; March 2001. Specifications for Quality Management Plans for organizations that receive funding from EPA. These specifications are equivalent to Chapter 3 of Manual 5360.

EPA QA/G4, Guidance for the Data Quality Objectives Process, EPA/600/R-96/055, August 2000 — This document provides guidance on the DQO process. The DQOs will be placed in the work plan or site specific QAPP as appropriate in order to assist with identifying analytical detection limits and analytical QA/QC that are needed in the decision-making process.

EPA QA/G-5, EPA Guidance for Quality Assurance Project Plans, EPA/240/B-01/002, March 2001, and EPA QA/R-5, EPA Requirements for Quality Assurance Project Plans, EPA/240/R-02/009, December 2002 — These documents provide guidance on preparing site-specific QAPPs, selecting QA objectives, and performing data validation. The document will be used by Weston to ensure proper sampling plan content, data verification, and data validation.

EPA QA/G9, Guidance for Data Quality Assessment: Practical Methods for Data Analysis, QA00 Version, EPA/600/R-96/084, July 2000. Guidance on a statistically based method to evaluate the extent to which data can be used for a specific purpose. This replaces all earlier versions of this guidance.

Weston Solution, Inc. (Weston), 2006. Preliminary Fish Passage Feasibility Evaluation for the Rahway River Water Supply Dam. January 2006.

SECTION 16.0

PROCUREMENT PROCEDURES AND INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES, CONSUMABLES AND SERVICES

Weston does not maintain an inventory of supplies, consumables or equipment specifically for this contract. Weston does maintain an inventory of field equipment and supplies in its corporate headquarters in West Chester, PA. This inventory is controlled and maintained by Weston's Equipment Solutions. Equipment Solutions utilizes an automated inventory control system, EquipTrack, to track and schedule maintenance of field equipment. Maintenance and most repairs are conducted by Weston's factory-trained equipment technicians (some repairs can only be done by the equipment manufactures). Weston has developed catalogue pricing for the use of this equipment on client projects. Weston will utilize equipment from this inventory on the project when appropriate. In addition Weston has preferred customer rental agreements with local and regional vendors to supply routine and non-routine field equipment.

Procurement activities are controlled by a single purchasing agent within the Edison, NJ office and will be conducted according to the Federal Acquisition Regulations (FAR). The PM, or his designee, is responsible for inspection and acceptance of all supplies, consumables and services.

16.1 SUPPLIES AND CONSUMABLES

When supplies and consumables are required the PM must complete a requisition which contains a detailed description and/or model number of the materials required. Upon approval of the PM, a purchase order number will be assigned to complete the purchase. Upon receipt of the supplies the delivery time and contents are checked against the requisition and purchase order form by the PM. Incomplete and late orders may result in partial payment or disqualification of the vendor for future purchases. If, upon inspection, the material does not meet the appropriate specifications, the material will be returned to the vendor for replacement, or, alternatively, for cancellation of the order. Supplies are charged to the appropriate project number.

Weston maintains a list of pre-qualified vendors and for certain materials has local or national basic ordering agreements in place to facilitate this process.

16.2 SERVICES

Services include the rental of project-specific field equipment (e.g., air monitoring equipment, groundwater sampling pumps, global positioning system units, etc.), subcontracted support (e.g., well drillers, etc.).

16.2.1 Field Equipment

If field equipment is required for the project, the PM will contact Equipment Solutions and/or an equipment vendor to determine the availability of the necessary equipment. Based on the source(s) selected the PM will issue an order form to Equipment Solutions and/or prepare a requisition for a purchase order to the selected vendor. The PM will be responsible for ensuring the appropriate equipment is received and that it functions properly (according to manufacturer's

specifications) prior to its use. Malfunctioning equipment will be returned to the supplier by the PM. Equipment calibration will be conducted as discussed in Section 7.

16.2.2 Subcontracting

Subcontracted services will be procured in accordance with Weston procurement policy and the FAR. The PM will develop a request for proposal (RFP) which will include a detailed SOW, selection criteria, and price quotation form. The SOW will provide the technical requirements of the work, project schedule, deliverable due dates and administrative requirements. The RFP will be reviewed by Weston's corporate procurement group and approved by the PM prior to its release to potential vendors.

Bid packages will be evaluated by the PM to determine compliance with the RFP. In addition, references (as requested in the RFP) will be checked by the PM and the Federal Government Debarment List will be checked by the PM. Selection of the winning vendor will be based on technical capability and price. The subcontract agreement will be approved and signed by the PM.

Payment to subcontractors will be in accordance with the subcontract agreements. The payment approval process will include an evaluation of the subcontractor's performance by the PM. Final payment approval will be the responsibility of the PM.

16.2.3 Analytical Services

Analytical services are not required by the current SOW for the grant.



APPENDIX A

Fish Collection by Seining or Electrofishing SOP

SOP # SRC-OGDEN-03
Fish Collection by Seining or Electrofishing

(Adapted from Draft ERT/REAC SOP for Fish Collection)

TECHNICAL STANDARD OPERATING PROCEDURE
FISH COLLECTION

TABLE OF CONTENTS

1.0 SCOPE AND APPLICATION	Page 1
2.0 METHOD SUMMARY	Page 1
3.0 SAMPLE PRESERVATION, HANDLING AND STORAGE	Page 1
4.0 INTERFERENCES AND POTENTIAL PROBLEMS	Page 2
4.0.1 Seining	Page 2
4.0.2 Electrofishing	Page 2
4.0.3 General	Page 2
5.0 EQUIPMENT	Page 3
6.0 REAGENTS	Page 3
7.0. PROCEDURES	Page 3
7.0.1 Seining	Page 3
7.0.2 Electrofishing	Page 4
8.0 CALCULATIONS	Page 5
9.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)	Page 5
10.0 DATA VALIDATION	Page 5
11.0 HEALTH AND SAFETY	Page 6
12.0 REFERENCES	Page 7

APPENDIX A Fish handling and processing

TECHNICAL STANDARD OPERATING PROCEDURE

FISH COLLECTION

1.0 SCOPE AND APPLICATION

Two methods which can be used to sample fish populations on hazardous waste sites are described below. These methods are applicable for fish collection in streams and shallow portions of lakes.

2.0 METHOD SUMMARY

A seine is an active netting technique that traps fish by encircling them with a wall of net. The bottom of the net is weighed down by lead weights or a leadline, and floats are attached to the top of the net. Many seines have a bag in the middle, where fish are concentrated as the net is closed.

Electrofishing uses electricity to capture fish. An electrical field is created in the water by passing a current between two submersed electrodes. Alternating current (ac) stuns fish in its field; they temporarily lose equilibrium and can be dip netted. Direct current (dc) will pull fish toward the anode, where they can be netted. Research objectives, habitat characteristics and availability of power source dictate the type of current to be used.

If fish are being collected for residue analysis, a minimum of five game fish, five rough fish and five catfish should be collected at each sampling location. Similar species should be collected at each area.

3.0 SAMPLE PRESERVATION, HANDLING AND STORAGE

If tissues are being analyzed for contaminants, fish should be kept on dry ice after processing. Fish for heavy metal analysis should be placed in plastic bags. Fish that are going to be analyzed for organic compounds should be wrapped in aluminum foil which has been rinsed with hexane and air-dried.

Fish collected for population studies can be preserved in ethanol or 10% formalin. Specimens should be stored in glass jars or buckets with non-rusting lids. Small fish can be fixed by simply placing them in ethanol or formalin. When preserving large fish, a slit should be made along the belly on the right side of the midline. Incisions should also be made in the dorsal muscle mass, on either side of the vertebral column. For proper fixation, the specimen volume should be no more than 50% of the total volume occupied by specimen and preservative.

Fish handling and processing activities will be conducted according to the procedures outlined in Appendix A.

TECHNICAL STANDARD OPERATING PROCEDURE

FISH COLLECTION

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

4.0.1 Seining

Mesh size and length of a seine will determine size of fish which can be caught, and may affect how efficiently the seine can be pulled. Mesh sizes too small will be difficult to pull, especially if there is much debris in the water. High current velocity in a stream will also decrease seining effectiveness.

To prevent fish from escaping under or over the net, it is imperative that the leadline be kept in contact with the bottom, and the float line must stay on or above the water surface. Streams or lakes with rocky bottoms or debris that snags the leadline will be difficult to seine effectively. Having a third person follow the seine and free it from snags helps prevent losing fish when the seine gets caught.

Seines can be torn as they are pulled through the water, leaving holes through which fish can escape. The seine should be inspected frequently, and repaired as necessary.

4.0.2 Electrofishing

Environmental factors which can affect electrofishing include water conductivity, temperature, season, and time of day. Electrofishing success is poor in water with very high or low conductivity. Electrofishing is most effective in shallow habitats. If water temperatures are high, some fish species may move into deeper water where temperature is lower and oxygen is higher. During spawning season, some species may be captured in shallow areas that would normally be found in deeper areas. Electrofishing at night catches more species, larger individuals, and more fish than similar effort during the day.

Because batteries and generators used for electrofishing provide more than enough current to electrocute a person, it is vital that safety rules be observed. All members of an electrofishing crew should understand the system and the risks involved. One person should be in charge of the operation, and this person should control the power source. Shut down the power source before any repairs or equipment changes are made. Electrofishing should never be done alone, and the crew and power source should stay close together.

4.0.3 General

Any time fish are collected, water and boat safety procedures must be followed. Wading can be dangerous, especially in swift currents or if the bottom is uneven or algae-covered. Samplers should always work in pairs, and wader belts should be worn to prevent waders filling with water if falls occur.

There is always a potential for drowning accidents when working around water. All field crews should include a person who is trained in CPR. When a person has stopped breathing, breathing must be restarted within 4 to 6 minutes. However, an attempt should be made to resuscitate anyone who has been submerged for up to one hour.

TECHNICAL STANDARD OPERATING PROCEDURE

FISH COLLECTION

General guidelines for boating safety should be reviewed and followed for all activities which require transportation by boat.

When collecting fish on a hazardous waste site, field workers can be exposed to hazardous materials. Personal protective equipment should be worn to prevent exposure, and extra care should be taken to avoid falls into potentially contaminated water.

5.0 EQUIPMENT

Equipment needed for fish collection is listed below, by procedure.

SEINING

Seine
Buckets
Carpet needle and string
Waders
Wader belts

ELECTROFISHING

Backpack electroshocker
Battery
Waders
Buckets
Wader belts
Fiberglass handled dip nets

6.0 REAGENTS

No reagents are needed for fish collection if fish are being collected for residue analysis.

If fish are being collected for population studies, fish should be preserved in either 70% ethanol or 10% formalin.

7.0. PROCEDURES

7.0.1 Seining

Seine nets are constructed of mesh panels hung from a float line with a weighted lead line attached to the lower edge. Seines are selective sampling gear, and will not capture all sizes of fish. The size of fish you want to sample will determine the mesh size of the seine. Mesh size should be small relative to the target fish. Too large a mesh size will allow fish to escape through the net, however mesh sizes too small will be difficult to pull through the water. Seines are most effective in water no deeper than two-thirds the height of the net.

The net should have a pole at each end which is at least equal to the height of the net. Poles should be held at a 45° angle away from the direction of movement when pulling the seine.

TECHNICAL STANDARD OPERATING PROCEDURE

FISH COLLECTION

For sampling a stream, the seine should be long enough to reach from bank to bank. Unless stream flow is very low, the seine is pulled against the current. Care should be taken to run the poles holding the seine directly along the bank, and under it if the bank is undercut. The leadline must remain in contact with the bottom to prevent fish from escaping under the net, and the float line must stay on or above the water surface. Several fish species (e.g. largemouth bass) will attempt to jump over the top of the seine when confined, so the float line should be above water when these are the target species.

After a collection is made, both seiners should walk onshore and pull the leadline up immediately. If there is no convenient place to beach the seine, the leadline can be lifted above water by both collectors at the same time. After the net is out of the water, captured fish should immediately be transferred to water-filled containers.

In a lake, a seine may be pulled parallel to the shore or from offshore toward the shore. Alternatively, one end of the seine can be planted on the bank, and the other end can be pulled out, around, then back in to the bank.

7.0.2 Electrofishing

Use of electricity to capture fish is one of the least selective of all active fish capture methods. This method involves creating an electrical field in the water by passing a current between two submersed electrodes. There are two types of electrical current. DC always flows in one direction because the negative and positive ends (electrodes) of the circuit do not change. Direct current will induce galvanotaxis (forced swimming with orientation) and fish will move toward the anode. With ac, the anode (the positive electrode) and the cathode (the negative electrode) switch positions, so the current flows alternately in both directions. Fish exposed to ac will be stunned and lose equilibrium, and can be easily netted.

Electrofishing can be done using a backpack-mounted electroshocker unit, a shore-based unit, or from a boat. Backpack shockers are best for small streams. A minimum of three people are needed, one to run the shocker and two dip netters. The crew should wade upstream, with the dip netters beside or behind the electrode handler. All stunned fish, regardless of size or species, should be collected. The sampling area should be fished slowly and methodically, especially areas with in-stream cover. Captured fish should be placed in water-filled buckets. Nets can be set at the upper and lower ends of a stream section to prevent movement of fish out of the sample area.

Shore-based electrofishing is similar to backpack shocking, except that the power source stays onshore. Shore-based fishing is more dangerous, as voltages of shore-based units are higher than backpack units. The crew is also separated from the power source, and may not have safety switches. A buddy system should always be used during a shore-based electrofishing operation.

When electrofishing from a boat, the electrodes are suspended from a boom off the front of the boat. The boat should be driven slowly through shallow areas or along weed beds, and one or two people should stand

TECHNICAL STANDARD OPERATING PROCEDURE

FISH COLLECTION

near the bow and dip net stunned fish.

Research objectives, habitat characteristics and availability of the power source will influence the choice of current to be used. DC should be used when it is important not to damage or kill fish, and is very effective in turbid water or in thick weeds or brush. AC generators are generally less bulky, and are effective in clear unobstructed water. AC is more harmful to fish than dc, and may cause hemorrhaging, rupture swim bladders or fracture vertebrae.

Both direct and alternating currents can be modified to produce various current shapes that have different effects on fish. Pulsed dc will sustain forced swimming with less damage to fish. In addition, pulsed dc requires less voltage than ac and a smaller electrical source can be used. Pulsed ac will have the same effect as unmodified ac, but is not as potentially harmful to fish.

Water conductivity will affect the efficiency of electrofishing. In water where the conductivity ranges between 100 and 500 micromhos/cm, electrofishing will be most effective. At high conductivities, water is less resistive than fish and the current will flow around them. Electrofishing is not used in salt water habitats. Low conductivity water is more resistant than fish, and the electrical field is limited to the immediate area of the electrode.

8.0 CALCULATIONS

No calculations are needed for the above procedures.

9.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

The following QA/QC procedures apply to fish collection and field processing:

1. All data will be documented on field data sheets or in logbooks. Photodocumentation will be done when possible.
2. Samples will be duplicated in an unimpacted reference area.
3. A sample plan specifying methods, target species, and sample size will be prepared before field work begins.
4. All deliverables will be peer-reviewed prior to release.

10.0 DATA VALIDATION

Data generated will be reviewed according to the QA/QC considerations listed in Section 9.0.

TECHNICAL STANDARD OPERATING PROCEDURE

FISH COLLECTION

If possible, species identifications will be confirmed by a regional biologist familiar with the site's aquatic fauna.

11.0 HEALTH AND SAFETY

A site-specific Health and Safety plan will be prepared prior to any field activity, and must be approved by the site Health and Safety officer.

Any time fish are collected, water and boat safety precautions must be taken. Wading can be hazardous in swift currents or if the bottom is uneven or algae-covered. Falls can be avoided by moving slowly, taking short steps, and wading sideways to the current. Guidelines for boating safety should be followed for all activities which require transportation by boat.

Safety procedures which should be observed while electrofishing include use of the buddy system, clear communication between the sampling team, and all samplers in waterproof gloves and waders which do not leak. The electrofishing equipment should be equipped with 'dead man' automatic shut-off switches, and one person should control the power source. All members of an electrofishing team must be certified in CPR.

TECHNICAL STANDARD OPERATING PROCEDURE
FISH COLLECTION

12.0 REFERENCES

Bagenal, T. 1968. Methods for assessment of fish production in fresh waters. IBP Handbook No. 3. Blackwell Scientific Publications, London. 365 pp.

Cailliet, G.M., M.S. Love and A.W. Ebeling. 1943. Fishes. A field and laboratory manual on their structure, identification and natural history. Wadsworth Publishing Company, Belmont, CA. 194 pp.

Hayes, M.L. 1983. Active fish capture methods. Pgs. 123-145 In: Fisheries Techniques, L.A. Nielson and D.L. Johnson, eds. American Fisheries Society, Bethesda, Maryland.

Reynolds, J.B. 1983. Electrofishing. Pgs. 147-163 In: Fisheries Techniques, L.A. Nielson and D.L. Johnson, eds. American Fisheries Society, Bethesda, Maryland.

TECHNICAL STANDARD OPERATING PROCEDURE
FISH COLLECTION

APPENDIX A

Fish Handling & Processing

(Adapted from ERT/REAC SOP #2039 Revision 0.0)

Fish Handling & Processing

(Adapted from ERT/REAC SOP #2039 Revision 0.0)

TECHNICAL STANDARD OPERATING PROCEDURE
FISH HANDLING & PROCESSING

TABLE OF CONTENTS

1.0	SCOPE AND DESCRIPTION	Page 1
2.0	METHOD SUMMARY	Page 1
3.0	SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE	Page 1
4.0	INTERFERENCES AND POTENTIAL PROBLEMS	Page 1
4.1	Length	Page 1
4.2	Weight	Page 1
4.3	General	Page 2
5.0	EQUIPMENT/APPARATUS	Page 2
6.0	REAGENTS	Page 2
7.0	PROCEDURES	Page 3
7.1	Length	Page 3
7.2	Weight	Page 3
7.3	Species Identification	Page 3
7.4	External Examination	Page 4
7.5	Final Processing	Page 4
7.6.1	Filleting	Page 4
7.6.2	Dissecting	Page 4
8.0	CALCULATIONS	Page 5
9.0	QUALITY ASSURANCE/QUALITY CONTROL	Page 5
10.0	DATA VALIDATION	Page 5
11.0	HEALTH AND SAFETY	Page 6
12.0	REFERENCES	Page 7

APPENDIX A - Figures

TECHNICAL STANDARD OPERATING PROCEDURE

FISH HANDLING & PROCESSING

1.0 SCOPE AND DESCRIPTION

This standard operating procedure (SOP) describes the basic procedures for field processing of fish collected at hazardous waste sites. Fish can be used to determine whether contaminants in aquatic habitats accumulate in fish tissue, cause histopathological damage, or affect fish condition or growth. Impacts on aquatic community structure can also be assessed.

2.0 METHOD SUMMARY

Specific procedures used to process fish will depend on the project objectives. Regardless of the objectives, data which should always be collected on fish in the field include length, weight, species, and information on parasites or other abnormalities. When possible, sex and stage of maturity should also be noted.

Fish which are collected for contaminant analysis should be measured, then filleted or frozen whole. If study objectives include histopathology, fish should be dissected so sections of target tissues can be collected.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

If tissues are being analyzed for contaminants, fish should be kept on dry ice after processing. Fish for heavy metal analysis may be placed directly into plastic bags. If fish are going to be analyzed for organic compounds, they should be wrapped in aluminum foil and then placed into plastic bags.

Fish collected for population studies can be preserved in ethanol or 10 percent formalin. Specimens should be stored in glass jars or plastic buckets. Small fish can be preserved by simply placing them in ethanol or formalin. When preserving large fish, a slit should be made along the belly on the right side of the midline. Incisions should also be made in the dorsal muscle mass, on either side of the vertebral column. For proper preservation, the specimen volume should be no more than 50 percent of the total volume occupied by specimen and preservative.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

4.1 Length

Factors which contribute to length measurement errors are muscular tension in live fish, eroded fins, shrinkage of fish due to preservation, and failure to consistently squeeze the tail to get maximum total length.

4.2 Weight

When taking weights, an attempt should be made to have fish at a standard degree of wetness. Variation in stomach contents or amount of water swallowed at capture will also affect fish weights. Other sources of error include movement of the scale due to fish movements, wind or boat motion.

TECHNICAL STANDARD OPERATING PROCEDURE

FISH HANDLING & PROCESSING

4.3 General

Extreme temperatures can alter tissue characteristics, making tissues unsuitable for analysis. Exposure of dead specimens to extreme cold can cause tissue to freeze, making histopathological analysis difficult. Extreme heat can cause rapid decomposition of tissue. An effort should be made to keep fish alive until they are processed. Dead animals should be processed as soon as possible.

All members of the processing staff should be trained in techniques used to make length and weight measurements. Inconsistencies in the way these measurements are taken can lead to errors.

In some cases, fish collected may not have sufficient body mass for analysis of a containment to a given detection limit. If this occurs, then individuals of the same species from the same sampling location may be pooled for analysis. If multiple analyses of contaminants in tissues are being done, these may need to be prioritized if body mass of the specimens is insufficient to conduct all of the analysis. Analyses to be conducted on each specimen should be carefully documented.

5.0 EQUIPMENT/APPARATUS

Equipment needed for processing fish is listed below:

Processing Fish

Data Sheets	Measuring board
Balance or scale	Field guides or keys
Coin envelopes	Knife
Forceps	Saw
Probe	Pliers
Ziploc® bags	Aluminum foil
Large scissors	Small scissors
Dissecting microscope	Glass scintillation vials with lids
Glass jars with lids	Preservative
Scalpel	Fillet knives
Knife sharpener	Dissecting trays

6.0 REAGENTS

No reagents are needed for fish processing if fish are being collected for residue analysis. Tissue sections collected for histopathological analysis should be preserved in glass scintillation vials filled with 4 percent buffered paraformaldehyde. Buffered paraformaldehyde can be purchased through commercial chemical supply companies. Tissue sections for histopathology should be collected before fish are frozen. Fish being collected for population studies can be preserved in either 70 percent ethanol or 10 percent formalin.

TECHNICAL STANDARD OPERATING PROCEDURE
FISH HANDLING & PROCESSING

7.0 PROCEDURES

When fish are collected for residue analysis, generally the largest fish captured are the ones which should be analyzed. All animals captured should be held either until a sufficient number and weight of fish are caught at a station, or until the end of the day. If necessary, fish should be marked or tagged as they are captured so that individual fish can be identified later. Length, weight and species should be determined at the time a fish is tagged. Other data can be collected after fish which will be analyzed have been selected.

A data sheet should be completed for each specimen processed. Sampling location, tag number, date, species, and data on the specimen metrics described below should be recorded.

7.1 Length

Fish length is measured using a measuring board on which the anterior end of a fish is placed against a stop at the beginning of a measuring scale. The fish should be measured with mouth closed, and the body positioned on its right side with the head to the measurer's left. Any one of three measurements can be taken: total, fork or standard length (Figure 1, Appendix A). Total length is the greatest length of a fish from its anterior most extremity (usually the mouth) to the end of the tail fin. For fish with a forked tail, the two lobes should be pressed together, and the length of the longest lobe should be taken. Fork length is measured from the anterior end of the fish to the tip of the middle rays of the tail. Standard length is the length of a fish from the anterior end of the fish to the tip of the middle rays of the tail. Standard length is the length of a fish from the anterior end to where the base of the median tail fin rays join the caudal peduncle. This spot can be located by bending the tail sharply. A crease should form where the tail fin rays end. Total length or fork length measurements are used most often. Determination of standard length is very difficult on some species.

7.2 Weight

Spring balances or electronic digital scales are generally used to weigh individual fish. Fish can be weighed by themselves, or by placing them in a container of water. Taking the weight in water reduces error due to fish movement, but may not be practicable for large fish. Large numbers of fish can be weighed in bulk if individual weights are not needed (e.g., for population studies).

Because most fish maintain near-neutral buoyancy in water, their specific gravity is close to 1.0 and body volume is proportional to weight. Therefore, the amount of water displaced in a container can also be used to determine weight.

7.3 Species Identification

Study objectives will dictate what level of identification is needed for a fish. Fish collected for residue analysis should be identified to species, as different genera may have different feeding habits.

TECHNICAL STANDARD OPERATING PROCEDURE

FISH HANDLING & PROCESSING

Local authorities should be consulted before field work begins to determine whether regional taxonomic references exist.

7.4 External Examination

While processing fish, note any external abnormalities or parasites on data sheets or in field logbooks. Information on sex and stage of maturity should also be noted. If fish are collected during spawning season, some fish can be sexed based on breeding colors. Mature fish may release eggs or milt when they are handled.

7.5 Final Processing

To assess environmental risk through food chain concentration of contaminants, the whole body should be analysed for tissue residue. Based on the objectives of the study, the stomach contents of the fish may be removed (using dissection technique) prior to analysis. Alternately, fish may be held in aerated chambers for 24 hours to depurate stomach contents. This will allow for a determination of the concentration of contaminants accumulated in the tissue versus contaminants entrained in the gut.

To assess risk to humans from fish consumption, the fish should be filleted and only muscle tissue sent to the laboratory for analysis. Fish should be dissected if tissues are being collected for histopathology or for residue analysis on specific organs.

Procedures for filleting or dissecting a fish are described below. Fish should be killed by a blow to the head immediately before processing.

7.6.1 Filleting

To fillet a fish, an initial cut should be made from the dorsal fin to the pelvic fin, just behind the opercular flap (Figure 2, Appendix A). Run the tip of the knife along the dorsal side of the fish, from the initial cut to the caudal fin. Continue making successively deeper cuts, running the knife blade as close to the neural spines and ribs as possible. After the fillet is obtained, remove the skin. Place the skin side of the fillet down on the dissecting tray, hold on to the tail portion of the fillet, and run the knife between the skin and the muscle tissue. Turn the fish over and repeat the process to obtain the other fillet.

7.6.2 Dissecting

Begin the dissection by laying the fish on its right side and making an incision from just above the vent to the top of the rib cage. Cut along the rib cage, forward through the pectoral girdle. Make a shallow incision to avoid damage to internal organs. Pull the flap downward to open the body cavity. Note any gross abnormalities or parasites observed in the body cavity. Also record sex and stage of maturity.

Liver, gill and kidney tissues are the fish tissues collected most often for histopathology or residue analysis. The liver should be located near the anterior end

TECHNICAL STANDARD OPERATING PROCEDURE

FISH HANDLING & PROCESSING

of the stomach. It is connected to the gut by the gall bladder and bile duct. The liver should be removed and weighed to the nearest 0.001 g. A hepatosomatic index, liver weight expressed as a percentage of body weight, can be used as an indicator of fish condition. For histopathology, two tissue sections should be obtained from the distal end of the medial lobe. The sections should be cut 1.0 centimeter (cm) towards the center of the lobe, and 0.5 cm thick. Cut the section using a scalpel, and handle carefully to avoid crushing the tissue. Place the tissue sections in a glass scintillation vial filled with 4 percent buffered paraformaldehyde.

The gills are located beneath the opercular flap. Pull back or remove the operculum to expose the gills. Carefully remove a section of gill tissue, taking care not to crush it. Place the gill tissue in the scintillation vial with the liver tissue.

The kidney is located along the backbone above the gas bladder. Kidney tissue is difficult to remove from fish because it adheres to the body wall and is soft. Thin slices can be taken through the vertebral column which include the kidney. These tissue sections should be preserved with the liver and gill tissue sections. Again, for proper preservation, the specimen volume should be no more than 50 percent of the total volume occupied by specimen and preservative.

Unless specific organs are being analyzed for residues, place all tissues back in the body cavity and wrap the fish in plastic or aluminum foil. Samples should be labeled and shipped following procedures outlined in the Sample Documentation and Sample Packaging and Shipping SOPs.

8.0 CALCULATIONS

No calculations are needed for the above procedures.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

The following QA/QC procedures apply to fish collection and field processing.

- 1) All data will be documented on field data sheets or in logbooks. Photodocumentation will be done when possible.
- 2) Samples will be duplicated in an unimpacted reference area.
- 3) A quality assurance work plan (QAWP) will be prepared prior to field work which specifies the methods, target species, and sample size.
- 4) All deliverables will be peer-reviewed prior to release.

10.0 DATA VALIDATION

Data generated will be reviewed according to the QA/QC considerations listed in Section 9.0.

TECHNICAL STANDARD OPERATING PROCEDURE
FISH HANDLING & PROCESSING

If possible, species identifications will be confirmed by a regional biologist familiar with the site's aquatic fauna.

11.0 HEALTH AND SAFETY

A site-specific Health and Safety plan will be prepared prior to any field activity, and must be approved by the site Health and Safety officer. All members of field crews should be trained in CPR.

Any time fish are collected, water and boat safety precautions must be taken. Wading can be dangerous, especially in swift currents or if the bottom is uneven or algae-covered. Samplers should always work in pairs, and wader belts should be worn to prevent waders filling with water if falls occur. Boating safety guidelines should be followed for activities which require transportation by boat.

TECHNICAL STANDARD OPERATING PROCEDURE
FISH HANDLING & PROCESSING

12.0 REFERENCES

Anderson, R.O. and S. J. Gutreuter. 1983. Length, weight and associated structural indices. Pgs. 283-300 In: Fisheries Techniques, L.A. Nielson and D. L. Johnson (eds). American Fisheries Society, Bethesda, Maryland.

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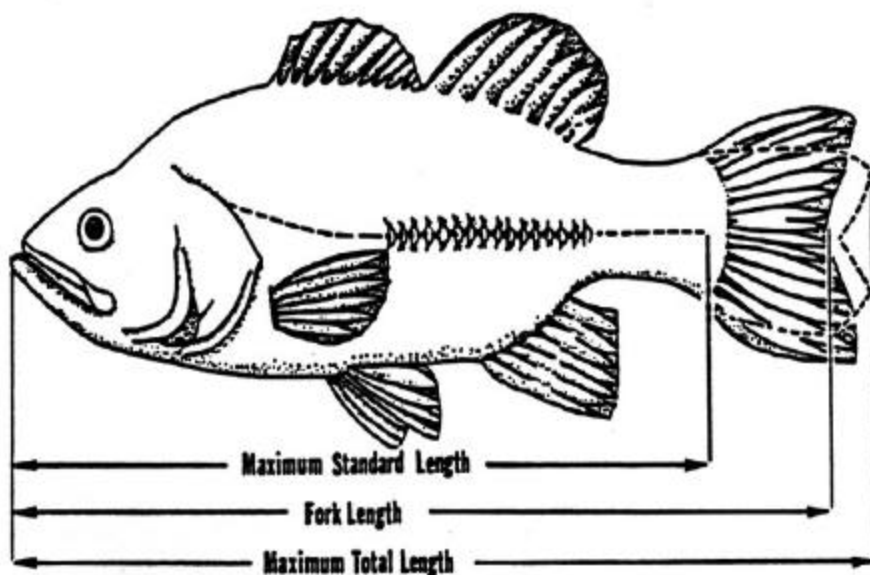
TECHNICAL STANDARD OPERATING PROCEDURE
FISH HANDLING & PROCESSING

APPENDIX A

Figures

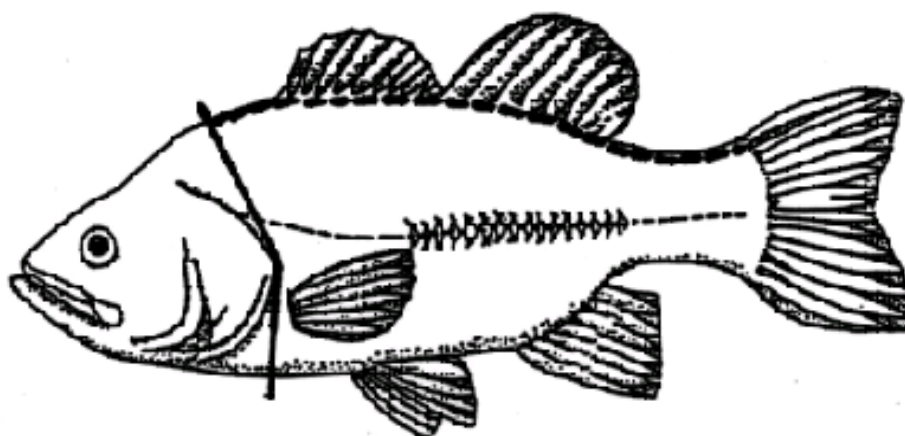
TECHNICAL STANDARD OPERATING PROCEDURE
FISH HANDLING & PROCESSING

FIGURE 1. Measurements of Fish Length - Standard, Fork, and Total
(From Anderson and Gutreuter 1983)



TECHNICAL STANDARD OPERATING PROCEDURE
FISH HANDLING & PROCESSING

FIGURE 2. Location of Cuts for Filleting a Fish





ATTACHMENT 3
Underground Utility Survey Report



June 11, 2008

UPS Overnight

To: Dyna Krumich
Assistant Project Scientist
Weston Solutions, Inc.
205 Campus Drive
Edison, NJ 08837
P: 732-417-5838

Reference: Fish Ladder
Rahway River, Rahway, New Jersey

Subject: Submission of Test Hole Forms and plan sheet.
InfraMap Corp. Project No. 08102

Dear Ms. Krumich:

We are pleased to submit the following items and or documents for the above mentioned project:

1. One (1) copy each of Test Hole Forms number 1 to 9 for a total of 9 forms.
2. One (1) copy of Test Hole inventory dated June 10, 2008.
3. One (1) copy of Rahway Fish Ladder original field sheet (FIGURE 2) with the Test Hole locations drawn on it (not to scale) dated December, 2005.

Please note:

- All Test Hole locations were chosen by Western Solutions personnel.
- The test Hole locations were hand placed on the original field sheet no to scale.
- Survey to be performed by others

If there are any questions, I can be contacted at (609)-371-5420, extension 222 or e-mailed at cqdeangelis@inframap.net

Very truly yours,
InfraMap Corp.

A handwritten signature in black ink, appearing to read "Christopher G. DeAngelis".

Christopher G. DeAngelis
Senior Utility Location Manager

cc: Ryan Brown, P.M., Weston Solutions, Inc.
Kenneth C. Kerr, P.E., InfraMap Corp. Regional Manager

Complete Utility Infrastructure Surveying and Mapping Since 1987



TEST HOLE INVENTORY

PROJECT: RAHWAY RIVER - PHASE II - FISH LADDER
CLIENT: WESTON SOLUTIONS
PROJECT MANAGER: ANTHONY ROMEO
PROJECT NO.: 08102

DATE: 06/10/08

CHECKED BY: CHRIS D. / KEN K.

