Lower Passaic River Restoration Project

DRAFT FINAL BIOLOGICAL LITERATURE REVIEW

December 2004

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December 1, 2004

Ms. Lisa A. Baron
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Office of Maritime Resources
New Jersey Department of Transportation
1035 Parkway Avenue, E & O Building
Trenton, NJ 08625-0837.

RE: Draft Final Biological Literature Review Report
Lower Passaic River Investigation and Feasibility Study
Remediation and Ecosystem Restoration Program
NJDOT Agreement No. 2001-NJMR02

Dear Ms. Baron:

Earth Tech is pleased to submit the attached Draft Final Biological Literature Review Report. This represents the interim deliverable for Task 2 – Environmental Resource Inventory Report that was prepared for the Lower Passaic River Investigation and Feasibility Study. This submittal is a partial fulfillment of the requirements under the above referenced contract for the Lower Passaic River Site. If you have any questions concerning this submittal, please call me at (973) 338-6680.

Very truly yours,

Earth Tech, Inc.

Original Signed

Mark D. Moese, Ph.D.
Senior Environmental Scientist

LOWER PASSAIC RIVER RESTORATION PROJECT

ENVIRONMENTAL RESOURCE INVENTORY

BIOLOGICAL LITERATURE REVIEW

BY
EARTH TECH, INC. AND MALCOLM PIRNIE, INC.

FOR
STATE OF NEW JERSEY
DEPARTMENT OF TRANSPORTATION
OFFICE OF MARITIME RESOURCES

DECEMBER 2004

Lower Passaic River Restoration Project

Table Of Contents

1.0 INTRODUCTION

1.1 Lower Passaic River Restoration

The Lower Passaic River has been identified by the U.S. Army Corps of Engineers (Corps) as a priority restoration area. This area includes the tidal portion of the Lower Passaic River Basin, extending from Newark Bay to the Dundee Dam (River Mile 17), and its tributaries. The preliminary assessment of water resource problems and needs in the Lower Passaic River Basin identified extensive habitat loss and degradation that has greatly reduced the structural and functional integrity of ecosystems within the study area. To design a successful restoration plan for the River, a dataset must be created that identifies and measures appropriate parameters so that restoration areas may be selected, created and monitored. This report presents a literature review of biological studies performed within the project boundaries.

2.0 GENERAL PRINCIPLES OF ECOSYSTEM RESTORATION

2.1 Ecosystem Restoration Data Needs

Ecosystem restoration attempts to alter an existing ecosystem so that it becomes more similar to a pre-disturbance model[1]. To attempt this alteration, a comprehensive dataset of the system to be restored must be collected including biological, physical, and chemical information. These types of data include a broad range of information that may or may not be necessary for the restoration. Therefore, a strategic selection of assessment criteria must be performed to accomplish the desired restoration goals.

The restoration process should consider, in addition to both extant and historical floral and faunal species present in the target system, "candidate species" that could utilize the system once structural improvements (i.e., habitat alteration, improved water quality) have been implemented. Ecological data from historic sources, other reaches of the Passaic and other river systems that are physically similar, but less impacted than the Passaic, could be valuable tools in restoration planning. Useful historic data would focus

[1] National Research Council. Restoration of Aquatic Ecosystems. National Academy Press. Washington D.C. 1992.

on species that could realistically utilize the restored system, rather than those whose current absences are due more to global pressures than local impacts.

2.2 Assessment Criteria

To achieve the envisioned goals of ecosystem restoration, assessment criteria must include both structural and functional attributes of the system, as well as pre-restoration data and reference area information. These criteria need to be ecologically consistent and linked to specific project objectives. For a project such as the Lower Passaic River Restoration, which covers a 17-mile stretch of river and the surrounding watershed, spatial and temporal variations also need to be assessed. Structural characteristics of an ecosystem measure its physical parameters, while functional characteristics are the valuable uses of the system.

Biological data comprise only one piece of the information matrix required for ecosystem restoration. The purpose of this biological literature review is to review the existing and available biological data for the Lower Passaic River. Once restoration opportunities are selected a future document will determine gaps in information regarding biological communities of the Lower Passaic, and assess the need for additional information to evaluate these communities. Further in the restoration planning process for the Lower Passaic River, these biological data need to be assessed in the context of other structural and functional aspects of the system to create an integrated database and plan for the River.

3.0 LOWER PASSAIC RIVER DATASET REVIEW

3.1 Existing Habitats

The "Project Management Plan: Lower Passaic River Investigation and Feasibility Study for Remediation and Ecosystem Restoration" (April 2003), prepared by the Corps, the U.S. Environmental Protection Agency (USEPA) and the New Jersey Department of Transportation - Office of Marine Resources (NJDOT-OMR), identified several types of restoration opportunities in the Lower Passaic River: benthic habitat, mud flat, open water, submerged aquatic vegetation (SAV), wetlands, floodplain, and shoreline.

Biological informational needs for each of these habitats are listed below and summarized in Table 1.

Benthic Habitat Restoration

- Macroinvertebrate community (epibenthic and infaunal)

Mud Flat Restoration

- Avian community
- Macroinvertebrate community
- Fish community
- Threatened and endangered species

Open Water Habitat Restoration

- Plankton community
- Fish community (resident and transient)
- Threatened and endangered species

Submerged Aquatic Vegetation Restoration

- SAV community
- Fish community (resident and transient)
- Macroinvertebrate community

Wetland Restoration

- Vegetative community
- Wildlife community (bird and mammal)
- Fish community (resident and transient)
- Macroinvertebrate community
- Threatened and endangered species

Floodplain Restoration

- Vegetative community
- Wildlife community (bird and mammal)
- Threatened and endangered species

Shoreline Restoration

- Vegetative community
- Wildlife community (bird and mammal)
- Fish community (resident and transient)
- Macroinvertebrate community
- Threatened and endangered species

3.2 Existing and Available Data: Overview

This literature review examined data that were available as of November 12, 2004. A list and brief overview of these data is included as Appendix A.

For the purposes of this review, the river is sub-divided into three sections:

- Mile 0-1, the transition area between Newark Bay and the Passaic River at Kearny Point
- Miles 1-7, referred to as the "Passaic River Study Area (PRSA)"; PRSA was the boundary of the Diamond Alkali Superfund site [Note: the PRSA data lists its river miles of coverage for the Lower Passaic River as Miles 0-6]
- Miles 7-17, the Lower Passaic River Upstream Reach.

As shown in Figure 1 Project Map Overview.

The Project Management Plan, Lower Passaic River (USACE, USEPA and NJDOT, 2003) lists additional areas, not located in the Lower Passaic River proper, for restoration opportunities:

- Oak Islands Yards (identified as area 4 in the Project Management Plan): this area is in the City of Newark, and borders Newark Bay; general ecological descriptions of habitat type are the only available data for this area (USACE, October 2000)
- Second River Corridor (identified as Area 5 in the Project Management Plan): Second River extends from its confluence with the Lower Passaic River (approximately at Passaic River Mile 8) upstream to Montclair, New Jersey.
- Passaic River left descending bank from Kearny Point to East Rutherford (identified as area 6 in the Project Management Plan). Shoreline data for this area is available, and is discussed in the Wetlands, Floodplain and Shoreline portions of sections 3.2.2 and 3.2.3
- Passaic River left descending bank, Wallingford and Garfield (identified as area 7 in the Project Management Plan). No data is available for this area.

