City of New York
Department of Environmental Protection
Bureau of Environmental Engineering

USE AND STANDARDS ATTAINMENT PROJECT

JAMAICA BAY FIELD SAMPLING AND ANALYSIS PROGRAM YEAR 2001

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HydroQual

Environmental
Engineers & Scientists

USE AND STANDARDS ATTAINMENT (USA) PROJECT
JAMAICA BAY
FIELD SAMPLING AND ANALYSIS PROGRAM (FSAP)

PREPARED BY:

HYDROQUAL ENVIRONMENTAL ENGINEERS AND SCIENTISTS, P.C.

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SECTION 1.0

INTRODUCTION

The Use and Standards Attainment (USA) Project is being conducted by the New York City Department of Environmental Protection (DEP). The goals of the Use and Standards Attainment Project are to:

- define, through a public process, more specific and comprehensive long-term beneficial use goals for each waterbody, including habitat, recreational, wetlands and riparian goals, in addition to water quality goals, thus maximizing the overall environmental benefit;

- develop technical, economic, public and regulatory support for prioritizing and expediting implementation of projects and actions needed to attain the defined goals; and

- provide the technical, scientific and economic bases to support the regulatory process needed to define water quality standards for the highest reasonably-attainable use and to allow water quality standards to be attained upon implementation of recommended projects.

Currently, pursuant to the U.S. Environmental Protection Agency's (EPA) Clean Water Act (CWA) as administered by the New York State Department of Environmental Conservation (DEC), most of the USA Project waterbodies have *use classifications* of either "SB" or "I". The best usages of Class SB waters are primary and secondary contact recreation and fishing; these waters shall be suitable for fish propagation and survival. The best usages of Class I waters are secondary contact recreation and fishing; these waters shall be suitable for fish propagation and survival. Connected with these classifications are narrative and numeric water quality *standards*, the latter of which are based on scientifically-derived water quality *criteria*. Periodically, the use classifications must be re-evaluated, the goal being to make all waters "fishable" or "swimmable," upgrading their use classifications to higher standards if at all possible. The two most important standards, for purposes of the USA Project, are bacterial counts (e.g. coliforms) and dissolved oxygen (DO) concentrations in the waterbodies.

This Field Sampling and Analysis Program (FSAP) has been developed to help evaluate use and standards attainment in Jamaica Bay. It is part of a series of FSAPs being used in the USA Project. Over a four-year period, studies of twenty-three waterbodies will be conducted (Figure 1-1). Some of these studies will be performed during the same time periods over the range of waterbodies. Others, like this Jamaica Bay FSAP, will be performed sequentially. The rationale for Jamaica Bay studies, the materials and methods to be used, the sampling locations and schedule to be followed, and the procedures to be followed in the field and in the lab are found in this FSAP. Specific methods and materials and step-by-step use of them, are found in the USA Project Standard Operating Procedures (SOP) manual, a companion document for program- or waterbody-specific FSAPs.

The FSAP is also a program-specific Quality Assurance Project Plan (QAPP). A QAPP provides all team members with an understanding of the project organization, data quality objectives, measurement criteria, and specific Quality Assurance (QA) and Quality Control (QC) standards.

The FSAP has been developed to be consistent with the following guidance documents and recommended examples thereof.

- Guidance for Quality Assurance Project Plans. EPA QA/G-5, February 1998.
- Guidance for the Preparation of Standard Operating Procedures (SOPs) for Quality-Related Documents. EPA QA/G-6, November 1995.
- Coastal 2000 Environmental Monitoring and Assessment Program (EMAP), Northeast Component, Field Operations Manual, EPA/600/R-00/002, April 2000.
- Generic Quality Assurance Project Plan Guidance for Programs Using Community Level Biological Assessment in Wadeable Streams and Rivers, EPA 841-B-95, July 1995.
- Guidance for the Data Quality Objectives Process. EPA QA/G-4, EPA/600/R-96/055, August 2000.