TH#	TYPE OF UTILITY	COVER	REMARKS
1	36" CONCRETE CYLINDER WATER (3" CONDUIT. SEE TEST HOLE FORM)	11.89	PERFORMED ON 06-02-08
2	ELECTRIC DUCT	1.84	PERFORMED ON 06-02-08
3	3" STEEL ELECTRIC CONDUIT	1.63	PERFORMED ON 06-02-08
4	STEEL ELECTRIC CONDUITS (3 @ 2" EACH)	2.14	PERFORMED ON 06-03-08
5	ELECTRIC DUCT	2.69	PERFORMED ON 06-03-08
6	15" REINFORCED CONCRETE STORM DRAIN	2.55	PERFORMED ON 06-03-08
7	6" CAST IRON WATER	8.64	PERFORMED ON 06-03-08
8	10" CAST IRON WATER	6.28	PERFORMED ON 06-04-08
9	3" STEEL ELECTRIC CONDUIT	1.50	PERFORMED ON 06-04-08

<p>PROJECT NAME: RAHWAY RIVER - PHASE II - FISH LADDER</p> <p>LOCATE REQUESTED BY: WESTON SOLUTIONS</p> <p>UTILITY REQUESTED: 36" WATER</p> <p>UTILITY FOUND: SEE NOTE</p> <p>MATERIAL AS FOUND: SEE NOTE</p> <p>SIZE AS FOUND: SEE NOTE</p>	<p>IMC PROJECT # 08102</p> <p>PROJECT LOCATION: RAHWAY, UNION COUNTY, NEW JERSEY</p> <p>SHEET #: 1 OF 1 PROPOSED: CONSTRUCTION</p> <p>FORM BY: TR ASSISTED BY: AW AR # OF HOLES: 1</p> <p>PAVING CONDITION: N/A DATE DUG: 06-02-08</p> <p>SOIL CONDITIONS: HARD WET ROCKY</p> <p>UTILITY CONDITION: SEE NOTE</p>
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

COVER (TOP)
1.67

COVER (TOP)
11.89

ELEV. (TOP)

COVER (BOTTOM)

ELEV. (BOTTOM)

INSTALLED: 3" CONDUIT

EXIST. GRADE

FACING
NE

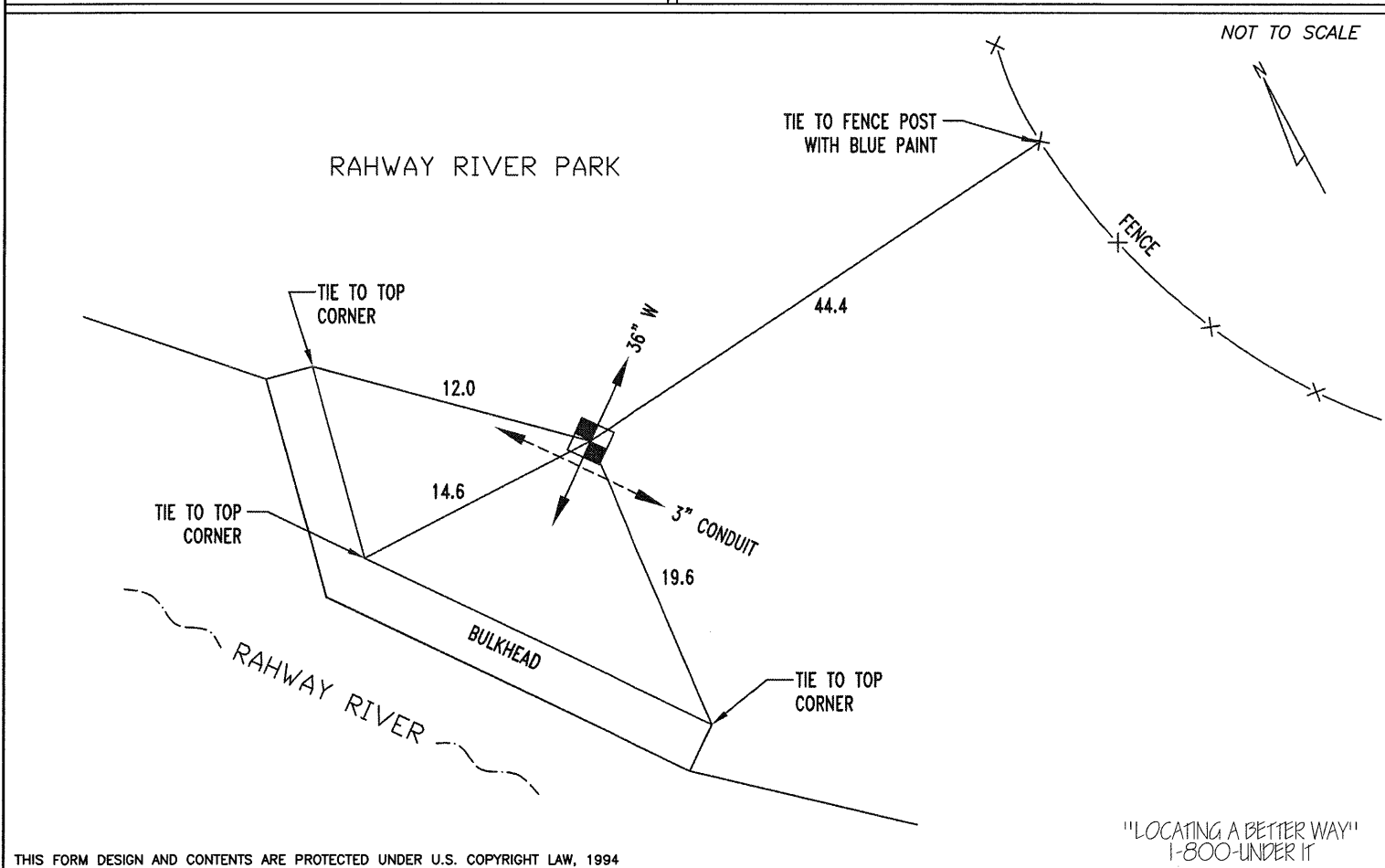
WIDTH
SEE NOTE

HUB & TACK AT: SEE NOTE OF UTILITY. **MARKING TAPE:** BLUE

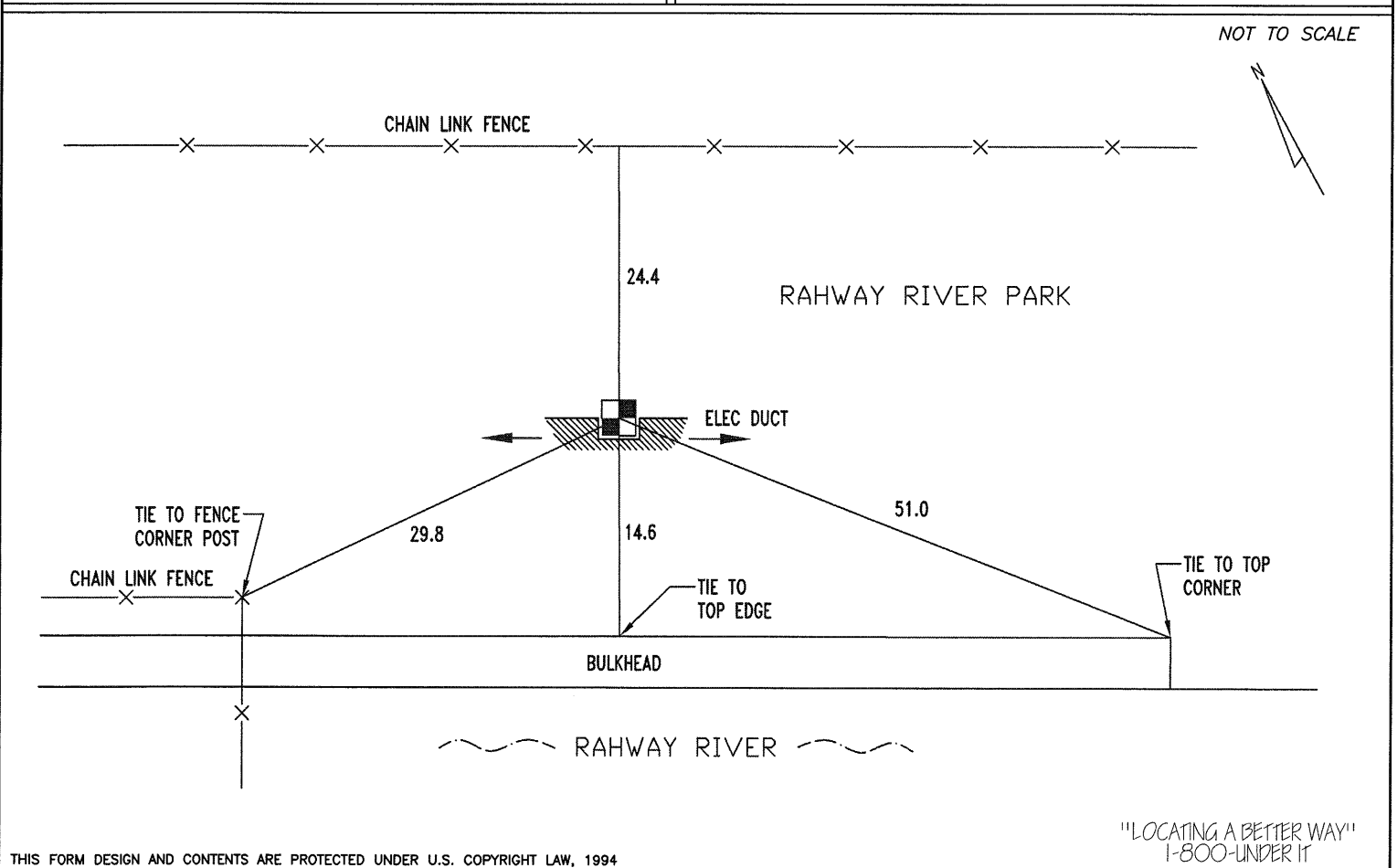
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SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

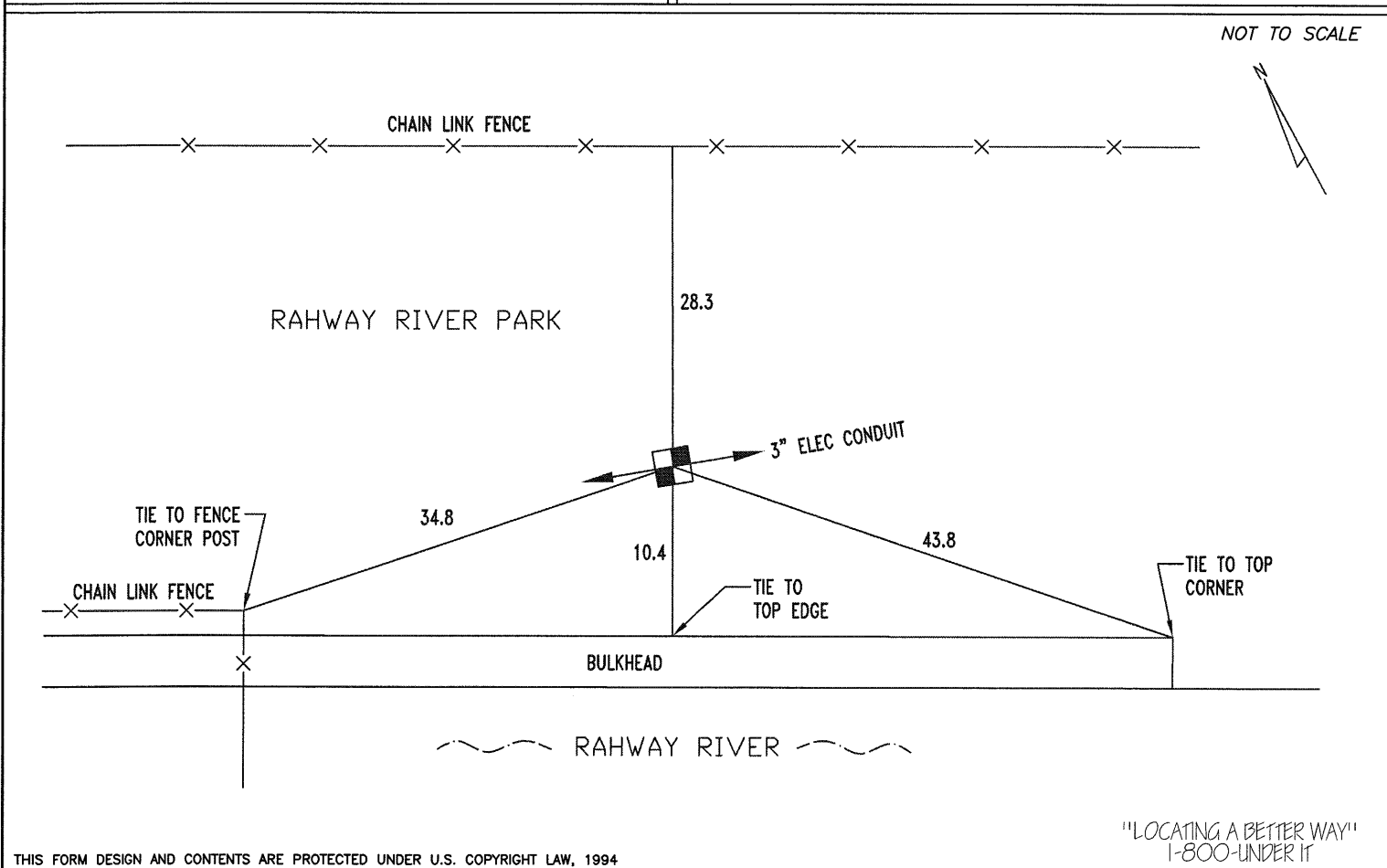
NOTES: UNABLE TO OBTAIN SIZE AND MATERIAL OF PIPE DUE TO EXCESSIVE GROUND WATER. RECORDS INDICATE 36" CONCRETE CYLINDER PIPE WATER AT THIS LOCATION. PROBED IN SEVERAL AREAS, HUB SET OVER HIGHEST POINT (APPROXIMATE CROWN OF UTILITY). TEST HOLE ALSO REVEALED A 3" GALVANIZED STEEL CONDUIT RUNNING PERPENDICULAR TO WATER LINE. COVER = 1.67. OFFSET 1.1± SOUTHWEST OF HUB.



PROJECT NAME: RAHWAY RIVER - PHASE II - FISH LADDER	IMC PROJECT # 08102
LOCATE REQUESTED BY: WESTON SOLUTIONS	PROJECT LOCATION: RAHWAY, UNION COUNTY, NEW JERSEY
UTILITY REQUESTED: ELECTRIC	SHEET #: 1 OF 1 PROPOSED: CONSTRUCTION
UTILITY FOUND: ELECTRIC DUCT	FORM BY: TR ASSISTED BY: AW AR # OF HOLES: 1
MATERIAL AS FOUND: CAST IN PLACE CONCRETE	PAVING CONDITION: N/A DATE DUG: 06-02-08
SIZE AS FOUND: N/A	SOIL CONDITIONS: HARD WET ROCKY
	UTILITY CONDITION: FAIR
ELEV SURVEY PIN []	HUB & TACK AT: EDGE OF UTILITY. MARKING TAPE: RED
EXIST. GRADE	SURVEY PIN LOCATED BY: N/A
COVER (TOP) 1.84	SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).
ELEV. (TOP)	
COVER (BOTTOM) 2.56	NOTES: HUB PLACED OVER NORTHEAST EDGE OF DUCT BANK.
ELEV. (BOTTOM)	
WIDTH DUCT	
FACING SE	

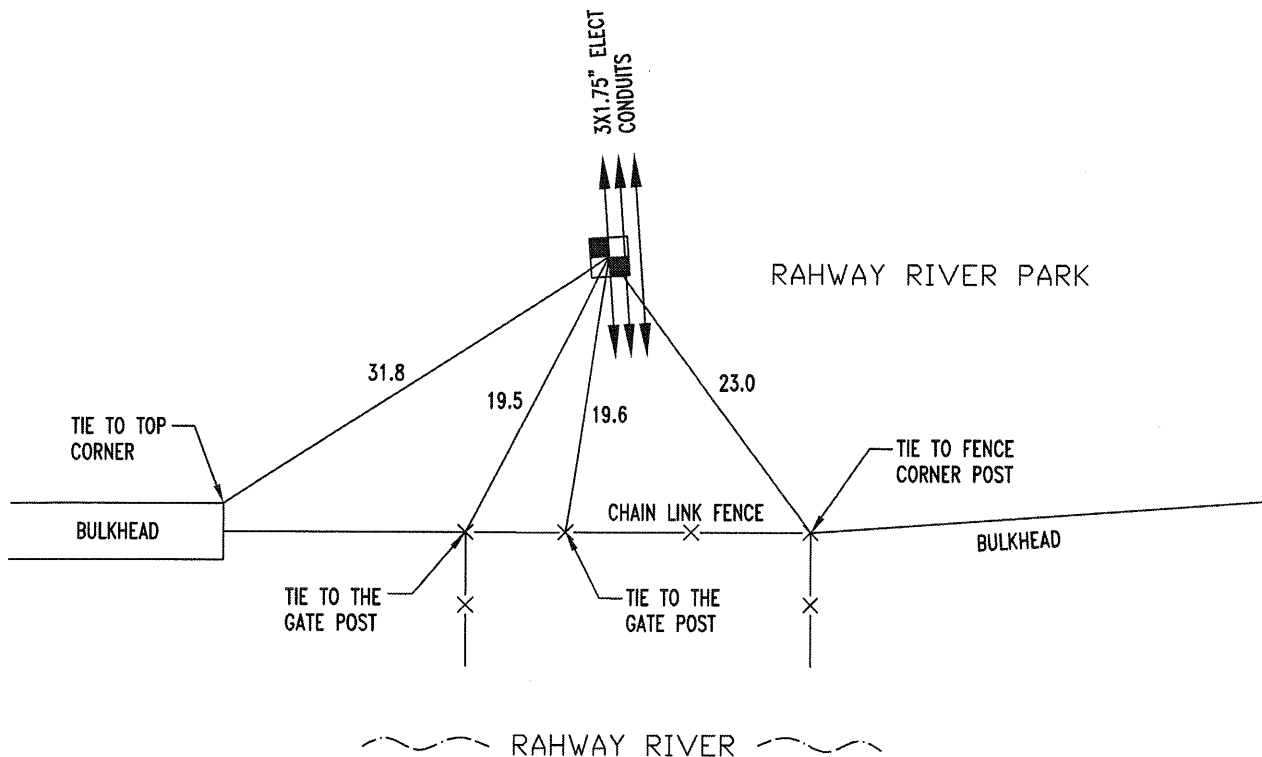


<p>PROJECT NAME: RAHWAY RIVER - PHASE II - FISH LADDER</p> <p>LOCATE REQUESTED BY: WESTON SOLUTIONS</p> <p>UTILITY REQUESTED: ELECTRIC</p> <p>UTILITY FOUND: ELECTRIC CONDUIT</p> <p>MATERIAL AS FOUND: STEEL</p> <p>SIZE AS FOUND: 3"</p>	<p>IMC PROJECT # 08102</p> <p>PROJECT LOCATION: RAHWAY, UNION COUNTY, NEW JERSEY</p> <p>SHEET #: 1 OF 1 PROPOSED: CONSTRUCTION</p> <p>FORM BY: TR ASSISTED BY: AW AR # OF HOLES: 1</p> <p>PAVING CONDITION: N/A DATE DUG: 06-02-08</p> <p>SOIL CONDITIONS: HARD WET ROCKY</p> <p>UTILITY CONDITION: FAIR</p>
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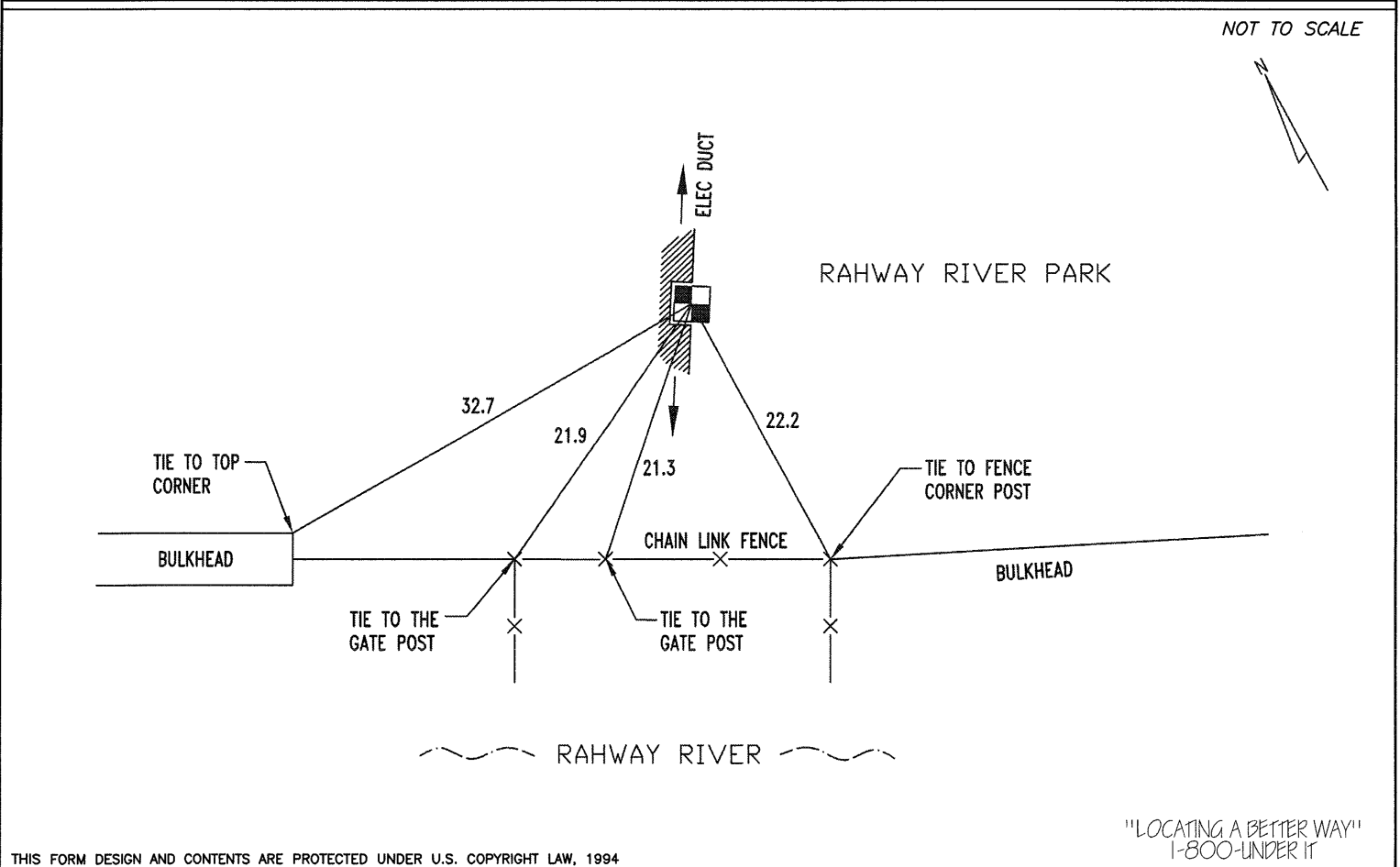


<p>PROJECT NAME: RAHWAY RIVER - PHASE II - FISH LADDER</p> <p>LOCATE REQUESTED BY: WESTON SOLUTIONS</p> <p>UTILITY REQUESTED: ELECTRIC</p> <p>UTILITY FOUND: ELECTRIC CONDUITS</p> <p>MATERIAL AS FOUND: STEEL</p> <p>SIZE AS FOUND: 3 X 1.75" (SEE NOTE)</p>	<p>IMC PROJECT # 08102</p> <p>PROJECT LOCATION: RAHWAY, UNION COUNTY, NEW JERSEY</p> <p>SHEET #: 1 OF 1 PROPOSED: CONSTRUCTION</p> <p>FORM BY: TR ASSISTED BY: AW AR # OF HOLES: 1</p> <p>PAVING CONDITION: N/A DATE DUG: 06-03-08</p> <p>SOIL CONDITIONS: HARD MOIST ROCKY</p> <p>UTILITY CONDITION: FAIR</p>
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<p>NOTES: TEST HOLE REVEALED 3 - 1.75" CONDUITS. HUB SET OVER NORTHWESTERN MOST CONDUIT. (A) - COVER TO CONDUIT (B) = 2.18. OFFSET = 0.3'± SOUTHEAST OF HUB. COVER TO CONDUIT (C) = 2.23. OFFSET = 0.5'± SOUTHEAST OF HUB.</p>	

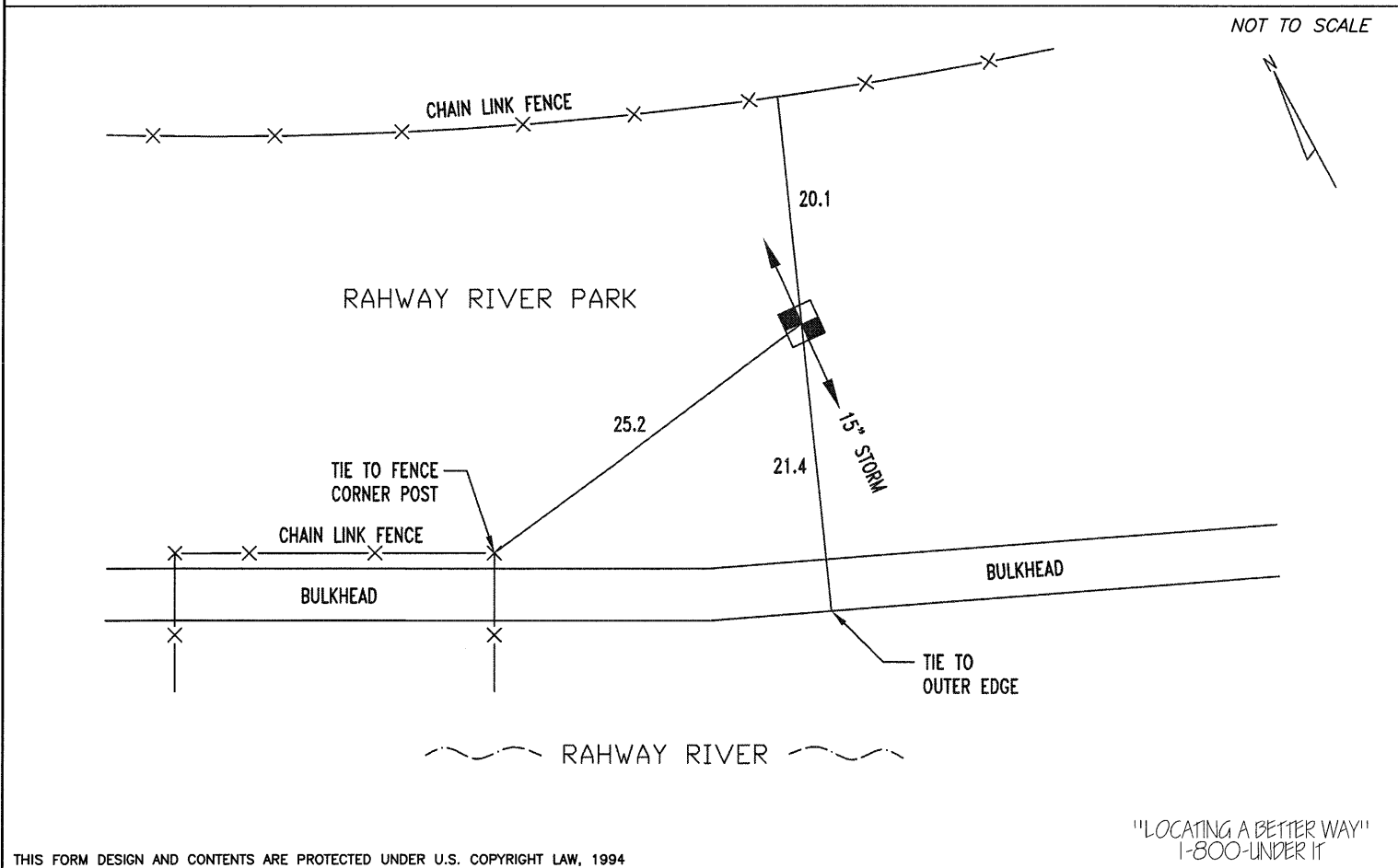
NOT TO SCALE



PROJECT NAME: RAHWAY RIVER - PHASE II - FISH LADDER	IMC PROJECT # 08102
LOCATE REQUESTED BY: WESTON SOLUTIONS	PROJECT LOCATION: RAHWAY, UNION COUNTY, NEW JERSEY
UTILITY REQUESTED: ELECTRIC	SHEET #: 1 OF 1 PROPOSED: CONSTRUCTION
UTILITY FOUND: ELECTRIC DUCT	FORM BY: TR ASSISTED BY: AW AR # OF HOLES: 1
MATERIAL AS FOUND: CAST IN PLACE CONCRETE	PAVING CONDITION: N/A DATE DUG: 06-03-08
SIZE AS FOUND: N/A	SOIL CONDITIONS: HARD WET ROCKY
	UTILITY CONDITION: FAIR
ELEV SURVEY PIN 	
COVER (TOP) 2.69 ELEV. (TOP) COVER (BOTTOM) 3.25 ELEV. (BOTTOM) FACING NE	
SURVEY PIN LOCATED BY: N/A SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET). NOTES: HUB PLACED OVER SOUTHEAST EDGE OF DUCT BANK.	



<p>PROJECT NAME: RAHWAY RIVER - PHASE II - FISH LADDER</p> <p>LOCATE REQUESTED BY: WESTON SOLUTIONS</p> <p>UTILITY REQUESTED: STORM DRAIN</p> <p>UTILITY FOUND: STORM DRAIN</p> <p>MATERIAL AS FOUND: REINFORCED CONCRETE</p> <p>SIZE AS FOUND: 15"</p>	<p>IMC PROJECT # 08102</p> <p>PROJECT LOCATION: RAHWAY, UNION COUNTY, NEW JERSEY</p> <p>SHEET #: 1 OF 1 PROPOSED: CONSTRUCTION</p> <p>FORM BY: TR ASSISTED BY: AW AS # OF HOLES: 1</p> <p>PAVING CONDITION: N/A DATE DUG: 06-03-08</p> <p>SOIL CONDITIONS: HARD MOIST ROCKY</p> <p>UTILITY CONDITION: GOOD</p>
<p>ELEV SURVEY PIN</p> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 80px; height: 20px; margin-right: 10px;"></div> <div style="text-align: center;"> </div> <div style="margin-left: 20px;"> <p>INSTALLED: HUB & TACK AT: CROWN OF UTILITY. MARKING TAPE: GREEN</p> </div> </div>	
<p>SURVEY PIN LOCATED BY: N/A</p> <p>SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).</p>	
<p>NOTES:</p>	



<p>PROJECT NAME: RAHWAY RIVER - PHASE II - FISH LADDER</p> <p>LOCATE REQUESTED BY: WESTON SOLUTIONS</p> <p>UTILITY REQUESTED: 6" WATER</p> <p>UTILITY FOUND: SEE NOTE</p> <p>MATERIAL AS FOUND: SEE NOTE</p> <p>SIZE AS FOUND: SEE NOTE</p>	<p>IMC PROJECT # 08102</p> <p>PROJECT LOCATION: RAHWAY, UNION COUNTY, NEW JERSEY</p> <p>SHEET #: 1 OF 1 PROPOSED: CONSTRUCTION</p> <p>FORM BY: TR ASSISTED BY: AW AR # OF HOLES: 1</p> <p>PAVING CONDITION: N/A DATE DUG: 06-03-08</p> <p>SOIL CONDITIONS: HARD WET ROCKY</p> <p>UTILITY CONDITION: SEE NOTE</p>
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ELEV SURVEY PIN

EXIST. GRADE

COVER (TOP)

8.64

ELEV. (TOP)

COVER (BOTTOM)

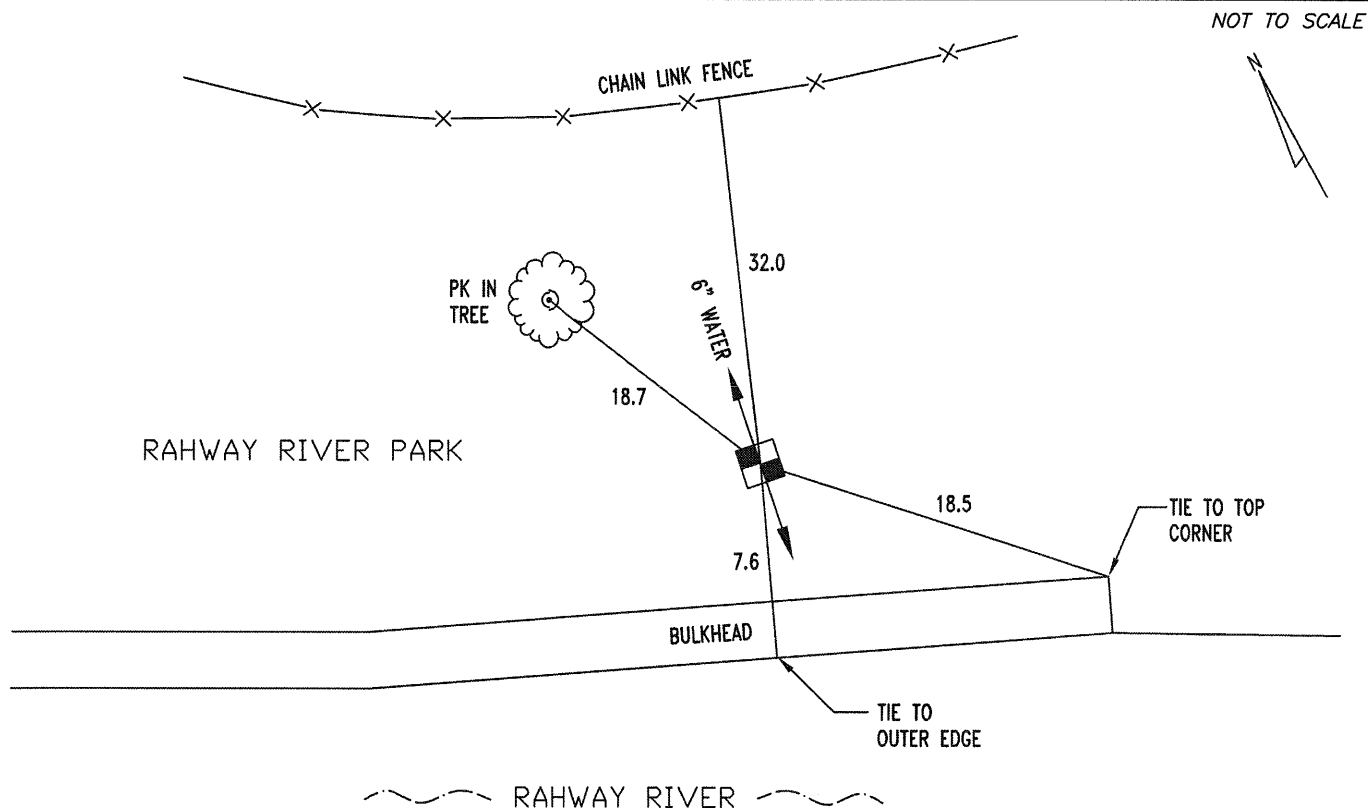
ELEV. (BOTTOM)

INSTALLLED: HUB & TACK AT: CROWN OF UTILITY. MARKING TAPE: BLUE

SURVEY PIN LOCATED BY: N/A

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NOTES: TEST HOLE EXCAVATED ON A LOCATION WHERE ELECTRONIC SIGNAL RECEIVED. UNABLE TO OBTAIN SIZE AND MATERIAL OF PIPE DUE TO EXCESSIVE GROUND WATER AND MUD. RECORDS INDICATE 6" CAST IRON WATER PIPE AT THIS LOCATION.