3.2.1 River Mile (RM) 0-1

River Miles 0 – 1 of the Passaic River have been studied as part of the BSAF ecosystem development effort and the 1987 Army Corps report "Flood Protection Feasibility Main Stem Passaic River" Environmental Impact Statement (EIS). The flood tunnel data are presented in the EIS for the lower 17 miles as a single river reach and discussed below in the sections for river miles 1-7 and 7-17.

Benthic Macroinvertebrate Data (RM 0-1)

Jacques Whitford Company

A sampling program conducted by Jacques Whitford Company (JWC), Inc. in northern Newark Bay near Kearny Point on March 15, 2001, collected twelve benthic samples from the intertidal zone and twelve samples from the subtidal zone. Seven of the twelve intertidal and all twelve subtidal samples were analyzed to characterize the macrobenthic invertebrate community at these locations. The study concluded that the benthic data suggested an invertebrate community that was relatively low in diversity and species richness and that exhibited moderate abundance. The study also concluded that the observed taxa were "fairly representative" of those found in similar estuaries.

Mud Flat Data (RM 0-1)

Jacques Whitford Company

Newark Bay contains extensive mudflat area near Kearny Point. The JWC study discussed in the River Mile 0-1 Benthic Data and Open Water sections contains biological data, but only discusses mudflat habitat in a very general sense. Similarly, a companion document, "Regulatory Consultation Document For Future Ecosystem Development Near The Mouth Of The Passaic River, Kearney, New Jersey" (2000) prepared for BASF by JWC records the existence of a mudflat area south of Kearney Point. No other data on mud flat areas for River Mile 0-1 were available for review during preparation of this report.

Open Water Data (River Mile 0-1)

Jacques Whitford Company

A sampling program conducted by JWC in northern Newark Bay near Kearny Point during winter (February and March) and summer (June and August) 2001 utilized test netting and otter trawl gear to sample for winter flounder and summer flounder.

Sampling focused around two locations: Kearny Point and Droyers Point. The latter, also located in upper Newark Bay, is situated approximately one mile south east of Kearny Point, near the mouth of the Hackensack River.

Winter sampling collected the following species:

- Winter flounder (*Pseudopleuronectes americanus*)
- Atlantic silverside (*Menidia menidia*)
- Striped bass (*Morone saxatilis*)
- Three-spine stickleback (*Gasterosteus aculeatus*)
- Scup (*Stenotomus chrysops*)
- Anchovy (*Engraulidae* sp.)

Summer sampling collected the following species:

- Winter flounder
- Striped bass
- Weakfish (*Cynoscion regalis*)
- Summer flounder (*Paralichthys dentatus*)
- Northern pipefish (*Syngnathus fuscus*)
- Northern puffer (*Sphoeroides maculates*)
- Bluefish (*Pomatomus saltatrix*)
- Anchovy

As most winter flounder were caught near Droyers Point, the study concluded that the mudflats at Kearney Point did not serve as important winter flounder habitat.

Submerged Aquatic Vegetation (SAV) Data (RM 0 - 1)

Data on SAV communities and associated species are not available. Likewise, information on residential and transient fish communities and species utilizing SAV areas in River Mile 0 -1 are not available.

Wetland, Floodplain, and Shoreline Data (RM 0 - 1)

Jacques Whitford Company

During this review, no data on vegetative communities or wetland, floodplain, or shoreline habitat in River Miles 0 -1 were found. The JWC "Regulatory Consultation Document" (2000) qualitatively discussed birds, mammals and herptiles likely to be found in the Kearny Point area. The same document listed New Jersey and federal threatened/endangered species, and concluded that the site was currently used by peregrine falcon (*Falco peregrinus*) and osprey (*Pandion haliaetus*), two species listed as endangered and threatened, respectively, by the State of New Jersey.

While the following species where not known to be present at the site, the JWC report also concluded that it was "possible" that they could use the site vicinity in some fashion:

- Bald eagle (*Haliaeetus leucocephalus*)
- Shortnose sturgeon (*Acipenser breviostrum*)
- Northeastern beach tiger beetle (*Cicindela doesalis dorsalis*)
- American bittern (*Botaurus lentiginosos*)
- Pied-billed grebe (*Podilymbus podiceps*)
- Yellow-crowned night-heron (*Nyctanassa violaceus*)
- Black -crowned night-heron (*Nycticorax nycticorax*)
- Piping plover (*Charadrius melodus*)
- Black skimmer (*Rynchops niger*)
- Least tern (*Sterna antillarum*)
- Sedge wren (*Cistothorus platensis*)
- Red knot (*Calidris canutus*)
- Black rail (*Laterallus jamaicensis*)
- Savannah sparrow (*Passerculus sandwichensis*)
- Seabeach amaranth (*Amaranthus pumilus*)

3.2.2 Passaic River Study Area Six Mile Reach (RM 1 – 7)

River Miles 1 - 7 (six miles) of the Passaic River have been studied as part of the Remedial Investigation for the Diamond Alkali Superfund Site, the New Jersey Turnpike Authority EIS, and the US Army Corps of Engineers Flood Passaic River Tunnel EIS.

The Superfund study refers to this stretch of river as the Passaic River Study Area (PRSA), which is primarily located in Newark, New Jersey. The PRSA spans five navigation reaches, as defined by the Corps, (proceeding upriver from the river mouth): Point No Point Reach, Harrison Reach, Newark Reach, Kearny Reach, and Arlington Reach. The Project Management Plan (2003) refers to this section of the River as Area #1. Land use along the PRSA is dominated by high-density commercial and industrial/commercial development, resulting in little or no public access to the River and limited "green space."

Benthic Macroinvertebrate Data River Miles (1 – 7)

TSI Data

Benthic macroinvertebrate data is available for this stretch of the River. Fifteen stations and three Mullica River reference areas were sampled in Fall 1999 and Spring 2000 for the PRSA Preliminary Findings Report (Tierra Solutions Inc., 2001). Community metrics and statistical analyses were performed as part of these studies. Samples were collected using either a petite ponar or modified VanVeen sampler. Three replicates were collected per station; collected specimens were identified to the lowest practicable.

Benthic community species richness and Shannon-Wiener Diversity H´ were calculated from 1995 data. Species richness was reported as low (ranging from 4 to 6), while H´ ranged from 0.236 to 1.66, showing low diversity, typical of impacted communities (Stainken 1984). The study observed that the benthic community is primarily comprised of pollution tolerant organisms (i.e., oligochaetes and polychaetes).

Passaic River stations, when compared to reference stations, exhibited:

- Higher range of Number of Total Individuals per Square Meter
- Lower range of Number of Taxa
- Lower Shannon-Weiner Diversity value
- Lower Percent Abundance of Crustacea

The above comparisons, when taken together, suggest that Passaic River samples represent stressed conditions.

Passaic River stations and reference station data were roughly similar in terms of:

- Pielou Evenness
- Brillouin Diversity
- Schwartz Dominance

TSI also provided an overall rating for each of the 15 Passaic River stations; 6 stations were rated poor, 4 stations poor to good, 4 stations good and 1 station excellent. Available data indicates that the benthic invertebrate community in the Passaic River is comprised of a relatively large number of pollution-tolerant species and, unlike the community at reference stations in the Mullica River, is representative of stressed water and sediment conditions.