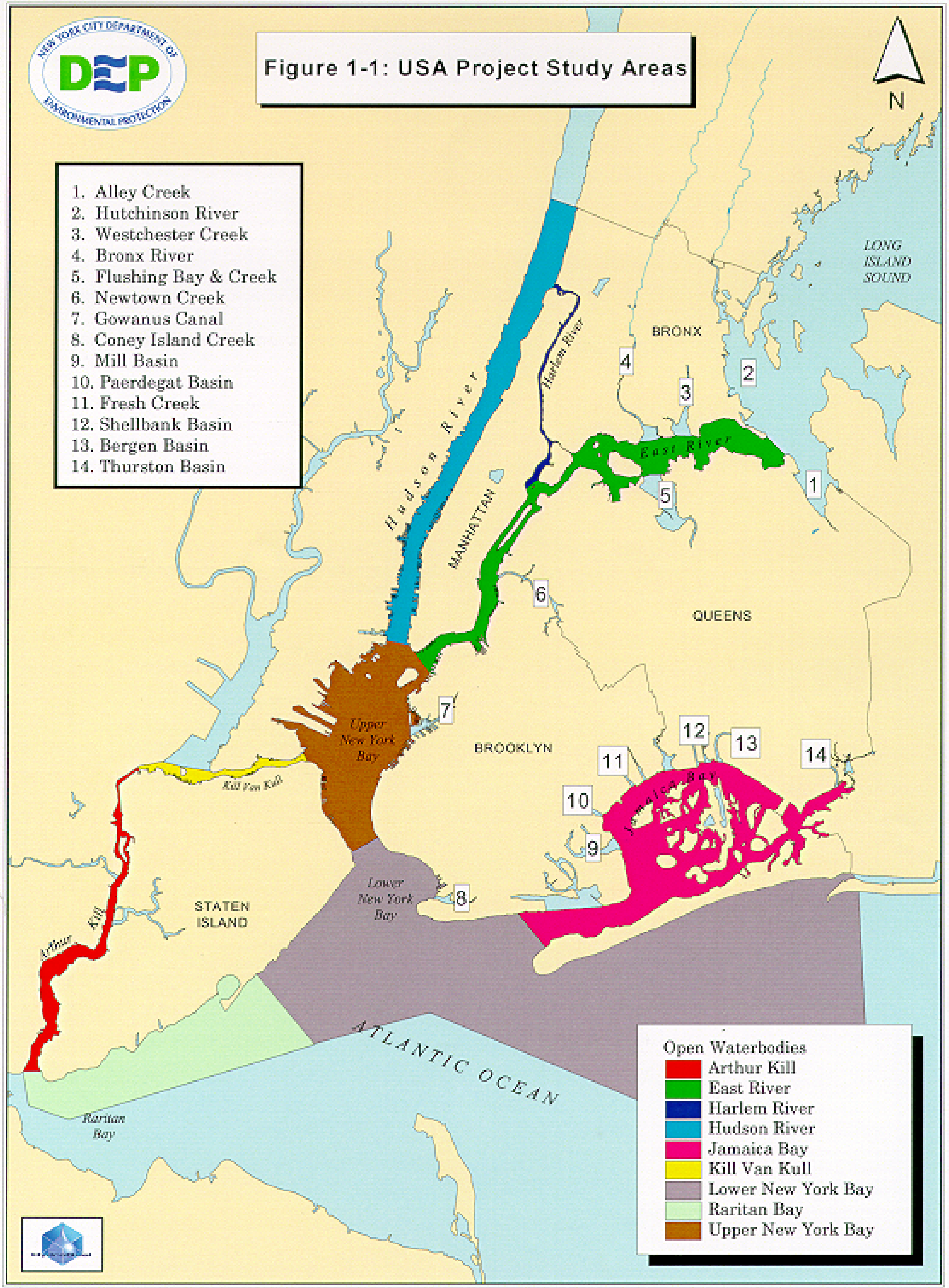

Figure 1-1: USA Project Study Areas
NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION
DEP
N
1. Alley Creek
2. Hutchinson River
3. Westchester Creek
4. Bronx River
5. Flushing Bay & Creek
6. Newtown Creek
7. Gowanus Canal
8. Coney Island Creek
9. Mill Basin
10. Paerdegat Basin
11. Fresh Creek
12. Shellbank Basin
13. Bergen Basin
14. Thurston Basin
LONG ISLAND SOUND
BRONX
Harlem River
Hudson River
East River
MANHATTAN
QUEENS
BROOKLYN
Upper New York Bay
Kill Van Kull
Jamaica Bay
STATEN ISLAND
Arthur Kill
Lower New York Bay
ATLANTIC OCEAN
Raritan Bay
Open Waterbodies
Arthur Kill
East River
Harlem River
Hudson River
Jamaica Bay
Kill Van Kull
Lower New York Bay
Raritan Bay
Upper New York Bay

- EPA Requirements for Quality Management Plans. EPA QA/R-2, November 1999.

- Guidance on Technical Audits and Related Assessments for Environmental Data Operations. EPA QA/G-7, January 2000.

- Guidance for Data Quality Assessment - Practical Methods for Data Analysis. EPA QA/G-9, July, 2000.

The FSAP (QAPP), and the SOP, will be updated as new programs are added, or new techniques are advanced, and must be maintained in all facilities (offices, vessels, labs) involved in performance of the USA project.

1.1 PROBLEM DEFINITION/BACKGROUND

The ability of a waterbody to support fish survival and propagation is fundamental to attainment of a Class I or SB use designation. Implicit to fish survival is availability of food. This, in turn, is a function of habitat and water quality. For fishes that pick or sift their food from the bottom of the waterbody (such as flatfish, spot, searobins, and even species with a more pelagic [open water] lifestyle like striped bass and weakfish), the invertebrates living in or on the available substrate are a critical component of the food web. These organisms comprise the benthic invertebrate community. The variety and abundance of benthic invertebrates are a function of substrate type and quality, and the quality of the water overlying the substrate. In tandem with water quality models, results of other USA Project FSAPs (e.g. "Epibenthic Recruitment"; "Ichthyoplankton"), historical databases, and results of other ongoing or recently completed studies of Jamaica Bay, the goal of this FSAP is to help sort-out which habitat variables are most limiting to aquatic life in Jamaica Bay and its tributaries.

1.2 WATERBODY DESCRIPTIONS AND USA PROJECT PERSPECTIVES