<p>PROJECT NAME: RAHWAY RIVER - PHASE II - FISH LADDER</p> <p>LOCATE REQUESTED BY: WESTON SOLUTIONS</p> <p>UTILITY REQUESTED: 10" WATER</p> <p>UTILITY FOUND: SEE NOTE</p> <p>MATERIAL AS FOUND: SEE NOTE</p> <p>SIZE AS FOUND: SEE NOTE</p>	<p>IMC PROJECT # 08102</p> <p>PROJECT LOCATION: RAHWAY, UNION COUNTY, NEW JERSEY</p> <p>SHEET #: 1 OF 1 PROPOSED: CONSTRUCTION</p> <p>FORM BY: TR ASSISTED BY: AW AR # OF HOLES: 1</p> <p>PAVING CONDITION: N/A DATE DUG: 06-04-08</p> <p>SOIL CONDITIONS: HARD WET ROCKY</p> <p>UTILITY CONDITION: SEE NOTE</p>
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ELEV SURVEY PIN

EXIST. GRADE

COVER (TOP)
6.28

ELEV. (TOP)

COVER (BOTTOM)

ELEV. (BOTTOM)

WIDTH
11"±

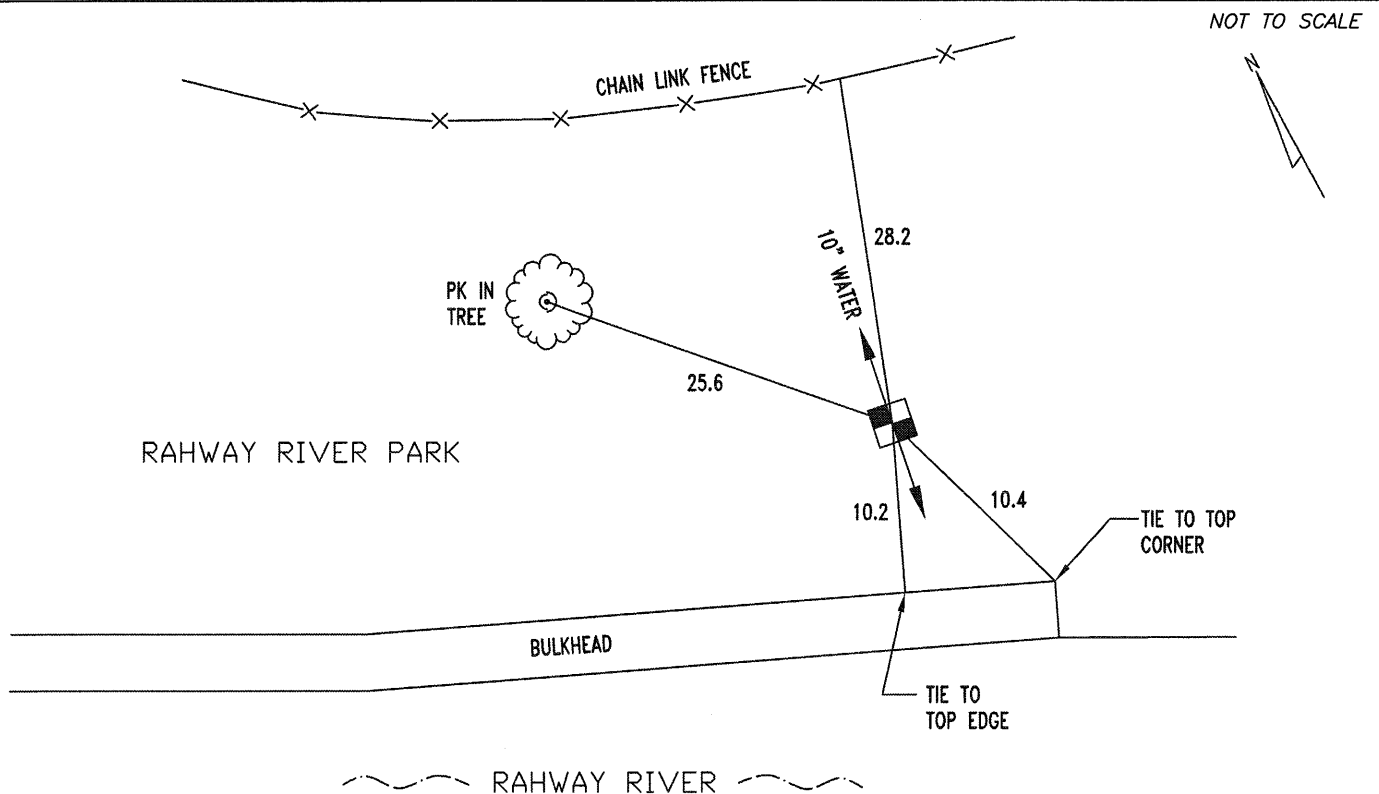
FACING NORTH

INSTALLED: HUB & TACK AT: CROWN OF UTILITY. MARKING TAPE: BLUE

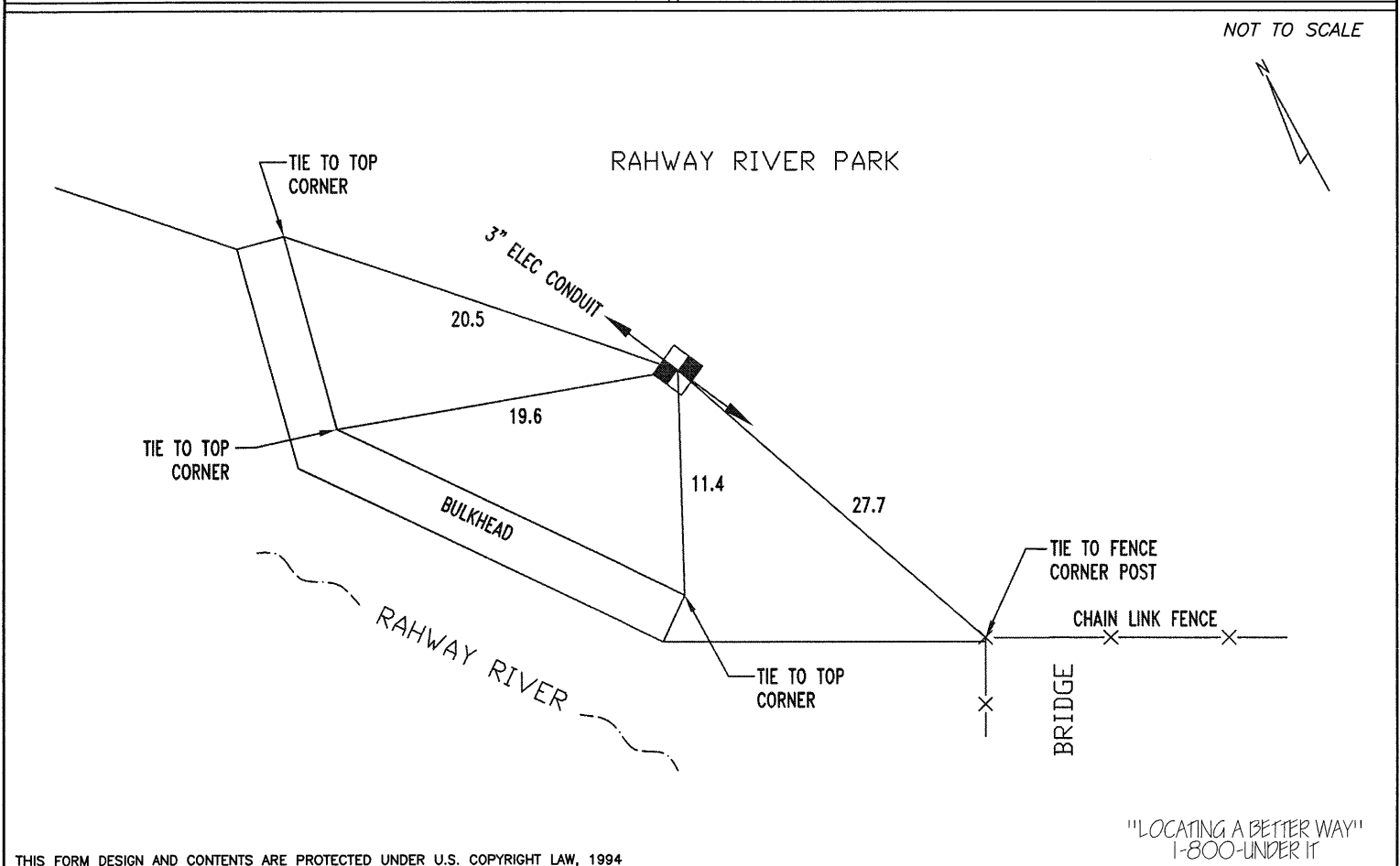
SURVEY PIN LOCATED BY: N/A

SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).

NOTES: UNABLE TO OBTAIN SIZE AND MATERIAL OF PIPE DUE TO EXCESSIVE GROUND WATER AND MUD. RECORDS INDICATE 10" CAST IRON WATER PIPE AT THIS LOCATION.



<p>PROJECT NAME: RAHWAY RIVER - PHASE II - FISH LADDER</p> <p>LOCATE REQUESTED BY: WESTON SOLUTIONS</p> <p>UTILITY REQUESTED: ELECTRIC</p> <p>UTILITY FOUND: ELECTRIC CONDUIT</p> <p>MATERIAL AS FOUND: STEEL</p> <p>SIZE AS FOUND: 3"</p>	<p>IMC PROJECT # 08102</p> <p>PROJECT LOCATION: RAHWAY, UNION COUNTY, NEW JERSEY</p> <p>SHEET #: 1 OF 1 PROPOSED: CONSTRUCTION</p> <p>FORM BY: TR ASSISTED BY: AW AR # OF HOLES: 1</p> <p>PAVING CONDITION: N/A DATE DUG: 06-04-08</p> <p>SOIL CONDITIONS: HARD WET ROCKY</p> <p>UTILITY CONDITION: FAIR</p>
<p>ELEV SURVEY PIN</p> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 80px; height: 20px; margin-right: 10px;"></div> <div style="text-align: center;"> </div> </div> <p>EXIST. GRADE</p> <p>COVER (TOP) 1.50</p> <p>ELEV. (TOP)</p> <p>COVER (BOTTOM)</p> <p>ELEV. (BOTTOM)</p> <p>WIDTH 3.25"±</p> <p>FACING NW</p>	
<p>INSTALLED: HUB & TACK AT: CROWN OF UTILITY. MARKING TAPE: RED</p> <p>SURVEY PIN LOCATED BY: N/A</p> <p>SURVEY INFO.: ALL MEASUREMENTS ON THIS FORM ARE IN ENGLISH UNITS (FEET).</p> <p>NOTES:</p>	



ATTACHMENT 4

Dam Safety Permit Application



State of New Jersey
Department of Environmental Protection
Division of Engineering & Construction
Bureau of Dam Safety & Flood Control

P.O. Box 419
Trenton, N.J. 08625-0419
TEL: (609) 984-0859
FAX: (609) 984-1908




Fax Transmittal

To:	Nadia Oliveira	Phone:	
Company:	Weston Solutions	Fax:	732-417-5801
From:	Jillian Lawrence	CC:	
Date:	07/25/08	Pages:	1
Re:	Fish Ladder on Rahway River		
<input type="checkbox"/> Urgent <input type="checkbox"/> For Review <input type="checkbox"/> Please Comment <input type="checkbox"/> Please Reply <input checked="" type="checkbox"/> Please Recycle			

Ms. Oliveira:

In regards to the fish ladder design, the person you need to contact is Curt Orvis at the US Fish and Wildlife Service Fisheries. He's located at 300 Westgate Center Drive, Hadley Massachusetts 01035-9589. His telephone (413) 253-8288. Again, a completed permit application package including plans and specification of the work to be performed is necessary even if the installation of the fish ladder is the only work to be done. Again, the fish ladder must not impact the hydraulics of the structure. I looked for dams in Rahway and there is three dams in Rahway. I would need to know which dam you are proposing the fish ladder at so that I could provide you the necessary information about the dam to complete the dam permit application.

Regards,


Jillian M. Lawrence, P.E.

Principal Civil Engineer

Email: Jillian.Lawrence@dep.state.nj.us

State of New Jersey
Department of Environmental Protection
Dam Safety Permit Application

Submit to:
Dam Safety Section
P.O. Box 419
501 E. State Street
Trenton, NJ 08625
Tel: (609) 984-0859 Fax: (609) 984-1908

Read requirements and follow instructions carefully. Please print or type.

1a. Applicant/Owner _____ Telephone _____
Legal Address _____
City or Town _____ State _____ Zip Code _____

1b. Applicant/Owner _____ Telephone _____
Legal Address _____
City or Town _____ State _____ Zip Code _____

1c. Co-permittee _____ Telephone _____
Legal Address _____
City or Town _____ State _____ Zip Code _____

2. Owner's Engineer
Name _____ N.J. License No. _____
Name of Firm _____
Address _____
City or Town _____ State _____ Zip Code _____
Telephone _____

3. Project Description _____

4. Estimated construction cost of project _____

5. Will the work require the lake to be
lowered? _____

Date received:	Assigned to:
----------------	--------------

6. Project Location _____
 Name of Dam _____
 Across (name of Stream) _____
 At a Point _____
 (A distance from mouth of stream or County or municipal boundary)
 Municipality _____ County _____
 Latitude _____ Longitude _____
 Quad sheet Location _____ Nearest downstream Municipality _____
 Lot _____ Block _____

7. GENERAL INFORMATION:

NJ File No. _____
 Federal ID No. _____
 Application No. _____

Hazard Classification _____	Purpose of Dam _____
Dam Height (ft) _____	Normal Surface (ac) _____
Dam Length (ft) _____	Normal Capacity (af) _____
Dam Type _____	Maximum Capacity (af) _____
Upstream slope _____	Downstream slope _____
Spillway type _____	Design Flood Flow (cfs) _____
Other Spillway _____	Freeboard (SDF) (ft) _____
Drainage (sq. mls) _____	Spillway Capacity (cfs) _____

8. The Dam Safety Standards (N.J.A.C. 7:20-1 et. seq.) must be used in preparation of the following attachments which must be submitted in addition to this form:

- A. Two sets of construction specifications.
- B. Site location map (U.S.G.S. sheet)
- C. Five sets of all construction plans and details.
- D. Two sets of the final design report including all supporting calculations.
- E. Operation and Maintenance Manual (O&M).
- F. Emergency Action Plan (EAP). Required for Class I and II only.

9. Have any other applications for this site/project been submitted, or have any state permits been issued for this project? (If yes, indicate status and project number below.)

	<u>Permit Type</u>	<u>Application Status</u> (i.e. pending/approved)	<u>Project No.</u>
9.1	Stream Encroachment Permit.....	_____	_____
9.2	Waterfront Development Permit.....	_____	_____
9.3	Statewide General FWW Permit.....	_____	_____
9.4	Freshwater Wetlands Individual Permit..	_____	_____
9.5	Pinelands Certificate of Filing.....	_____	_____
9.6	D & R Canal Commission Certificate.....	_____	_____
9.7	Temporary Water Lowering.....	_____	_____
9.8	Permanent Water Lowering.....	_____	_____
9.9	Water Diversion.....	_____	_____
9.10	Local Permits (Specify).....	_____	_____
9.11	Federal Permits (Specify).....	_____	_____

ENDORSEMENTS

A. APPLICANT SIGNATURE

I certify under penalty of law that the information provided in this document is true and accurate. I am aware that there are significant civil and criminal penalties for submitting false or inaccurate information.

Type name

Type name

Signature of Applicant/Owner

Signature of Applicant/Owner

Date

Date

B. **PROPERTY OWNER'S CERTIFICATION**

I hereby certify that the undersigned is the owner of the property upon which the proposed work is to be done. This endorsement is certification that the owner grants permission for the conduct of the proposed activity. In addition, I hereby give unconditional written consent to allow access to the site by representatives or agents of the Department for the purpose of conducting a site inspection or survey of the project site.

In addition, the undersigned property owner hereby certifies:

1. Whether any work is to be done within an easement - Yes ____ No ____
2. Whether any part of the entire project (e.g., pipeline, roadway, cable, transmission line, structure, etc.) will be located within property belonging to the State of New Jersey
Yes ____ No ____

Type or print name and address of owner, if
different from item 1 on page 1

Date

Signature of Property Owner

C. **STATEMENT OF PREPARER OF PLANS, SPECIFICATIONS, SURVEYOR'S OR ENGINEER'S REPORT.**

I hereby certify that the plans, specifications and engineer's report, if any, applicable to this project comply with the current rules and regulations of the New Jersey Department of Environmental Protection and that I am familiar with the laws and regulations governing the practice of engineering and land surveying in New Jersey and the definition of •responsible charge• therein and my responsibility under this definition.

Signature

Print Name and Date

Position, name of firm

Professional Engineer's
Embossed Seal

DAM SAFETY STANDARDS
N.J.A.C. 7:20
EFFECTIVE DATE: SEPTEMBER 8, 2005,
AMENDMENT OCTOBER 3, 2005,
EXPIRATION DATE: SEPTEMBER 8, 2010

**SUBCHAPTER 1. APPLICATION PROCEDURE; DESIGN CRITERIA
FOR DAM CONSTRUCTION; DAM INSPECTION
PROCEDURE**

N.J.A.C. 7:20-1.1 Scope and applicability

The rules in this subchapter were adopted pursuant to the authority of N.J.S.A. 58:4-1 et seq., as amended by the Safe Dam Act of 1981, and N.J.S.A. 13:1D-1 et seq.

1. These rules set forth procedures for application to construct, repair or modify a dam, as defined in N.J.A.C. 7:20-1.2 and set standards for design and maintenance of dams. These rules also establish a dam inspection procedure.
2. Any dam which raises the waters of a stream five feet or less above its usual, mean, low water height falls under the jurisdiction of the Flood Hazard Area Control Act, N.J.S.A. 58:16A-50 et seq.
3. The requirements in this subchapter shall not affect or relate to a dam or reservoir in the pinelands area, as designated by subsection a. of section 10 of P.L. 1979, c.111 (C. 13:18A-II), which will raise the waters of any river or stream less than eight feet above the surface of the ground where the drainage area above the same is less than one square mile in extent and where the water surface created by the dam or reservoir is less than 100 acres in extent except that the commissioner may investigate and take appropriate action regarding any dam or reservoir about which he has a security or safety concern. With respect to dams and reservoirs located on lands utilized for agricultural or horticultural purposes within the pinelands area, the commissioner's actions shall be undertaken after consultation with the Secretary of Agriculture. See N.J.S.A. 58:4-1, P.L. 1985, c.33, SI and 2.

N.J.A.C. 7:20-1.2 Definitions

The following words and terms, as used in this chapter, shall have the following meanings, unless the context clearly indicates otherwise.

"Applicant" means any person making application for a dam permit.

"Auxiliary spillway" means the second used spillway during flood flows which is not the emergency spillway.

"Dam" means any artificial dike, levee or other barrier, together with appurtenant works, which is constructed for the purpose of impounding water on a permanent or temporary basis, that raises the water level five feet or more above the usual, mean, low water height when measured from the downstream toe-of-dam to the emergency spillway crest or, in the absence of an emergency spillway, the top-of dam.

"Department" means the New Jersey Department of Environmental Protection.

"Design freeboard" means the minimum freeboard which would exist during passage of the design flood.

"Division" means the Division of Engineering and Construction in the Department of Environmental Protection.

"Emergency spillway" means the spillway capable of passing the spillway design storm with the principal and/or auxiliary spillway blocked.

"Environmental impact statement" means a report which describes the real and potential impacts which will or may result from the construction and operation of a proposed dam project, the adverse environmental impacts which cannot be avoided, the steps to be taken to minimize adverse impacts and the alternatives to the project with reasons for the acceptability or unacceptability; and

1. The report shall address real or potential impacts upon ecology, natural resources, historical and archeological resource, recreational resources, aesthetic resources, endangered and non-game species, fisheries and any other identifiable impacts;
2. The report shall include a listing of qualifications of those preparing the report and a reference list of pertinent published information relating to the project, the project site and the surrounding region.

"Formal inspection" means the inspection by a New Jersey licensed professional engineer to reevaluate the safety and integrity of the dam and appurtenant structures to determine if the structure meets current design criteria, including a field inspection and a review of the records on project design, construction and performance.

"Freeboard" means the vertical dimension between the crest of the embankment of a dam (without camber) and the reservoir water surface at the spillway design flood stage.

"Height-of-dam" means the vertical dimension from the lowest point in the stream bed or ground surface at the downstream toe of the dam to the elevation of the top of dam (without camber).

"Independent Review Board" means one or more independent professional engineers who are qualified in the design, construction and rehabilitation of dams to perform a review of

the project design and construction.

"Informal inspection" means the visual inspection of the dam by the dam owner or operator to detect apparent signs of deterioration or other deficiencies of the dam structure or function.

"Levee" or "dike" means any artificial barrier together with appurtenant works that will divert or restrain the flow of a stream or river.

"One-hundred-year storm" means the storm which is estimated to have a one percent chance, or one chance in 100, of being equaled or exceeded in one year.

"Outlet" means an opening through which water can be freely discharged from a reservoir for a particular purpose.

"Owner and/or operator" means any person who owns, controls, operates, maintains, manages or proposes to construct a dam.

"Permit" or "dam permit" means all approvals required under N.J.S.A. 58:4-1 et seq. for the construction and operation of a dam.

"Person" means any individual, proprietorship, partnership, association, corporation, municipality, county or public agency.

"Principal spillway" means the primary or first used spillway during normal inflow and flood flows.

"Probable maximum precipitation" or "(PMP)" means the theoretically greatest depth of precipitation for a given duration that is physically possible, over a given size storm area, at a particular geographic location, at a certain time of year.

"Regular inspection" means the visual inspection of a dam by a New Jersey licensed professional engineer to detect any signs of deterioration in material, developing weaknesses or unsafe hydraulic or structural behavior.

"Reservoir" means any impoundment or any potential impoundment that will be created by a dam, dike or levee.

"Spillway" means a structure other than low flow outlets, over or through which flood flows are discharged.

"Spillway design storm" means the storm upon which the hydraulic capacity of the spillway structure is designed.

"Toe-of-dam" means the junction of the downstream face of a dam with the ground surface or the invert of the outlet pipe whichever is the lowest point.

N.J.A.C. 7:20-1.3 Permit-by-rule

- (a) All dams must be designed, constructed, operated maintained or removed in compliance with the rules in this subchapter except as set forth below:
 - 1. Owners and operators of Class IV dams (see N.J.A.C. 7:20-1.8, Dam classification) are not required to file documents with nor obtain a permit from the Department, but must meet the following requirements, in addition to those set forth elsewhere in this subchapter:
 - i. Design must be based upon a spillway design storm that results in rainfall of 50 percent greater than a 24- hour, 100-year, Type III storm (Later technology adopted by the United States Department of Agriculture, Natural Resources Conservation Service may be substituted for the use of the Type III storm.); and
 - ii. All necessary local approvals must be obtained;
 - iii. A New Jersey licensed professional engineer must design the Class IV Dam to meet all technical requirements of this subchapter; and
 - iv. If the Class IV dam is designed or constructed for stormwater management purposes, the dam shall comply with the Stormwater Management Rules at N.J.A.C. 7:8.
 - 2. Owners and operators of Class III agricultural impoundments, meaning any impoundment used for fish and wildlife, fire control or livestock or crop production and maintenance, where the drainage area is less than one-half square mile in extent, must meet only the following requirements.
 - i. All necessary local approvals must be obtained;
 - ii. Design and construction must be supervised by the United States Department of Agriculture, Natural Resources Conservation Service.
- (b) The Department may, in its discretion, require the owner or operator of any dam subject to (a) above to obtain a permit and/or to submit any information relating to dam design, construction, operation or maintenance.
- (c) The Department may, in its discretion, require the owner or operator of any dam to make modification of the design, construction or operation of the dam in order to comply with the intent of this chapter and the Safe Dam Act, N.J.S.A. 58:4-1 et

seq.

N.J.A.C. 7:20-1.4 General requirements and prohibitions

- (a) No person may construct or operate a new dam or modify or repair an existing dam without first having obtained a permit from the Department, unless subject to the permit-by-rule provision in N.J.A.C. 7:20-1.3. Where emergency circumstances justify, repairs of a dam may be undertaken prior to obtaining a permit, in accordance with (i) below.
- (b) No dam may be approved by the Department where, in the opinion of the Department, there is an unacceptable potential for harm to human health or to human safety.
- (c) Backwater created by a dam during a 100-year storm shall be the minimum which is contained within the applicant's property unless written consent is obtained from all potentially affected property owners. Effects on both surface and ground water shall be considered, during normal pool conditions.
- (d) No person may construct a dam in any waterway of this state which is a runway for migratory fish, without installing a fish ladder or other approved structure to permit the fish to pass the dam in either direction (see N.J.S.A. 23:5-29.1).
 - 1. This provision is applicable to dams of any size.
 - 2. The Department will determine whether a stream is currently a runway for migratory fish, during the review of the dam permit application. Applicants should consult the Division of Fish and Wildlife in this matter prior to finalizing the application.
- (e) Unless otherwise approved by the Department, dam construction shall commence within one year from the date of the permit and be completed within two years from the said date or the permit will become null and void. For good cause shown, the Department may extend the two year construction deadline for a total of no more than five years, one year at a time. Applicants must make written request for an extension, prior to the expiration date of the permit or prior extension.
- (f) No action shall be brought against the State or the Department or its agents or employees for the recovery of damages caused by the partial or total failure of any dam or reservoir or through the operation of any dam or reservoir upon the ground that the Department is liable by virtue of any of the following:
 - 1. The approval of the dam or reservoir, or approval of flood handling plans during construction.

2. The issuance or enforcement of orders relative to maintenance or operation of the dam or reservoir.
 3. Control, regulation and inspection of the dam or reservoir.
 4. Measures taken to protect against failure during an emergency.
- (g) The Department may deny any application for a dam permit, based upon its conclusion that the construction or operation of dam will cause an unacceptable threat to or impact on natural or cultural resources or the environment.
- (h) The Department shall be notified immediately by the owner or operator upon the detection of any condition which may jeopardize the safety of the structure.
- (i) Situations which threaten the public health, safety, and welfare and require emergency dam repair will be considered by the Department under the following procedure:
1. The owner or operator shall inform the Department by telephone as to the extent of work to be performed, the reason for the emergency and the location of the project.
 2. The owner or operator shall perform the emergency work upon verbal approval of the Department, which approval shall be verified by the Department in writing within three working days. The Department shall offer guidance and instructions in performing the work.
 3. After the work has been completed in accordance with the Department's instructions, the owner or operator shall submit a dam Permit Application and "as built" drawings to the Department for review. A letter shall be issued by Department in lieu of a dam permit.
- (j) The Department shall be notified in writing on or before the transfer of dam ownership.
- (k) Unless otherwise approved by the Department in writing, no person shall dredge within 200 feet of a dam.
- (l) Utilities crossing within dam embankments are prohibited unless demonstrated to the satisfaction of the Department that such utilities will not jeopardize the safety of the dam.
- (m) No person shall remove or breach an existing dam without first having obtained a permit from the Department unless subject to the permit-by-rule provisions in N.J.A.C. 7:20-1.3.

- (n) Unless otherwise approved by the Department, no trees shall be permitted to grow on the dam embankment.

N.J.A.C. 7:20-1.5 General application procedures

- (a) The procedures for applying for a dam construction, modification or repair permit and for submitting the supporting engineering documents include the preapplication stage and the application stage, as described below. For Class III dams (see N.J.A.C. 7:20-1.8) all required information may be submitted at one time, with such detail as is appropriate to the safe design of the type of structure proposed.
- (b) The applicant for a dam permit must use a New Jersey licensed professional engineer to prepare the plans and specifications and to supervise the inspection of the construction.
- (c) The Department may require any owner or operator of an existing dam to obtain a permit for repair or modification of the dam and appurtenances where:
 - 1. Repair or modification is necessary to insure protection of human health or safety; or
 - 2. Modification is required to comply with the provisions of this chapter, unless the following circumstances exist:
 - i. Compliance is impracticable; and,
 - ii. Noncompliance poses no unacceptable threat to human health or safety.
- (d) Appeal procedures; permit denials
 - 1. An applicant for a dam permit may request in writing an administrative hearing from the Department within 15 days of receipt of the decision by the Department to deny the application.
 - 2. The request for a hearing shall specify in detail the basis for the request, including all issues of fact or law. The Department may attempt to settle the dispute by conducting such proceedings, meetings and conferences as

deemed appropriate. Should the efforts to settle the dispute fail and if the Department determines that the matter is a contested case, the Department shall forward the request for a hearing to the Office of Administrative Law, pursuant to the provisions of the Administrative Procedure Act (N.J.S.A. 52:14B-1 et seq.)

- (e) Applicants for a dam permit for a Class III dam, as defined pursuant to N.J.A.C. 7:20-1.8, may submit a preliminary application, which should include that information needed to establish a Class III hazard classification. Thereafter, in its discretion, the Department may waive certain documentation and inspection requirements set forth in these rules.

N.J.A.C. 7:20-1.6 Preapplication Stage

- (a) The applicant must submit a written Preliminary Report which must include the following:
 - 1. A general description of the dam and all appurtenances thereto, and the proposed dam classification, pursuant to N.J.A.C. 7:20-1.8. The description shall include the following:
 - i. A statement of the purpose for which the dam and appurtenances are to be used; and
 - ii. A description of the potential effects of project construction and operation upon the environment.
 - 2. Maps of the area within one-half mile of the dam and impoundment boundary, showing the following:
 - i. The location of the proposed dam and all appurtenances, thereto;
 - ii. The location of all structures;
 - iii. The county and township;
 - iv. The boundary of the reservoir;
 - v. The location of all streets and roads;
 - vi. The location of all major utilities, i.e. pipe lines and transmission, telegraph, and telephone lines; all minor utilities shall be identified in the immediate vicinity of the dam and impoundment area.

- vii. The topography and scale; and
 - viii. All other structures or facilities affected by the proposed dam, including the area downstream from the dam (State, county, and U.S.G.S. maps and aerial photographs may be used for this purpose).
 - 3. A written report of the surficial conditions (i.e. geology, topography, and culture), based upon a field reconnaissance by the applicant's engineer;
 - 4. Typical cross-sections of the dam, and any dike(s) and levee(s), showing proposed elevations, pool levels and top and bottom widths;
 - 5. Preliminary design data, tentative conclusions and references. The design data shall address hydrologic features such as drainage area and rainfall data, the basis for proposed dam location, the basis for the type of structure and spillway proposed, the soils and geologic engineering criteria and the basis for design and construction;
 - 6. The hydrologic design procedure and the storm durations which are used in the design;
 - 7. All documentation and information related to determining hazard classification; and
 - 8. Other information required by the Department.
- (b) Upon review of the pre-application, the Department will notify the applicant of what design criteria will apply.
 - (c) Applicants for a permit to repair an existing dam are not required to submit a preliminary report unless the Department determines it to be necessary.

N.J.A.C. 7:20-1.7 Application Stage

- (a) The application shall be on forms specified and supplied by the Department and must be accompanied by two copies of the final design report, construction specifications and all plans, drawings, and designs. Upon the written request of the applicant, the Department may waive certain requirements for documentation in the application stage set forth at (b) to (g) below for a permit to modify or repair an existing dam.
- (b) The application shall include a Final Design Report, which must contain the following:
 - 1. A report of the field and laboratory investigation(s) of the foundation soils

and/or bedrock, a location map to identify borings and the materials that will comprise the dam and any dikes or levees. Stability and settlement analyses and seepage and underseepage studies are required, unless the applicant can demonstrate to the satisfaction of the Department that these analyses are not necessary.

2. The bases, references, calculations and conclusions relative to hydrologic studies and design of spillway.
 3. Structural and hydraulic design studies and calculations. Structural, hydraulic and hydrologic design procedures should be used, as established by one of the following: the U.S. Army Corps of Engineers, the U.S. Bureau of Reclamation, the U.S. Natural Resources Conservation Service and other procedures universally accepted as sound engineering practice.
- (c) The application must include all drawings necessary to fully describe the proposal. Drawings must be prepared in accordance with the following:
1. All drawings must be prepared by a New Jersey licensed professional engineer or land surveyor, as appropriate. Each drawing shall have a title block which meets the requirements of the State Board of Professional Engineers and Land Surveyors.
 2. Drawings must clearly show the datum to which elevations shown are referred. The National Geodetic Vertical Datum of 1929 (N.G.V.D.), formerly known as the U.S. Coast & Geodetic Survey datum, should be used wherever possible. If the N.G.V.D. datum is not used, an appropriate conversion equation must be indicated on the drawings.
 3. The applicant must submit drawings showing the following information:
 - i. A general plan of the dam, drawn to an appropriate scale, which must show accurately the position of all essential details, such as the spillway and its point of discharge into the stream, pipes through the dam, inlets, outlets, screen chambers, gate or valve houses, head-races, the canal mill or power plant, tailraces and downstream bridges which might cause backwater on the dam;
 - ii. A longitudinal section of the dam and cross-section of the valley at the site of the dam, showing the elevation of the crest of the dam, the elevation of the normal and design storm flow line of the lake or reservoir, the original surface of the ground, the nature and depth of the underlying strata, the probable depth of the excavation for the

foundation of the dam and for the cutoff, foundation treatment, elevation of the restored surface of the ground, the location and elevation of all pipes or conduits passing through the dam, the core wall, if any, and the spillway structure;

iii. Typical cross sections, including a maximum section of the dam and of a spillway section which shall meet the following requirements;

- (1) Cross sections must show the original surface of the ground, subsurface conditions as disclosed by test pits or borings, the probable depth of excavations for the foundation and for cutoff, the elevations of the top of the dam, the crest of the spillway and the normal flow line or water surface in the reservoir;
- (2) For earth dams, the depth of stripping must be shown, as well as the position, material and dimensions of the cutoff or core wall, the width of the crest, the slopes and the nature and dimensions of the slope protection, the position and dimensions of the outlet pipes or conduits and the cutoff to prevent seepage along such structures, the disposition of different classes of embankment material if of varying composition, toe drains and clay blankets;
- (3) For concrete or other composite dams, the cross sections shall show all dimensions and shall indicate the position and kinds of material to be included in the structure.

iv. If not clearly indicated on one or more of the drawings listed above, the following details shall be shown on additional detail sheets:

- (1) Detail of spillway or overflow, showing the length and depth of opening, together with the width and shape of the crest, grade and shape of the approach and discharge channels, if any, methods of protecting the toe of the dam or end of the discharge channel from erosion and the dimensions of all walls, floors and paving;
- (2) Details of the intake and outlet works, showing the location and dimensions of all valves or sluice gates, intakes, screen chambers, racks, outlet towers and gate houses and appurtenances;
- (3) For reinforced concrete dams, detailed drawings must also be

submitted, showing the size, spacing and arrangement of all reinforcing steel and expansion joints; and

- (4) Special drawings shall be submitted showing any special construction features not otherwise shown, such as piling, fishways, aprons, materials used in the core wall, movable dams, tainter gates and mechanical devices, drains and instrumentation.

(d) The application must include specifications, containing the following:

1. General provisions, specifying the rights, duties and responsibilities of the owner, applicant, applicant's engineer and the builder;
2. The estimated project schedule and sequence of work; and
3. Technical provisions, describing carefully and in detail the approved work methods and procedures, standards for equipment and testing, materials to be used and the results to be obtained.