NJ Turnpike Authority Data

The Final Environmental Impact Statement produced by New Jersey Turnpike Authority (September 1987) discussed, in general terms, benthic invertebrate species found in local water bodies (including the Lower Passaic River) and concluded that the biota at most sites exhibited signs of stress (New Jersey Turnpike Authority 1987).

Chemrisk Data

The Screening Level Ecological Risk Assessment conducted by Chemrisk (1995) includes a brief discussion of previous sampling conducted in the lower Passaic River, which indicated relatively low benthic community diversity; the authors qualified these observations by noting that some of the previous sampling was conducted near combined sewer outfalls. Quantitative data are not presented in this report. Six locations were sampled. The authors note that species composition (dominated by polychaetes in more saline sections of the river and by oligochaetes in upstream areas with lower salinity); Shannon-Weaver diversity (which ranged from 0.236 to 1.66) and abundance were typical of a degraded estuarine environment (Chemrisk 1995).

National Coastal Assessment Program Data

The available data consists of a single sampling event at a station in the Newark-Kearny reach of the Passaic River. The sample consisted largely of chironomids, which NJDEP

lists in their Ambient Biomonitoring Network Generalized Executive Summary (August, 2004) as taxa usually indicative of poor water quality; other data included were:

- Sieve mesh size
- Total number of species
- Species collected
- Number of each individual species.

US Army Corps of Engineers

The 1987 Army Corps EIS discusses the Lower Passaic River from the Dundee Dam to the confluence with Newark Bay as a single river reach. This report indicates that the benthic community is pollutant tolerant due to the heavy organic loadings and is comprised of chironomid larvae, tubificid worms, nematodes, leeches and polychaete worms.

Mud Flat Data (RM 1 - 7)

TSI Data

Mud flat study areas were also sampled as part of the 2001 PRSA study (TSI 2001). Six of the 15-benthic stations were located in the mud flat areas. The study determined that approximately 8% of the PRSA is intertidal (mud) flat. Based on the community metrics used, TSI rated two stations as good, two locations as poor to good, and two stations as poor. Avian communities were also sampled and analyzed.

NJ Turnpike Authority Data

The FEIS study produced by New Jersey Turnpike Authority (September 1987) estimated the occurrence of mudflat area in certain Passaic River reaches. In the following section, "right" and "left" refer to those directions as seen when one looks downstream from the Dundee Dam:

- Point No Point Reach (none on the right bank, 1,500 ft on the left bank)
- Harrison Reach (4,000 ft on the right bank, 2,500 ft on the left bank)
- Newark Reach (750 ft on the right bank, none on the left bank)
- Kearny Reach (1,000 ft on both right and left banks)
- Arlington Reach (none on the right bank, 680 ft on the left bank).

The FEIS also contains lists of bird and plant species typically found in a zone extending from Route 46 to the Passaic River, along the I-95 corridor. No quantitative data are presented in this report.

Open-Water Data (RM 1 - 7)

US Army Corps of Engineers

The 1987 Army Corps EIS report discusses the fish community in the estuarine section of the river, which it defines as the lower 12.3 miles. It describes the community as being comprised of pollution tolerant fish, with a smaller component of "persistent" game fish, and states that the presence of juvenile anadromous fish in this section of the river indicates successful spawning by these species. The species collected include Atlantic Tomcod, red and silver hake, northern pipefish, mummichogs, Atlantic silversides, alewife, American Shad, blueback herring, striped bass, and white perch.

Chemrisk Data

The Chemrisk 1995 Ecological Risk Assessment (ERA) included data on plankton and periphyton species collected in the Passaic River during Fall 1981 and Spring 1982 from four stations. The Chemrisk ERA also collected fish from four locations in the Passaic River using gill nets, minnow traps and dip nets; results were used to generally characterize fish populations at the four stations. Mummichog and Atlantic silverside dominated the catch. No finfish were caught in the gill nets, though some carp were observed in the area.

TSI Data

Fish were collected as part of the PRSA study in Summer/Fall 1999 and Spring 2000 (15 stations); sampling methodology included targeting 3 river reaches (lower, middle and upper-river) using multiple gear types (gill nets, eel traps, minnow traps and crab traps). Data collected included length, weight, and pathology for certain species (TSI 2002). A total 22 species were caught; samples were dominated by mummichog and blue crab. The total number of fish caught by all gear was 4,329, (3,337 mummichogs, 477 inland silversides, and 232 white perch,) and 1,500 blue crabs. TSI (2002) concluded that the Passaic River fish community, which is dominated by mummichogs and blue crabs, is limited and exhibits low diversity.

National Coastal Assessment Program Data

The available data consists of a single sampling event at a station in the Newark-Kearny reach of the Passaic River. Captured species were:

- Menhaden
- White perch
- Atlantic tomcod
- Striped bass

The report also includes data on method of capture, total number of each captured species and the length of each fish in centimeters.

Submerged Aquatic Vegetation (SAV) Data (RM 1 - 7)

TSI Data

Data on SAV communities and species in the PRSA are not available. Only emergent species are discussed in the TSI study (2002).

Likewise, data on benthic macroinvertebrate communities and resident and transient fish communities utilizing SAV areas in the PRSA are not available. It is not known whether the fish community sampling conducted as part of the PRSA study occurred in SAV areas.

Wetland, Floodplain, and Shoreline Data (RM 1 - 7)

TSI Data

TSI (2002) collected visual data of the PRSA. The shoreline along the PRSA was examined, videotaped, and analyzed by habitat type, which consisted of bulkhead, riprap, vegetation mixed with riprap, and aquatic vegetation. The data provide definitions and physical extent of each habitat type, including area measured in feet and percentage of each habitat type for each bank of a particular river reach. In the following section, "right" and "left" refer to those directions as seen when one looks downstream from the Dundee Dam.

The Point-No-Point Reach right bank consists of:

- 1,219 feet of bulkhead

- 4,128 feet of riprap
- 883 feet of vegetation mixed with riprap
- 1,407 feet of aquatic vegetation

The left bank consists of:

- 4,994 feet of bulkhead
- 2,873 feet of riprap

The Harrison Reach right bank consists of:

- 4,524 feet of bulkhead
- 4,508 feet of riprap
- 2,171 feet of vegetation mixed with riprap
- 519 feet of aquatic vegetation

The left bank consists of:

- 3,131 feet of bulkhead,
- 4,037 feet of riprap
- 3,409 feet of vegetation mixed with riprap
- 1,917 feet of aquatic vegetation

The Newark Reach right bank consists of:

- 6,860 feet of bulkhead
- 1,562 feet of riprap

The left bank consists of:

- 5,973 feet of bulkhead
- 1,796 feet of riprap

The Kearney Reach right bank consists of:

- 4,802 feet of bulkhead
- 526 feet of riprap

The left bank consists of:

- 3,214 feet of bulkhead
- 800 feet of riprap
- 1,189 feet of vegetation mixed with riprap.

Note: part of the Kearny Reach falls in the RM 1-7 section of the river, as defined in this review, while the remainder is located in the RM 7-17 section. Results are combined here for clarity.