This section provides a brief description of Jamaica Bay (proper) and its tributary systems of concern, and a recapitulation of past, ongoing or planned studies that would complement USA Project studies scheduled for the year 2001. The description is based on a survey of contemporary (late 1980s through 1998) literature, and personal communication with agencies most familiar with work in and around Jamaica Bay. Though the NPS has indicated (Tanacredi, pers. comm. 2000), that recent Jamaica Bay Ecosystem Restoration Team (JBERRT) work has identified some 250 references, we feel that the USA project has captured salient facts. In addition, possible uses (and current limitations on such uses) of these waterbodies are introduced; salient Use Attainability Analysis (UAA) questions are posed; and data gaps helpful in focusing the FSAP consistent with stakeholder interests and scientific UAA guidance are identified.

1.2.1 Jamaica Bay

Jamaica Bay is New York City's largest and most important saltwater embayment. The open waters of Jamaica Bay were designated in 1948 as a city wildlife refuge [the Jamaica Bay Wildlife Refuge (JBWR)] which, in 1972, became part of Gateway National Recreation Area (GNRA). Originally circular with about 25,000 acres of open water and tens of thousands of acres of wetlands, the bay now has only 13,000 acres of open water and some 20,000 fewer acres of marshes. Both were sacrificed to dredging and filling associated with urban expansion along the north shore of the bay and John F. Kennedy International Airport. Natural freshwater input was replaced by larger volumes of sewerage, and portions of what was a well-flushed tidal system became a sediment trap. Grassy Bay, on the eastern end of Jamaica Bay, was deepened up to 50 feet and cut off from the natural flushing pattern of the bay, while at the same time receiving a greater load of silt, organic compounds and heavy metals from wastewater treatment plants, urban runoff, and airport runoff. West-Valle et al. (1992) concluded that "in addition to controlling the quality of sewage, sewer and CSO effluents to the bay... curbs on discharge of toxins were required to protect fish larvae and juveniles, and restrictions had to be placed on commercial and recreational fishing." U.S. Army Corps of Engineers has proposed restoration of original depth contours in borrow pits like Grassy Bay, and re-establishing prototypical wetlands throughout the bay (USACE, 1997).