(e) The applicant shall complete all investigations, including the following, prior to submission of the final design report which shall meet the following requirements:

1. The scope and the degree of precision of investigations required for a specific project shall be based on the complexities of the site, the importance of the proposed structure and the hazard created by the proposed structure.
2. The foundation investigation shall consist of borings, test pits, seismic investigations or other subsurface explorations and must be performed so as to accurately define the soil and rock stratigraphy and the ground water conditions to the satisfaction of the Department.
3. Laboratory testing of undisturbed and remolded soil specimens and rock samples may be required by the Department.
4. The applicant must determine the nature and extent of materials which are proposed for use in the structure, (e.g., borrow material, concrete aggregate, riprap stone, filter materials) and their structural properties when incorporated into the proposed structure.
5. Stability analysis and calculations for the proposed structure to ensure safety against failure due to overturning, sliding or overstressing must be

submitted and approved by the Department.

6. Topographic surveys must be performed with sufficient accuracy to locate the proposed construction and to define the volume of the storage in the reservoir and the flowage limits. The upstream and downstream area must be investigated in order to delineate the area of potential damage in case of failure or flooding. Locations of baselines, centerlines and other horizontal and vertical control points must be shown on the topographic map of the site.
7. The drainage area must be accurately determined. Both present and projected future land use must be considered in determining the runoff characteristics of the drainage area. The most severe of these two conditions must be used in the design. The hydrologic assumptions and design calculations used in spillway designs shall be specified and shall include:
 - i. Drainage area size;
 - ii. Rainfall and runoff data;
 - iii. Reservoir inflow hydrographs;
 - iv. Reservoir area-capacity-elevation data;
 - v. Spillway elevation-discharge data; and
 - vi. Reservoir flood routings, except as otherwise provided in this subchapter.
- (f) All applicants must submit an Operation and Maintenance Manual in accordance with N.J.A.C. 7:20-1.1 and applicants for Class I and II dams (see N.J.A.C. 7:20-1.8) shall prepare and submit an Emergency Action Plan which shall at least include a Dam Breach Analysis, Inundation Maps and Emergency Notification and Evacuation Plans.
- (g) The Department may require the submission of an Environmental Impact Statement, as defined in N.J.A.C. 7:20- 1.2, by any applicant for a dam permit.
- (h) The application to remove or breach a dam shall include the following:
 1. Design report, and plans and computations to effect the breach including size of breach, shape of breach, disposal of spoil material;
 2. Plans and computations for stabilization of the lake bed including the channel upstream of the breach, and for the control of sediment within the lake and downstream of the breach during and after the breach has been

effected;

3. Computations for design of the method and timing for dewatering the lake;
 4. Computations detailing the effects of the breach on the downstream channel and demonstrating that the project will not adversely affect flooding conditions downstream during the 10, 50 and 100 year storms;
 5. Specifications containing the technical provision which describe in detail the proposed work methods and equipment and, in addition, a work schedule for the entire project;
 6. A plan of the existing dam and lake along with surrounding property lines;
 7. Evidence that all adjoining property owners of the impoundment and the municipality where the reservoir or dam is located have received notification that an application has been submitted to the Department to remove or breach a dam and proof of publication of notice of the proposed removal application in at least one newspaper of general circulation in the municipality where the reservoir or dam is located;
 8. A description of the potential effects of the dam removal or breach upon the environment; and
 9. A description of the potential effects of the dam removal or breach upon life and property downstream of the dam.
- (i) When a petition has been filed in accordance with the Safe Dam Act, N.J.S.A. 58:4-9, protesting against the removal of any reservoir, water or dam or against the decommissioning of any reservoir or dam, the Commissioner shall, pursuant to the requirements of N.J.S.A. 58:4-10, hold a public hearing, upon 30 days notice to all parties interested, and following prior notice published 30 days before the hearing in at least one newspaper of general circulation in the municipality in which the reservoir or dam is located.

N.J.A.C. 7:20-1.8 Dam Classification

- (a) The Department will use the following guidelines to classify dams according to hazard. Probable future development of the area downstream from the dam which might be affected by its failure will be considered in determining the hazard classification. The Department may, in its discretion, change the hazard class of any proposed or existing dam.
1. Class I - High Hazard Potential: This classification includes those dams, the

failure of which may cause the probable loss of life or extensive property damage.

- i. The existence of normally occupied homes in the area that are susceptible to significant damage in the event of a dam failure will be assumed to mean "probable loss of life".
 - ii. Extensive property damage means the destructive loss of industrial or commercial facilities, essential public utilities, main highways, railroads or bridges. A dam may be classified as having a high hazard potential based solely on high projected economic loss.
 - iii. Recreational facilities below a dam, such as a campground or recreation area, may be sufficient reason to classify a dam as having a high hazard potential.
2. Class II - Significant Hazard Potential: This classification includes those dams, the failure of which may cause significant damage to property and project operation, but loss of human life is not envisioned. This classification applies to predominantly rural, agricultural areas, where dam failure may damage isolated homes, major highways or railroads or cause interruption of service of relatively important public utilities.
 3. Class III - Low Hazard Potential: This classification includes those dams, the failure of which would cause loss of the dam itself but little or no additional damage to other property. This classification applies to rural or agricultural areas where failure may damage farm buildings other than residences, agricultural lands or non-major roads.
 4. Class IV - Small Dams: This classification includes any project which impounds less than 15 acre-feet of water to the top of dam, has less than 15 feet height-of-dam and which has a drainage area above the dam of 150 acres or less in extent. No dam may be included in Class IV if it meets the criteria for Class I or II. Any applicant may request consideration as a Class III dam upon submission of a positive report and demonstration proving low hazard.

N.J.A.C. 7:20-1.9 Design criteria

- (a) The minimum design storm used to calculate required spillway capacity must be determined according to the following table:

<u>Hazard</u>	<u>Spillway Design Storm (SDS)</u>
Class I	PMP
Class II	One-half PMP

Class III	24 hour 100 year frequency, Type III storm*
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Class IV	24 hour 100 year frequency, Type III storm plus 50%*
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*Any later technology adopted by the U.S. Department of Agriculture, Natural Resources Conservation Service may be substituted for the use of the Type III storm.

- (b) For existing dams, it is recognized that the relationships between valley slope and width, total reservoir storage, drainage area, and other hydrologic factors have a critical bearing on determining the safe spillway design flood. When appropriate, based on the design of a dam, rational selection of a reduced spillway design for specific site conditions based on quantitative and relative impact analysis is acceptable. The spillway should be sized so that the increased downstream damage resulting from overtopping failure of the dam would not be significant as compared with the damage caused by the flood in the absence of a dam overtopping failure. The minimum design storm for the dam shall be the 100 year storm.
- (c) All Class II and III dams shall, where practicable incorporate in the proposed design, the ability to make modifications necessary to increase the spillway capacity of the facility or other alternative measures if the downstream hazard potential increases.
- (d) All dams shall have an adequate storage for the design storm or have a spillway system which will safely pass the design storm without endangering the safety of the dam.
- (e) Each spillway shall include a satisfactory means of dissipating the energy of flow at its outlet without endangering the safety of the dam.
- (f) The capacity of the spillway system shall be equal to the peak inflow of the design flood unless the applicant demonstrates by flood routing procedures that the spillway system has the capacity to safely pass the resulting water flow.
- (g) Pipe conduits may be used for the primary (principal) spillway. When so used, the following requirements shall be met:
 - 1. Pipe conduits shall be of such design as to safely support the total external loads in addition to the total internal hydraulic pressure without leakage. The type of construction material used shall be consistent with the anticipated life of the structure. Corrugated metal pipe shall not be used in the construction of new dams.
 - i. For Class I and II dams, the minimum allowable inside dimension of

the pipe conduit is 30 inches.

- ii. For Class III dams, the minimum allowable inside diameter of the pipe conduit is 18 inches.
 - iii. For Class IV dams, the minimum allowable inside diameter of the pipe conduit is 12 inches.
- 2. All pipe conduits shall convey water at the maximum design velocity without damage to the interior surface;
 - 3. The pipe conduit must be designed so that negative pressures will not occur at any point along the primary (principal) spillway system;
 - 4. Anti-seep collars or other methods approved by the Department must be installed to control seepage along the conduit;
 - 5. Adequate allowances shall be incorporated in the design to compensate for differential settlement and possible elongation of the pipe conduit;
 - 6. An anti-vortex device must be included in the design, unless the applicant can demonstrate that one is not necessary.
 - 7. A trash rack, approved by the Department, shall be installed at the intake to prevent clogging of the pipe conduit; and
 - 8. An emergency spillway shall be provided; and
 - 9. Cathodic protection is required for all metal pipes .
- (h) Should a vegetated or unlined auxiliary spillway, approved by the Department, be installed, it must be able to pass the design storm without jeopardizing the safety of the structure and that has a predicted average frequency of use less than:
- 1. Once in 100 years for Class I dams:
 - 2. Once in 50 years for Class II dams; or
 - 3. Once in 25 years for Class III and IV dams.
- (i) Drawdown requirements are as follows:

1. Except for excavated impoundments, all dams shall include a device to permit draining the reservoir, as approved in writing by the Department. Computations for the minimum time required to drain the reservoir shall be required for new and existing dams.
 2. Unless the applicant demonstrates to the satisfaction of the Department that there is a need to locate a valve downstream from the dam and that the areas downstream of the dam will remain protected, all valves or sluice gates in pipe conduit drains must be installed upstream of the dam.
 3. All pipe conduits used as drawdown drains for all dam classifications shall meet requirements of (g) above, except that the minimum allowable inside dimension may be less than 30 inches.
 4. Dams which impound water on a permanent basis shall include a means to allow the reduction of the reservoir water surface elevation five feet in 10 days at a rate not to exceed one foot per day. This requirement shall not apply to dams whose intended purpose requires and whose design allows faster drawdown times. For existing dams which satisfactorily meet Department safety and operating criteria, the applicant may, with prior approval of the Department, present alternative reservoir drawdown plans.
- (j) Design references used shall be cited in the information submitted to the Department.
- (k) Monitoring devices to permit inspection and assessment of the dam's condition may be required by the Department for use in the inspections during and after completion of construction.
- (l) The applicant shall demonstrate to the Department that the riparian rights of downstream property owners will be protected during construction, during the period when the reservoir is being filled and during the life of the dam and reservoir.
- (m) Unless the applicant can demonstrate that an alternative slope is acceptable, upstream slopes of an earth dam may be no steeper than three horizontal to one vertical ratio, and downstream slopes may be no steeper than two horizontal to one vertical ratio. Measures are required for protection of upstream slopes against wave action or rapid draw-down and for protection of the downstream slope against scour or erosion due to high tailwater.
- (n) Freeboard requirements are as follows:
1. Sufficient freeboard shall be provided to prevent overtopping of the dam or any dike or levee due to passage of the design flood or due to frost damage, ice damage or wave action.

2. For all dams the minimum elevation of the top of the dam must be that necessary to pass the design storm with at least one foot of freeboard to the top of dam.
 3. Where special conditions of severe frost damage, ice damage or wave action may occur, higher elevations than required in (n)2 above may be required and should be considered by the applicant.
- (o) The Department may require the design and installation of any additional or modified measures by any applicant for a dam permit where appropriate to insure the protection of human health or safety.

N.J.A.C. 7:20-1.10 Construction

- (a) Requirements relating to supervision of dam construction are as follows:
1. All applicants shall submit a written description and schedule of the proposed construction, including:
 - i. The estimated time to complete the construction activities, see N.J.A.C. 7:20-1.4(e);
 - ii. Where applicable, a description of the means by which stream flow will be diverted around or through the dam site, or otherwise kept from interfering with the work;
 - iii. The number of inspectors designated for inspection for construction quality control; and
 - iv. Steps to be taken to minimize erosion and sediment production during construction.
 2. The extent and method of inspection for construction quality control must be described and approved by the Department, including an inspection schedule.
 3. The diversion facility, as outlined in 1.i above, must remain open and no water may be permanently stored in the reservoir until the permittee demonstrates to the Department that storage of water will neither interfere with construction activities nor create a hazard to life, health or property.
 4. The professional engineer responsible for inspecting the construction must submit progress reports to the Department at least once each month, during the construction period.

5. The permittee shall promptly advise the Department of all proposed changes in the approved design, plans or specifications. There may be no change in the approved design, plans or specifications without prior approval of the Department. All approved changes must be recorded on the complete set of as-built plans, required in (a) 6, below. The Department may require the submission of revised designs at any time. Written prior approval from the Department is required for major modifications, which shall include significant changes in scale, use, design, impact, etc. of the project, as initially approved. The Department may require written, prior approval of any proposed modification.
 6. A complete set of as-built designs, plans and specifications must be submitted to the Department upon completion of the project.
 7. The professional engineer who has inspected the construction shall submit written certification that the structure has been built in conformance with the designs, plans and specifications, and with any changes approved by the Department.
- (b) The Department may, in its discretion, require the owner to obtain the services of an Independent Review Board to oversee the design and construction of any proposed or existing dam.
- c) Construction inspection program requirements are as follows:
1. The Department may inspect the dam during construction to insure that it is being built in compliance with the designs, plans and specifications submitted to the Department. Departmental inspections in no way relieve either the permittee or the professional engineer in charge from the responsibility of providing adequate inspection of the work.
 2. If, at any time during the progress of the work, the Department finds that the work is not being performed in accordance with the approved designs, plans and specifications and any approved changes, the Department will serve a written notice to that effect on the permittee or his representative. Such notice will state the particulars with which the work has not complied. Additionally, the Department may order the immediate compliance with such designs, plans, specifications, and changes and suspension of all other work until compliance has been effected. If the owner or his representative fails to comply with this order, the permit under which construction is authorized may be revoked or suspended by the Department.
 3. Upon receipt of the as-built plans required in subsection (a) 6 above and the engineer's certification required in subsection (a) 7 above the Department will inspect the completed construction within 45 days. If the Department finds that construction was completed in accordance with the approved

designs, plans, specifications and approved changes, the construction will be approved in writing within 30 days. The approval date shall be the date such approval is sent by the Department.

4. In the 12th month following approval of construction by the Department pursuant to (c) 3 above, the Department will make a final inspection of the construction. If the Department makes a final inspection of the construction, a final approval may be given by the Department, if the final inspection shows that the terms of the permit, designs, plans, specifications and approved changes thereof have been met.

N.J.A.C. 7:20-1.11 Dam operating requirements and inspections: new and existing dams

- (a) The owners and operators of all dams shall develop and use an Operation and Maintenance Manual which provides guidance and instruction to project personnel for the proper operation and maintenance of the reservoir and dam, and meets the following requirements:
 1. The manual shall be composed of two parts:
 - i. Part One shall include an introduction, project description, project authorizations, project history and list of project contracts.
 - ii. Part Two shall contain the operation and maintenance instructions for major project facilities and equipment and a schedule for maintenance.
- (b) The owners or operators of all dams which raise the waters of any stream more than 70 feet above its usual mean low-water height or which impound more than 10,000 acre-feet of water shall have a regular inspection performed annually and formal inspections performed every three years by a New Jersey licensed professional engineer. These inspections must be attended by a professional engineer assigned from the Department. In the year of the formal inspection, regular or informal inspections need not be performed.
- (c) Owners or operators of Class I dams not meeting the size characteristics described in (b) above shall have a regular inspection performed once every two years and a formal inspection performed every six years.
- (d) Owners or operators of Class II dams shall have a regular inspection performed once every two years and a formal inspection performed every 10 years.
- (e) Owners or operators of Class III and IV dams shall have a regular inspection

performed every four years. The Department may at its discretion require the owner or operators to perform a formal inspection of a Class III or IV dam.

- (f) All dam inspections shall be performed from March through December.
- (g) All inspections shall be performed in compliance with the following requirements:
 - 1. A written guide provided by the Department for the preparation of a Report on Condition of the dam shall be used for all inspections.
 - 2. Formal and regular dam inspections shall be performed by a licensed New Jersey professional engineer. Except for Class IV dams, the required report shall be submitted to the Department by the engineer within 30 days of completion of the inspection. The report shall indicate the results of the inspection, documenting the conclusions and recommendations. Reports for Class IV dams shall be submitted to the county and/or municipal engineer having jurisdiction over the dam structure.
 - 3. Informal inspections may be performed by the dam owner or operator and the Report on Condition shall be part of the owner's or operator's permanent file and, unless requested by the Department, Reports shall not be submitted to the Department.
 - 4. The Department may extend the time for submission of the required material for up to 30 days, if the owner or operator justifies the need for such extension.
 - 5. Failure by the permittee to inspect within the required time periods or failure to submit the Report on Condition may result in an order to drain the impoundment under the provisions of the Safe Dam Act (N.J.S.A. 58:4-1 et seq.), and/or any other remedy allowed by law.
- (h) For good cause, the Department may require the owner or operator of any dam to perform an inspection of any type at any time.
- (i) The owner or operator of all Class I and II dams shall prepare and use an Emergency Action Plan, as described in N.J.A.C. 7:20-1.7(f).

SAFE DAM ACT

58:4-1 Reservoir, dam restrictions.

58:4-1. a. No municipality, corporation or person shall, without the consent of the Commissioner of Environmental Protection, hereafter in this chapter designated as the commissioner, build any reservoir or construct any dam, or repair, alter or improve existing dams on any river or stream in this State or between this State and any other state which will raise the waters of the river or stream more than five feet above its usual mean low-water height.

No municipality, corporation or person shall, without the consent of the commissioner, build any reservoir or construct any dam, or repair, alter or improve existing dams in the pinelands area, as designated by subsection a. of section 10 of P.L.1979, c.111 (C.13:18A-11), which will raise the waters of any river or stream more than eight feet above the surface of the ground where the drainage area above the dam or reservoir is more than one square mile in extent and where the water surface created by the dam or reservoir is more than 100 acres in extent.

The commissioner may investigate and take appropriate action regarding any dam or reservoir about which the commissioner has a security or safety concern.

With respect to dams and reservoirs located on lands utilized for agricultural or horticultural purposes within the pinelands area, the commissioner's actions shall be undertaken after consultation with the Secretary of Agriculture.

b. The commissioner shall not require a permit for the repair of any dam used for agricultural purposes within a special agricultural production area designated pursuant to N.J.A.C.7:50-5.14 in the pinelands area.

Amended 1981, c.249, s.3; 1985, c.33; 1995, c.402, s.1; 2001, c.82, s.1.

58:4-2. Approval of plans of reservoirs and dams

Every municipality, corporation or person, before constructing any reservoir or dam subject to the provisions of this chapter shall apply to the commissioner for the approval of the plans of such reservoir or dam, which approval the commissioner may grant with such modifications, limitations or changes as in his judgment may be necessary for the protection of life and property.

Amended by L.1981, c. 249, s. 4, eff. Aug. 6, 1981.

58:4-3. Descriptions, surveys and plans of existing reservoirs and dams

Every municipality, corporation or person owning and maintaining or having control of any reservoir or dam shall, upon written request therefor, furnish to the commissioner as full, true and particular description of the reservoir or dam as may be practicable, and shall, when so requested by the commissioner cause to be made such surveys, plans and drawings of the reservoir or dam as may be necessary to give sufficient information for the determination of its safety as may be required by the commissioner.

Amended by L.1981, c. 249, s. 5, eff. Aug. 6, 1981.

58:4-4. Inspection of reservoirs and dams

Upon written application by any person owning or representing property liable to be injured or destroyed by the breaking of any reservoir or dam, or upon application by the mayor or governing body of any municipality on account of possible danger of loss of life or of injury to any property within the municipality from the breaking of any reservoir or dam, or without such complaint whenever the commissioner shall choose, he shall forthwith thoroughly inspect such reservoir or dam.

Amended by L.1981, c. 249, s. 6, eff. Aug. 6, 1981.

58:4-5 Alterations, additions and repairs of unsafe reservoirs or dams; duties of owner.

58:4-5. a. An owner or person having control of a reservoir or dam shall:

(1)Implement all measures required pursuant to this chapter or the provisions of P.L.1981, c.249 (C.58:4-8.1 et seq.), or any rule, regulation, code, permit or order issued pursuant thereto, including but not limited to, performance of periodic inspections required pursuant to section 2 of P.L.1981, c.249 (C.58:4-8.2) or development, updating and implementation of emergency action plans;

(2)Provide to the Department of Environmental Protection, upon request, any reports or information required pursuant to this chapter or the provisions of P.L.1981, c.249, or any rule or regulation adopted, or permit or order issued pursuant thereto; and

(3)Implement any action ordered by the Commissioner of Environmental Protection to correct conditions that render the reservoir or dam to be considered, as determined by the commissioner, unsafe or improperly maintained or to bring the reservoir or dam into compliance with standards established pursuant to this chapter, or any rule or regulation adopted, or permit or order issued pursuant thereto.

b. If, in the judgment of the commissioner, any reservoir or dam is not sufficiently strong to resist the pressure of water that is or may be upon it or there is reasonable cause to believe that danger to life or property may be anticipated from the reservoir or dam, or if for any other cause the commissioner shall determine the reservoir or dam to be unsafe or improperly maintained, the commissioner shall take any action authorized pursuant to this section to compel compliance with the provisions of this chapter, or any rule or regulation adopted, or permit or order issued pursuant thereto, and shall determine whether the water in the reservoir or above the dam shall be drawn off in whole or in part, and what alterations, additions and repairs are necessary to be made to the reservoir or dam to make it safe and properly maintained or whether the dam or appurtenant structures located therein should be removed. The commissioner also may take action as authorized pursuant to R.S.58:4-6 against the owner or person having control of the reservoir or dam for such relief as the commissioner may determine. The commissioner shall forthwith in writing order the owner or person having control of the reservoir or dam to cause the alterations, additions and repairs to be made within the time to be limited in the order. A copy of any order issued by the commissioner pursuant to this section shall be sent to the clerk of the municipality and the clerk of the county in which the reservoir or dam is located. The commissioner also may order the water in the reservoir or above the dam to be drawn off in whole or in part as the commissioner may determine. The commissioner shall not approve the decommissioning of a reservoir or dam until the commissioner has provided 30 days' prior notice

and the commissioner has complied with the provisions of R.S.58:4-10 as applicable. The notice of the proposed decommissioning shall be published at least 30 days prior to the decommissioning of the reservoir or dam in at least one newspaper of general circulation in the municipality in which the reservoir or dam is located. The commissioner shall have the right to enter upon any and all properties for the purpose of obtaining information about the safety and proper maintenance of any reservoir, dam or appurtenant structures located therein.

c. Any owner or person having control of a reservoir or dam who fails to comply with an order issued pursuant to this section or R.S.58:4-6 may be liable to the department in an amount equal to the cost of removal of the dam or appurtenant structures located therein undertaken by the department, including attorney's fees and court costs, pursuant to subsection d. of this section.

Whenever two or more owners or persons having control of a reservoir or dam are liable for the cost of removal, including attorney's fees and court costs, the department may allocate the cost of removal among the liable parties using such factors as the department determines are appropriate. Nothing in this subsection shall affect the right of any party to seek contribution from any other person responsible for the cost of removal of the dam pursuant to any other statute or under common law.

d. (1) Whenever the commissioner determines that a dam is in imminent danger of failure and has reasonable cause to believe that danger to life or property may be anticipated from the reservoir, dam or appurtenant structures located therein, and the owner of the dam or person having control of the reservoir or dam has failed to comply with an order to repair the dam issued pursuant to subsection a. of this section or R.S.58:4-6, or to take such interim measures as the department determines are appropriate, including reducing the amount of water impounded by the dam or breaching the dam, the department may, in addition to actions authorized pursuant to R.S.58:4-6, enter upon any and all properties wherein the reservoir, dam or appurtenant structures are located and, using resources and personnel available to the department, remove or cause to be removed the dam or appurtenant structures located therein, allowing the water to flow freely.

Prior to any action by the department pursuant to this subsection, the owner or person having control of the reservoir or dam, shall, no later than 60 days after receipt of a notice from the department of a pending removal action, submit to the department, in writing, an acceptable implementation plan addressing the proposed actions to be taken regarding the failed or failing reservoir or dam.

(2) Any expenditures made by the department pursuant to this section shall constitute, in each instance, a debt to the State. The debt shall constitute a lien on all property owned by the owner or person having control of the reservoir or dam when a certificate of debt, incorporating a description of the property of the owner or person having control of the reservoir or dam subject to the repair, and related costs, is duly filed with the clerk of the Superior Court. The clerk shall promptly enter upon the civil judgment and order docket the name and address of the owner or person having control of the reservoir or dam and the amount of the lien as set forth in the certificate of debt. Upon entry by the clerk, the lien, to the amount committed by the department for dam repair, shall attach to the revenues and all real and personal property of the owner or person having control of the reservoir or dam, whether or not the owner or person having control of the reservoir or dam is insolvent.

The certificate of debt filed pursuant to this paragraph which affects the property of an owner or person having control of a reservoir or dam subject to the dam repairs shall create a lien with priority over all other claims or liens which are or have been filed against the property, except if the property comprises six dwelling units or less and is used exclusively for residential purposes, this certificate of debt shall not affect any valid lien, right or interest in the property filed in accordance with established procedure prior to the filing of this certificate of debt.

The certificate of debt filed pursuant to this subsection which affects any property of an owner or person having control of a reservoir or dam, other than the property subject to the repairs, shall have priority from the day of the filing of the certificate of debt over all other claims and liens filed against the property, but shall not affect any valid lien, right, or interest in the property filed in accordance with established procedure prior to the filing of a certificate of debt pursuant to this subsection.

Whenever the owner or person having control of the reservoir or dam is a private lake association or other body representing owners of property adjacent to the reservoir or lake created by the dam or impoundment, liens may be imposed upon the individual owners of the property represented by the association. An owner whose property has such a lien imposed may release the property from a lien claimed under this subsection by filing with the clerk of the Superior Court a cash or surety bond, payable to the department in the amount of the sums expended by the department pursuant to this section, including attorney's fees and court costs, or the value of the property after the abatement action is complete, whichever is less.

e. The provisions of this section shall not limit the use of other remedies available to the department pursuant to law.

f. The commissioner may adopt, pursuant to the "Administrative Procedure Act," P.L.1968, c.410 (C.52:14B-1 et seq.), any rules or regulations necessary to implement the provisions of this section.

Amended 1981, c.249, s.7; 1994, c.84, s.1; 2005, c.228, s.1.

58:4-6 Enforcement powers of department, civil, criminal; violations; penalties.

58:4-6. a. Whenever the Commissioner of Environmental Protection finds that a person has violated any provision of the "Safe Dam Act," P.L.1981, c.249 (C.58:4-8.1 et seq.), or any rule, regulation or order issued pursuant thereto, the commissioner may:

(1) Issue an order requiring any such person to comply in accordance with subsection b. of this section; or

(2) Bring a civil action in accordance with subsection c. of this section; or

(3) Levy a civil administrative penalty in accordance with subsection d. of this section; or

(4) Bring an action for a civil penalty in accordance with subsection e. of this section; or

(5) Petition the Attorney General to bring a criminal action in accordance with subsection f. of this section.

Recourse to any of the remedies available under this section shall not preclude recourse to any of the other remedies prescribed in this section or by any other applicable law.

b. Whenever, on the basis of available information, the commissioner finds a person in violation of any provision of P.L.1981, c.249, or any rule, regulation or order issued pursuant thereto, the commissioner may issue an administrative order: (1) specifying the provision or provisions of the law, rule, regulation, or order, of which the person is in violation; (2) citing the action which constituted the violation; (3) requiring compliance with the provision or provisions violated; (4) requiring the restoration of the area which is the site of the violation; and (5) providing notice to the person of the right to a hearing on the matters contained in the order.

c. The commissioner is authorized to institute a civil action in Superior Court for appropriate relief from any violation of P.L.1981, c.249, or any rule, regulation or order issued pursuant thereto. Such relief may include, singly or in combination:

(1) A temporary or permanent injunction, including an order or judgment as will effectually secure the persons interested from danger of loss from the breaking of a dam. The court may proceed in the action in a summary manner or otherwise;

(2) Assessment of the violator for the costs of any investigation, inspection, or monitoring survey which led to the establishment of the violation, and for the reasonable costs of preparing and bringing legal action under this subsection;

(3) Assessment of the violator for any costs incurred by the State in removing, correcting, or terminating the adverse effects resulting from any violation for which legal action under this subsection may have been brought;

(4) Assessment against the violator for compensatory damages for any loss or destruction of wildlife, fish or aquatic life, and for any other actual damages caused by a violation;

(5) A requirement that the violator restore the site of the violation to the maximum extent practicable and feasible.

d. The commissioner is authorized to assess a civil administrative penalty of up to \$25,000 for each violation of any provision of P.L.1981, c.249, or any rule, regulation or order issued pursuant thereto, and each day during which each violation continues shall constitute an additional, separate, and distinct offense. Any amount assessed under this subsection shall fall within a range established by regulation by the commissioner for violations of similar type, seriousness, and duration. In adopting rules and regulations establishing the amount of any penalty to be assessed, the commissioner may take into account the economic benefits from the violation gained by the violator. No assessment shall be levied pursuant to this section until after the party has been notified by certified mail or personal service. The notice shall: (1) identify the section of the law, rule, regulation or order violated; (2) recite the facts alleged to constitute a violation; (3) state the amount of the civil penalties to be imposed; and (4) affirm the rights of the alleged violator to a hearing. The ordered party shall have 20 days from receipt of the notice within which to deliver to the commissioner a written request for a hearing. After the hearing and upon finding that a violation has occurred, the commissioner may issue a final order specifying the amount of the fine imposed. If no hearing is requested, the notice shall become final after the expiration of the 20-day period. Payment of the assessment is due when a final order is issued or

the notice becomes a final order. The authority to levy an administrative penalty is in addition to all other enforcement provisions in this act and in any other applicable law, rule, or regulation, and the payment of any assessment shall not be deemed to affect the availability of any other enforcement provisions in connection with the violation for which the assessment is levied. Any civil administrative penalty assessed under this section may be compromised by the commissioner upon the posting of a performance bond by the violator, or upon such terms and conditions as the commissioner may establish by regulation.

e. A person who violates any provision of P.L.1981, c.249 or any rule, regulation or order issued pursuant thereto, an administrative order issued pursuant to subsection b. of this section, or a court order issued pursuant to subsection c. of this section, or who fails to pay a civil administrative penalty in full pursuant to subsection d. of this section, shall be subject, upon order of a court, to a civil penalty not to exceed \$10,000 per day of such violation, and each day during which the violation continues shall constitute an additional, separate, and distinct offense. Any civil penalty imposed pursuant to this subsection may be collected with costs in a summary proceeding pursuant to the "Penalty Enforcement Law of 1999," P.L.1999, c.274 (C.2A:58-10 et seq.). In addition to any penalties, costs or interest charges, the court may assess against the violator the amount of actual economic benefit accruing to the violator from the violation. The Superior Court and the municipal court shall have jurisdiction to enforce the provisions of the "Penalty Enforcement Law of 1999" in connection with this section.

f. A person who purposely, knowingly or recklessly violates any provision of P.L.1981, c.249, or any rule, regulation or order issued pursuant thereto, shall be guilty, upon conviction, of a crime of the fourth degree and, notwithstanding any provision of N.J.S.2C:43-3 to the contrary, shall be subject to a fine of not less than \$2,500 nor more than \$25,000 per day of violation, in addition to any other applicable penalties and provisions under Title 2C of the New Jersey Statutes. A second or subsequent offense under this subsection shall subject the violator to a fine, notwithstanding any provision of N.J.S.2C:43-3 to the contrary, of not less than \$5,000 nor more than \$50,000 per day of violation, in addition to any other applicable penalties and provisions under Title 2C of the New Jersey Statutes. A person who knowingly makes a false statement, representation, or certification in any application, record, or other document filed or required to be maintained under the provisions of P.L.1981, c.249 shall be guilty, upon conviction, of a crime of the fourth degree and, notwithstanding any provision of N.J.S.2C:43-3 to the contrary, shall be subject to a fine of not more than \$10,000, in addition to any other applicable penalties and provisions under Title 2C of the New Jersey Statutes.

g. In addition to the penalties prescribed in this section, a notice of violation of any provision of P.L.1981, c.249, or any rule, regulation or order issued pursuant thereto, shall be recorded on the deed of the property wherein the violation occurred, on order of the commissioner, by the clerk or register of deeds and mortgages of the county wherein the affected property is located and with the clerk of the Superior Court and shall remain attached thereto until such time as the violation has been remedied and the commissioner orders the notice of violation removed.

h. The department may require an owner or person having control of a reservoir or dam to provide any information the department requires to determine compliance with any provision of P.L.1981, c.249, or any rule, regulation or order issued pursuant thereto.

i. Any person who knowingly, recklessly, or negligently makes a false statement, representation or certification in any application, record, or other document filed or required to be maintained

under the provisions of P.L.1981, c.249, shall be in violation of the act and shall be subject to the penalties assessed pursuant to subsections d. and e. of this section.

j. All penalties collected pursuant to this section or sums collected pursuant to R.S.58:4-5 shall be deposited in the "Environmental Services Fund," established pursuant to section 5 of P.L.1975, c.232 (C.13:1D-33), and kept separate from other receipts deposited therein, and appropriated to the department for the removal of dams in the State.

k. The department shall have the authority to enter any property, facility, premises, or site for the purpose of conducting inspections to determine the condition of any dam, or to conduct inspections of ordered repairs or to otherwise determine compliance with the provisions of P.L.1981, c.249.

Amended 1953, c.54, s.5; 1981, c.249, s.8; 2005, c.228, s.2.

58:4-8. Personnel to conduct inspections

The commissioner may, when provided with sufficient funds, employ personnel for the inspection of existing reservoirs and dams and the supervision of the erection of new reservoirs and dams in this State or between this and any other state so that said structures may be built with due regard for the safety of property and life which might be endangered by improper construction thereof.

Amended by L.1981, c. 249, s. 9, eff. Aug. 6, 1981.

58:4-8.1. Short title

This act shall be known and may be cited as the "Safe Dam Act."

L.1981, c. 249, s. 1, eff. Aug. 6, 1981.

58:4-8.2. Periodic dam safety inspection and reporting procedure

The Commissioner of Environmental Protection shall, by rule, establish a periodic dam safety inspection and reporting procedure, on an annual or longer term basis, for the owner of any dam meeting the criteria contained in R.S. 58:4-1. The owner shall have a professional engineer inspect the dam and prepare and submit a report containing such information as the commissioner may require, concerning the safety of said dam and appurtenant structures. Every dam which raises the waters of any stream more than 70 feet above its usual mean low-water height or which impounds more than 10,000 acre-feet of water shall be inspected on an annual basis by a professional engineer retained by the owner, in the company of a professional engineer assigned from the Department of Environmental Protection.

L.1981, c. 249, s. 2, eff. Aug. 6, 1981.

58:4-9. Maintenance of existing reservoirs and dams; petition against abandonment

58:4-9. Where a reservoir or dam has been in existence 20 years and the owners of land along the shores above the dam or on the reservoir have made or shall have made permanent improvements on the land or where the shores have become a populated community, depending upon the permanency of the condition created, or where the reservoir or dam has become a valuable resource for the quality of life in the municipality in which the reservoir or dam is located, and a petition signed by a majority of the landowners along the shore of any pond formed by the reservoir or dam, or by any number of residents of the municipality in which the

reservoir or dam is located, or by the governing body of the municipality, protesting against the removal of the reservoir, water or dam or the decommissioning of the reservoir or dam has been filed with the commissioner, the owner or owners of the reservoir or dam shall not, without the consent of the commissioner, tear down, destroy or abandon the reservoir or dam, or, except for the purpose of making necessary repairs, withdraw the water below the usual low-water mark, or maintain the water at the reduced level.