Overall, TSI (2002) determined that the cumulative habitat in the PRSA study area included, on the right bank:

- 17,978 feet of bulkhead (52.5% of the right bank total)
- 10,794 feet of riprap (32.3%)
- 3,054 feet of vegetation mixed with riprap (9.2%)
- 1,976 feet of aquatic vegetation (6.0%)

The left bank cumulative habitat was comprised of:

- 17,312 feet of bulkhead (51.9% of the left bank total)
- 9,506 feet of riprap (28.5%)
- 4,598 feet of vegetation mixed with riprap (13.8%)
- 1,917 feet of aquatic vegetation (5.8%)

According to the TSI (2002) analysis, all shoreline habitats were degraded, with little habitat value; the key remaining habitats in the PRSA were the intertidal mud flats and the mouth of Frank's and Lawyer's Creek.

According to the TSI study, aquatic vegetation was represented by emergent wetland species, such as smooth cordgrass (*Spartina alterniflora*) and common reed (*Phragmites australis*). The study characterized areas with aquatic vegetation interspersed with riprap and bulkhead areas of riprap shoreline with significant over-hanging riparian vegetation as 'vegetation areas mixed with riprap'. Wetland communities in PRSA can be characterized as either patchy cordgrass or monocultures of common reed based communities.

US Army Corps of Engineers

The 1987 Army Corps EIS indicated that despite the preponderance of urban and industrial land in the lower 17 miles of river, urban wildlife resources include raccoon, eastern gray squirrel, eastern cottontail rabbit and opossum with approximately 45 acres of remaining wetland (4 acres of palustrine forest, one acre of palustrine scrub-shrub wetland and 40 acres of emergent wetland).

Avian Data (River Mile 1-7)

TSI Data

A four-season avian survey was conducted from autumn 1999 through summer 2000 at four locations within the PRSA (TSI 2002). The survey examined mud flat, wetland, floodplain, and shoreline areas. TSI observed 48 avian species. Spring, summer and autumn had similar numbers of observed species (24, 21, and 22, respectively); only 8 species were observed during winter. These 48 species fall into 18 general classifications: wading birds; swans, geese and ducks; pelicaniformes; diurnal raptors; shore birds; gulls; old world parrots; pigeons and doves; kingfishers; tyrant flycatchers; jays and crows; swallows; mimids; starlings, cardinals; emberzine sparrows and allies; icterids; and finches and old world sparrows. Based on available data, the bird community in the study area appears to be dominated by gulls, swallows and doves.

Chemrisk and NJ Turnpike Authority Data

Studies conducted in the Lower Passaic River Basin by Chemrisk (1995) and NJ Turnpike EIS (1985-1990) simply listed species observed during fieldwork. No quantitative data or associations to habitat type are presented.

The Chemrisk study (1995) contacted the New Jersey Department of Environmental Protection, The U.S. Fish and Wildlife Service and the National Marine Fisheries Service regarding the possible presence of federal or state listed species in the project vicinity; responses from all three agencies indicated that such species were not known to be present in the area. No additional data are available for threatened and endangered species in the PRSA.

US Army Corps of Engineers

The 1987 Army Corps EIS points out that portions of the Lower River are used by certain species of water fowl as stop-over habitats including the canvasback, redhead, bufflehead, mallard and black duck with house sparrows filling the niche left by song birds.

3.2.3 Upstream Reach of the Lower Passaic River (RM 7 - 17)

Data available for the Lower Passaic River between the PRSA and the Dundee Dam are very limited.

Land use along this portion of the Lower Passaic River is a mix of commercial and residential development, with significantly more public access and "green space" than the PRSA. The Project Management Plan (April 2003) identifies and discusses several restoration opportunity areas located on or along River Miles 7 – 17 of the Lower Passaic River

- Area #3 – Upstream Reach (Belleville, Nutley, Rutherford and Wallington reaches)
- Area #7 (Passaic river descending left bank, Wallingford and Garfield)
- The northern portion of Area #6 (left descending bank – East Rutherford to Kearny Point

Benthic Macroinvertebrate Data (River Miles 7 - 17)

NJDEP Data

Limited quantitative benthic community data exists from two NJDEP Ambient Biomonitoring Network (AMNET) stations collected in 1998 (NJDEP 2000). The stations are located at:

- The outlet of the Dundee Dam
- Second River near its confluence with the Passaic River
- Third River in Brookdale and Nutley

Available datasets from these AMNET stations are currently limited to a single sampling event; presumably, more data would be available in the future from this ongoing program. Organisms in this dataset are only identified to Family level.

Dundee Dam station: 16 Families were identified in the sample, which was comprised of 100 individuals. Some pollution tolerant organisms were found at this location; accordingly, NJDEP classified this station as moderately impaired. At the Second River station, 17 Families were identified in a sample comprised of 110 individuals; NJDEP determined that this location was moderately impaired as well. For both Third River

locations 11 to 13 Families were identified with 100 individuals at each station; NJDEP determined that these locations were moderately impaired.

National Coastal Assessment Program Data

The USEPA Coastal Assessment sampling program has a Passaic River sampling station located near the Bellevue-Lyndhurst area. While the resulting data are quantitative, available results are also limited to a single sampling event. The lone sample yielded only 2 individuals, a tubificid and a gastropod. A second sampling event was performed in 2001, however the data are not available.

US Army Corps of Engineers

The 1987 Army Corps EIS discusses that the benthic community in the lower 17-miles of the Passaic River is pollutant tolerant due to the heavy organic loadings and is comprised of chironomid larvae, tubificid worms, nematodes, leeches and polychaete worms.

Mud Flat Data (RM 7 - 17)

No data on mud flat areas or local bird populations for River Miles 8-17 were found during this data review. While some benthic macroinvertebrate data for River Miles 8-17 exist, as detailed in the previous section, it is not currently known if any data specifically correspond to mud flat areas.

Open Water Data (RM 7 - 17)

Chemrisk Data

The Chemrisk Screening-Level Human Health and Ecological Risk Assessment for the PRSA (Volume I, Draft Report) mainly focused on River Miles 1-7, but contained lists of plankton and periphyton species collected at one station located at River Mile 8.

National Coastal Assessment Program Data

The USEPA Coastal Assessment sampling program has a fish sampling station located in Upstream Reach of the Lower Passaic River near Bellevue-Lyndhurst. The fish sample collected at the two stations contained only two individuals: a white perch and an Atlantic menhaden. While the data are quantitative, they are limited to a single sampling event. A second sampling event was conducted in 2001, however the data are not available.

US Army Corps of Engineers Data

The 1987 Army Corps EIS discusses the fish community in the fresh water section of the river (Miles 12.3 –17), characterizing it as pollution stressed warm water fishery.

Submerged Aquatic Vegetation (SAV) Data (RM 7 - 17)

Data on SAV communities and species are not available. Likewise, information on residential and transient fish communities and species utilizing SAV areas in River Miles 7-17 are not available.

Wetland, Floodplain, and Shoreline Data (RM 7 - 17)

TSI Data

TSI (2002) collected visual data of the Passaic River. The shoreline along the river was examined, videotaped, and analyzed by habitat type, which consisted of bulkhead, riprap, vegetation mixed with riprap, and aquatic vegetation The study included the following shoreline data for the Arlington Reach of the Passaic River.

The right bank consists of:

- 573 feet of bulkhead
- 70 feet of riprap

The left bank consists of

- 30 feet of riprap
- 655 feet of vegetation mixed with riprap

TSI (2002) concluded that all shoreline habitats were degraded, with little habitat value.