Notwithstanding its current pathogen and CSO-related listing under CWA §303(d) and consumption advisories for eels, bluefish and striped bass, coliform counts in Jamaica Bay were an order-of-magnitude lower than those observed in the rest of New York Harbor during the 20 year period ending in 1991. The bay is classified SB, and with the exception of the Grassy Bay sub-basin, DO levels generally meet standards.

From a habitat standpoint, deeper channels and the Grassy Bay sub-basin have supplanted shallow water habitats and seagrass beds [as of 1991 there was an almost complete absence of *Zostera marina* (eelgrass)], and artificial islands with steeper intertidal slopes have replaced more natural marshes. Shellfishing, once a thriving industry, was a concern relative to pathogens as early as 1904 and was banned in 1921. Bottom substrate and lack of significant sources of natural, clean freshwater input to the system will likely limit oyster production into the foreseeable future. Benthic communities are now dominated by polychaete worms, and amphipods. The most abundant species of amphipods found in the bay is *Ampelisca abdita*, which is considered an important forage species for birds and fish. The quahog clam population (*Mercenaria mercenaria*) has increased and species distribution and abundance in the 1980s appeared similar to that of at least one cleaner estuary in southern New Jersey (Franz and Harris, 1985). Baitfish (menhaden, anchovy, silverside, mummichog, butterfish, mullet) are found along with sport species such as winter and summer flounder, weakfish, bluefish, scup, tautog, striped bass, puffer and sea bass.

Twenty-four of 35 species of indigenous reptiles and amphibians were, as of 1992, extinct or endangered. JBWR lists nine species of reptiles; seven species of amphibians, 17 species of terrestrial mammals, and 326 species of birds. In a NPS pamphlet, it was noted that "Jamaica Bay was originally salt marsh, tidal flats, and bay. While excellent wildlife habitats, they are not important to most reptiles, amphibians and mammals" (Lochan, 1993; Cook and Pinnock, 1989). In 1986, the red-backed salamander and additional species of frogs, turtles and snakes were released in JBWR. Two of the 11 species introduced, the spring peeper and the northern brown snake, were found to have established viable populations by 1984. Populations of osprey have also been re-established into the area (West-Valle et al., 1992).

1.2.2 Mill Basin

Mill Basin includes both west ("Mill Basin") and east ("East Mill Basin") reaches. Mill Basin exceeds 2 miles in length; it ranges from 150 to 2,000 feet in width; and its depth is between 3 and 33 feet at mean low water - deeper at the head of the basin rather than the mouth. East Mill Basin is approximately 1/3 the length of Mill Basin (4,700 feet) and 500 feet wide on average, but it is much deeper (40 to 45 feet). These basins are located near parkland and residential and commercial development. Both basins have been highly channelized and bulkheaded to facilitate boating and marinas. Despite this, the Mill Basin system has significant areas of mud flats and other intertidal habitat near its mouth, and (by definition as a Jamaica Bay tributary) is a State-designated "Significant Coastal Fish and Wildlife Habitat." It, like Jamaica Bay, harbors a significant population of Diamond-backed terrapins. The Mill Basin system is on the New York State §303(d) list for TMDL development with concerns being organic enrichment and DO. The USACE (1997) has suggested that habitat could be improved by restoring "Four Sparrow Marsh" (on the southern shore of Mill Basin); protecting other shoreline marshes; and restoring the upland buffer zone to woodland habitat.

1.2.3 Paerdegat Basin

Paerdegat Basin is the focus of a separate FSAP (HydroQual, 2000). The program began in June 2000, and included sampling of benthos, fish, and ichthyoplankton. This current FSAP is modeled after the Paerdegat Basin FSAP, and the data for Jamaica Bay will be analyzed and interpreted in tandem with the Paerdegat Basin data.