Amended 1981,c.249,s.10; 1994,c.84,s.2.

58:4-10. Hearing on petition; fixing low-water mark; maintenance expenses

58:4-10. When a petition has been filed protesting against the removal of any reservoir, water or dam or against the decommissioning of any reservoir or dam as provided in R.S.58:4-9, the commissioner shall hold a public hearing, upon 30 days' notice to all parties interested, and following prior notice published 30 days before the hearing in at least one newspaper of general circulation in the municipality in which the reservoir or dam is located. Following this public hearing, the commissioner may make a determination concerning the removal of the reservoir, water or dam or decommissioning of the reservoir or dam and may then establish and fix a permanent low-water mark. Should it appear that the maintenance of the reservoir or dam would be an undue burden upon the owner thereof, the commissioner shall enter into negotiations with the landowners interested around the reservoir or above the dam, the governing body of the municipality in which the reservoir or dam is located, and any other parties to the petition filed with the commissioner protesting against the removal of the reservoir, water or dam or the decommissioning of the reservoir or dam, for the purpose of determining how and by whom the expenses of maintenance shall be paid.

Amended 1981,c.249,s.11; 1994,c.84,s.3.



ATTACHMENT 5

Union County Support Letter



ATTACHMENT 6

USGS Concurrence Letter



United States Department of the Interior

U.S. GEOLOGICAL SURVEY

New Jersey Water Science Center
810 Bear Tavern Road, Suite 206
West Trenton, NJ 08628

February 25, 2008

Mr. Ryan Brown
Weston Solutions, Inc.
205 Campus Drive
Edison, NJ 08837

Dear Mr. Brown:

Thank you for your letter and news letter describing the fish passage feasibility project on the Rahway River in Rahway New Jersey. As we discussed in our phone conversation last week, the USGS gaging station on the Rahway River at Rahway New Jersey (USGS downstream order number 01395000) is located about 0.3 mile downstream from the proposed location of the fish ladder installation on the Rahway River Water Supply Dam. The fish ladder will not effect the operation of our gaging station. The USGS does not have any objections to the proposed project.

I understand that your feasibility study considered the migration of fish over the weir at the gaging station and found that fish passage in the spring was not hindered by the weir. Stream velocities during flood events have caused stream bank erosion at the gage weir. The erosion is compromising the structure and contributing to sedimentation problems in the stream. The sedimentation may be degrading spawning habitat in the stream. We would be willing to work with you if repair of the stream banks would contribute to your stream restoration project.

Stream stage and discharge data from the gaging station on Rahway River at Rahway New Jersey (01395000) and another gaging station on Rahway River at Springfield, New Jersey (01394500) located upstream of your site are available on USGS New Jersey Water Science Center's website <http://nj.usgs.gov> . Equipment inside the gage houses records stage every 15 minutes and transmits the data hourly via the GOES satellite to our website.

Please give me a call at (609)771-3980 if you have any further questions or would like to talk about restoration of the stream banks at the gaging station.

Sincerely,

Robert G. Reiser
Chief, Hydrologic Data Assessment Program

cc Robert Schopp, NJWSC, Surface Water Specialist



ATTACHMENT 7

Permit Coordination and Environmental Review Program Response

Krumich, Dyna

From: Ruth Foster [Ruth.Foster@dep.state.nj.us]
Sent: Tuesday, December 02, 2008 11:34 AM
To: Ruth Foster; Krumich, Dyna
Subject: PRC review: Rahway Fish Ladder

The Office of Permit Coordination and Environmental Review (PCER) has reviewed a Permit Readiness Checklist (PRC) submitted to the office on September 8, 2008. The following represents comments from the applicable permitting programs:

1. State Historic Preservation Office (SHPO) - Kate Marcopul - 609-984-5816

HPO-I2008-155
Union County, Rahway City
Rahway River Fish Ladder

The project site indicated on the documentation submitted is situated within the boundaries of three overlapping and related historic districts: the Rahway River Park Historic District (determined to be National Register eligible on October 28, 1982), the Rahway River Parkway Historic District (determined to be National Register eligible on September 18, 2002), and the Union County Park System Historic District (determined to be National Register eligible on March 18, 2005). The Union County Park System Historic District, of which the Rahway River Park and Rahway River Parkway Historic District are a part, are significant under National Register Criterion A for their association with the conservation movement and under National Register Criterion C for their association with the work of a master, Olmsted Brothers Landscape Architects.

All plans for the proposed fish ladder should be compatible with the surrounding historic district in both materials and design. Accordingly, the HPO recommends that the applicant consult with Sean Ryan, Landscape Architect for the Union County, and Dan Bernier, Director of Union County Division of Park Planning and Environmental Services at (908) 527-4911 in developing an appropriate plan for the fish ladder.

It appears that the project is receiving funding from the U.S. Environmental Protection Agency, and, as result, review of the project under Section 106 of the National Historic Preservation Act will be necessary. Expeditious review of the project during the Section 106 process would be facilitated by the involvement of a historic preservation consultant in the project planning process. The HPO maintains a list of historic preservation consulting firms who have conducted work in New Jersey and have requested to be included on this list. This list is available from the Historic Preservation Office upon request.

Kate Marcopul
New Jersey Historic Preservation Office
501 East State Street, 5 Station Plaza

2. Land Use Regulation - John King - 609-633-6758

Based on the information submitted, it appears that they would need to obtain a freshwater wetland permit and a flood hazard area permit. They state that they are above the head of tide and I am basing my comments on that. I can't confirm this. As for the freshwater permits, may qualify for a general permit no. 16. They can determine if they qualify (N.J.A.C. 7:7A-5.16). If they can't, they would need an individual permit or transition area waiver. As for the flood hazard permit, they may qualify for a permit by rule (N.J.A.C. 7:13-7.2(a)7. If not they would need to get an individual permit.

3. Fish, Game, Wildlife - Kelly Davis - 908-236-2118

The DFW has no issues with the readiness checklist and looks forward to working with the applicant on the final design for the fish ladder.

Please refer to the permit identification form found at www.state.nj.us/dep under programs

and units: permit coordination for basic information on the applicable permits. Please also contact the individual program contacts for any additional permitting assistance. If we can be of additional assistance, you may reach me at Ruth.Foster@dep.state.nj.us.

ATTACHMENT 8

Natural Heritage Data Response Letter



State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION

JON S. CORZINE
Governor

Division of Parks and Forestry
Office of Natural Lands Management
Natural Heritage Program
P.O. Box 404
Trenton, NJ 08625-0404
Tel. #609-984-1339
Fax. #609-984-1427

LISA P. JACKSON
Commissioner

February 7, 2008

Ryan Brown
Weston Solutions, Inc.
205 Campus Drive
Edison, NJ 08837

Re: Rahway River Fish Ladder Feasibility Evaluation (Block 201, Lot 1)

Dear Mr. Brown:

Thank you for your data request regarding rare species information for the above referenced project site in Rahway City, Union County.

Searches of the Natural Heritage Database and the Landscape Project (Version 2) are based on a representation of the boundaries of your project site in our Geographic Information System (GIS). We make every effort to accurately transfer your project bounds from the topographic map(s) submitted with the Request for Data into our Geographic Information System. We do not typically verify that your project bounds are accurate, or check them against other sources.

Neither the Natural Heritage Database nor the Landscape Project has records for occurrences of any rare wildlife species on or within 1/4 mile of the referenced site.

We have also checked the Natural Heritage Database for occurrences of rare plant species or ecological communities. The Natural Heritage Database does not have any records for rare plants or ecological communities on or within 1/4 mile of the site.

Attached is a list of rare species and ecological communities that have been documented from Union County. If suitable habitat is present at the project site, these species have potential to be present.

Status and rank codes used in the tables and lists are defined in the attached EXPLANATION OF CODES USED IN NATURAL HERITAGE REPORTS.

If you have questions concerning the wildlife records or wildlife species mentioned in this response, we recommend that you visit the interactive I-Map-NJ website at the following URL, <http://www.state.nj.us/dep/gis/depsplash.htm> or contact the Division of Fish and Wildlife, Endangered and Nongame Species Program at (609) 292 9400.

PLEASE SEE THE ATTACHED 'CAUTIONS AND RESTRICTIONS ON NHP DATA'.

Thank you for consulting the Natural Heritage Program. The attached invoice details the payment due for processing this data request. Feel free to contact us again regarding any future data requests.

Sincerely,

Herbert A. Lord

Herbert A. Lord
Data Request Specialist

cc: Robert J. Cartica
NHP File No. 08-4007453

CAUTIONS AND RESTRICTIONS ON NATURAL HERITAGE DATA

The quantity and quality of data collected by the Natural Heritage Program is dependent on the research and observations of many individuals and organizations. Not all of this information is the result of comprehensive or site-specific field surveys. Some natural areas in New Jersey have never been thoroughly surveyed. As a result, new locations for plant and animal species are continuously added to the database. Since data acquisition is a dynamic, ongoing process, the Natural Heritage Program cannot provide a definitive statement on the presence, absence, or condition of biological elements in any part of New Jersey. Information supplied by the Natural Heritage Program summarizes existing data known to the program at the time of the request regarding the biological elements or locations in question. They should never be regarded as final statements on the elements or areas being considered, nor should they be substituted for on-site surveys required for environmental assessments. The attached data is provided as one source of information to assist others in the preservation of natural diversity.

This office cannot provide a letter of interpretation or a statement addressing the classification of wetlands as defined by the Freshwater Wetlands Act. Requests for such determination should be sent to the DEP Land Use Regulation Program, P.O. Box 401, Trenton, NJ 08625-0401.

The Landscape Project was developed by the Division of Fish & Wildlife, Endangered and Nongame Species Program in order to map critical habitat for rare animal species. Natural Heritage Database response letters will also list all species (if any) found during a search of the Landscape Project. However, this office cannot answer any inquiries about the Landscape Project. All questions should be directed to the DEP Division of Fish and Wildlife, Endangered and Nongame Species Program, P.O. Box 400, Trenton, NJ 08625-0400.

This cautions and restrictions notice must be included whenever information provided by the Natural Heritage Database is published.



NJ Department of Environmental Protection
Division of Parks and Forestry

Natural Lands Management

EXPLANATIONS OF CODES USED IN NATURAL HERITAGE REPORTS

FEDERAL STATUS CODES

The following U.S. Fish and Wildlife Service categories and their definitions of endangered and threatened plants and animals have been modified from the U.S. Fish and Wildlife Service (F.R. Vol. 50 No. 188; Vol. 61, No. 40; F.R. 50 CFR Part 17). Federal Status codes reported for species follow the most recent listing.

LE	Taxa formally listed as endangered.
LT	Taxa formally listed as threatened.
PE	Taxa already proposed to be formally listed as endangered.
PT	Taxa already proposed to be formally listed as threatened.
C	Taxa for which the Service currently has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species.
S/A	Similarity of appearance species.

STATE STATUS CODES

Two animal lists provide state status codes after the Endangered and Nongame Species Conservation Act of 1973 (NSSA 23:2A-13 et. seq.): the list of endangered species (N.J.A.C. 7:25-4.13) and the list defining status of indigenous, nongame wildlife species of New Jersey (N.J.A.C. 7:25-4.17(a)). The status of animal species is determined by the Nongame and Endangered Species Program (ENSP). The state status codes and definitions provided reflect the most recent lists that were revised in the New Jersey Register, Monday, June 3, 1991.

D	Declining species—a species which has exhibited a continued decline in population numbers over the years.
E	Endangered species—an endangered species is one whose prospects for survival within the state are in immediate danger due to one or many factors – a loss of habitat, over exploitation, predation, competition, disease. An endangered species requires immediate assistance or extinction will probably follow.
EX	Extirpated species—a species that formerly occurred in New Jersey, but is not now known to exist within the state.
I	Introduced species—a species not native to New Jersey that could not have established itself here without the assistance of man.
INC	Increasing species—a species whose population has exhibited a significant increase, beyond the normal range of its life cycle, over a long term period.
T	Threatened species—a species that may become endangered if conditions surrounding the species begin to or continue to deteriorate.
P	Peripheral species—a species whose occurrence in New Jersey is at the extreme edge of its present natural range.
S	Stable species—a species whose population is not undergoing any long-term increase/decrease within its natural cycle.
U	Undetermined species—a species about which there is not enough information available to determine the status.

Status for animals separated by a slash(/) indicate a dual status. First status refers to the state breeding population, and the second status refers to the migratory or winter population.

SC Special Concern – applies to animal species that warrant special attention because of some evidence of decline, inherent vulnerability to environmental deterioration, or habitat modification that would result in their becoming a Threatened species. This category would also be applied to species that meet the foregoing criteria and for which there is little understanding of their current population status in the state.

Plant taxa listed as endangered are from New Jersey's official Endangered Plant Species List N.J.S.A. 131B-15.151 et seq.

E Native New Jersey plant species whose survival in the State or nation is in jeopardy.

REGIONAL STATUS CODES FOR PLANTS AND ECOLOGICAL COMMUNITIES

LP Indicates taxa listed by the Pinelands Commission as endangered or threatened within their legal jurisdiction. Not all species currently tracked by the Pinelands Commission are tracked by the Natural Heritage Program. A complete list of endangered and threatened Pineland species is included in the New Jersey Pinelands Comprehensive Management Plan.

HL Indicates taxa or ecological communities protected by the Highlands Water Protection and Planning Act within the jurisdiction of the Highlands Preservation Area.

EXPLANATION OF GLOBAL AND STATE ELEMENT RANKS

The Nature Conservancy developed a ranking system for use in identifying elements (rare species and ecological communities) of natural diversity most endangered with extinction. Each element is ranked according to its global, national, and state (or subnational in other countries) rarity. These ranks are used to prioritize conservation work so that the most endangered elements receive attention first. Definitions for element ranks are after The Nature Conservancy (1982: Chapter 4, 4.1-1 through 4.4.1.3-3).

GLOBAL ELEMENT RANKS

G1 Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.

G2 Imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.

G3 Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g., a single western state, a physiographic region in the East) or because of other factors making it vulnerable to extinction throughout its range; with the number of occurrences in the range of 21 to 100.

G4 Apparently secure globally; although it may be quite rare in parts of its range, especially at the periphery.

G5 Demonstrably secure globally; although it may be quite rare in parts of its range, especially at the periphery.

GH Of historical occurrence throughout its range i.e., formerly part of the established biota, with the expectation that it may be rediscovered.

GU Possibly in peril range-wide but status uncertain; more information needed.

GX Believed to be extinct throughout range (e.g., passenger pigeon) with virtually no likelihood that it will be rediscovered.

G? Species has not yet been ranked.

GNR Species has not yet been ranked.

STATE ELEMENT RANKS

- S1 Critically imperiled in New Jersey because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres). Elements so ranked are often restricted to very specialized conditions or habitats and/or restricted to an extremely small geographical area of the state. Also included are elements which were formerly more abundant, but because of habitat destruction or some other critical factor of its biology, they have been demonstrably reduced in abundance. In essence, these are elements for which, even with intensive searching, sizable additional occurrences are unlikely to be discovered.
- S2 Imperiled in New Jersey because of rarity (6 to 20 occurrences). Historically many of these elements may have been more frequent but are now known from very few extant occurrences, primarily because of habitat destruction. Diligent searching may yield additional occurrences.
- S3 Rare in state with 21 to 100 occurrences (plant species and ecological communities in this category have only 21 to 50 occurrences). Includes elements which are widely distributed in the state but with small populations/acreage or elements with restricted distribution, but locally abundant. Not yet imperiled in state but may soon be if current trends continue. Searching often yields additional occurrences.
- S4 Apparently secure in state, with many occurrences.
- S5 Demonstrably secure in state and essentially ineradicable under present conditions.
- SA Accidental in state, including species (usually birds or butterflies) recorded once or twice or only at very great intervals, hundreds or even thousands of miles outside their usual range; a few of these species may even have bred on the one or two occasions they were recorded; examples include European strays or western birds on the East Coast and vice-versa.
- SE Elements that are clearly exotic in New Jersey including those taxa not native to North America (introduced taxa) or taxa deliberately or accidentally introduced into the State from other parts of North America (adventive taxa). Taxa ranked SE are not a conservation priority (viable introduced occurrences of G1 or G2 elements may be exceptions).
- SH Elements of historical occurrence in New Jersey. Despite some searching of historical occurrences and/or potential habitat, no extant occurrences are known. Since not all of the historical occurrences have been field surveyed, and unsearched potential habitat remains, historically ranked taxa are considered possibly extant, and remain a conservation priority for continued field work.
- SP Element has potential to occur in New Jersey, but no occurrences have been reported.
- SR Elements reported from New Jersey, but without persuasive documentation which would provide a basis for either accepting or rejecting the report. In some instances documentation may exist, but as of yet, its source or location has not been determined.
- SRF Elements erroneously reported from New Jersey, but this error persists in the literature.
- SU Elements believed to be in peril but the degree of rarity uncertain. Also included are rare taxa of uncertain taxonomical standing. More information is needed to resolve rank.
- SX Elements that have been determined or are presumed to be extirpated from New Jersey. All historical occurrences have been searched and a reasonable search of potential habitat has been completed. Extirpated taxa are not a current conservation priority.
- SXC Elements presumed extirpated from New Jersey, but native populations collected from the wild exist in cultivation.

SZ Not of practical conservation concern in New Jersey, because there are no definable occurrences, although the taxon is native and appears regularly in the state. An SZ rank will generally be used for long distance migrants whose occurrences during their migrations are too irregular (in terms of repeated visitation to the same locations), transitory, and dispersed to be reliably identified, mapped and protected. In other words, the migrant regularly passes through the state, but enduring, mappable element occurrences cannot be defined.

Typically, the SZ rank applies to a non-breeding population (N) in the state – for example, birds on migration. An SZ rank may in a few instances also apply to a breeding population (B), for example certain lepidoptera which regularly die out every year with no significant return migration.

Although the SZ rank typically applies to migrants, it should not be used indiscriminately. Just because a species is on migration does not mean it receives an SZ rank. SZ will only apply when the migrants occur in an irregular, transitory and dispersed manner.

B Refers to the breeding population of the element in the state.

N Refers to the non-breeding population of the element in the state.

T Element ranks containing a "T" indicate that the infraspecific taxon is being ranked differently than the full species. For example *Stachys palustris* var. *homotricha* is ranked "G5T? SH" meaning the full species is globally secure but the global rarity of the var. *homotricha* has not been determined; in New Jersey the variety is ranked historic.

Q Elements containing a "Q" in the global portion of its rank indicates that the taxon is of questionable, or uncertain taxonomical standing, e.g., some authors regard it as a full species, while others treat it at the subspecific level.

.1 Elements documented from a single location.

Note: To express uncertainty, the most likely rank is assigned and a question mark added (e.g., G2?). A range is indicated by combining two ranks (e.g., G1G2, S1S3).

IDENTIFICATION CODES

These codes refer to whether the identification of the species or community has been checked by a reliable individual and is indicative of significant habitat.

Y Identification has been verified and is indicative of significant habitat.

BLANK Identification has not been verified but there is no reason to believe it is not indicative of significant habitat.

? Either it has not been determined if the record is indicative of significant habitat or the identification of the species or community may be confusing or disputed.

30 AUG 2004

UNION COUNTY
RARE SPECIES AND NATURAL COMMUNITIES PRESENTLY RECORDED IN
THE NEW JERSEY NATURAL HERITAGE DATABASE

NAME	COMMON NAME	FEDERAL STATUS	STATE STATUS	REGIONAL STATUS	GRANK	SRANK
*** Vertebrates						
BARTRAMIA LONGICAUDA	UPLAND SANDPIPER		E		G5	S1B
CLEMmys INSCULPTA	WOOD TURTLE		T		G4	S3
CLEMmys MOHLEBERGII	BOG TURTLE	LT	E		G3	S2
EURYCEA LONGICAUDA LONGICAUDA	LONGTAIL SALAMANDER		T		G5T5	S2
PASSERCULUS SANDWICHENSIS	SAVANNAH SPARROW		T/T		G5	S2B, SAN
STERNA ANTILLARUM	LEAST TERN		E		G4	S1B
STRIX VARIA	BARRED OWL		T/T		G5	S3B
*** Ecosystems						
TRAPROCK GLADE/ROCK OUTCROP COMMUNITY	TRAPROCK GLADE/ROCK OUTCROP COMMUNITY				G2	S1
*** Invertebrates						
ALASMIDONTA UNDULATA	TRIANGLE FLOATER		T		G4	S3
PAPAIPEMA AERATA	A BORER MOTH				GH	SH
POLITES MYSTIC	LONG DASH				G5	S3?
PONTIA PROTODICE	CHECKERED WHITE		T		G4	S1
*** Other types						
COASTAL HERON ROOKERY	COASTAL HERON ROOKERY				GU	S3
*** Vascular plants						
CAREX BEBBII	BEBB'S SEDGE				G5	S2
CAREX POLYMORPHA	VARIABLE SEDGE		E		G3	S1
CYNOGLOSSUM VIRGINIANUM VAR VIRGINIANUM	WILD COMFREY				G5T5	S2
LEMNA VALDIVIANA	PALE DUCKWEED		E		G5	S1
LIATRIS SCARIOSA VAR NOVAE-ANGLIAE	NORTHERN BLAZING-STAR		E		G5?T3	SH

30 AUG 2004

UNION COUNTY
RARE SPECIES AND NATURAL COMMUNITIES PRESENTLY RECORDED IN
THE NEW JERSEY NATURAL HERITAGE DATABASE

NAME	COMMON NAME	FEDERAL STATUS	STATE STATUS	REGIONAL STATUS	CRANK	SRANK
MIMULUS ALATUS	WINGED MONKEY-FLOWER				G5	S3
MONARDA CLINOPODIA	EASIL BEEBALM		E		G5	SH
MUHLENBERGIA CAPILLARIS	LONG-AWN SMOKE GRASS		E		G5T?	S1
PHLOX PILOSA	DOWNY PHLOX		E		G5T5	SH
RANUNCULUS FUSILLUS VAR FUSILLUS	LOW SPEARWORT				G5T4?	S2
VIOLA CANADENSIS	CANADIAN VIOLET		E		G5T?	S1

24 Records Processed

ATTACHMENT 9

Cultural Resources Survey Results

9 MI TO N.J. 17
1 MI TO INTERCHANGE 135
17°30"
ELIZABETH (P.O.) 4.7 MI
2110000 FEET (N.J.) 563 74°15'
7.3 MINUTE SERIES (TOPOGRAPHIC)



(ELIZABETH)
6165 11 NW

15'
40°37'30"

1-2-1
MI
MI

4371

94-B

ELIZABETH
JERS

Tree B

650 000 FEET
N. J.)

C200

496 MID

٥٨

80

Co:

9

28

7b

1958 Z 6ers

How
COE 11/1

30 145

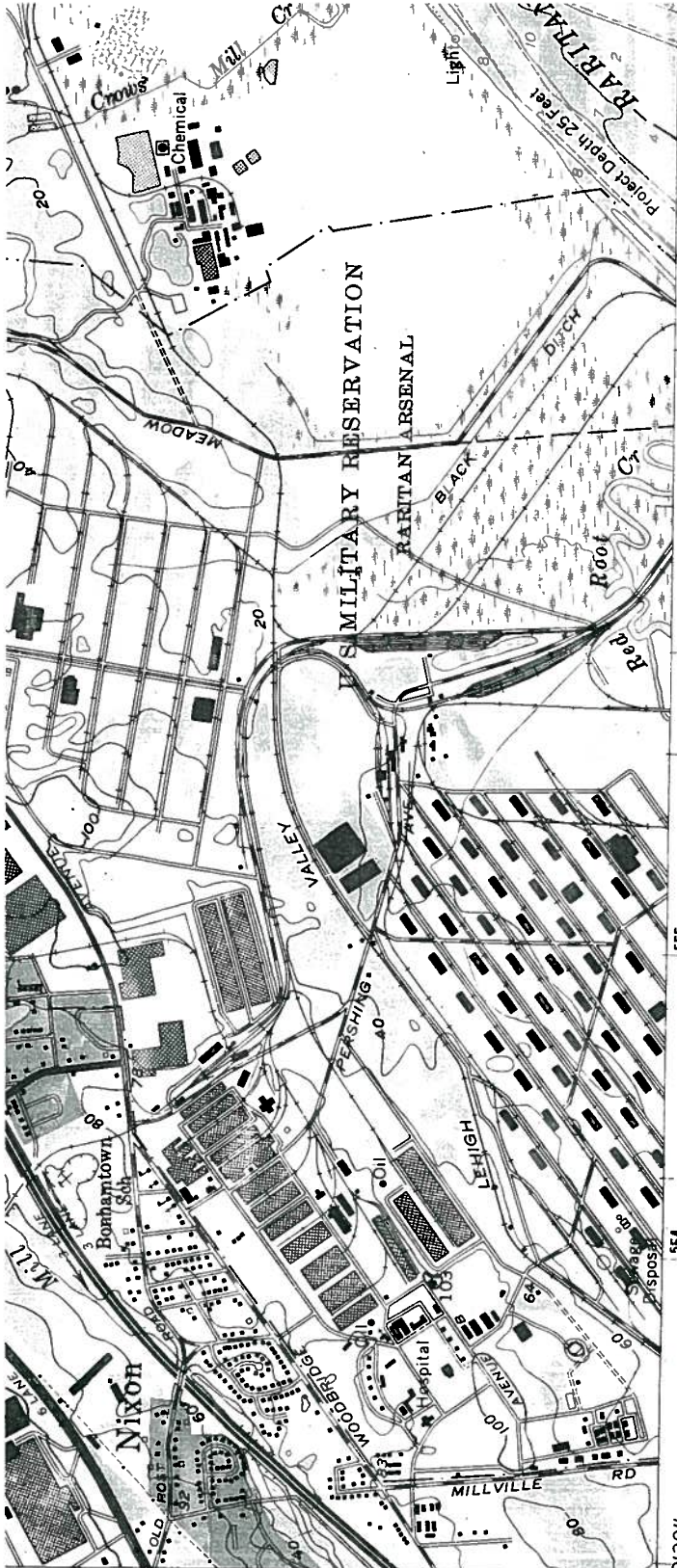
$\mathcal{B} \subseteq \mathcal{N}AC$
 $\mathcal{A} \subseteq \mathcal{F}IN$

5110.988

69

9454900

27/11/20



2 090 000 FEET (N. J.) 20' 555 557

SCAL 1 1000 0 1000 2000

CONTOUR IN DATUM IS 1

DEPTH CURVES AND SOUNDINGS SHORELINE SHOWN REPRESENTS THE MEAN RANGE OF TIDE

THIS MAP COMPLIES WITH NA FOR SALE BY U. S. GEOLOGICAL A FOLDER DESCRIBING TOPOGRAPHIC M

UTM GRID AND 1970 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

Revisions shown in purple compiled by the Geological Survey from aerial photographs taken 1970. This information not field checked

Purple tint indicates extension of urban areas

Maped by the Army Map Service Edited and published by the Geological Survey

Control by USGS, USC&GS, USCE, and New Jersey Geodetic Survey

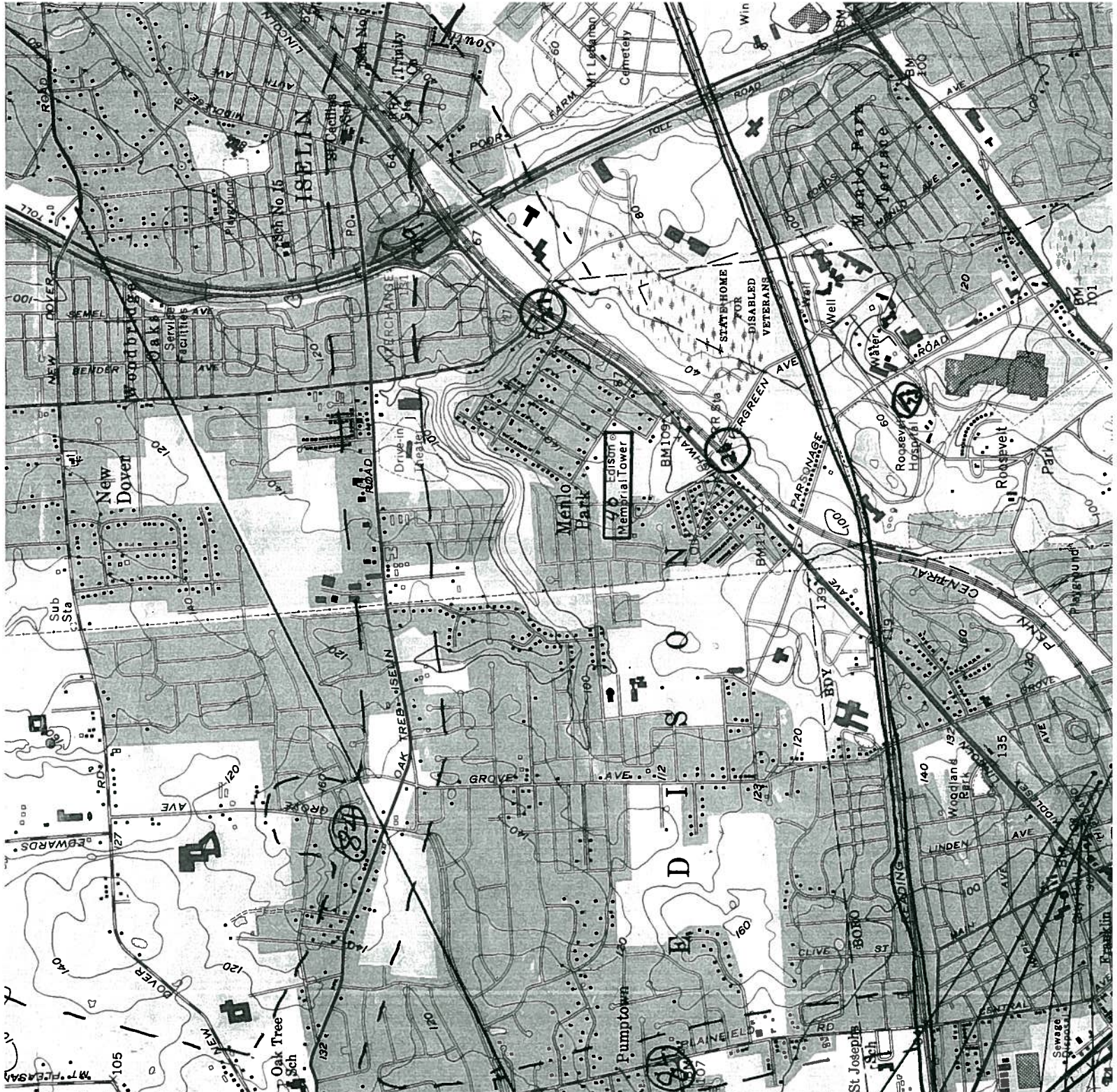
Topography by planetable surveys 1933-1934 Culture revised by the Geological Survey 1955-1956

Hydrography compiled from USC&GS charts 286 (1954), and 375 (1953)

Polyconic projection. 1927 North American datum 10,000-foot grids based on New Jersey coordinate system, and New York coordinate system, Long Island zone 1000 meter Universal Transverse Mercator grid ticks, zone 18, shown in blue

Red tint indicates areas in which only landmark buildings are shown

- 74. LEHIGH VALLEY RAILROAD H.O. SHPO 03/15/02 HPO-C2002-151 PROD
- 75 PORT READING RAILROAD H.O. SHPO 02/15/02 HPO-C2002-151 PROD
- 76 PERTH AMBOY FIRE DEPT. GARFIELD CO. STATION SHPO 9/24/01 HPO-I2001-172 PROD
- 77 OVERHEAD CONTACT SYSTEM NUTTRANSIT 40°30' NORTH JERSEY COASTLINE 4°22'30" SHPO OPINION 4/26/02
- 78 REGINA HISTORIC DISTRICT NEW BRUNSWICK SHPO 2/14/02
- 79. Garden State Parkway HD SHPO 10-12-01
- 80. Raritan River Parkway HD SHPO 09-18-02
- 81 OUTERBRIDGE CROSSING 2/25/03
- 82 Shuammon Golf Course SHPO. 12/12/02



- 31-22. retro Episcopal Church - SR/1483
- 38-Perth Ambboy Ferry slip - SE/NR
- 39- Proprietary House - SE/NR
- 40- Edison Memorial Tower - SE/NR
- 41- Barron Library - SE/NR
- 42- 17th Century Clark House - SE/NR
- 43- Merchants & Diggers Tavern - SE/NR
- 44- Lawrence Kearny House - SE/NR
- 45- George Triness House - SE/NR
- 46- McCormick Tentant House Harbor Light Tavern - SR
- 47- Ambboy Ferry Slip - SE/NR
- 48- Perth Ambboy Ferry Station
- 49- Avers Allen House - SR/NR
- 50- Railway Theater - SR/NR
- 51- 28 UN13 prehis. - historic archeo. site F143
- 52- Homestead Farm at Oak Ridge - SR
- 53- Perth Ambboy Commercial H.D. 818193 SHVO OPINION HPO-H93-104
- 54- Union Tower SHVO Opinion 2/6/97 397-16
- 55- HPO opinions 7/23/98 HPO-G98-111 MULT A97a
- 56- Structure 132, American Smelting & Refining Company pier
- 57- Vessel 30
- 58- Vessel 32
- 59- Vessel 34
- 60- Vessel 54
- 61- Vessel 57
- 62- Vessel 58
- 63- Vessel 59
- 64- Vessel 79
- 65- Vessel 92
- 66- Vessel 98



Van Wyck Brooks Historic District (ID#2708)

Portions of West 8th and 9th streets; Park, Arlington, Madison, Central, Stelle, & Field avenues; Randolph Road

NR: 12/10/1985 (NR Reference #: 85003337)

SR: 10/7/1985

(Local Certified District: 12/30/82)

Orville Taylor Waring House (Runyon Funeral Home) (ID#2709)

900 Park Avenue

NR: 5/14/1979 (NR Reference #: 79003252)

SR: 2/16/1979

YWCA of Plainfield/North Plainfield (ID#3484)

232 East Front Street

NR: 3/12/1998 (NR Reference #: 98000232)

SR: 1/15/1998

COE: 5/20/1997

Rahway City

Lower Rahway / Main Street Historic District (ID#2711)

SHPO Opinion: 6/24/1991

(Previous SHPO Opinion 11/17/86)

Merchants and Drovers Tavern (ID#2712)

1632 St. Georges Avenue

NR: 11/21/1978 (NR Reference #: 78001801)

SR: 4/4/1975

Overhead Contact System, Pennsylvania Railroad Company (ID#3990)

Between Rahway, Union County and South Amboy, Middlesex County

SHPO Opinion: 4/26/2002

See Main Entry / Filed Location:

Middlesex County, South Amboy City

Pennsylvania Railroad New York to Philadelphia Historic District (ID#4568)

SHPO Opinion: 3/3/2003

See Main Entry / Filed Location:

Hudson County, Hoboken City

Rahway River Park (ID#2713)

DOE: 10/28/1983

SHPO Opinion: 10/14/1980

Rahway Theatre (ID#2714)

1601 Irving Street

NR: 8/13/1986 (NR Reference #: 86001509)