US Army Corps of Engineers

The 1987 Army Corps EIS indicated that despite the preponderance of urban and industrial land in the lower 17-miles of river, urban wildlife resources include raccoon, eastern gray squirrel, eastern cottontail rabbit and opossum with approximately 45 acres of remaining wetland (4 acres of palustrine forest, one acre of palustrine scrub-shrub wetland and 40 acres of emergent wetland).

Avian Data (River Mile 7-17)

US Army Corps of Engineers

The 1987 Army Corps EIS points out that portions of the Lower River are used as stop-over habitat by certain species of water fowl including the canvasback, redhead, bufflehead, mallard and black duck with house sparrows filling the niche left by song birds.

4.0 CONCLUSIONS

Limited available data exists for certain habitat types in the Lower Passaic River (RM 1-7), while for the Upstream (RM 7-17) Reaches, the River's tributaries including the Second River corridor, and the Oak Island Yards wetland area there is even less available data, and slightly more for Lower Reach (RM 0-1) of the Lower Passaic River.

Kearny Point (RM 0-1)

Existing data include information on:

- Benthic invertebrates
- Fish community
- Threatened & Endangered species
- Birds, mammals and herptiles

Lower Passaic River (RM 1-7)

Existing data include information on:

- Benthic invertebrates
- Fish community
- Threatened & Endangered species (brief discussion)
- Plankton
- Birds
- Extent of mudflat areas in certain reaches of the river.

The Upstream Reach (RM 7 – 17) has very limited data on benthic macroinvertebrate communities, open water communities (i.e., fish and plankton) and mudflat areas, and no data for SAV and shoreline vegetation.

One NJDEP benthic invertebrate station is at the confluence of Second River and the Passaic River, while two sampling stations from the 1987 Army Corps report "Flood Protection Feasibility Main Stem Passaic River" are available along the Second River. Only general data were found for the Oak Island Yards wetland area; the sole source of information being the "Restoration Options Report" (USACE October 2000), which describes habitat associated with the property, such as marsh habitat, tidal creeks and pools, and the presence of vegetative species, such as *Spartina* and *Phragmites*.

To develop a restoration plan for the Lower Passaic River, additional biological data will need to be collected for habitat types and sections of the River and study area that are identified as candidate restoration sites, as well as from other reaches of the Passaic River, and similar river systems in the northeast. Since characterization of existing or candidate biological communities will inform the development of specific potential restoration projects, future sampling programs must focus on gathering data pertinent to estoration efforts. In addition, restoration success will be measured, to some degree, by observation of the post-restoration biological community development.

APPENDIX A

LOWER PASSAIC RIVER RESTORATION STUDY
DOCUMENT REVIEW

GENERAL PROJECT DATA

USACE, USEPA, OMR/NJDOT. April 2003. Project Management Plan: Lower Passaic River New Jersey. Investigation and Feasibility Study for Remediation and Ecosystem Restoration.

Plan outlines and describes all tasks to be undertaken for the Lower Passaic investigation and feasibility study, including an environmental resource inventory report.

Data Summary: No specific biological data.

USACE, October, 2000. Restoration Options Report

Contains general descriptions of habitat types present on Oak Island

Data Summary: No quantitative data.

NJDEP, 1998. Bureau of Freshwater and Biological Monitoring.

Invertebrate data for one sampling event for each of four stations: a) AN0292O (Passaic River, proximal to outlet of Dundee Dam); b) AN0292 and AN0292A (both stations are on the Third River, upstream of confluence with the Passaic River); AN0293 (Second River at confluence with the Passaic River). Additionally, 1993 data for station AN0292A.

- Number of taxa
- Total number of individuals
- % Contribution of dominant family
- Family biotic index
- Scraper/Filterer Collector ratio
- Shredder/Total ratio
- EPT species
- % EPT
- Various observations regarding physical habitat.

Notes: Visual observations of substrate, but no corresponding grain size or TOC data. Most taxa are identified to Family level.

Data Summary: Benthic sampling, (1998 and 1993), four stations (all above PRSA; three in tributary river confluences, one downstream of Dundee Dam).

Jacques Whitford Company, Inc. 2002. Marine Environmental Sampling Program, Kearny Point New Jersey; BASF Corporation.

The study conducted test fishing to evaluate the possibility that winter flounder and summer flounder utilize mudflat areas in Newark Bay proximal to Kearny Point as spawning or juvenile rearing areas. Sampling was conducted via otter trawl in winter and summer, 2001 near both Kearney Point and a reference area (Droyers Point). Four trawls were completed in both areas on each of three days in the winter (February/early March) and on each of two days during the summer (June and August). Collected fish were identified by species, measured, weighed and examined for overall and reproductive condition.

Benthic Samples were collected via modified Ted Young Grab, on March 15, 2001. Twelve samples each were collected from both the intertidal and subtidal zones. Seven of the twelve collected intertidal samples, and all twelve subtidal samples were processed. Species richness, abundance, evenness and diversity were calculated from the resulting data.

Data Summary: Quantitative data

Jacques Whitford Company, Inc. 2000. Regulatory Consultation Document for Future Ecosystem Development near the Mouth of the Passaic River, Kearny, New Jersey; BASF Corporation.

This document reviews existing ecological information on the Kearny Point vicinity, including upper Newark Bay and associated mudflat areas. State and federally listed species and fish managed under the National Marine Fisheries Service Essential Fish Habitat program are discussed, and their potential utilization of the project vicinity is considered.

Data Summary: No quantitative data.

Tierra Solutions, Inc., 2002. Passaic River Study Area Benthic Community Data
The report contains raw data for the fall 1999 and spring 2000 program that sampled Passaic River (15 stations) and the Mullica River (3 stations). Three replicates were collected at each station. Data were previously summarized in the TSI 9/26/2002 Data Presentation Summary. Data include:

- Dates sampled.

- Collected organisms identified at least to the Genus level. The majority of organisms are identified to the species level; common names are often included.
- Organism counts per replicate.
- Total Count (number of individual taxa at each station), Density (number of individual taxa/m^2 at each station), Percent of Total (number of individual taxa at each station/ number of all organisms collected at each station), Total Taxa (per station), Total Specimens, Total Density (number/m^2).

Report also notes that specimens were collected using a Petite Ponar Grab (0.023m^2) sampler.

Data Summary: Quantitative Data

New Jersey Turnpike Authority, September 1987. New Jersey Turnpike 1985-90 Widening Final Environmental Impact Statement Interchange 11 to U.S. Route 46

Biological sections cover two zones: Woodbridge to the Passaic River and the Passaic River to Route 46. The document contains information on the number of mammal and herptile species observed in the Lower Passaic River area and qualitative information on which fish, benthic invertebrate and bird species have been observed in this area. The document mentions a Technical Study Volume II: Biological Resources, which may have additional information.

Data Summary: Numbers of species of mammal and herptiles were given (no species names) and species of fish, benthic invertebrates, and birds listed.

ChemRisk, July 6, 1995. Screening-Level Human Health and Ecological Risk Assessment for the PRSA Volume I, Draft Report and Volume IIB Appendices;

Study area is the lower 6-mile section of the Passaic River. Contains qualitative information on plankton and periphyton species found in study area (and one station slightly upstream), fish species, and benthic invertebrate species. Also, contains qualitative information on bird and mammal species and vegetation found in the study area. The references section of the document contains other possible data sources for plankton, fish, benthic invertebrates and bird species currently or historically present in the study area. All plankton data are from previous studies in the 1980s and some fish and benthic data are from 1994.