1.2.4 Fresh, Hendrix, and Spring Creeks

Sampling of water and sediments, invertebrates, fish and ichthyoplankton in Fresh and Hendrix Creeks started in conjunction with the Paerdegat Basin FSAP.

Fresh Creek is approximately a mile long, ranging in width from 650 feet at its widest point to approximately 125 feet at its narrowest point. Depths at MLW range from 3 to 19 feet. Fresh Creek is not a §303(d)-listed waterbody, but given that more than 30% of DEP's monitoring samples have contained less than 4 mg/L DO, and wet weather samples exceed coliform bacteria standards, it still is not fully compliant with Class I standards. USACE (1997) studies technically supported re-establishment of submerged aquatic vegetation (SAV) for fish and invertebrate habitat, and replacement of monotypic upland stands of "mugwort" with better (hardwood) habitat for wildlife.

Hendrix Creek has been greatly affected by channelization and filling (Blanchard, 1992). The width of the creek has been made a uniform 60 to 80 feet; and its depth (at low tide) reduced 2 to 5 feet. It is a §303(d)-listed waterbody; it does not meet the DO standard of 4 mg/L for a Class I waterbody; and coliform bacteria data indicates an exceedence of the standard. The 26th Ward Wastewater Treatment Plant (WWTP) occupies a large portion of the western shore. In addition, the Pennsylvania and Fountain Avenue landfills occupy the east and west shores near the mouth of the creek. The USACE (1997) has suggested that tidal marsh restoration may be possible, which would improve the habitat diversity for fish and wildlife. Final closure of the landfills should retard leaching of contaminants to the creek.

Spring Creek, the easternmost of the three waterbodies, is actually tributary to Old Mill Creek, which opens to Jamaica Bay. Ralph Creek is tributary to Spring Creek. In sequence of their original stream orders, Ralph Creek is the shortest and narrowest (2,100 feet x 100 feet); Spring Creek per se is 3,800 feet by an average of 180 feet; and Old Mill Creek is a mile long and between 200 and 2,300 feet in width. Depths throughout the system range from 3 to 12 feet at MLW, and extensive areas of low and high marsh exist in Old Mill Creek up-basin from its junction with Spring Creek. Though the system as a whole has been altered to the point where freshwater input is wholly derived from CSO and storm sewer discharge, Spring and Ralph Creeks have retained some semblance of their original channel configuration. The system is classified as a Class I waterbody, but it is not on the §303(d) list and DO deficits are not as frequent or significant as those of other tributaries to Jamaica Bay. A DEP CSO retention facility overflows to the head end of Old Mill Creek. Upland habitat is dominated by plants characteristic of disturbed habitat (mugwort and common reed). The USACE (1997) has recommended creation of additional marsh habitat and upland woodlands, and the DEP will have upgraded its CSO facility by 2004.

1.2.5 Shellbank Basin

Shellbank Basin is mostly bulk-headed and is around 5,200 feet long and on average, 250 feet wide. The depths in the basin range from 10 feet to 52 feet at MLW. The basin is wider and deepest at the head rather than at the mouth, which severely limits circulation and results in near-zero oxygen concentrations in bottom waters (as early as late winter). There have been occasional reports of unpleasant odors probably due to the release of hydrogen sulfide from the sediment bed under anoxic conditions. Shellbank Basin is on the §303(d) list with parameters of concern being organic enrichment and low DO concentrations. DEP has made several recommendations to improve water quality in the basin. One recommended action is the elimination of an inactive CSO outfall at the head of the basin. A second recommendation was a pilot test (now underway) to determine if a reduction of stratification will eliminate odors in the basin. The basin is bulkheaded and lined with commercial and private pleasure boat dockage, and swimming is not permitted at beaches near its mouth. As a Jamaica Bay tributary, it is considered a State-designated "Significant Coastal Fish and Wildlife Habitat."