SR: 6/24/1986

Regina Historic District (ID#4048)

Portions of Esterbrook, Jaques, Central, Maple, Milton avenues, Irving and Broad streets

SHPO Opinion: 2/14/1992

Union County Park System Historic District (ID#4424)

SHPO Opinion: 3/18/2005

See Main Entry / Filed Location:

Union County, Berkeley Heights Township

Union Tower (ID#3486)

Amtrak Northeast Corridor Line, Milepost 19.40

SHPO Opinion: 2/6/1997

US Route 1, 1&9 Bridge (5C) (ID#2715)

SHPO Opinion: 1/23/1992

Roselle Borough

Central Railroad of New Jersey Main Line Corridor Historic District (ID#3500)

Railroad Right-of-way from Phillipsburg to Bayonne, including all associated features

DOE: 11/30/1995

SHPO Opinion: 7/19/1991

(Historic district extends through 29 municipalities in 5 counties)

See Main Entry / Filed Location:

Warren County, Phillipsburg Town

Gordon Street Bridge (SI&A #2050150) (ID#3487)

Gordon Street over the Elizabeth Branch Railroad

SHPO Opinion: 9/3/1993

Lehigh Valley Railroad Historic District (ID#4154)

SHPO Opinion: 3/15/2002

See Main Entry / Filed Location:

Warren County, Phillipsburg Town

Roselle North and South Railroad Stations (ID#2716)

SHPO Opinion: 9/29/1977

Staten Island Railroad Historic District (ID#3482)

SHPO Opinion: 2/27/1995

See Main Entry / Filed Location:

Union County, Elizabeth City

Union County Park System Historic District (ID#4424)

SHPO Opinion: 3/18/2005

See Main Entry / Filed Location:

Union County, Berkeley Heights Township

Warinanco Park (ID#2678)

SHPO Opinion: 8/10/1983

Also located in:

Union County, Elizabeth City

Roselle Park Borough

Central Railroad of New Jersey Main Line Corridor Historic District (ID#3500)

Railroad Right-of-way from Phillipsburg to Bayonne, including all associated features

DOE: 11/30/1995

SHPO Opinion: 7/19/1991

(Historic district extends through 29 municipalities in 5 counties)

See Main Entry / Filed Location:

Warren County, Phillipsburg Town

Cultural Resource GIS Digitizing Form

Name: Rahway River Park

Inv. ID: 2713 Attrib. ID: _____ HSI ID: _____

Date: 6/29 Staff Name: M. Markell

Applicable Layers:

<input checked="" type="checkbox"/> HD_PLY	<input type="checkbox"/> AD_PLY
<input checked="" type="checkbox"/> PR_PLY	<input type="checkbox"/> ST_PLY
<input checked="" type="checkbox"/> PR_PT	<input type="checkbox"/> ST_PT

Issues Revealed:

<input type="checkbox"/>	Address
<input type="checkbox"/>	Block / Lot
<input type="checkbox"/>	Boundary / Extent
<input type="checkbox"/>	Demolished / Destroyed

Notes:

TYPE:

- ☐ New District
☒ Individually Eligible
☐ Individual and Contributing
☐ Contributing Only

☒ Mapped
 USGS Quad Name Perth Amboy
 Quad Reference Number 47
 Digital Identification Number _____

ELIGIBLE PROPERTY WORKSHEET

Name Rahway River Park A.K.A. _____

Address / Location Main Street

Block / Lot _____ / _____

County and Municipality Union, Rahway City

District (If applicable) _____

☒ SHPO OPINION ☒ DOE ^{10/28/83} ☐ COE ☐ ITC (HPCA-Part 1)

DATE SIGNED 10/14/80 CHRONO _____ LOG _____ AUTHOR _____

REPORT (Accession Number) UN1B36-missing

SURVEY FORM# (Historic Sites Inventory, Historic Bridge Survey) _____

Enclosure Checklist

- ☒ SHPO Signed Document
☒ NPS Signed Document
☐ Report Information (Title Page, Photograph copies, Relevant Sections)
☐ Property Information (Survey forms)
☐ Photographs (Historic and Current)
☐ HABS/HAER documentation
☒ Maps (Copy of Historic Properties USGS Quad, Historic, Tax)
☐ Other

PROJECT FILE NAME

Union County
CITY OF RAHWAY
Rahway River Park

CABINET LOCATION OF FILE

ISTEA Bikeway Project
UNI-Elizabeth → Uni-westfield

COVENANT / AGREEMENT _____

STATUS OF THE PROPERTY _____

Prepared by: D. FISK Date: 7/21/2000

only
 contains
 SHPO
 letter
 DOE



STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
JERRY FITZGERALD ENGLISH, COMMISSIONER
P.O. BOX 1390
TRENTON, N.J. 08625
609-292-2885

14 October 1980

Mr. Robert W. McIntosh, Jr.
Regional Director
Heritage Conservation and
Recreation Service
Northeast Regional Office
Room 9510
800 Arch Street
Philadelphia, Pennsylvania 19106

Dear Mr. McIntosh:

As Deputy State Historic Preservation Officer for New Jersey, in accordance with 36 C.F.R. Part 800: Protection of Historic and Cultural Properties, as published in the Federal Register, January 30, 1979 (Vol. 44, No. 21, pp. 6072-6081), I am attaching Consultation Comments for the following project:

Union County
Rahway City
Rahway River Pool and Bath House
Urban Parks and Recreation Recovery Program 1980
Heritage Conservation and Recreation Service and Green Acres,
New Jersey Department of Environmental Protection

If you have any questions after reviewing the attached document, please feel free to contact the Office of Cultural and Environmental Services at (609) 292-2662.

Sincerely,

Lawrence C. Schmidt
Deputy State Historic
Preservation Officer

LCS/JG/mw

cc: Advisory Council on Historic Preservation
Mr. Dennis Davidson, New Jersey Green Acres
Mr. Geoffrey S. Perselay, Union County

NEW JERSEY STATE HISTORIC PRESERVATION OFFICE

Deputy State Historic Preservation Officer
Lawrence C. Schmidt
Department of Environmental Protection

ADVISORY COUNCIL ON HISTORIC PRESERVATION

SECTION 106: SHPO Consultation and Comments (36 CFR Part 800)

PROJECT TITLE: Union County, New Jersey
Rahway City
Rahway River Pool and Bath House
Urban Parks and Recreation Recovery Program 1980
and Green Acres, New Jersey Department of
Environmental Protection

FEDERAL AGENCY: U.S. Department of the Interior
Heritage Conservation and Recreation Service
Northeast Regional Office
Room 9510
800 Arch Street
Philadelphia, Pennsylvania 19106

I. 800.4 (a) Identification of Cultural Resources

The Deputy SHPO is of the opinion that Rahway River Park is a property which meets the criteria for inclusion in the National Register of Historic Places for its significance in Community Planning and Social/Humanitarian movements in the State.

Rahway River Park was designed in 1929 by Olmsted Brothers for the Union County Park Commission, formed eight years earlier. The public outdoor bathing complex was the first in the county and became the model for other communities.

In the opinion of the Deputy SHPO, archeological testing has shown that there are no subterranean cultural resources in the places to be affected by the proposed undertaking.

II. 800.4 (b) Determination of Effect

The Deputy SHPO is of the opinion that the proposed undertaking will have an effect on a property deemed eligible for inclusion on the National Register of Historic Places, viz., Rahway River Park and Pool and Bath House.

III. 800.4 (c-d) Determination of Adverse Effect

The Deputy SHPO is of the opinion that the proposed renovation, rehabilitation, and new construction will not have an adverse effect, provided that the significant elements of the Rahway River Park layout and its Pool and Bath House architecture are respected, by adherence to the Secretary of the Interior's Standards for Rehabilitation; and provided that the SHPO is given an opportunity to review and comment upon plans and specifications before the stage of final design.

Additional Comments:

The comments of the Deputy SHPO are based upon a project that comprises the following elements:

1. Excavation for two new pools.
2. Construction of a new bath house.
3. Conversion of the existing bath house to a field house.
4. Rehabilitation of the filter house and conversion to a snack bar or to storage.
5. Conversion of the refreshment stand to storage.
6. Construction of a macadamized walkway.
7. Construction of two parking lots.

The Deputy SHPO requests an opportunity to review and comment on: floor plans of the Bath House which show existing conditions; sections indicating the trusses; and elevations of the interior and exterior which show the intended renovation. It is suggested that the features of the Bath House that give it distinction should be incorporated, as much as possible, into the renovation and conversion.

Likewise, in the Filter House (1933-34) and the Refreshment Stand (c. 1929), exteriors and distinctive or typical decorative features and architectural elements should, wherever possible, be restored rather than remodelled, in keeping with the Secretary of the Interior's Standards for Rehabilitation.

Insofar as distinctive features of the original (1929) park layout by Olmsted Brothers survive, these should be accorded the same preservation consideration as the buildings.

The Deputy SHPO's opinions are based upon a report, 1 October 1980, by Janet A. Pittipaldi, Green Acres, New Jersey Department of Environmental Protection, and upon observations by the staff professional architectural historian on a visit to the Park.

E.O. 11593**DETERMINATION OF ELIGIBILITY NOTIFICATION****National Register of Historic Places****National Park Service****Name of property:** *Rahway River Park***Location:** *Union County***State:** *NJ***Request submitted by:** *NPS/Anthony M. Corbisiero***Date received:** *9-14-82***Additional information received:****Opinion of the State Historic Preservation Officer:**☒ **Eligible**☐ **Not Eligible**☐ **No Response****Comments:****The Secretary of the Interior has determined that this property is:**☒ **Eligible****Applicable criteria:** *A, C*☐ **Not Eligible**

Comments: *The loss of the Rahway River Park Pool is unfortunate, however, it does not adversely affect the qualities for which the park was determined eligible for inclusion in the National Register on August 11, 1981. The park continues to be locally significant as a good example of park design in the early twentieth century, and it is historically significant for its associations with the 1920's social movement that created a public park system to conserve the beauty of the river and provide recreational facilities in Rahway.*

☐ **Documentation insufficient****(Please see accompanying sheet explaining additional materials required)**

Thomas J. Donnell

Keeper of the National Register

Date: *10/03/82*





Union County

Berkeley Heights Township

Bell Labs (ID#4081)

600 Mountain Avenue

SHPO Opinion: 9/20/2002

See Main Entry / Filed Location:

Union County, New Providence Borough

Feltonville Historic District (ID#2648)

Centered around Cataract Hollow Road

NR: 6/6/1980 (NR Reference #: 80002522)

SR: 2/20/1980

DOE: 9/2/1977

Also located in:

Union County, Mountainside Borough

Union County, Scotch Plains Township

Littell-Lord Farmstead (ID#2649)

23 and 31 Horseshoe Road

NR: 3/7/1979 (NR Reference #: 79001528)

SR: 12/28/1978

Nathaniel Smith House (ID#2650)

105 Springfield Avenue

NR: 9/28/1989 (NR Reference #: 89001584)

SR: 8/14/1989

Union County Park System Historic District (ID#4424)

SHPO Opinion: 3/18/2005

Also located in:

Union County, Clark Township

Union County, Cranford Township

Union County, Elizabeth City

Union County, Garwood Borough

Union County, Hillside Township

Union County, Kenilworth Borough

Union County, Linden City

Union County, Mountainside Borough

Union County, New Providence Borough

Union County, Plainfield City

Union County, Rahway City

Union County, Roselle Borough

Union County, Scotch Plains Township

Union County, Springfield Township

Union County, Summit City

Union County, Union Township

Union County, Westfield Town

Union County, Winfield Township

Clark Township

Clark House (Dr. James Robeson House) (ID#2651)

593 Madison Hill Road

NR: 11/19/1974 (NR Reference #: 74001193)

SR: 7/1/1974

Garden State Parkway Historic District (ID#3874)

Entire Garden State Parkway Right-of-Way

SHPO Opinion: 10/12/2001

See Main Entry / Filed Location:

Cape May County, Lower Township

Homestead Farm at Oak Ridge (ID#2800)

Oak Ridge Golf Club

NR: 10/25/1995 (NR Reference #: 95001185)

SR: 9/8/1995

Also located in:

Middlesex County, Edison Township

Lehigh Valley Railroad Historic District (ID#4154)

SHPO Opinion: 3/15/2002

See Main Entry / Filed Location:

Warren County, Phillipsburg Town

Rahway River Parkway Historic District (ID#4079)

SHPO Opinion: 9/18/2002

See Main Entry / Filed Location:

Union County, Springfield Township

Union County Park System Historic District (ID#4424)

SHPO Opinion: 3/18/2005

See Main Entry / Filed Location:

Union County, Berkeley Heights Township

Cranford Township

Central Railroad of New Jersey Main Line Corridor Historic District (ID#3500)

Railroad Right-of-way from Phillipsburg to Bayonne, including all associated features

DOE: 11/30/1995

SHPO Opinion: 7/19/1991

(Historic district extends through 29 municipalities in 5 counties)

See Main Entry / Filed Location:

Warren County, Phillipsburg Town

Crane-Phillips House (ID#3474)

124 Union Avenue North

NR: 8/14/1997 (NR Reference #: 97000842)

SR: 6/3/1997

COE: 1/19/1996

Droescher's Mill (ID#2653)

347 Lincoln Avenue East

NR: 1/8/1974 (NR Reference #: 74001192)

SR: 9/18/1973

Cultural Resource GIS Digitizing Form

Name: Rahway River Parkway Historic District

Inv. ID: 4079

Attrib. ID: _____

HSI ID: _____

Date: 6/27/2007

Staff Name: A. Stoll

Applicable Layers:

☒ HD_PLY
☐ PR_PLY
☐ PR_PT

☐ AD_PLY
☐ ST_PLY
☐ ST_PT

Issues Revealed:

☐ Address
☐ Block / Lot
☒ Boundary / Extent
☐ Demolished / Destroyed

Notes:

HD re-created by selecting digital parcels tagged with parks system ownership - either County or Municipality - and merging parcels & connecting these manually, where necessary. Where HD traverses private property lines, an attempt is made to allow the boundary to follow the River Centerline, allowing for a 20' - 30' buffer.

TYPE:

- ☒ New District
☐ Individually Eligible
☐ Individual and Contributing
☐ Contributing Only

☒ MappedUSGS Quad Name Roselle + Perth Amboy

Quad Reference Number _____

Digital Identification Number _____

ELIGIBLE PROPERTY WORKSHEET

Name Rahway River Parkway HD A.K.A. _____

Address / Location _____

_____ Block / Lot _____ / _____

County and Municipality UNION - ^{home} Springfield, Union, Cranford + Clark Twp + Kenilworth Boro

District (If applicable) _____

☒ SHPO OPINION ☐ DOE ☐ COE ☐ ITC (HPCA-Part 1)
DATE SIGNED 9-18-02 CHRONO I2002-189 LOG 02-3189 AUTHOR ATREPORT (Accession Number) UNI F78B _____

SURVEY FORM# (Historic Sites Inventory, Historic Bridge Survey) _____

Enclosure Checklist

- ☒ SHPO Signed Document
☐ NPS Signed Document
☒ Report Information (Title Page, Photograph copies, Relevant Sections)
☒ Property Information (Survey forms)
☐ Photographs (Historic and Current)
☐ HABS/HAER documentation
☐ Maps (Copy of Historic Properties USGS Quad, Historic, Tax)
☐ Other

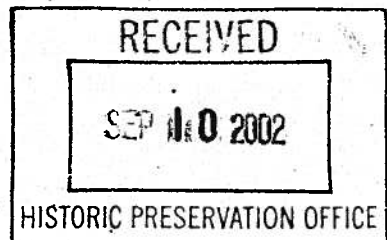
PROJECT FILE NAME Replacement of the Morris Ave (Rt 82) Bridge over Rahway RiverCABINET LOCATION OF FILE Road Highways- Rt 82

COVENANT / AGREEMENT _____

STATUS OF THE PROPERTY _____

Prepared by: Andrea Tingey Date: 10-15-02

UNI
F
78b
ID2965



CULTURAL RESOURCES INVESTIGATION
ROUTE 82 (MORRIS AVENUE) BRIDGE OVER RAHWAY RIVER
(STRUCTURE NO. 2012-150)
SPRINGFIELD AND UNION TOWNSHIPS
UNION COUNTY, NEW JERSEY

JUNE 2002

RICHARD GRUBB AND ASSOCIATES, INC.
Cultural Resource Consultants

SECTION 1.0 EXECUTIVE SUMMARY

This report presents the results of a cultural resources investigation in the Area of Potential Effects (APE) for the proposed replacement of the Route 82 (Morris Avenue) Bridge over Rahway River (Structure No. 2012-150) in Springfield and Union townships, Union County, New Jersey. This report has been prepared by Richard Grubb & Associates, Inc. for Killam Associates, Inc., prime engineering consultants to the Union County Department of Operational Services. The purpose of the cultural resources investigation was the identification of all buildings, structures, sites, and objects listed in or eligible for the National Register and to assess the effects of the project on any National Register-listed or eligible resources.

No significant archaeological resources were recovered during the archaeological survey. The landscape within the APE-Archaeology was found to be largely altered by the previous construction of Route 82 and other housing and recreational development in adjacent areas. All historic materials were recovered from fill contexts related to either road or bridge construction. The only artifact recovered that could be related to the Battle of Springfield was a single impacted musket ball found approximately 50 feet southwest of the APE. This artifact is believed to be related to site 28-Un-16.

Twelve resources more than 50 years of age were identified during the architectural survey. These include ten residences on Morris and Washington avenues, the Route 82 Bridge over Rahway River and the Rahway River Parkway. It is the conclusion of this investigation that the Rahway River Parkway, a significant linear greenway designed by the Olmsted Brothers Landscape Architects for the Union County Park Commission, is eligible for the National Register of Historic Places. Suggested boundaries for this resource extend from Springfield Avenue in Springfield Township to Elizabeth Avenue in the City of Rahway and include Robinsons Branch to Madison Hill Road in Rahway. The period of significance is 1921-1968. The Route 82 Bridge over Rahway River, while not individually eligible for the National Register, is eligible for listing as a contributing resource to the Rahway River Parkway because it was present during the period of significance and its stone arch construction is aesthetically compatible to its park setting. The proposed replacement of the bridge will therefore have an adverse effect to the National Register-eligible Rahway River Parkway. Mitigation measures should include a context sensitive design for the replacement bridge that is compatible with the historic and aesthetic characteristics of the Rahway River Parkway in terms of massing, scale, color and materials.

SECTION 9.0 ARCHITECTURAL SURVEY

The architectural survey, conducted in September 2001 and June 2002, consisted of a visual assessment to determine the scope of the APE-Architecture and a survey of all resources more than 50 years old within the APE. All resources more than 50 years old within the APE-Architecture were photographed and documented on New Jersey Historic Preservation Office (HPO) historic structure survey forms. Twelve properties were identified and surveyed for the current project. None of these properties are currently listed in or eligible for the National Register of Historic Places. As a result of the architectural survey, it has been determined that one resource is individually eligible for the National Register- the Rahway River Parkway. While not individually eligible, the Route 82 Bridge has been determined to be a contributing resource to the parkway. Full descriptions of all surveyed structures on New Jersey Historic Preservation Office survey forms are located in Appendix I.

9.1 Results

9.1.1 Rahway River Parkway

Historic Background and Description

The Rahway River Parkway is a riverine greenway, defined by the dense vegetation bordering the river and designed by the Olmsted Brothers Landscape Architects for the Union County Park Commission. As the first park unit planned by the park commission, the Rahway River Parkway serves several purposes: to restore the Rahway River as a natural aquifer, to preserve fish and wildlife, to provide recreation to county residents, and most importantly, to be the cross county link between the entire Union County Park system. Located nearly in the center of Union County, the Rahway River Parkway forms the spine of an interconnected series of parks planned and developed by the Union County Park Commission, only the second county park commission in the country when it was formed in 1921.

BASE SURVEY FORM

Historic Sites #

Property Name: Rahway River Parkway

Street Address: Street #: _____ (Low) _____ (High) Apartment #: _____ (Low) _____ (High)

Prefix: _____ Street Name: _____ Suffix: _____ Type: _____

County(s): Union Zip Code: 07081

Municipality(s): Townships of Springfield, Union, Cranford and Clark; Borough of Kenilworth;

Cities of Rahway and Linden Block(s): _____ Lot(s): _____

Ownership: Public USGS Quad: Roselle and Perth Amboy

Description:

The Rahway River Parkway is a riverine greenway, defined by the dense vegetation bordering the river and designed by the Olmsted Brothers Landscape Architects for the Union County Park Commission. As the first park unit planned by the park commission, the Rahway River Parkway serves several purposes: to restore the Rahway River as a natural aquifer, to preserve fish and wildlife, to provide recreation to county residents, and most importantly, to be the cross county link between the entire Union County Park system. Located nearly in the center of Union County, the Rahway River Parkway forms the spine of an interconnected series of parks planned and developed by the Union County Park Commission, only the second county park commission in the country when it was formed in 1921.

Registration and Status Dates:

National Historic Landmark: _____

National Register: _____

New Jersey Register: _____

Determination of Eligibility: _____

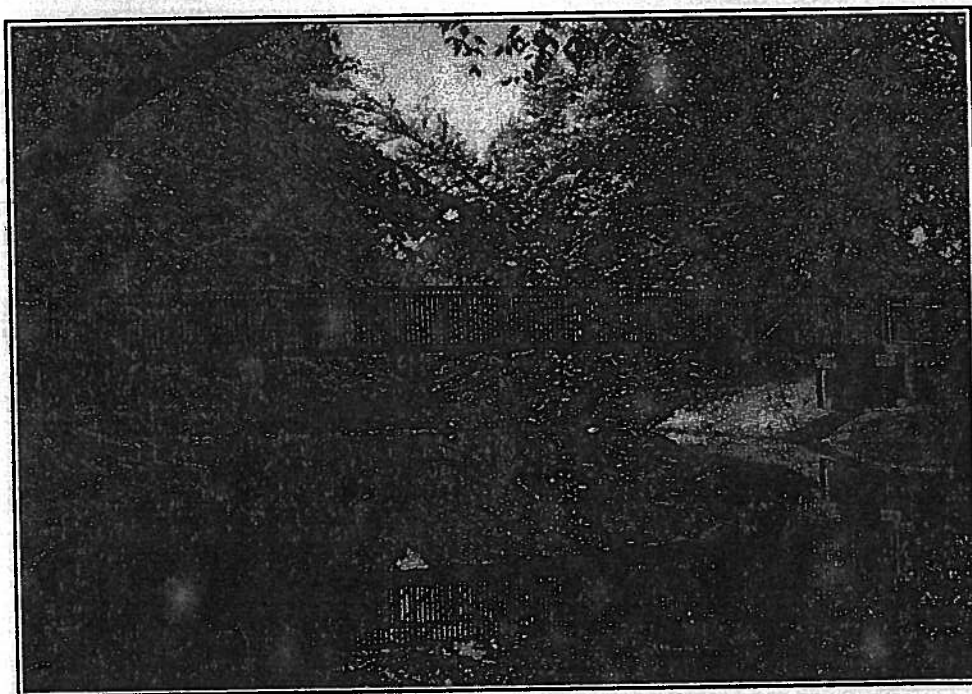
SHPO Opinion: _____

Local Designation: _____

Other Designation: _____

Other Designation Date: _____

Photograph:



Survey Name: NJ Route 82 Bridge over Rahway River

Date: January 2002

Surveyor: Glenn R. Modica

Organization: Richard Grubb & Associates

BASE SURVEY FORM

Historic Sites #

Location Map:

2.5" x 3.5"
(Include North Arrow and Bar Scale)

SEE CONTINUATION SHEET

Site Map:

INTENSIVE-LEVEL USE ONLY

2.5" x 3.5"
(Include North Arrow and Bar Scale)

Bibliography/Sources:
SEE CONTINUATION SHEET

Additional Information:

More Research Needed? ☐ Yes ☐ No

INTENSIVE-LEVEL USE ONLY:

Attachments Included: _____ Building/Element _____ Landscape _____ Farm
_____ Bridge _____ Industry

Historic District: ☐ Yes ☐ No Historic District Name: _____

Status: _____ Key Contributing _____ Contributing _____ Non Contributing

Associated Archaeological Site/Deposits? ☐ Yes ☐ No

(Known or potential sites - If yes, please describe briefly)

Unknown

Survey Name: NI Route 82 Bridge over Rahway River

Date: January 2002

Surveyor: Glenn R. Modica

Organization: Richard Grubb & Associates

CONTINUATION SHEET

Historic Sites #:



Survey Name: NI Route 82 Bridge over Rahway River
Surveyor: Glenn R. Modica
Organization: Richard Grubb & Associates

Date: January 2002

CONTINUATION SHEET

Historic Sites #

STATEMENT OF SIGNIFICANCE

The Rahway River Parkway has a national level of significance as an intact, early and unique example of a river-oriented greenway that is an integral part of one of the first planned regional park systems in the United States. The Rahway River Parkway meets National Register Criterion A for its significant historical association with the conservation movement, a movement that originated with the nineteenth century National Parks system. The creation of the Rahway River Parkway represents an early and successful effort to safeguard the water supply and preserve the scenic qualities of the Rahway River. Furthermore, the Rahway River Parkway, in particular, and the Union County park system, in general, represent a benchmark in an evolving social movement to develop public parkland in the face of growing urbanization. Since the mid-nineteenth century, prominent landscape architects such as Alexander Jackson Downing and Frederick Law Olmsted advocated the creation of public parkland to intellectually, morally and spiritually benefit society. By the early twentieth century, the movement to incorporate landscape architecture with urban land use planning had reached its fullest expression in metropolitan settings with the City Beautiful Movement. Following this tradition the Union County Park Commission was established in 1921, only the second county park commission in the country, with the express mission of developing a county-based park system linked through a series of riverine parkways. Through their continual effort to acquire and develop a system of interconnected of parks using public funds for the benefit of the public, the Union County Park Commission set an example that would be followed by other municipal park commissions later in the century.

The Rahway River Parkway also meets National Register Criterion C for its association with a master landscape architectural firm—Olmsted Brothers Landscape Architects of Brookline, Massachusetts. Carrying on the tradition of Frederick Law Olmsted, Sr., Olmsted Brothers Landscape Architects were the foremost landscape design firm of the early twentieth century, having consulted on major projects throughout the United States, including the Essex County park system in New Jersey. The temporary Union County Park Commission hired the firm in 1921 to recommend a county-wide park system, and in the following decades the firm continued to consult and prepare plans for the development of Rahway River Parkway.

The suggested period of significance is 1921-1968, a period that represents the parkway's extended period of design and development, beginning with the year the Union County Park Commission was formed and ending with the last documented plan for the parkway prepared by Olmsted Brothers Landscape Architects (Union County Park Commission 1930b, revised 1956 and 1968). Boundaries for this historic resource, which are based on a review of original plans for the Rahway River Parkway and an assessment of existing integrity, should include the entirety of the Rahway River Parkway as well as the local parks which it links. The suggested boundaries are shown on Figure 9.4. In general terms, the northern boundary for the Rahway River Parkway is the south side of Springfield Avenue in Springfield Township and the southern boundary is the north side of Elizabeth Avenue in Rahway. The parkway should also include the Robinsons Branch from its confluence with the Rahway River just north of Elizabeth Avenue to the south side of Madison Hill Road. The boundaries should encompass the vegetative buffer that lines both banks of the Rahway River. Within the original boundaries of the Rahway River Parkway— as depicted on early plans (see Figures 9.1-9.3)— are present-day Lenape Park, Nomahegan Park, Rahway River Park¹, Black Brook Park, Wheatena Park and Milton Lake Park. It is recommended that these individual parks, conceived and developed after the Rahway River Parkway and designated Project Number 7173— the same as the parkway— by the Olmsted Brothers Landscape Architects, should be included within the parkway's boundaries. The smaller municipal parks within the parkway should also be included as they contribute to the recreational nature of the resource.

Additionally, all bridges spanning the Rahway River within the boundaries of the Rahway River Parkway and built prior to 1968 should be considered contributing resources to the parkway.

Not evaluated as part of this investigation is the contributing or non-contributing status of the numerous extended and truncated segments of vehicular roads that parallel the Rahway River Parkway. These roads are an external and secondary feature to the parkway rather than part of an inter-connected circulation system. Within the APE, one such example is Riverside Drive in Springfield Township. This road is an extension of Washington Avenue that parallels the west side of the parkway and continues south beyond Meisel Avenue Park and the boundaries of the parkway.

Survey Name: NJ Route 82 Bridge over Rahway River

Date: January 2002

Surveyor: Glenn R. Modica

Organization: Richard Grubb & Associates

CONTINUATION SHEET

Historic Sites #

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Survey Name: NI Route 82 Bridge over Rahway River
Surveyor: Glenn R. Modica
Organization: Richard Grubb & Associates

Date: January 2002

CONTINUATION SHEET

Historic Sites #

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Survey Name: NJ Route 82 Bridge over Rahway River

Date: January 2002

Surveyor: Glenn R. Modica

Organization: Richard Grubb & Associates

LANDSCAPE ATTACHMENT

Historic Sites #

Common Name: Rahway River Parkway

Historic Name: Rawhay River Parkway

Present Use: Passive recreation-outdoor

Historic Use: Passive recreation-outdoor

Construction Date: 1922 Source: Union County Park Commission 1922

Alteration Date(s): 1922-present Source: Union County Park Commission 1922-1963; Ryan 2002

Primary Landscape

Architect/Designer: Olmsted Brothers Landscape Architects

Type: Greenway

Physical Condition: Good

Style: Olmstedian

Remaining Historic Fabric: Medium

Acreage: 533

Hardscape: _____

Plantings: Mature Hardwoods

Other Features: Ponds; dams

Description:

See Base Form

Setting:

While the setting within the Rahway River Parkway appears largely naturalistic, bordered by a dense growth of trees and vegetation, land use along its outside borders vary from low-density single family houses at its northern extremities, then gradually changing to high-density multi-family dwellings and modern commercial standalone buildings at the parkway's southern reaches.

Survey Name: NI Route 82 Bridge over Rahway River

Date: January 2002

Surveyor: Glenn R. Modica

Organization: Richard Grubb & Associates

ELIGIBILITY WORKSHEET

Historic Sites #

History:

SEE CONTINUATION SHEET

Statement of Significance:

SEE CONTINUATION SHEET

**Eligibility for New Jersey
and National Registers:**

☒ Yes ☐ No

National

Register Criteria: ☐ A ☐ B ☒ C ☐ D

Level of Significance: ☐ Local ☐ State ☒ National

Justification of Eligibility/Ineligibility:

The Rahway River Parkway retains integrity of setting, location, workmanship, design, materials, feeling and association. Over time, certain sections of the parkway have been altered, sometimes to its detriment, as in the construction of the Garden State Parkway, and other times to meet the needs of the community, such as the addition of ballfields or playgrounds. Nonetheless, the extent and original borders of the Rahway River Parkway have remained intact.

For Historic Districts Only:

Property Count: Key Contributing: _____ Contributing: _____ Non Contributing: _____

For Individual Properties Only:

List the completed Attachments related to the property's significance:

Landscape Attachment

Narrative Boundary Description:

Bordered on the north by the south side of Springfield Avenue, Springfield Township and to the south by the north side of Elizabeth Avenue, City of Rahway, and including, Lenape, Nomahegan, Rahway River, Milton Lake, Black Brook and Wheatena parks.

Survey Name: NI Route 82 Bridge over Rahway River

Date: January 2002

Surveyor: Glenn R. Modica

Organization: Richard Grubb & Associates

CONTINUATION SHEET

Historic Sites #

HISTORY

How the Rahway River Parkway came to be and how it has changed over time represents society's changing perceptions of nature. The desirability of urban parks and their benefits can be traced to the development of garden cemeteries in the 1830s. Generally located in suburban areas such as Cambridge, Massachusetts and Brooklyn, New York, these attractively laid out garden cemeteries were intended to provide moral, religious and intellectual uplift. This combination of moralism and landscape aesthetics reached a wide American audience through the work of Andrew Jackson Downing, who espoused the idea that exposure to rural and pastoral scenery would cleanse the soul and improve moral behavior. According to Downing, "parks would soften and humanize the rude, educate and enlighten the ignorant, and give continual enjoyment to the educated" (Schuyler 1986:66).

Social reform through landscape architecture found its most forceful and influential protagonist in Frederick Law Olmsted. As the foremost designer of parks in the United States, Frederick Law Olmsted's best-known works are Central and Prospect Parks in New York City and the "Emerald Necklace" in Boston. Not only a skilled landscape designer, Olmsted advocated that open public spaces and parkland would provide relief from overcrowded urban conditions. Like other reformers of his day, Olmsted was particularly concerned about the well-being of the working poor, who endured the worst conditions and lacked the means to escape their plight (Newton 1971: 267). Unlike earlier reformers who linked pastoral scenery with moral behavior, Olmsted advocated development of public parks in terms of their therapeutic value: "the enjoyment of scenery employs the mind without fatigue and yet exercises it, tranquilizes it, and yet enlivens it; and thus, through the influence of the mind over body the effect of refreshing rest and reinvigoration of the whole system" (Rybczynski 1999: 258). When Olmsted, along with his partner Calvert Vaux, designed Central Park in New York they ushered in a new era in park planning. Previously, urban parks had been laid out as afterthoughts, on land left over after street openings. Building Central Park set a precedent as it was the first urban park built with public funds and open to all (Newton 1971: 267).

At the same time yet on a larger scale, the national park movement in the American west ushered in a new conservation ethic. As westward settlement encroached on scenic areas and vital watersheds, the federal government stepped in and acquired vast acres of land, beginning with Yellowstone Park in 1872, thereby forming the foundation of the national park system. Conservation efforts in the east focused on reclaiming rivers and streams from years of pollution by industrial and human waste. During the 1880s, Frederick Law Olmsted and the city of Boston embarked on a project to link multiple parks within the city by tree-lined parkways. To connect the city's parks, Olmsted proposed the Muddy River Improvement project, also known as "green fingers." This continuous strip of parkland followed the Muddy River valley and connected a series of parks from Boston Commons to Franklin Park. In later years sections of this riverine parkway would be known as Riverway and Jamaica Way. In 1893, development of the city's parkland was placed under the jurisdiction of the Metropolitan Park Commission (Newton 1971: 294, 300). In 1906, engineers in Westchester County, New York began to clean and beautify the Bronx River, long a receptacle of sewage and industrial waste, by creating parkland on both sides of the river. Although not initially planned, this conservation effort led to the construction of the Bronx River Parkway (Newton 1971: 598).

In the early twentieth century, the forces of conservation and landscape architecture fused with urban planning to create the City Beautiful movement. Originating from Chicago's 1893 World's Columbian Exposition, proponents of the City Beautiful movement were concerned with rescuing cities from their chaos, ugliness, filth and poverty. They called upon landscape architects, artists, planners and businessmen to integrate city planning with a design aesthetic to revive the American city and relieve the maladies of urban life. While the most obvious manifestation of the City Beautiful movement is monumental neoclassical architecture, City Beautiful advocates were also interested in shaping and beautifying the whole urban environment. Many City Beautiful plans for urban areas included extensive systems of outlying parks, parkways and boulevards, such as Daniel Burnham's plans for San Francisco (1906) and Chicago (1909), Charles Mulford Robinson's design for Denver (1906) and Honolulu (1906) and John Nolan's recommendations for San Diego (1909) and Reading, Pennsylvania (1910) (Wilson 1980: 176-83).