Data Summary: Plankton: phyto- 5 stations 1 season, zoo- 1 station, 1 season, periphyton 5 stations, 2 seasons. Fish and Benthic data. 6 stations, 2 seasons. Bird and mammal data is a list of species.

National Coastal Assessment Program., 2000.

Two files (fish and invertebrate), each containing data resulting from a single sampling event (08/21/2000) for two Passaic River Stations: a) *NJ00-0011-B* (near Newark/Kearny); b) *NJ00-0013 – A* (near Bellevue and Lyndhurst).

1) Fish Data
    - Method of capture
    - Total number of captured fish species
    - Species captured
    - Number of each individual species
    - Length of each fish in cm

2) Invertebrate Data
    - Sieve mesh size
    - Total number of species
    - Species collected
    - Number of each individual species

Notes: No corresponding qualitative (visual) observations or sediment grain size or Total Organic Carbon (TOC) data are available in this file. 50% of taxa are identified to Family level and above.

Data Summary: Fish and benthic sampling, two stations (one below PRSA and one above PRSA), one event (August 2000).

Passaic River Study Area Habitat Characterization TSI, Inc. Newark, NJ. (September 2002)

This document contains data on shoreline Habitat Type in the Newark, Kearny and Arlington reaches of the Lower Passaic River Study Area. Data were previously summarized in the TSI 9/26/2002 Data Presentation Summary. Habitat types are classified as:

- Bulkhead.
- Riprap.
- Vegetation mixed with riprap.
- Aquatic Vegetation.

The document provides definitions of each habitat type, as well as cumulative totals for each type.

Data include:

- Feet of each Habitat Type
- Percent of Total Habitat
- Each data category is specific to Right Bank or Left Bank of the river.

Data Summary: Quantitative Data

Passaic River Study Area Avian Survey TSI, Inc. Newark, NJ. 2002

The report contains raw data for the 1999/ 2000 program that survey birds observed in the Lower Passaic River Study Area. Data were previously summarized in the TSI 9/26/2002 Data Presentation Summary. Data include:

- Species observed (including aquatic species).
- Aquatic species observed by season.
- Dates, time, tide stage and weather conditions.
- Species observed fall 1999 and winter, spring, summer 2000 by date, time, tide, River Mile, location (e.g., mid-river, left bank, etc.) life stage and structure (e.g., mud flat, water, etc.).
- Seven maps that break down the Lower Passaic River Study Area in tenth of a mile segments that also identify mud flat areas.

Data Summary: Quantitative Data

USACE, December 1987. Flood Protection Feasibility Main Stem Passaic River.

This document discusses the fish community in the estuarine (miles 1-8) and freshwater (river miles 8-17) sections of the river.

Data Summary: Quantitative data.

Passaic River Study Area Fish Community Data TSI, Inc. Newark, NJ. September 18, 2002

The report contains raw data for the fall 1999 and spring 2000 program that collected fish and Blue crab in the Passaic River. Fish are identified to the species level. Data were previously summarized in the TSI 9/26/2002 Data Presentation Summary. Data include:

- Summary of fish caught in the Passaic River Study Area, by all gear types.
- Catch per Unit Effort (CPUE) by gear type, all stations combined.
- Summary of length data for fish (except Mummichog), all stations, all gear types.
- CPUE by station for fish caught by gillnet, fall 1999/spring 2000.
- Summary of length data for fish (except Mummichog), all stations, all gear types.
- Summary of length data for fish (except Mummichog), fall 1999/spring 2000 by station, all gear types.
- Summary of weight data for fish (except Mummichog), all stations, all gear types.

- Summary of weight data for fish (except Mummichog), fall 1999/spring 2000 by station, all gear types.
- CPUE by station for Blue crab in Passaic River Study Area.
- Summary of length and weight by station and event for blue crab in Passaic River Study Area.
- CPUE for Mummichog caught by minnow trap in Passaic River Study Area.
- Sex ratios for Mummichog caught by minnow trap in Passaic River Study Area.
- Summary of length and weight by station and event for male Mummichog caught in Passaic River Study Area.
- Summary of length and weight by station and event for female Mummichog caught in Passaic River Study Area.
- Non-target fish caught in minnow traps in Passaic River Study Area by Station, fall 1999 and spring 2000 combined.

Data Summary: Quantitative Data

Lower Passaic River Restoration Project: Draft GIS Mapping Overview and Design Report. December 2003.

Report presents the results of a Geographic Information System (GIS) data inventory and needs assessment conducted for the Lower Passaic and its watershed, as well as other water bodies in the area (e.g., Hackensack River, Newark Bay, Berry's Creek, Arthur Kill, etc.)

GIS information includes NJDEP tidal shoreline and tidelands, National Wetlands Inventory (NWI) and NJDEP wetlands, some critical wildlife habitat, NJDEP stream and watershed data, and current T&E.

Data gaps identified in the report include bathymetric data for Lower Passaic River mile 8 to the Dundee Dam, historic ownership and use information, and buried infrastructure data. Also, tidal data is from before 1991, updated data may be necessary. NWI and NJDEP wetland mapping does not show level of detail necessary for restoration development. Critical wildlife habitat focus is on lower 6 miles; NJDEP has some additional data on the upstream area. Other data gaps in GIS: fisheries, hardened shoreline, public parklands, SAV, groundwater data, historic wetlands, and historic T&E.

Data summary: Locational data on State and federal wetland and T&E areas. (See Table 2)

Other Documents Reviewed

Potential Long-Term Ecological Impacts Caused by Disturbance of Contaminated Sediments: A Case Study. Su, Steave H., L.C. Pearlman, J.A. Rothrock, T.J. Iannuzzi, B.L. Finley. Environmental Management Vol. 29, No. 2, pp. 234-249. Springer Verlag New York, Inc. 2002.

This study examined the potential chemical bioaccumulation from the water column into residential aquatic receptors during submerged barge removal in the Passaic River. Conclusions were based on the measurement of turbidity levels and chemical parameters during the removal.

Data Summary: No specific biological data.

Urban angler's perception of risk from contaminated fish. Pflugh, Kerry Kirk, L. Lurig, L.A. Von Hagen, S. Von Hagen, J Burger. The Science of Total Environment 228 (1999) 203-218.

Study performed to study the risk perceptions and knowledge of fish consumption advisories of recreationally caught fish and crabs among urban anglers in the Newark Bay Complex. The Newark Bay Complex includes the Lower Passaic River as well as tidal portions of the Hackensack River, Arthur Kill, and the Kill van Kull.

Data Summary: No specific biological data.

Chemical Land Holding letter to EPA. Remedial Investigation Feasibility Study – Ecological Sampling. (Mud flat Locations and Tissue Configurations). April 25, 2000.

This letter presents late Summer/early Fall fish catch data for the PRSA from OCC. Letter states that Occidental Chemical Corporation (OCC) has GPS coordinates for mud flats in the PRSA as well.