1.2.6 Bergen and Thurston Basins

Bergen Basin is over a mile long, with average widths and depths (MLW) of 400 feet and 12.5 feet, respectively. Thurston Basin is 5,000 feet long and 250 feet wide, and ranging in depth at MLW from 3 feet at its head to 20 feet at its mouth. Neither basin is compliant with DO or total coliform standards for Class I waterbodies. DEP is currently conducting CSO facility planning for these waterbodies. For Bergen Basin, the lowest DO concentrations were found in bottom waters near the head of the basin and are attributed to CSOs and sediment oxygen demand (SOD). The primary sources of pollutants to Bergen Basin are CSO and storm sewers, effluent from the Jamaica WWTP, storm sewers from JFK International Airport, and spills or leakage from fuel unloading facilities. The primary sources of pollutants to Thurston Basin are CSO and storm sewers, which are located at the head of the basin, and runoff from JFK International Airport. In Bergen Basin, fish and wildlife habitat is limited to a small area of intertidal flats and wetlands near the mouth on Grassy Bay, but such areas more-or-less surround Thurston Basin. Bergen Basin, as a Jamaica Bay tributary, is considered a State-designated "Significant Coastal Fish and Wildlife Habitat." The USACE (1997) has suggested two possible restoration activities for Bergen Basin. One recommendation is the restoration of the shoreline and upland community to improve the terrestrial wildlife habitat. A second recommendation is the restoration of shoreline and creation of tidal marsh, which would serve to improve fish and wildlife habitat.

1.3 STATUS OF DATABASE/DATA GAPS

There is a significant quantity of literature and data on Jamaica Bay (proper). But unlike Jamaica Bay, there is limited information on the tributaries. The Jamaica Bay CSO Facility Planning Project (O'Brien and Gere, 1993) and the Jamaica Bay Navigational Channels and Shoreline Environmental Surveys (USACE, 1997) were the two main studies that had reported sampling or field observations inside the tributaries of the bay.

1.3.1 Water and Sediment Sampling and Analyses

The DEP's Harbor Survey (HS), which includes sampling and analysis of DO, bacteria, nutrients and other water quality parameters throughout New York Harbor, has been in place since 1909. The HS regularly monitors stations in Jamaica Bay and has recently added tributary sampling.

For a one year period beginning in July 1995 and continuing through June 1996, New York City funded a special study of the Jamaica Bay system. This study, known as the Jamaica Bay Eutrophication Project, collected and analyzed water column samples for salinity temperature, DO, chlorophyll-a, and various forms of organic and inorganic nutrients.

As part of a salt marsh cordgrass biomass survey, the Jamaica Bay Eutrophication Project (EEA, 1997) collected and analyzed sediment for chlorophyll-a, total kjeldahl nitrogen (TKN), total oxygen carbon (TOC), and total phosphorus (TP). As part of its bivalve survey, the eutrophication project collected sediment samples at 91 stations for grain size analysis. Other Jamaica Bay sampling programs have included the NPS's long-term monitoring program and the Jamaica Bay CSO Facility Planning Project (O'Brien and Gere, 1993), which included sampling in all of the tributaries. The EPA's Regional Environmental Monitoring and Assessment Program (R-EMAP) conducted sampling at 28 random stations in Jamaica Bay during 1993 and 1994 surveys, subsamples were collected for metals, organics, grain size, TOC and toxicity tests. The EPA's new National Coastal Assessment (also referred to as Coastal 2000) is a five-year monitoring program that focuses sampling efforts on water quality, sediment quality, and fish and benthos communities in the New York area, including the mouth of Jamaica Bay. Other sediment studies in the bay have focused on contaminants (Bopp et al., 1993) and metal pollution (Seidemann, 1991).

Finally, the USACE has announced that it will be performing a grain size and TOC mapping program in Jamaica Bay and its tributaries in August 2001. This Jamaica Bay FSAP has been redesigned to be coordinated with the USACE program, for purposes of collecting subtidal benthos samples.