In New Jersey, the Park Act of 1895 enabled local governments to create multi-jurisdictional park commissions. As a result, Essex County established the first county park commission in the United States. The Park Act was modeled on the one established in Boston in 1893 creating the Metropolitan Park Commission. Established two years prior to the Essex County Park Commission, Boston's Metropolitan Park Commission has the distinction of being the first metropolitan park system (Newton 1971: 323). Although the Park Act of 1895 provided the basis for the establishment of other county and municipal park commissions in New Jersey, it would not be until 1921 that the state's second park commission was established in Union County.

Survey Name: NI Route 82 Bridge over Rahway River

Surveyor: Glenn R. Modica

Date: January 2002

Organization: Richard Grubb & Associates

CONTINUATION SHEET

Historic Sites #:

HISTORY CONTINUED

The Rahway River supplied Union County residents with fundamental and recreational needs, for bathing, drinking, canoeing, skating and fishing. In Rahway, that city's incipient development as a center of shipping and trade owes much to the fact that large sailing vessels could not navigate the Rahway River beyond the city. From its river landings, Rahway carried on a brisk trade with Perth Amboy, and as steamboats were introduced in the nineteenth century direct service was provided to New Brunswick and Elizabeth (Lane 1939:63 and 214). While the river's narrow channel precluded maritime trade further upstream, it did provide ample flow to power early mills. In 1834, twenty mill seats between Springfield and Rahway were engaged in grinding grain, sawing lumber and producing paper, cotton and wool (Gordon 1834: 222). By the early twentieth century more intensive industries located along the banks of the river, which had become by then a receptacle for human and industrial waste. The pollution of the Rahway River became such a concern that it motivated influential citizens to take action.

In 1919, Union County Sheriff James E. Warner, who in his youth had swam and fished in the Rahway River, decried its polluted condition in a letter to the *Cranford Citizen* (Foley 1990: 3). Warner's letter moved Cranford Township Committeeman D.C.N. Collins to bring further attention to the situation in a letter to the *Elizabeth Daily Journal* and in a privately printed booklet distributed to the Cranford Township Committee. Collins was dismayed at the gradual deterioration of the Rahway River; industrial and human waste that poured into the river poisoned all the fish; new development that encroached along its banks pushed out wildlife; and, private ownership of adjacent land precluded public enjoyment. To safeguard the natural beauty of the Rahway River, Collins, an engineer by trade, sketched a plan for "Union County Memorial Park," a linear greenway dedicated to the veterans of the First World War, that stretched along the banks of the Rahway River from Springfield Avenue in Springfield Township to St. George Avenue in Rahway (Cunningham 1971). The Memorial Park, Collins hoped, would eventually connect with the parks in Essex County. But Collins did not stop there. He also envisioned miles of interconnected drives, recreational areas and camp grounds that linked every municipality in the county, a "connecting chain of recreation scenes," as Collins wrote.

The Union County Park Association was duly formed and charged with the task of establishing a permanent park commission. On April 30, 1921 New Jersey Superior Court Justice James J. Bergen appointed a temporary commission to study the feasibility of a permanent park commission (Union County Park Commission 1922a:5). The temporary commission was given two years and a budget of \$10,000 to prepare their report. In September 1921, after only five months and spending less than two thousand dollars, the temporary commission urged prompt action to establish a county park system. In their report the commission couched their language in the rhetoric of contemporary progressive reformers, asserting that "with no provision for recreation, no breathing places for its increasing population, no spots available for outdoor amusement...the health of the whole community is menaced," and taking a page from Frederick Law Olmsted, stating that only a county park system would "assure proper development of mind and body" (Union County Park Commission 1922a:29-30). Well aware of their county's proximity to the New York metropolitan area, the temporary commission presciently warned that it would be only a matter of time before their county would become more urbanized and densely populated, thereby foreclosing any opportunity to acquire any undeveloped land. The commission was "particularly impressed by large areas of ground either now or wholly waste land or occupied as farm or wood land, admirably adapted for Park purposes, which are now available at reasonable prices but which are in imminent danger of soon being beyond the reach of reasonable acquisition" (Union County Park Commission 1946 Report: 5). The acquisition of such land, urged the commission, would achieve their goals of preserving the water supply and establishing much needed parkland (Union County Park Commission 1922a: 26-30). In the November elections a referendum was put on the ballot to appoint a permanent park commission. Despite opposition from the more populated areas of the county, voters approved the referendum, and on November 19, 1921 Justice Bergen appointed a permanent five-member Union County Park Commission. Its original members were Henry S. Chatfield of Elizabeth, Arthur R. Wendell of Rahway, Charles Hansell of Cranford, Caxton Brown of Summit and Charles A. Reed of Plainfield (Union County Park Commission 1922a:6).

The choice for a landscape architect was easy. Olmsted Brothers Landscape Architects of Brookline, Massachusetts, who had worked so successfully on the Essex County park system, were the obvious choice. The legacy of Frederick Law Olmsted, Sr. had passed to his son, Frederick, Jr. and to his stepson, John Charles Olmsted. Working together under the name Olmsted Brothers, this second generation landscape design firm formed the core of the nation's leading landscape design firm in the early-to mid-twentieth century (Louis Berger & Associates, Inc. 1999:8). Early in 1921, the temporary park commission retained the firm to recommend a feasible approach to the county-wide park system.

The Olmsted Brothers plan for Union County called for series of parks linked by the county's natural features, its "undulating topography and the quiet pastoral character of the county-side." Main elements of the plan were a park in the Watchung Reservation, the "parking" of the Elizabeth and Rahway rivers, which ran north to south through the county, and an east-west parkway linking the whole. Individual parks to serve local communities were also recommended as land became available. The Olmsted's envisioned linking the Rahway and Elizabeth river parkways with the Essex County Parks. This vision never was realized (Olmsted Brothers Landscape Architects 1921).

Survey Name: NI Route 82 Bridge over Rahway River

Date: January 2002

Surveyor: Glenn R. Modica

Organization: Richard Grubb & Associates

CONTINUATION SHEET

Historic Sites #

HISTORY CONTINUED

The Olmsted Brothers plan for "parking" the Rahway River, the firm acknowledged, was based on D.C. Newman Collins plan for the Union County Memorial Park drawn up two years earlier but with some modifications (Olmsted Brothers Landscape Architects 1921). The Olmsted's reduced the extent of the parkway in areas they believed the land was more suitable for residential purposes, such as in Cranford, the Sperry Farm in Kenilworth and the region south of Morris Avenue in Springfield. The Olmsted's expanded the Collins plan in Rahway, where they proposed extending the parkway along the Robinson's Branch up to Madison Hill Road. They advocated acquiring a minimum amount of land bordering the river- "a narrow margin of bank-" that was too low and marshy for development yet would provide a pleasing environment for future residential development. In all, the Olmsted Brothers envisioned a river park encompassing 1097 acres (Olmsted Brothers Landscape Architects 1921).

While the Olmsted Brothers made their recommendations and prepared general plans for the parkway, it was up to the Union County Park Commission to carry out the work. They immediately got to the task of surveying the Rahway River valley. By August 1922 the park commission had completed a topographical survey of land in Cranford, and by February 1923 another survey had been made from Cranford through Springfield Township to the Essex County border (Union County Park Commission 1922b and 1923). In time, the swamps and low-lying areas bordering the river would either be drained or filled to create lakes; farmland and wood lots would be graded and landscaped. While still in the planning stages, the Union County Park Commission described the Rahway River as a picturesque and winding stream that "offers unusual opportunities for a continuous parkway development linking up a series of neighborhood parks and other parks, preserving places of exceptional natural beauty." According to the commission, it was to be perhaps the most important unit in the Park System" (Union County Park Commission 1925: 18).

To oversee the engineering and to work with the county's landscape architects, the Union County Park Commission hired W. Richmond Tracy. Tracy had been chief bridge builder on the Bronx River Parkway but was lured away to the park commission in 1922 to serve as the newly appointed Engineer and Secretary, positions he held until 1957 (Louis Berger & Associates, Inc. 1999: 10). Tracy was largely responsible for implementing Olmsted's Plan and approving most development plans for the Union County Park system.

The first piece of land obtained for the Rahway River Parkway, and for that matter, the Union County Park System, was donated in 1922 by the Wheatena Company of Rahway. By a unanimous vote, the stockholders of the Wheatena Company donated five acres of improved land in Rahway with a proviso that the land be used solely for park or playground purposes (Union County Park Commission 1922a: 16; 1925: 11). This property at Elizabeth and Grand Avenue's with a 2300 foot frontage along the river and Main streets is today's Wheatena Park.

In 1925, the City of Rahway donated to the county a 40-acre tract of land occupied by the Rahway Poor Farm. In the next four years the park commission had built baseball and soccer fields and dammed the river to create a lake. By the summer of 1931, the park had become a summer paradise, replete with a bath house, swimming pool and sand beach, the first outdoor bathing complex in the county (Schmidt 1980). Now called Rahway River Park, this section was known until the 1940s simply as the Rahway River Parkway-Rahway Section. Perhaps planned as the gateway to the entire parkway, a vehicular drive enters Rahway River Park at St. Georges Avenue and continues north past Valley Road allowing an uninterrupted scenic drive along the river.

Land acquisition continued apace in the 1920s. Capital expenditures between 1924-1927 exceeded \$800,000 a year, a figure that would never be approached again (Union County Park Commission 1963: 46). In fact, by October 1925 about 35% of lands for the Rahway Parkway had been acquired or were under contract, and by the end of the decade the commission had expended more money for land acquisition for the Rahway River Parkway than any other park (Union County Park Commission 1925: 19). The Park Act of 1895 authorized the commission to acquire land for park purposes either by purchase, donation or, as a last resort, condemnation. Most of the property for the Rahway River Parkway, in particular, and the Union County Park system, in general, had been purchased directly from the property owners. By 1957, when the county parks encompassed 4874 acres, the commission had acquired 3594 acres through purchase, 650 acres through donations and 630 acres by condemnation (Union County Park Commission 1957: 13). By 1930, the county had acquired nearly 90% of the land intended for the entire park system, an impressive achievement. Still, most of the proposed parkway still lay undeveloped. And although the commission had by 1929 completed the first step- acquire the land- with the depression of the 1930s and then the Second World War, it would be up to future generations to shape it.

The Park Commission had produced four annual reports between 1922-1931, yet not another was prepared until 1946. Whereas the earlier reports had proudly listed notable accomplishments and had expressed optimism about the future, the 1946 Report, fifteen years in the making, exudes a far more somber, almost defeated tone. In his Presidents Report, Caxton Brown, now 68 years old and a member of the commission since its inception in 1921, speaks of the troubled period the park commission had experienced in the intervening years. Brown singled out the Rahway River Parkway as a project that was "still in its incipency."

Survey Name: NI Route 82 Bridge over Rahway River

Date: January 2002

Surveyor: Glenn R. Modica

Organization: Richard Grubb & Associates

CONTINUATION SHEET

Historic Sites #

HISTORY CONTINUED

Both sides of the river still needed to be landscaped, Brown pointed out, with a "protective fringe and the establishment of suitable paths, driveways and bridges to make the area conform in appearance to some of the famous river treatment of the Westchester County Park System in New York" (Union County Park Commission 1946: 2). After nearly two decades of economic uncertainty, the park commission had to keep expenditures down. New land acquisition came to a virtual halt and little was expended for maintenance, allowing the park system to deteriorate. Lawns, shrubs and trees suffered from insects; soils were depleted. Capital expenditures that had exceeded \$5 million in the first ten year period of the park commission (1922-1931) had been reduced in the ensuing fifteen years (1932-1946) to less than \$500,000 (Union County Park Commission 1946: 46). "Hence it was proved," Brown stated in his report, "that there could be no more unwise economy than to jeopardize the existing investment and the beauty and facilities of that which had been developed" (Union County Park Commission 1946:3).

Federal work relief programs, such as the CCC, WPA and PWA, in cooperation with the National Park Service did provide some funding, labor and materials for further development of the county's parks. The CCC program, active between 1933-1939, converted the American Chemical Factory at Meisel Avenue into Camp NJ SP-3 Company 1272 (Union County Park Commission ca. 1935). This complex of 17 buildings was converted to workshops, dormitories, an infirmary, recreation hall and administration buildings (Union County Park Commission 1946:36). Brown certainly had been proud of the previous era's work, commending the park commission's previous effort and achievement, particularly in land acquisition. Yet "that character of work," Brown pointed out, "is not now indispensable." Considering that nearly all of the land for the county park system had been acquired, Brown suggested that its future development and beautification "should be assumed by those who later on will have a real need of them" (Union County Park Commission 1946: 2).

But the next generation had other issues to contend with. New highway construction infringed upon existing parkland, leaving isolated sections of parkland that bore no relation to the county plan. The Garden State Parkway removed part of the western edge of the Rahway River Parkway for about a mile before finally severing it at Raritan Road, taking away twenty-two acres of greenway (Union County Park Commission 1957: 11). In the face of "an even greater problem with the recently announced Federal-State highway program" (the Interstate Highway Act of 1956), the Union County Park Commission conceded that "we see no virtue in stubborn opposition" (Union County Park Commission 1957: 5). By 1958, 58 acres of parkland had been ceded to highway development. Highway acquisition did, however, put much needed revenue into the county coffers- \$709,000 by 1958- thereby allowing the park commission to acquire an additional 404 acres for parkland between 1947-57 (Union County Park Commission 1957:13).

More highways also meant more people, placing even greater demands upon the park system. As the population changed so too did their perceptions of nature. With the rise of suburbs, naturalistic parks became less essential than before when they provided the only means to escape congested urban centers. As communities grew, they demanded more active recreational facilities, more ball fields and playgrounds, more picnic areas and refreshment stands. The public's idea of nature no longer meant a place of pastoral scenery meant for quiet contemplation but rather as the backdrop to large open areas of active play and recreation (Nash 1973). To meet the need, the Park Commission began clearing discrete sections of the Rahway River Parkway for recreational facilities and small playgrounds to serve the local community. These projects, however, have occurred outside the margin of the Rahway River's vegetative fringe.

In 1978, the autonomous Union County Park Commission was abolished and replaced by the Union County Department of Parks and Recreation. Today, the Union County park system contains 26 parks totaling 5,574 acres (Union County Department of Parks and Recreation 1999).

Survey Name: NJ Route 82 Bridge over Rahway River
Surveyor: Glenn R. Modica
Organization: Richard Grubb & Associates

Date: January 2002



ATTACHMENT 10

Cost Estimate Documentation

Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity

Default Parameters of Project Alternative: Water Supply Options

Code	Description	Value
dywk	Labor work days per week	5.000
hrsdy	Hours Per Day	10.000
nequip	Number of Equipment	1.000
nper	Labor number of People	1.000
usehrs	Number of hours per day used	9.000
wrkdywk	Equipment Work Days Week	5.000



Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity

1
01. WBS:Project 1
Plans

				Cost	Hours	Price
Worksheet: 01...0010.0 - Health & Safety Plan						
WBS Quantity:	1.000	LS	perUoM:	2,292.00	58.000	8,958.00
AQ-Quantity:	1.000	LS	Total:	2,292.00	58.000	8,958.00

		Cost Group Assignments
Group Id	Description	

Notes:

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	01000680	Project Engineer		1.000	32.000	35.00	Hrs		1,120.00
	01000825	Senior Cert. Industrial Hygienist		1.000	6.000	55.00	Hrs		330.00
	01000025	Admin Assistant		1.000	4.000	25.00	Hrs		100.00
	01000865	Project Manager		1.000	16.000	42.00	Hrs		672.00
	40010006	Home Office Copies		1.000	1,000.000	0.07	Ea		70.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
2,222.00	0.00	0.00	70.00	0.00	0.00	0.00	0.00	2,292.00

Pricing

UoM	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
Total	2,292.00	0.00	0.00	6,666.00	0.00	0.00	8,958.00	0.00	8,958.00
	2,292.00	0.00	0.00	6,666.00	0.00	0.00	8,958.00	0.00	8,958.00



Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity

1
01. WBS:Project 1
Plans

				Cost	Hours	Price
Worksheet: 01...0040.0 - QA/QC Plan						
WBS Quantity:	1.000	LS	perUoM:	2,478.00	64.000	9,702.00
AQ-Quantity:	1.000	LS	Total:	2,478.00	64.000	9,702.00

		Cost Group Assignments
Group Id	Description	

Notes:

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	01000865	Project Manager		1.000	24.000	42.00	Hrs		1,008.00
	01000680	Project Engineer		1.000	40.000	35.00	Hrs		1,400.00
	40010006	Home Office Copies		1.000	1,000.000	0.07	Ea		70.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
2,408.00	0.00	0.00	70.00	0.00	0.00	0.00	0.00	2,478.00

Pricing

	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
UoM	2,478.00	0.00	0.00	7,224.00	0.00	0.00	9,702.00	0.00	9,702.00
Total	2,478.00	0.00	0.00	7,224.00	0.00	0.00	9,702.00	0.00	9,702.00



Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity

1
01. WBS:Project 1
Plans

				Cost	Hours	Price
Worksheet: 01...0050.0 - Coordination and Meetings						
WBS Quantity:	1.000	LS	perUoM:	3,711.00	80.000	11,160.00
AQ-Quantity:	1.000	LS	Total:	3,711.00	80.000	11,160.00

		Cost Group Assignments
Group Id	Description	

Notes:

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	01000865	Project Manager		1.000	40.000	42.00	Hrs		1,680.00
	10000320	Const-Superintendent		1.000	40.000	38.00	Hrs		1,520.00
	600100	POV Milage		1.000	500.000	0.55	Mi		275.00
	600015	Per Diem Daily (Meals)		1.000	4.000	59.00	day		236.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
3,200.00	0.00	0.00	0.00	0.00	511.00	0.00	0.00	3,711.00

Pricing

UoM	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
Total	3,711.00	0.00	0.00	7,447.13	0.00	1.87	11,160.00	0.00	11,160.00



Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity

1
01. WBS:Project 1
Plans

				Cost	Hours	Price
Worksheet: 01...0060.0 - Final Report						
WBS Quantity:	1.000	LS	perUoM:	5,904.28	138.000	22,780.00
AQ-Quantity:	1.000	LS	Total:	5,904.28	138.000	22,780.00

		Cost Group Assignments
Group Id	Description	

Notes:

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	01000865	Project Manager		1.000	40.000	42.00	Hrs		1,680.00
	01000680	Project Engineer		1.000	80.000	35.00	Hrs		2,800.00
	02000190	Cadd Operator		1.000	16.000	69.08	Hrs		1,105.28
	10000320	Const-Superintendent		1.000	2.000	38.00	Hrs		76.00
	40010006	Home Office Copies		1.000	500.000	0.07	Ea		35.00
	40010007	CADD Usage		1.000	16.000	13.00	Hr		208.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
5,661.28	0.00	0.00	243.00	0.00	0.00	0.00	0.00	5,904.28

Pricing

UoM	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
Total	5,904.28	0.00	0.00	16,873.64	0.00	2.08	22,780.00	0.00	22,780.00
	5,904.28	0.00	0.00	16,873.64	0.00	2.08	22,780.00	0.00	22,780.00



Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity

1
02. WBS:Project 1
Mobilization/Demobilization

				Cost	Hours	Price
Worksheet: 02...0070.0 - Mobilization & Demobilization						
WBS Quantity:	1.000	LS	perUoM:	5,977.28	64.000	9,435.00
AQ-Quantity:	1.000	LS	Total:	5,977.28	64.000	9,435.00

		Cost Group Assignments
Group Id	Description	

Notes:

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	30TD0015	Delivery Heavy Equipment, Local		1.000	8.000	350.00	ea		2,800.00
	11000250	Const-Equipment Operator II		2.000	32.000	61.67	Hrs		1,973.44
	11000265	Laborer		1.000	16.000	47.10	Hrs		753.60
	11000270	Truck Driver		1.000	16.000	28.14	Hrs		450.24

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
3,177.28	0.00	2,800.00	0.00	0.00	0.00	0.00	0.00	5,977.28

Pricing

UoM	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
Total	5,977.28	0.00	0.00	3,457.34	0.00	0.38	9,435.00	0.00	9,435.00
	5,977.28	0.00	0.00	3,457.34	0.00	0.38	9,435.00	0.00	9,435.00



Rahway River Fish Ladder Options
 RahwayFishLadder -
 Based on Qty:WQ-Quantity

1 02.	WBS:Project 1 Mobilization/Demobilization
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Worksheet: 02...0080.0	- Survey and Stake-out	Cost	Hours	Price
WBS Quantity: 1.000	LS	perUoM: 4,000.00	0.000	4,400.00
AQ-Quantity: 1.000	LS	Total: 4,000.00	0.000	4,400.00

Group Id	Description	Cost Group Assignments
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Notes:

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	30SV005	Land Survey		1.000	2.000	2,000.00	DY		4,000.00

RAW COST TOTALS

LABOR 0.00	EQUIPMENT 0.00	SUBCONTRACTS 4,000.00	INTERNALS 0.00	EXTERNALS 0.00	TRAVEL 0.00	P.I.C. 0.00	Bonds 0.00	TOTAL 4,000.00
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Pricing

UoM	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
Total	4,000.00	0.00	0.00	400.00	0.00	0.00	4,400.00	0.00	4,400.00

**Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity**

1
03. **WBS:Project 1**
E & S Controls

				Cost	Hours	Price
Worksheet: 03...0005.0 - Clear & Grub						
WBS Quantity:	1.000	LS	perUoM:	5,369.30	46.000	8,096.00
AQ-Quantity:	1.000	LS	Total:	5,369.30	46.000	8,096.00

Cost Group Assignments

Group Id	Description
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Notes:

Calculation Basis

Calculates Equipment Usage	$((1/\text{prodrate}) * (7/\text{wrkdywk})) * \text{nequip}$	Units Per	day
FOG Rate	$1/\text{prodrate} * \text{usehrs} * \text{gph} * \text{nequip}$	Units Per	Gal
Gallons per hour used	5	Units Per	
Calculates Overtime Hours	$((1/\text{prodrate} * \text{hrsdy}) - (1/\text{prodrate}/\text{dywk} * 40)) * \text{nper}$	Units Per	HR
Production Rate	500	Units Per	
Calculates Labor Straight Time	$1/\text{prodrate}/\text{dywk} * 40 * \text{nper}$	Units Per	Hrs

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	11000250	Const-Equipment Operator II		2.000	16.000	61.67	Hrs		986.72
	11100250	Const-Equipment Operator (OT)		2.000	4.000	82.00	Hrs		328.00
	11000265	Laborer		1.000	8.000	47.10	Hrs		376.80
	11100265	Laborer (OT)		1.000	2.000	61.45	Hrs		122.90
	11000270	Truck Driver		2.000	16.000	28.14	Hrs		450.24
	11100270	Truck Driver (OT)		2.000	4.000	42.21	Hrs		168.84
	25HE320B	Excavator, Cat 320B or Equal		1.000	1.400	450.00	DAY		630.00
	25BDD5C0	Cat D5 or Equal		1.000	1.400	250.00	DAY		350.00
	25ULBCA1	Rubber Tire Loader		1.000	1.400	228.00	day		319.20
	25STD250	Cat D250		2.000	2.800	397.00	day		1,111.60
	50FG05	FOG		5.000	150.000	3.50	Gal		525.00



03...0005.0										
FlagRef #	Description			FRM	Factor	Total	URate	UoM	Man Hours	Total Cost
RAW COST TOTALS										
	LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL	
	2,433.50	2,410.80	0.00	0.00	525.00	0.00	0.00	0.00	5,369.30	
Pricing										
	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue	
UoM	5,369.30	0.00	0.00	2,727.13	0.00	-0.43	8,096.00	0.00	8,096.00	
Total	5,369.30	0.00	0.00	2,727.13	0.00	-0.43	8,096.00	0.00	8,096.00	



**Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity**

1
03. **WBS:Project 1**
E & S Controls

				Cost	Hours	Price
Worksheet: 03...0110.0 - E & S Controls						
WBS Quantity:	1.000	LS	perUoM:	7,634.84	60.000	11,660.00
AQ-Quantity:	1.000	LS	Total:	7,634.84	60.000	11,660.00

		Cost Group Assignments
Group Id	Description	

Notes:

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	11000250	Const-Equipment Operator II		2.000	32.000	61.67	Hrs		1,973.44
	11100250	Const-Equipment Operator (OT)		2.000	8.000	82.00	Hrs		656.00
	11000265	Laborer		1.000	16.000	47.10	Hrs		753.60
	11100265	Laborer (OT)		1.000	4.000	61.45	Hrs		245.80
	25HE320B	Excavator, Cat 320B or Equal		1.000	4.200	450.00	DAY		1,890.00
	50FG05	FOG		1.000	30.000	3.50	Gal		105.00
	52EB005	Silt Fence		1.000	460.000	1.00	LF		460.00
	50FG05	FOG		1.000	150.000	3.50	Gal		525.00
	50EB006	Erosion Control Blanket		1.000	3,420.000	0.30	sf		1,026.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
3,628.84	1,890.00	0.00	0.00	2,116.00	0.00	0.00	0.00	7,634.84

Pricing

	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
UoM	7,634.84	0.00	0.00	4,029.51	0.00	-4.35	11,660.00	0.00	11,660.00
Total	7,634.84	0.00	0.00	4,029.51	0.00	-4.35	11,660.00	0.00	11,660.00

Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity

1 WBS:Project 1
03. E & S Controls

Worksheet: 03...0120.0				Cost	Hours	Price
- Stabilized Construction Entrance						
WBS Quantity:	1.000	LS	perUoM:	4,405.29	30.000	6,479.00
AQ-Quantity:	1.000	LS	Total:	4,405.29	30.000	6,479.00

Cost Group Assignments

Group Id	Description
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Notes:

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	11000250	Const-Equipment Operator II		2.000	16.000	61.67	Hrs		986.72
	11100250	Const-Equipment Operator (OT)		2.000	4.000	82.00	Hrs		328.00
	11000265	Laborer		1.000	8.000	47.10	Hrs		376.80
	11100265	Laborer (OT)		1.000	2.000	61.45	Hrs		122.90
	25BL426C	Skid Steer 287B		1.000	1.400	240.00	DAY		336.00
	25BDD4C0	Cat D4G LGP or Equal		1.000	1.400	140.62	DY		196.87
	50FG05	FOG		2.000	120.000	3.50	Gal		420.00
	52AG055	No. 2 Stone		1.000	60.000	20.50	TN		1,230.00
	52GT010	Geotextile		1.000	3,400.000	0.12	SF		408.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
1,814.42	532.87	0.00	0.00	2,058.00	0.00	0.00	0.00	4,405.29

Pricing

	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
UoM	4,405.29	0.00	0.00	2,073.54	0.00	0.17	6,479.00	0.00	6,479.00
Total	4,405.29	0.00	0.00	2,073.54	0.00	0.17	6,479.00	0.00	6,479.00



**Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity**

1
04. **WBS:Project 1**
Excavation and Installation

				Cost	Hours	Price
Worksheet: 04...0130.0 - Excavation						
WBS Quantity:	540.000	cy	perUoM:	17.98	0.167	28.85
AQ-Quantity:	540.000	cy	Total:	9,708.36	90.000	15,579.00

		Cost Group Assignments
Group Id	Description	

Notes:

<u>Calculation Basis</u>							
Calculates Equipment Usage	((1/prodrate)*(7/wrkdywk))*nequip	Units Per	day				
FOG Rate	1/prodrate*usehrs*gph*nequip	Units Per	Gal				
Gallons per hour used	5	Units Per					
Calculates Overtime Hours	((1/prodrate*hrsdy)-(1/prodrate/dywk*40))*nper	Units Per	HR				
Production Rate	180	Units Per					
Calculates Labor Straight Time	1/prodrate/dywk*40*nper	Units Per	Hrs				

<u>Estimate Details</u>									
Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	11000250	Const-Equipment Operator II	ST	2.000	48.000	61.67	Hrs		2,960.16
	11100250	Const-Equipment Operator (OT)	OT	2.000	12.000	82.00	Hrs		984.00
	11000265	Laborer	ST	1.000	24.000	47.10	Hrs		1,130.40
	11100265	Laborer (OT)	OT	1.000	6.000	61.45	Hrs		368.70
	25HE320B	Excavator, Cat 320B or Equal	ER	1.000	4.200	450.00	DAY		1,890.00
	25ULBCA1	Rubber Tire Loader	ER	1.000	4.200	228.00	day		957.60
	50FG05	FOG	FG	3.000	405.000	3.50	Gal		1,417.50

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
5,443.26	2,847.60	0.00	0.00	1,417.50	0.00	0.00	0.00	9,708.36

Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity

1 04.	WBS:Project 1 Excavation and Installation
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04...0130.0 FlagRef #	Description	FRM	Factor	Total	URate	UoM	Man Hours	Total Cost
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Pricing

UoM	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
	17.98	0.00	0.00	10.87	0.00	0.00	28.85	0.00	28.85
Total	9,708.36	0.00	0.00	5,869.88	0.00	0.76	15,579.00	0.00	15,579.00



**Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity**

1
04. **WBS:Project 1**
Excavation and Installation

				Cost	Hours	Price
Worksheet: 04...0135.0 - Place Controlled Base						
WBS Quantity:	415.000	cy	perUoM:	23.84	0.145	34.09
AQ-Quantity:	415.000	cy	Total:	9,892.24	60.000	14,147.35

		Cost Group Assignments				
Group Id	Description					

Notes:

<u>Calculation Basis</u>						
Calculates Equipment Usage	((1/prodrate)*(7/wrkdwyk))*nequip	Units Per	day			
FOG Rate	1/prodrate*usehrs*gph*nequip	Units Per	Gal			
Gallons per hour used	5	Units Per				
Calculates Overtime Hours	((1/prodrate*hrsdy)-(1/prodrate/dywk*40))*nper	Units Per	HR			
Production Rate	207.5	Units Per				
Calculates Labor Straight Time	1/prodrate/dywk*40*nper	Units Per	Hrs			

<u>Estimate Details</u>									
Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	11000250	Const-Equipment Operator II	ST	2.000	32.000	61.67	Hrs		1,973.44
	11100250	Const-Equipment Operator (OT)	OT	2.000	8.000	82.00	Hrs		656.00
	11000265	Laborer	ST	1.000	16.000	47.10	Hrs		753.60
	11100265	Laborer (OT)	OT	1.000	4.000	61.45	Hrs		245.80
	25ULBCA1	Rubber Tire Loader	ER	1.000	2.800	228.00	day		638.40
	25HE320B	Excavator, Cat 320B or Equal	ER	1.000	2.800	450.00	DAY		1,260.00
	50FG05	FOG	FG	2.000	180.000	3.50	Gal		630.00
	52IS0010	Select Fill/Cy		1.000	415.000	9.00	Cy		3,735.00

RAW COST TOTALS								
LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
3,628.84	1,898.40	0.00	0.00	4,365.00	0.00	0.00	0.00	9,892.24



04...0135.0								
FlagRef #	Description	FRM	Factor	Total	URate	UoM	Man Hours	Total Cost

	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
UoM	23.84	0.00	0.00	10.25	0.00	0.00	34.09	0.00	34.09
Total	9,892.24	0.00	0.00	4,255.25	0.00	-0.14	14,147.35	0.00	14,147.35



**Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity**

1
04. **WBS:Project 1**
Excavation and Installation

				Cost	Hours	Price
Worksheet: 04...0137.0 - Place Boulders and Cobbles						
WBS Quantity:	65.000	cy	perUoM:	142.33	0.923	206.80
AQ-Quantity:	65.000	cy	Total:	9,251.24	60.000	13,442.00

Cost Group Assignments

Group Id	Description
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Notes:

Calculation Basis

Calculates Equipment Usage	$((1/\text{prodrate}) * (7/\text{wrkdywk})) * \text{nequip}$	Units Per	day
FOG Rate	$1/\text{prodrate} * \text{usehrs} * \text{gph} * \text{nequip}$	Units Per	Gal
Gallons per hour used	5	Units Per	
Calculates Overtime Hours	$((1/\text{prodrate} * \text{hrsdy}) - (1/\text{prodrate}/\text{dywk} * 40)) * \text{nper}$	Units Per	HR
Production Rate	32.5	Units Per	
Calculates Labor Straight Time	$1/\text{prodrate}/\text{dywk} * 40 * \text{nper}$	Units Per	Hrs

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	11000250	Const-Equipment Operator II	ST	2.000	32.000	61.67	Hrs		1,973.44
	11100250	Const-Equipment Operator (OT)	OT	2.000	8.000	82.00	Hrs		656.00
	11000265	Laborer	ST	1.000	16.000	47.10	Hrs		753.60
	11100265	Laborer (OT)	OT	1.000	4.000	61.45	Hrs		245.80
	25ULBCA1	Rubber Tire Loader	ER	1.000	2.800	228.00	day		638.40
	25HE320B	Excavator, Cat 320B or Equal	ER	1.000	2.800	450.00	DAY		1,260.00
	50FG05	FOG	FG	2.000	180.000	3.50	Gal		630.00
	52AG012	Rip Rap		1.700	110.500	28.00	TN		3,094.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
3,628.84	1,898.40	0.00	0.00	3,724.00	0.00	0.00	0.00	9,251.24

Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity

1 04.	WBS:Project 1 Excavation and Installation
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04...0137.0								
FlagRef #	Description	FRM	Factor	Total	URate	UoM	Man Hours	Total Cost

Pricing

	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
UoM	142.33	0.00	0.00	64.48	0.00	-0.01	206.80	0.00	206.80
Total	9,251.24	0.00	0.00	4,191.15	0.00	-0.39	13,442.00	0.00	13,442.00



**Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity**

1
04. **WBS:Project 1**
Excavation and Installation

				Cost	Hours	Price
Worksheet: 04...0140.0 - Plantings (Allowance)						
WBS Quantity:	1.000	LS	perUoM:	10,000.00	0.000	11,000.00
AQ-Quantity:	1.000	LS	Total:	10,000.00	0.000	11,000.00

		Cost Group Assignments
Group Id	Description	

Notes:

Calculation Basis

Calculates Equipment Usage	$((1/\text{prodrate}) * (7/\text{wrkdywk})) * \text{nequip}$	Units Per	day
FOG Rate	$1/\text{prodrate} * \text{usehrs} * \text{gph} * \text{nequip}$	Units Per	Gal
Gallons per hour used	5	Units Per	
Production Rate	800	Units Per	
Calculates Labor Straight Time	$1/\text{prodrate}/\text{dywk} * 40 * \text{nper}$	Units Per	Hrs

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	380007	Planting (Allowance)		1.000	1.000	10,000.00	LS		10,000.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
0.00	0.00	10,000.00	0.00	0.00	0.00	0.00	0.00	10,000.00

Pricing

	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
UoM	10,000.00	0.00	0.00	1,000.00	0.00	0.00	11,000.00	0.00	11,000.00
Total	10,000.00	0.00	0.00	1,000.00	0.00	0.00	11,000.00	0.00	11,000.00



Rahway River Fish Ladder Options
 RahwayFishLadder -
 Based on Qty:WQ-Quantity

1
 05. **WBS:Project 1**
 Relocate Utilities (Allowance)

				Cost	Hours	Price
Worksheet: 05...0010.0 - Relocate Utilities (Allowance)						
WBS Quantity:	1.000	LS	perUoM:	25,000.00	0.000	25,000.00
AQ-Quantity:	1.000	LS	Total:	25,000.00	0.000	25,000.00

		Cost Group Assignments
Group Id	Description	

Notes:

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	52EL1001	Relocate Utilities Allowance		1.000	1.000	25,000.00	LS		25,000.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
0.00	0.00	0.00	0.00	25,000.00	0.00	0.00	0.00	25,000.00

Pricing

UoM	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
	25,000.00	0.00	0.00	0.00	0.00	0.00	25,000.00	0.00	25,000.00
Total	25,000.00	0.00	0.00	0.00	0.00	0.00	25,000.00	0.00	25,000.00



Rahway River Fish Ladder Options
 RahwayFishLadder -
 Based on Qty:WQ-Quantity

1
06. **WBS:Project 1**
Project Management

				Cost	Hours	Price
Worksheet: 06...0150.0 - Field Office						
WBS Quantity:	15.000	DY	perUoM:	751.70	10.000	1,370.00
AQ-Quantity:	15.000	DY	Total:	11,275.50	150.000	20,550.00

Cost Group Assignments

Group Id	Description
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Notes:
 Based on 15 days in the field
 Site Manager 10hours per day

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	50EU060	Port-a-Johns		1.000	15.000	4.50	day		67.50
	50EU025	Cell Phone Charges		2.000	30.000	5.00	Day		150.00
	50EBU005	Water, Support Trailer, Mnthly Service		1.000	15.000	5.00	day		75.00
	52MS0005	Misc. ODC's		1.000	15.000	50.00	EA		750.00
	10000320	Const-Superintendent		1.000	150.000	38.00	Hrs		5,700.00
	4001008	Pick-up Truck		1.000	15.000	75.00	DY		1,125.00
	50FG07	FOG		1.000	15.000	6.00	DY		90.00
	6000015	Per Diem Daily		1.000	21.000	158.00	Day		3,318.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
5,700.00	0.00	0.00	1,125.00	1,132.50	3,318.00	0.00	0.00	11,275.50



WBS:Project 1
Project Management

Total Cost

	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
UoM	751.70	0.00	0.00	618.68	0.00	-0.38	1,370.00	0.00	1,370.00
Total	11,275.50	0.00	0.00	9,280.16	0.00	-5.66	20,550.00	0.00	20,550.00



Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity

1
06. WBS:Project 1
Project Management

				Cost	Hours	Price
Worksheet: 06...0160.0 - Home Office						
WBS Quantity:	5.000	wk	perUoM:	1,434.30	36.000	5,578.00
AQ-Quantity:	5.000	wk	Total:	7,171.50	180.000	27,890.00

		Cost Group Assignments
Group Id	Description	

Notes: Project Manager to visit the site twice a month.