Additional three tables for the Passaic River Study Area ESP Spring Upper Trophic Level Fish Catch: Planned Distribution as of 5/10/00.
- Table presents 5/10/2000 fish catch data for PRSA. Includes resident fish, migratory fish, and crabs. 3 stations.
- Table presenting Spring Crab data at 4 stations.
- Table presenting Spring Mummichog cumulative weight summary at 7 stations.

Data summary: Fish and blue crab sampling, six stations, 2 seasons.

Executive Summary: Passaic River Study Area Preliminary Findings. TSI, Inc. East Brunswick, NJ. January 2003.

Exec. Summary for the report outlined by the data presentation above. Ecological piece includes benthic invertebrate survey, fish community survey, and avian community survey. All surveys performed for lower 6 miles of Passaic (PRSA).

Data Summary: No specific biological data.

Passaic River Study Area Ecological Sampling Plan. Work Plan/Field Sampling Plan. Volume 1 of 6. March 1999.

Workplan and SOPs describing sampling effort and reasoning for restoration of the Lower Passaic River. Sampling plan is for the Passaic River Study Area (PRSA), lower six miles of the river.

Surface sediment. 15 stations: 12 stratified random stations and 3 judgmental station. 3 reference stations (Mullica River mud flats). 4 stations for sediment chemistry. 1 station benthic tox tests. 3 stations benthic community sampling.

Biota tissue data. 15 stations for mummichog and blue crab samples (same as sediment stations). 3 reference areas for mummichog and blue crab. Program consisted of whole fish and composite tissue sampling, 4 fish net sample locations for resident and migratory fish.

Transplanted bivalve investigation. Also, fish pathology investigation, bird community study (seasonal and tidal census), and creel/angler report. Data gaps: PRSA to Dundee Dam.

Data Summary: No specific biological data.

Passaic River and Newark Bay Estuary Data Presentation. TSI, Inc. Newark, NJ. May 29, 2002.

Power Point presentation outlining the results from the above ecological sampling plan. The presentation reviews historical impacts to the ecology of the Lower Passaic River watershed. Presentation also covers ecological sampling overview and brief description/conclusion of results.

Data Summary: No specific biological data.

Passaic River Study Area Data Presentation. TSI, Inc. Newark, NJ. September 26, 2002.

Again, data collected for lower 6 miles of Passaic (1999-2000). Detailed fish pathology data, fish community data, benthic community characterization, and avian survey data.

Benthic Invertebrate Community document: Sampling conducted in fifteen Passaic River stations and a reference area (Mullica River). Contains qualitative information regarding benthic invertebrate species found in the Passaic River study area (PRSA) and the reference area, and a suite of benthic community metrics (e.g., Evenness, Dominance, Abundance of Tolerant taxa, etc.) used to compare PRSA stations with the reference area. Original data not included in presentation.

Fish Community Characterization: (Fall 1999/Spring 2000/Summer 2001) Sampling conducted in fifteen Passaic River stations. Contains information regarding fish/ species (as well as blue crabs) found in the Passaic River study area, as well as number of fish caught, catch per unit effort (CPUE) and length and weight of mummichog and blue crab (dominant species in samples). Original data not included in presentation.

Avian Survey: Bird survey performed for one year.

Habitat Characterization: Presentation outlines habitat characterization study performed in the PRSA. Included videotape survey of lower 6 miles, low and high tide surveys, and classification of shoreline for 5 reaches and each bank (Totals: bulkhead 52%, riprap 30%, aquatic vegetation 6% and vegetation mixed with riprap 12%). Also, examined mud flats and wetlands (cannot tell to what degree).

Data Summary: Benthic and Fish sampling, 15 stations, 2 seasons. Avian survey, 4 areas of study, full year (4 seasons) of data. Habitat survey, general characterization of vegetative communities along the PRSA shoreline, one season. A summary of data also presented in other Tierra Solutions documents outlined above.

Passaic River Study Area Creel/Angler Survey: Data Report; Triangle Economic Research, September 27, 2001.

Study area is the lower 6-mile section of the Passaic River that starts at the Conrail Bridge (lower boundary) and ends at the HABA water tower (upper boundary). Observations were made at eight locations within the study area between August 2000 and July 2001. Data collected by Triangle staff included: fishing activity by location and month, number of anglers and fish caught at each location by date. Angler interview responses sometimes included information on fish "type" (e.g., catfish, perch, etc.) caught/kept by location and date, number of individuals of each type caught/consumed and approximate length in inches of individual fish caught.

Data Summary: Fish sampling. One full year of data (8/2000 to 7/2001).

TABLE 1
BIOLOGICAL DATA NEEDS
LOWER PASSAIC RIVER RESTORATION PROJECT
NEW JERSEY

Habitat Type	Biological Data	2nd River	Oak Island	Kearny Point Mile 0-1	Lower Passaic River Study Area (PRSA): Miles 1 - 7	Upstream of PRSA: Miles 8 - 17 (to Dundee Dam)
Benthic	Benthic community	X[1]	ND	X	X	X
Mud Flat	Avian	ND	ND	X	X	ND
	Community				X	ND
	Intertidal Community	ND	ND			
Open Water	Plankton community	ND	ND	ND X	X X	X X
	Fish community	ND	ND			
Submerged Aquatic Vegetation (SAV)	SAV community	ND	ND	ND	ND	ND
	Fish community	ND	ND	ND	ND	ND
Wetlands	Vegetative community	X	ND	ND	U	ND
	Wildlife				X	ND
	community			X	X	ND
	-birds	ND	ND	X	X	ND
	-mammals	ND	ND	X	X	ND
	-herptiles	ND	ND	X		
	Threatened and Endangered Species	ND	ND			
Floodplains	Vegetative communities	X	ND	ND	U	ND
	Wildlife				X	ND
	communities				X	ND
	-birds	ND	ND	X	X	ND
	-mammals	ND	ND	X	X	ND
	-herptiles	ND	ND	X		
	Threatened and Endangered species	ND	ND	X		

Shoreline	Vegetative communities	X	ND	ND	U	ND
	Wildlife communities					
	-birds	ND	ND	X	X	ND
	-mammals	ND	ND	X	X	ND
	-herptiles	ND	ND	X	X	ND
	Threatened and Endangered species	ND	ND	X	X	ND

ND = No data.
X = Existing Data
X^1 = Data is for confluence of Second River and Passaic River
U = Unknown. These data are on currently unavailable videotape.