1.3.2 Biological Sampling and Analyses

The Jamaica Bay Eutrophication Project (O'Brien and Gere, 1997) included sampling of zooplankton and bivalve mollusks (clams, mussels) in 1996. Studies have been performed measuring the abundance of plankton and primary productivity in the bay (Peterson and Dam, 1987; Cosper et al., 1989). Franz and Tanacredi (1992) studied secondary production of the amphipod, *Ampelisca abdita* (a dominant benthic invertebrate important in the diet of young fish, such as winter flounder), and in 1993 surveyed mussels at ten stations in Jamaica Bay. Franz and Harris (1985) performed a comprehensive study of benthic invertebrates and sediments in Jamaica Bay in 1984. Borowsky et al. (1997) conducted a study to determine what effects Jamaica Bay sediments [Grassy Bay, Ruffle

Bar, and East Hampton, Long Island (control sediment)] might have on the physiology and morphology of a local resident species of amphipod (*Melita nitida Smith*). The results from Borowsky et al. showed that changes in reproductive parameters occurred in sediments of Grassy Bay; and changes in physiology and morphology were positively correlated with sediment contaminants. Franz and Harris (1988) studied seasonality and spatial variability in macrobenthos communities in the bay. Franz (1997) studied resource allocation in an intertidal salt-marsh mussel (*Geukensia demissa*) in relation to shore level. EPA's 1993 and 1994 R-EMAP, along with sediment sampling, included studies of survival rates of *Ampelisca abdita* at 14 stations in 1993 and 1994. A benthic invertebrate study was performed in Jamaica Bay from summer 2000 through spring 2001 as part of a comprehensive study led by the NPS and funded by DEP and the USACE. The study included sampling of intertidal macroinvertebrates, interstitial copepods and subtidal benthos. Macroinvertebrates and copepods were sampled by taking sediment core samples. Subtidal benthos was sampled by taking grab samples; transect lines perpendicular and parallel to the shore were surveyed; and slices of *Spartina* in marsh habitats were cut and collected. The issues of sea level rise and other factors involved in wetlands loss is the subject of ongoing investigations by the Metropolitan East Coast Assessment program. The USA Project is coordinating with Columbia University and NASA-Goddard Institute of Space Studies regarding their research efforts on the marshes of Jamaica Bay. Finally, the USA Project includes a study of epibenthic organism communities colonizing artificial substrates throughout New York Harbor. That study, begun in Paerdegat Basin in 2000, was expanded to cover sites throughout the Bay and its tributaries in April 2001 (HydroQual, 2001a).

Surveys of fish in the bay have been irregular. The NPS and U.S. Fish and Wildlife Service (USFWS) conducted a one-year finfish inventory of Jamaica Bay; and in conjunction with this inventory, fish were collected for analysis and a fishing survey was developed (Riepe and Tanacredi, 1988). The NPS performed surveys in Jamaica Bay during 1994 and 1995, and is completing a new study of Jamaica Bay and its tributary mouths that has included monthly fish trawl surveys and gill netting (Tanacredi, pers. comm. 2000). The DEC collects finfish data during their annual striped bass survey program, which includes bi-weekly (May-October) seining surveys at eight stations in the bay; and although absolute and relative abundance of fish changes over time, species composition is relatively well known. Surveys were conducted to assess the biological communities of the lower Hudson-Raritan estuary system, which included trawl surveys in Jamaica Bay (Woodhead, 1992). DEC conducted a synoptic survey of PCB, organochlorine pesticide and mercury concentrations in edible fish, bivalves and crustaceans from the New York-New Jersey Harbor, with

Jamaica Bay being one of the study sites. The NPS and USFWS conducted histopathological evaluations of winter flounder to assess potential impacts from contaminant inputs to Jamaica Bay (USFWS, 1989). Augspurger et al. conducted this study in 1994 to reassess the 1989 findings of the NPS and USFWS. Finally, as part of the USA Project, HydroQual initiated ichthyoplankton (fish egg and larvae) studies in spring 2001 as part of the projects' waterbody-wide FSAP (HydroQual, 2001b).

1.4 ISSUES AND DATA GAPS OF RELEVANCE TO THE USA PROJECT

In this FSAP, a number of issues have been addressed. Salient questions of concern to the USA Project are best dealt with by separating them according to tributaries, or Jamaica Bay proper.