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	01000175	Construction QA/QC Specialist		1.000	10.000	45.00	Hrs		450.00
	01000680	Project Engineer		1.000	80.000	35.00	Hrs		2,800.00
	01000865	Project Manager		1.000	40.000	42.00	Hrs		1,680.00
	01000025	Admin Assistant		1.000	20.000	25.00	Hrs		500.00
	01000050	Cost Schedule Technician		1.000	10.000	67.09	Hrs		670.90
	02000010	Accounting clerk		1.000	20.000	39.78	Hrs		795.60
	600100	POV Milage		1.000	500.000	0.55	Mi		275.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
6,896.50	0.00	0.00	0.00	0.00	275.00	0.00	0.00	7,171.50

Pricing

	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
UoM	1,434.30	0.00	0.00	4,143.40	0.00	0.30	5,578.00	0.00	5,578.00
Total	7,171.50	0.00	0.00	20,717.00	0.00	1.50	27,890.00	0.00	27,890.00



Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity

1
20. WBS:Project 1
Plans

				Cost	Hours	Price
Worksheet: 20...0010.0 - Health & Safety Plan						
WBS Quantity:	1.000	LS	perUoM:	2,292.00	58.000	8,958.00
AQ-Quantity:	1.000	LS	Total:	2,292.00	58.000	8,958.00

		Cost Group Assignments
Group Id	Description	

Notes:

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	01000680	Project Engineer		1.000	32.000	35.00	Hrs		1,120.00
	01000825	Senior Cert. Industrial Hygienist		1.000	6.000	55.00	Hrs		330.00
	01000025	Admin Assistant		1.000	4.000	25.00	Hrs		100.00
	01000865	Project Manager		1.000	16.000	42.00	Hrs		672.00
	40010006	Home Office Copies		1.000	1,000.000	0.07	Ea		70.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
2,222.00	0.00	0.00	70.00	0.00	0.00	0.00	0.00	2,292.00

Pricing

UoM	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
Total	2,292.00	0.00	0.00	6,666.00	0.00	0.00	8,958.00	0.00	8,958.00
	2,292.00	0.00	0.00	6,666.00	0.00	0.00	8,958.00	0.00	8,958.00



Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity

1
20. WBS:Project 1
Plans

				Cost	Hours	Price
Worksheet: 20...0020.0 - QA/QC Plan						
WBS Quantity:	1.000	LS	perUoM:	2,478.00	64.000	9,702.00
AQ-Quantity:	1.000	LS	Total:	2,478.00	64.000	9,702.00

		Cost Group Assignments
Group Id	Description	

Notes:

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	01000865	Project Manager		1.000	24.000	42.00	Hrs		1,008.00
	01000680	Project Engineer		1.000	40.000	35.00	Hrs		1,400.00
	40010006	Home Office Copies		1.000	1,000.000	0.07	Ea		70.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
2,408.00	0.00	0.00	70.00	0.00	0.00	0.00	0.00	2,478.00

Pricing

	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
UoM	2,478.00	0.00	0.00	7,224.00	0.00	0.00	9,702.00	0.00	9,702.00
Total	2,478.00	0.00	0.00	7,224.00	0.00	0.00	9,702.00	0.00	9,702.00

Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity

1
20. WBS:Project 1
Plans

				Cost	Hours	Price
Worksheet: 20...0030.0 - Coordination and Meetings						
WBS Quantity:	1.000	LS	perUoM:	3,711.00	80.000	11,160.00
AQ-Quantity:	1.000	LS	Total:	3,711.00	80.000	11,160.00

		Cost Group Assignments
Group Id	Description	

Notes:

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	01000865	Project Manager		1.000	40.000	42.00	Hrs		1,680.00
	10000320	Const-Superintendent		1.000	40.000	38.00	Hrs		1,520.00
	600100	POV Milage		1.000	500.000	0.55	Mi		275.00
	600015	Per Diem Daily (Meals)		1.000	4.000	59.00	day		236.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
3,200.00	0.00	0.00	0.00	0.00	511.00	0.00	0.00	3,711.00

Pricing

UoM	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
Total	3,711.00	0.00	0.00	7,447.13	0.00	1.87	11,160.00	0.00	11,160.00



Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity

1
20. WBS:Project 1
Plans

				Cost	Hours	Price
Worksheet: 20...0040.0 - Final Report						
WBS Quantity:	1.000	LS	perUoM:	5,904.28	138.000	22,780.00
AQ-Quantity:	1.000	LS	Total:	5,904.28	138.000	22,780.00

		Cost Group Assignments
Group Id	Description	

Notes:

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	01000865	Project Manager		1.000	40.000	42.00	Hrs		1,680.00
	01000680	Project Engineer		1.000	80.000	35.00	Hrs		2,800.00
	02000190	Cadd Operator		1.000	16.000	69.08	Hrs		1,105.28
	10000320	Const-Superintendent		1.000	2.000	38.00	Hrs		76.00
	40010006	Home Office Copies		1.000	500.000	0.07	Ea		35.00
	40010007	CADD Usage		1.000	16.000	13.00	Hr		208.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
5,661.28	0.00	0.00	243.00	0.00	0.00	0.00	0.00	5,904.28

Pricing

UoM	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
Total	5,904.28	0.00	0.00	16,873.64	0.00	2.08	22,780.00	0.00	22,780.00
	5,904.28	0.00	0.00	16,873.64	0.00	2.08	22,780.00	0.00	22,780.00



Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity

1
21. **WBS:Project 1**
Mobilization/Demobilization

Worksheet: 21...0010.0 - Mobilization & Demobilization				Cost	Hours	Price
WBS Quantity:	1.000	LS	perUoM:	5,977.28	64.000	9,435.00
AQ-Quantity:	1.000	LS	Total:	5,977.28	64.000	9,435.00

Group Id		Description
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Notes:

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	30TD0015	Delivery Heavy Equipment, Local		1.000	8.000	350.00	ea		2,800.00
	11000250	Const-Equipment Operator II		2.000	32.000	61.67	Hrs		1,973.44
	11000265	Laborer		1.000	16.000	47.10	Hrs		753.60
	11000270	Truck Driver		1.000	16.000	28.14	Hrs		450.24

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
3,177.28	0.00	2,800.00	0.00	0.00	0.00	0.00	0.00	5,977.28

Pricing

UoM	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
Total	5,977.28	0.00	0.00	3,457.34	0.00	0.38	9,435.00	0.00	9,435.00
		0.00	0.00	3,457.34	0.00	0.38	9,435.00	0.00	9,435.00



Rahway River Fish Ladder Options
 RahwayFishLadder -
 Based on Qty:WQ-Quantity

1 21.	WBS:Project 1 Mobilization/Demobilization
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Worksheet: 21...0020.0	- Survey and Stake-out	Cost	Hours	Price
WBS Quantity: 1.000	LS	perUoM: 4,000.00	0.000	4,400.00
AQ-Quantity: 1.000	LS	Total: 4,000.00	0.000	4,400.00

	Cost Group Assignments
Group Id	Description

Notes:

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	30SV005	Land Survey		1.000	2.000	2,000.00	DY		4,000.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
0.00	0.00	4,000.00	0.00	0.00	0.00	0.00	0.00	4,000.00

Pricing

	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
UoM	4,000.00	0.00	0.00	400.00	0.00	0.00	4,400.00	0.00	4,400.00
Total	4,000.00	0.00	0.00	400.00	0.00	0.00	4,400.00	0.00	4,400.00

**Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity**

1
22. **WBS:Project 1**
E & S Controls

				Cost	Hours	Price
Worksheet: 22...0010.0 - Clear & Grub						
WBS Quantity:	1.000	LS	perUoM:	5,369.30	46.000	8,096.00
AQ-Quantity:	1.000	LS	Total:	5,369.30	46.000	8,096.00

Cost Group Assignments

Group Id	Description
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Notes:

Calculation Basis

Calculates Equipment Usage	$((1/\text{prodrate}) * (7/\text{wrkdywk})) * \text{nequip}$	Units Per	day
FOG Rate	$1/\text{prodrate} * \text{usehrs} * \text{gph} * \text{nequip}$	Units Per	Gal
Gallons per hour used	5	Units Per	
Calculates Overtime Hours	$((1/\text{prodrate} * \text{hrsdy}) - (1/\text{prodrate}/\text{dywk} * 40)) * \text{nper}$	Units Per	HR
Production Rate	500	Units Per	
Calculates Labor Straight Time	$1/\text{prodrate}/\text{dywk} * 40 * \text{nper}$	Units Per	Hrs

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	11000250	Const-Equipment Operator II		2.000	16.000	61.67	Hrs		986.72
	11100250	Const-Equipment Operator (OT)		2.000	4.000	82.00	Hrs		328.00
	11000265	Laborer		1.000	8.000	47.10	Hrs		376.80
	11100265	Laborer (OT)		1.000	2.000	61.45	Hrs		122.90
	11000270	Truck Driver		2.000	16.000	28.14	Hrs		450.24
	11100270	Truck Driver (OT)		2.000	4.000	42.21	Hrs		168.84
	25HE320B	Excavator, Cat 320B or Equal		1.000	1.400	450.00	DAY		630.00
	25BDD5C0	Cat D5 or Equal		1.000	1.400	250.00	DAY		350.00
	25ULBCA1	Rubber Tire Loader		1.000	1.400	228.00	day		319.20
	25STD250	Cat D250		2.000	2.800	397.00	day		1,111.60
	50FG05	FOG		5.000	150.000	3.50	Gal		525.00



Rahway River Fish Ladder Options
 RahwayFishLadder -
 Based on Qty:WQ-Quantity

1
 22. WBS:Project 1
 E & S Controls

22...0010.0 FlagRef #	Description	FRM	Factor	Total	URate	UoM	Man Hours	Total Cost
RAW COST TOTALS								
LABOR 2,433.50	EQUIPMENT 2,410.80	SUBCONTRACTS 0.00	INTERNALS 0.00	EXTERNALS 525.00	TRAVEL 0.00	P.I.C. 0.00	Bonds 0.00	TOTAL 5,369.30

Pricing									
	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
UoM	5,369.30	0.00	0.00	2,727.13	0.00	-0.43	8,096.00	0.00	8,096.00
Total	5,369.30	0.00	0.00	2,727.13	0.00	-0.43	8,096.00	0.00	8,096.00



**Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity**

1 **WBS:Project 1**
22. **E & S Controls**

				Cost	Hours	Price
Worksheet: 22...0020.0 - E & S Controls						
WBS Quantity:	1.000	LS	perUoM:	7,374.84	60.000	11,380.00
AQ-Quantity:	1.000	LS	Total:	7,374.84	60.000	11,380.00

		Cost Group Assignments
Group Id	Description	

Notes:

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	11000250	Const-Equipment Operator II		2.000	32.000	61.67	Hrs		1,973.44
	11100250	Const-Equipment Operator (OT)		2.000	8.000	82.00	Hrs		656.00
	11000265	Laborer		1.000	16.000	47.10	Hrs		753.60
	11100265	Laborer (OT)		1.000	4.000	61.45	Hrs		245.80
	25HE320B	Excavator, Cat 320B or Equal		1.000	4.200	450.00	DAY		1,890.00
	50FG05	FOG		1.000	30.000	3.50	Gal		105.00
	52EB005	Silt Fence		1.000	200.000	1.00	LF		200.00
	50FG05	FOG		1.000	150.000	3.50	Gal		525.00
	50EB006	Erosion Control Blanket		1.000	3,420.000	0.30	sf		1,026.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
3,628.84	1,890.00	0.00	0.00	1,856.00	0.00	0.00	0.00	7,374.84

Pricing

	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
UoM	7,374.84	0.00	0.00	4,003.51	0.00	1.65	11,380.00	0.00	11,380.00
Total	7,374.84	0.00	0.00	4,003.51	0.00	1.65	11,380.00	0.00	11,380.00



Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity

1 WBS:Project 1
22. E & S Controls

				Cost	Hours	Price
Worksheet: 22...0030.0 - Stabilized Construction Entrance						
WBS Quantity:	1.000	LS	perUoM:	4,405.29	30.000	6,479.00
AQ-Quantity:	1.000	LS	Total:	4,405.29	30.000	6,479.00

		Cost Group Assignments
Group Id	Description	

Notes:

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	11000250	Const-Equipment Operator II		2.000	16.000	61.67	Hrs		986.72
	11100250	Const-Equipment Operator (OT)		2.000	4.000	82.00	Hrs		328.00
	11000265	Laborer		1.000	8.000	47.10	Hrs		376.80
	11100265	Laborer (OT)		1.000	2.000	61.45	Hrs		122.90
	25BL426C	Skid Steer 287B		1.000	1.400	240.00	DAY		336.00
	25BDD4C0	Cat D4G LGP or Equal		1.000	1.400	140.62	DY		196.87
	50FG05	FOG		2.000	120.000	3.50	Gal		420.00
	52AG055	No. 2 Stone		1.000	60.000	20.50	TN		1,230.00
	52GT010	Geotextile		1.000	3,400.000	0.12	SF		408.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
1,814.42	532.87	0.00	0.00	2,058.00	0.00	0.00	0.00	4,405.29

Pricing

	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
UoM	4,405.29	0.00	0.00	2,073.54	0.00	0.17	6,479.00	0.00	6,479.00
Total	4,405.29	0.00	0.00	2,073.54	0.00	0.17	6,479.00	0.00	6,479.00



**Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity**

1
23. **WBS:Project 1**
Excavation & Installation

				Cost	Hours	Price
Worksheet: 23...0020.0 - Excavation						
WBS Quantity:	225.000	cy	perUoM:	28.77	0.267	46.16
AQ-Quantity:	225.000	cy	Total:	6,472.24	60.000	10,385.49

Cost Group Assignments

Group Id	Description
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Notes:

<u>Calculation Basis</u>							
Calculates Equipment Usage	((1/prodrate)*(7/wrkdywk))*nequip	Units Per	day				
FOG Rate	1/prodrate*usehrs*gph*nequip	Units Per	Gal				
Gallons per hour used	5	Units Per					
Calculates Overtime Hours	((1/prodrate*hrsdy)-(1/prodrate/dywk*40))*nper	Units Per	HR				
Production Rate	112.5	Units Per					
Calculates Labor Straight Time	1/prodrate/dywk*40*nper	Units Per	Hrs				

Estimate Details									
Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	11000250	Const-Equipment Operator II	ST	2.000	32.000	61.67	Hrs		1,973.44
	11100250	Const-Equipment Operator (OT)	OT	2.000	8.000	82.00	Hrs		656.00
	11000265	Laborer	ST	1.000	16.000	47.10	Hrs		753.60
	11100265	Laborer (OT)	OT	1.000	4.000	61.45	Hrs		245.80
	25HE320B	Excavator, Cat 320B or Equal	ER	1.000	2.800	450.00	DAY		1,260.00
	25ULBCA1	Rubber Tire Loader	ER	1.000	2.800	228.00	day		638.40
	50FG05	FOG	FG	3.000	270.000	3.50	Gal		945.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
3,628.84	1,898.40	0.00	0.00	945.00	0.00	0.00	0.00	6,472.24

Rahway River Fish Ladder Options
 RahwayFishLadder -
 Based on Qty:WQ-Quantity

1
 23. **WBS:Project 1**
 Excavation & Installation

23...0020.0 FlagRef #	Description	FRM	Factor	Total	URate	UoM	Man Hours	Total Cost
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Pricing

UoM	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
	28.77	0.00	0.00	17.39	0.00	0.00	46.16	0.00	46.16
Total	6,472.24	0.00	0.00	3,913.25	0.00	0.00	10,385.49	0.00	10,385.49



Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity

1 WBS:Project 1
23. Excavation & Installation

				Cost	Hours	Price
Worksheet: 23...0030.0 - Concrete Channel						
WBS Quantity:	100.000	LF	perUoM:	1,028.00	0.000	1,131.00
AQ-Quantity:	100.000	LF	Total:	102,800.00	0.000	113,100.00

Cost Group Assignments

Group Id	Description
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Notes: Concrete Channel 9' x 4'-6" x 100 lf x 6" Thick

Calculation Basis

Calculates Equipment Usage	$((1/\text{prodrate}) * (7/\text{wrkdywk})) * \text{nequip}$	Units Per	day
FOG Rate	$1/\text{prodrate} * \text{usehrs} * \text{gph} * \text{nequip}$	Units Per	Gal
Gallons per hour used	5	Units Per	
Calculates Overtime Hours	$((1/\text{prodrate} * \text{hrsdy}) - (1/\text{prodrate}/\text{dywk} * 40)) * \text{nper}$	Units Per	HR
Production Rate	207.5	Units Per	
Calculates Labor Straight Time	$1/\text{prodrate}/\text{dywk} * 40 * \text{nper}$	Units Per	Hrs

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
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SubItem: 1
Based on: 1.000LF Sub Item is Factor by a Quantity of: **1.000**
SubItem 1 is Lump Sum Subitem

SubItem Cos tPerUoM: 102,800.00
Sub Item Total Cost: 102,800.00

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	30CM012	Concrete		1.000	32.000	500.00	CY		16,000.00
	52MM020	Alum Trough		1.000	100.000	660.00	LF		66,000.00
	52MM026	Grating		1.000	800.000	26.00	SF		20,800.00



Rahway River Fish Ladder Options
 RahwayFishLadder -
 Based on Qty:WQ-Quantity

1	WBS:Project 1
23.	Excavation & Installation

23...0030.0 FlagRef #	Description	FRM	Factor	Total	URate	UoM	Man Hours	Total Cost
RAW COST TOTALS								
LABOR 0.00	EQUIPMENT 0.00	SUBCONTRACTS 16,000.00	INTERNALS 0.00	EXTERNALS 86,800.00	TRAVEL 0.00	P.I.C. 0.00	Bonds 0.00	TOTAL 102,800.00

Pricing									
	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
UoM	1,028.00	0.00	0.00	102.80	0.00	0.20	1,131.00	0.00	1,131.00
Total	102,800.00	0.00	0.00	10,280.00	0.00	20.00	113,100.00	0.00	113,100.00



**Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity**

1
23. **WBS:Project 1**
Excavation & Installation

				Cost	Hours	Price
Worksheet: 23...0035.0 - Backfill						
WBS Quantity:	75.000	cy	perUoM:	83.85	0.923	142.50
AQ-Quantity:	75.000	cy	Total:	6,288.77	69.231	10,687.50

Cost Group Assignments

Group Id	Description
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Notes:

<u>Calculation Basis</u>							
Calculates Equipment Usage	((1/prodrate)*(7/wrkdywk))*nequip	Units Per	day				
FOG Rate	1/prodrate*usehrs*gph*nequip	Units Per	Gal				
Gallons per hour used	5	Units Per					
Calculates Overtime Hours	((1/prodrate*hrsdy)-(1/prodrate/dywk*40))*nper	Units Per	HR				
Production Rate	32.5	Units Per					
Calculates Labor Straight Time	1/prodrate/dywk*40*nper	Units Per	Hrs				

Estimate Details									
Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	11000250	Const-Equipment Operator II	ST	2.000	36.923	61.67	Hrs		2,277.04
	11100250	Const-Equipment Operator (OT)	OT	2.000	9.231	82.00	Hrs		756.94
	11000265	Laborer	ST	1.000	18.462	47.10	Hrs		869.56
	11100265	Laborer (OT)	OT	1.000	4.615	61.45	Hrs		283.59
	25SC102	Trench Roller	ER	1.000	3.231	85.01	DY		274.67
	25ULBCA1	Rubber Tire Loader	ER	1.000	3.231	228.00	day		736.67
	50FG05	FOG	FG	3.000	311.538	3.50	Gal		1,090.38

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
4,187.12	1,011.26	0.00	0.00	1,090.38	0.00	0.00	0.00	6,288.76



Rahway River Fish Ladder Options
 RahwayFishLadder -
 Based on Qty:WQ-Quantity

1	WBS:Project 1
23.	Excavation & Installation

23...0035.0								
FlagRef #	Description	FRM	Factor	Total	URate	UoM	Man Hours	Total Cost

Pricing

	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
UoM	83.85	0.00	0.00	58.63	0.00	0.02	142.50	0.00	142.50
Total	6,288.77	0.00	0.00	4,397.37	0.00	1.36	10,687.50	0.00	10,687.50



**Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity**

1
23. **WBS:Project 1**
Excavation & Installation

				Cost	Hours	Price
Worksheet: 23...0050.0 - Plantings (Allowance)						
WBS Quantity:	1.000	LS	perUoM:	7,500.00	0.000	8,250.00
AQ-Quantity:	1.000	LS	Total:	7,500.00	0.000	8,250.00

		Cost Group Assignments
Group Id	Description	

Notes:

Calculation Basis

Calculates Equipment Usage	$((1/\text{prodrate}) * (7/\text{wrkdywk})) * \text{nequip}$	Units Per	day
FOG Rate	$1/\text{prodrate} * \text{usehrs} * \text{gph} * \text{nequip}$	Units Per	Gal
Gallons per hour used	5	Units Per	
Production Rate	800	Units Per	
Calculates Labor Straight Time	$1/\text{prodrate}/\text{dywk} * 40 * \text{nper}$	Units Per	Hrs

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	380007	Planting (Allowance)		0.750	0.750	10,000.00	LS		7,500.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
0.00	0.00	7,500.00	0.00	0.00	0.00	0.00	0.00	7,500.00

Pricing

	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
UoM	7,500.00	0.00	0.00	750.00	0.00	0.00	8,250.00	0.00	8,250.00
Total	7,500.00	0.00	0.00	750.00	0.00	0.00	8,250.00	0.00	8,250.00



Rahway River Fish Ladder Options
 RahwayFishLadder -
 Based on Qty:WQ-Quantity

1 **WBS:Project 1**
 24. Relocate Utilities (Allowance)

				Cost	Hours	Price
Worksheet: 24...0010.0 - Relocate Utilities (Allowance)						
WBS Quantity:	1.000	LS	perUoM:	25,000.00	0.000	25,000.00
AQ-Quantity:	1.000	LS	Total:	25,000.00	0.000	25,000.00

		Cost Group Assignments
Group Id	Description	

Notes:

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	52EL1001	Relocate Utilities Allowance		1.000	1.000	25,000.00	LS		25,000.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
0.00	0.00	0.00	0.00	25,000.00	0.00	0.00	0.00	25,000.00

Pricing

UoM	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
	25,000.00	0.00	0.00	0.00	0.00	0.00	25,000.00	0.00	25,000.00
Total	25,000.00	0.00	0.00	0.00	0.00	0.00	25,000.00	0.00	25,000.00



Rahway River Fish Ladder Options
 RahwayFishLadder -
 Based on Qty:WQ-Quantity

1
 25. **WBS:Project 1**
 Project Management

				Cost	Hours	Price
Worksheet: 25...0010.0 - Field Office						
WBS Quantity:	15.000	DY	perUoM:	726.70	10.000	1,343.00
AQ-Quantity:	15.000	DY	Total:	10,900.50	150.000	20,145.00

Cost Group Assignments

Group Id	Description
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Notes:
 Based on 15 days in the field
 Site Manager 10hours per day

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	50EU060	Port-a-Johns		1.000	15.000	4.50	day		67.50
	50EU025	Cell Phone Charges		2.000	30.000	5.00	Day		150.00
	50EBU005	Water, Support Trailer, Mnthly Service		1.000	15.000	5.00	day		75.00
	52MS0005	Misc. ODC's		0.500	7.500	50.00	EA		375.00
	10000320	Const-Superintendent		1.000	150.000	38.00	Hrs		5,700.00
	4001008	Pick-up Truck		1.000	15.000	75.00	DY		1,125.00
	50FG07	FOG		1.000	15.000	6.00	DY		90.00
	6000015	Per Diem Daily		1.000	21.000	158.00	Day		3,318.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
5,700.00	0.00	0.00	1,125.00	757.50	3,318.00	0.00	0.00	10,900.50

Rahway River Fish Ladder Options
 RahwayFishLadder -
 Based on Qty:WQ-Quantity

1	WBS:Project 1
25.	Project Management

25...0010.0								
FlagRef #	Description	FRM	Factor	Total	URate	UoM	Man Hours	Total Cost

Pricing

	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
UoM	726.70	0.00	0.00	616.18	0.00	0.12	1,343.00	0.00	1,343.00
Total	10,900.50	0.00	0.00	9,242.66	0.00	1.84	20,145.00	0.00	20,145.00



**Rahway River Fish Ladder Options
RahwayFishLadder -
Based on Qty:WQ-Quantity**

1 **WBS:Project 1**
25. **Project Management**

				Cost	Hours	Price
Worksheet: 25...0020.0 - Home Office						
WBS Quantity:	5.000	wk	perUoM:	1,434.30	36.000	5,578.00
AQ-Quantity:	5.000	wk	Total:	7,171.50	180.000	27,890.00

Cost Group Assignments

Group Id	Description
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Notes:
Project Manager to visit the site twice a month.

Estimate Details

Flag	Ref #	Description	FRM	Factor	Total	URate	UoM	Assembly Man Hours	Total Cost
	01000175	Construction QA/QC Specialist		1.000	10.000	45.00	Hrs		450.00
	01000680	Project Engineer		1.000	80.000	35.00	Hrs		2,800.00
	01000865	Project Manager		1.000	40.000	42.00	Hrs		1,680.00
	01000025	Admin Assistant		1.000	20.000	25.00	Hrs		500.00
	01000050	Cost Schedule Technician		1.000	10.000	67.09	Hrs		670.90
	02000010	Accounting clerk		1.000	20.000	39.78	Hrs		795.60
	600100	POV Milage		1.000	500.000	0.55	Mi		275.00

RAW COST TOTALS

LABOR	EQUIPMENT	SUBCONTRACTS	INTERNALS	EXTERNALS	TRAVEL	P.I.C.	Bonds	TOTAL
6,896.50	0.00	0.00	0.00	0.00	275.00	0.00	0.00	7,171.50

Pricing

UoM	DJC	AA	GC-Applied	Burden	MM	UPD	UP/IT	Discount	Revenue
	1,434.30	0.00	0.00	4,143.40	0.00	0.30	5,578.00	0.00	5,578.00
Total	7,171.50	0.00	0.00	20,717.00	0.00	1.50	27,890.00	0.00	27,890.00

ATTACHMENT 11

River Herring Stocking Programs Summary

ATTACHMENT 11

EXAMPLES OF RIVER HERRING STOCKING PROGRAMS IN THE NORTHEAST

Phase I Final Report, Fish Passage Needs and the Feasibility Assessment, City of New York, Parks and Recreation, March 2004

NEW YORK:

Peconic River (Byron Young, pers. comm.)

- NYSDEC is currently using stocking as part of a low cost, low tech approach to improving an existing run of river herring.

NEW JERSEY:

Batsto River (Mark Boriek, pers. comm.)

- New Jersey Division of Fish and Wildlife is currently stocking Batsto Lake, currently inaccessible habitat, with river herring.
- There is a plan to build fish passage over the dam that is blocking access to the lake in the near future.

Great Egg Harbor River (Mark Boriek, pers. comm.)

- New Jersey Division of Fish and Wildlife is currently stocking Lake Lenape, currently inaccessible habitat, with river herring.
- There is a plan to build fish passage over the dam that is blocking access to the lake in the near future.

NEW HAMPSHIRE:

Merrimack River (McKeon, pers. comm.)

- Alewives were stocked into Lake Winnisquam in Laconia, NH as a substitute forage for landlocked salmon because the smelt population they had foraged on had collapsed.
- Stocking of about 5,000 alewives annually resulted in large runs of herring in the Merrimack River in the late 1980's.
- Stocking ceased in the 1980's and the run that was generated from stocking in the Merrimack River began to collapse.
- In 1995 herring returns dropped to zero and USFWS began stocking inaccessible habitat where fish passage could be developed if the runs increase.

Cocheco River (McKeon, personal communication)

- A coastal stream, managed by stocking herring in currently inaccessible habitat
- Fish may never reach headwater areas on their own in the near future due to natural barriers but management efforts maintain reasonable runs of 40 – 60,000 fish.

Lamprey River

- A coastal stream, managed by stocking herring in currently inaccessible habitat. (McKeon, personal communication)
- The major elements of the program were construction of a fishway at the lowermost dam and a 5-year program of transplanting fish from below the dam to upstream areas. (ASMFC 1985 p V-37)

- Once substantial numbers of fish began passing through the fishway, trucking of fish was discontinued. (ASMFC 1985 p V-37)
- A run of 50,000 river herring was established by 1981, nine years after the initial stocking. (ASMFC 1985 p IV-67)

Exeter River

- A run size of over 15,000 was established by stocking in 1981 but declined to less than one thousand in 1982 and 1983. (ASMFC 1985 p IV-67)

MAINE:

Kennebec River (Maine DMR and Maine Atlantic Salmon Commission 2002)

- Plan to restore and enhance anadromous fish resources: Phase I (January 1, 1986 through December 31, 2001) involved restoration by means of trap and truck of alewives for release into spawning and nursery habitat. Phase II (January 1, 2002 through December 31, 2010), which is currently ongoing, involves providing upstream and downstream fish passage at Phase I release sites, as well as trap and truck operations to Phase II lakes.
- Due to the increased number of adult alewife returns to the Kennebec River since 1994, DMR typically not only meets Phase I stocking goals, but also has additional alewives available for other restoration sites in Maine. 153,103 adult alewives were collected from the Kennebec and stocked throughout the state in 2002. Stocking took place in over 20 ponds in the Kennebec drainage and 24 ponds in 11 other drainages: the Androscoggin, Bagaduce, Eastern, Mill Brook, Pemaquid, Royal, St. George, Seal Cove MDI, Sebasticook, Sheepscot, and Union.
- DMR deferred stocking alewives into the whole Sevenmile Brook drainage for a number of years due to the ongoing work in water quality improvement. In early 1995, DMR, DEP, and MDIFW agreed that alewife restoration at six alewives acre-1 would have no negative impact on water quality and may, in fact, have a positive long-term impact through phosphorus export from the lakes. A conservative stocking program was initiated in 1997.
- Despite the endorsement of the stocking plan by regional fishery biologists, MDIFW decided not to grant DMR permission to stock the Phase II lakes in 2002 as a result of some concerns from members of the Lake Association. Subsequently, DMR will initiate the stocking of Phase II lakes in 2003.

Royal River

- Fish passage facilities were constructed at two dams, and restoration was initiated by transplanting gravid adults from other systems. (ASMFC 1985 p V-37)
- Four years after the initial stocking of Sabbathday Lake, an estimated 50,000 alewives returned to the river in 1981, 24,160 returned in 1982, and 10,029 in 1983. (AMFC 1985 p IV-67)

MASSACHUSETTS:

- At least 20 streams being stocked with gravid adult alewife in 1985. (ASMFC 1985 p IV-67)
- 36,000 fish transported in 1981. (ASMFC 1985 p IV-67)
- Stocked at least 16 different river systems in 1992 with Monument River alewife to reestablish runs or augment resident populations. (Cooper et al. 1994)

Ipswich River

- Migrating blueback herring from the Charles River have been stocked into the Ipswich to boost river herring runs. (Doyle and Morrisson 2003)

Neponset River

- After a habitat feasibility study, the restoration project began stocking thousands of blueback herring from the Charles River in 1996. Stocking is ongoing and a study of fish passage alternatives was begun after stocking had already started. (Massachusetts DMF 2002)

Weweantic River

- In conjunction with a project to build a fish ladder over the dam to Horseshoe Pond, Massachusetts Department of Marine Fisheries will also stock Horseshoe Pond with 5,000 herring to boost the population. (Buzzard's Bay Project 2002)

MARYLAND:**Potomac River**

- The Woodrow Wilson Bridge Project includes restoring passage and a 5-year hatchery restocking program, through 2004. Approximately 2.7 million larval river herring have been released yearly since 2000. The stocking program hopes to accelerate the use of the opened upstream areas for future spawning and has also stocked herring fry in currently inaccessible habitat. (Potomac Basin Reporter 2001)

Patapsco and Patuxent rivers

- River herring have been transported from the Conowingo Dam on the Susquehanna and stocked into the Patapsco and Patuxent rivers. (ASMFC 1999 p41)

PENNSYLVANIA:**Susquehanna River**

- River herring are being trapped and transported to spawning waters above dams. (Pennsylvania Fish and Boat Commission 2002)
- Over 12,000 blueback herring were stocked above dams and 9,400 were given to Maryland for stocking in upper Chesapeake Bay tributaries. (Cooper et al. 1994)

RHODE ISLAND:

- Several inland streams were being stocked in 1992 with adult alewife from the Herring and Agawam rivers in Massachusetts.

Narrow River

Carr Pond was stocked with adult river herring from the Connecticut River and streams in Massachusetts. Fish are returning in the hundreds of thousands. (Cute 1999)