TABLE 2
DOCUMENT REVIEW FOR BIOLOGICAL DATA
LOWER PASSAIC RIVER RESTORATION PROJECT
NEW JERSEY

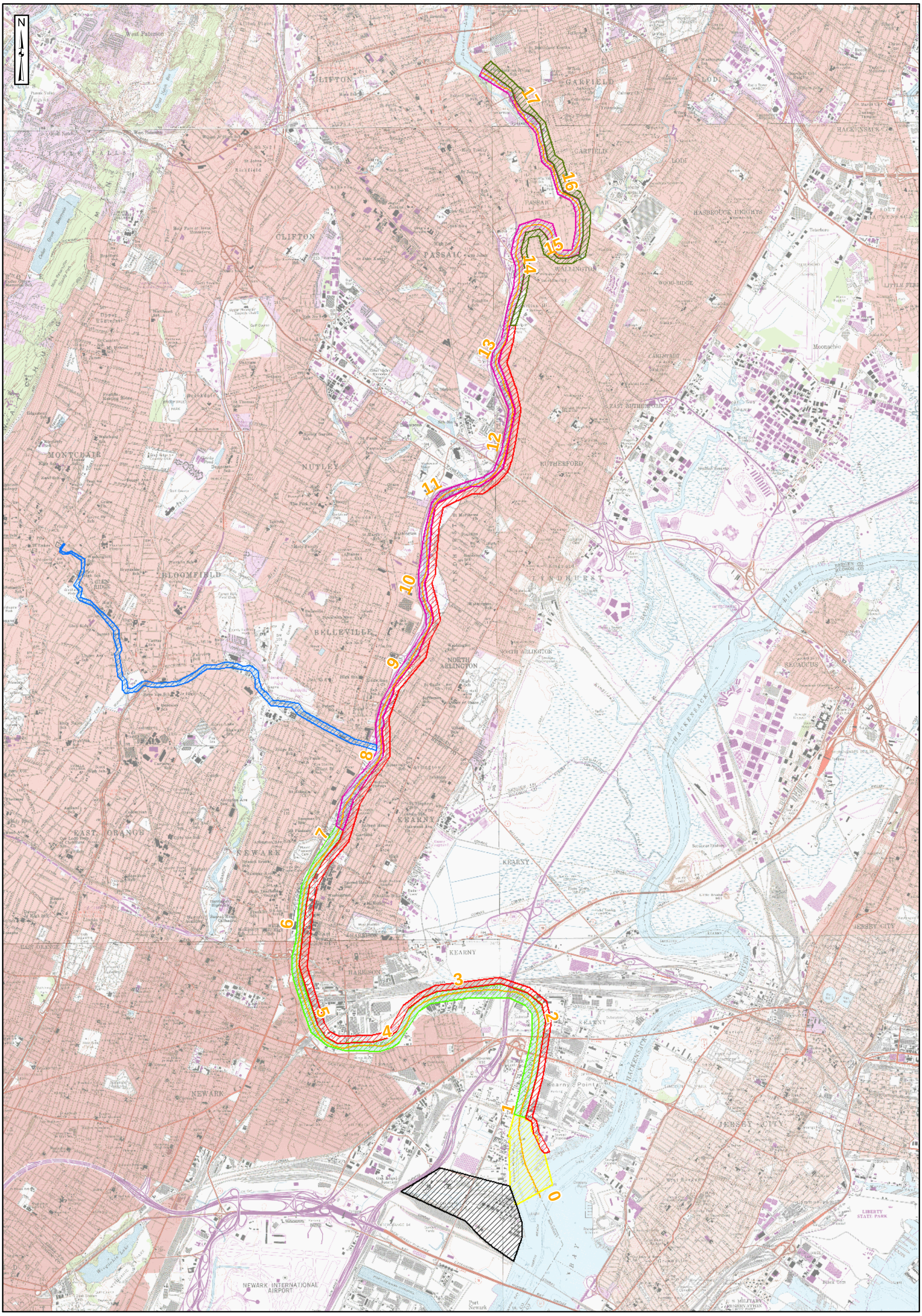
Document Name	Area of Lower Passaic River	Biological Data Included	Stations	Seasons	Comments
PRSA Benthic InvertebrateCommunity Data (2002)	PRSA*	Benthic Invertebrates	18	2	TSI PRSA report. Quantitative data.
PRSA Fish Community Data (2002)	PRSA*	Fish	15	2	TSI PRSA report. Quantitative data.
PRSA Avian Survey (2002)	PRSA*	Birds	Entire reach	4	TSI PRSA report. Quantitative data.
PRSA Habitat Characterization	PRSA*	Habitat	Entire reach	1	TSI PRSA report. Quantitative data.
Chemical Land Holding RI/FS tables (2000)	PRSA*	Fish	6	2	Ongoing EPA Superfund program.
New Jersey Turnpike Widening FEIS (1985-1990)	PRSA*	Benthic Invertebrates Fish	3 3	2 2	Benthic, fish, and bird data consisted of lists of species.
		Birds Mammals Herptiles	Along I-95 corridor		Mammal and herptile data had only the number of species.
PRSA Data Presentation (2002)	PRSA*	Benthic Invertebrates Fish Birds Wetlands Shoreline	15 15 4 NA NA	2 2 4 2 2	Ecological studies performed as part of the Superfund program. Visual survey of shoreline composition.
PRSA Creel/Angler Survey (2001)	PRSA*	Fish	NA	2	Qualitative survey, information from local fishermen.
Screening Level Human Health and ERA. ChemRisk (1995)	PRSA*	Benthic Invertebrates Fish Phytoplankton Zooplankton Periphyton Birds Mammal	6 6 5 1 5 NA NA	1 1 1 1 2 1 1	Performed as part of the EPA Superfund program. Avian and mammal species listings were incidental to habitat surveys of the area.

NA = Not Applicable.
* PRSA refers to the Passaic River Study Area, River Miles 1 – 7.

TABLE 2 (CONTINUED)
DOCUMENT REVIEW FOR BIOLOGICAL DATA
LOWER PASSAIC RIVER RESTORATION PROJECT
NEW JERSEY

Document Name	Area of Lower Passaic River	Biological Data Included	Stations	Seasons	Comments
Lower Passaic River Restoration Project: GIS Mapping Overview (2003)	Upstream Reach – above PRSA**	Wetlands T&E	NA	NA	GIS mapping for these components. No sampling conducted.
National Coastal Assessment Program (2000)	Upstream Reach – above PRSA**	Fish Benthic Invertebrates	2 2	1 1	Ongoing EPA program.
NJDEP Biological Monitoring Report (1998)	Upstream Reach – above PRSA**	Benthic Invertebrates	4	1	Ongoing NJDEP program.
BASF Regulatory Consultation Document for Future Ecosystem Development (2000)	River Mile 0-1	Benthic Invertebrates Fish Birds T&E Mammals Herptiles	NA NA NA NA NA NA	NA NA NA NA NA NA	Review of existing data No sampling conducted
BASF Marine Environmental Sampling Program (2002)	River Mile 0-1	Benthic Invertebrates Fish	12 Shallow 12 Deep 2	1 2	5 shallow, 12 deep samples processed Four trawls at each station on 3 days winter, 2 days summer.
USACE Flood Protection Feasibility (1987)	River Mile 0 -17	Benthic Invertebrates Fish Birds T&E Mammals Herptiles	16	NA	Quantitative and semi-quantitative data for EIS.
USACE Restoration Options Report (2000)	Oak Island	Habitat types	NA	NA	Brief generic discussion of Oak Island Habitat Types

NA = Not Applicable.
** Upstream Reach of the Lower Passaic River is River Miles 8 – 17.



US Army Corps of Engineers

MALCOLM PIRNIE

0 2,000 4,000 6,000 8,000 Feet

1 inch equals 5,000 feet

Figure 1: Project Overview Map
November 2004

Area*	Name	River Mile	Shading
1	Six Mile Reach	1 - 7	
2	Kearny Point Reach	0 - 1	
3	Upstream Reach	7 - 17	
4	Oak Island Yards	Newark Bay	
5	Second River Corridor	At Mile 8	
6	Left Bank - East Rutherford to Kearny Point	1-13	
7	Left Bank - Garfield to Wallington	13-17	

* Restoration Alternative Areas per Project Management Plan (April 2003).