The questions concerning the tributaries of Jamaica Bay, as introduced in the Paerdegat Basin FSAP, are as follows:

- Do any fish species (e.g. fluke, bluefish, anchovy) live in the tributaries during summer?

- Without accompanying improvement in physical habitat, would implementation of Jamaica Bay CSO facility planning alone be sufficient to create a better environment for fish to be attracted to?

- Do, or would, any fish species spawn there?

- Would physical habitat improvement alone be sufficient to better the tributary's fishing or propagation potential irrespective of present water quality (DO in particular)?

- With habitat improvement, are Class I water quality standards (4 mg/L DO) adequate for propagation and survival of representative fish species, or do they need 4.8 mg/L (proposed new saltwater criterion) to succeed? Can winter or spring spawners (e.g. winter flounder) survive and grow even if late spring and early summer spawners (e.g. bay anchovy) may be limited by DO?

- Does the whole tributary need to meet larval growth and survival criteria, or would maintenance of standards downstream of some mixing zone suffice?

- What is the incremental improvement in the invertebrate food base and in fish propagation and survival resulting from incremental improvements in DO on the basis of the latest EPA research?

- Is the particular tributary a candidate for site-specific criteria?

The questions posed for Jamaica Bay proper are a little bit different, as follows:

- Would any more fish species, or more of the present species, spawn in the bay if it uniformly attained Class SB standards? Is their propagation success, as measured by the density of their eggs and larvae in the water column, any different than that of their tributaries, or some nearby reference waterbodies?

- How important is wetlands loss, or gain?

- Would fish abundance and community diversity increase if USACE site restoration plans (alone) were implemented throughout the bay and its tributaries? Would they increase with implementation of CSO facility plans alone? Would they increase if both site restoration and CSO improvement occurred?

- Is Grassy Bay or other sections of Jamaica Bay a candidate for site-specific DO standards?

To help answer these questions, a variety of physical, chemical and biological data over a range of conditions needs to be examined. In the case of Jamaica Bay proper, the combination of fairly recent DEP CSO facility planning projects and HS monitoring surveys, recent NPS JABERRT studies, ongoing DEC seining surveys, and USA Project ichthyoplankton and epibenthic recruitment studies (which also include all of the Bay's tributaries) can be considered to be a fairly strong comprehensive and contemporaneous data base. However, in the case of fisheries and subtidal benthic communities, most other studies are focused on sites outside the tributary mouths and in the Bay proper.

Based on the foregoing, this Jamaica Bay FSAP focuses on data gaps related to invertebrate and finfish utilization of tributaries and Jamaica Bay reference stations during mid-summer. Additional studies of wetlands, as proposed in the draft FSAP for Jamaica Bay (September 2000), will be the subject of a separate FSAP.

SECTION 2.0

PROJECT MANAGEMENT

2.1 PROJECT/FSAP ORGANIZATION

The overall project organization responsible for field and laboratory activities on the USA Project is shown in Figure 2-1. HydroQual Engineers and Scientists, P.C. is the prime contractor for DEP, and as such is responsible for the overall performance of the USA Project. EEA, Inc. is the field subcontractor responsible for field sampling and laboratory identification of ichthyoplankton and [for other FSAPs] invertebrates. Physical/chemical, and bacteriological laboratory services associated with other FSAPs are provided by Environmental Testing Laboratories (ETL) and Sani-Pure Food Testing Laboratories, respectively.

2.2 ROLES AND RESPONSIBILITIES

John St. John is the Project Manager for the USA Project and will be responsible for providing the final approval on all proposed activities, and providing final approval for changes to the scope of work or work plans and the release of the study reports.

William McMillin, Jr. is the Project QA Officer. He will be responsible for the Project QA/QC for sampling and analytical portions of the investigation.

Key personnel assigned to this FSAP are the Project Technical Advisor, the EEA Principal-in-Charge, the EEA Field Manager, the EEA Taxonomists, the outside QA expert, and the Project QC Officer.

2.2.1 Project Technical Advisor

Dr. Glenn Piehler is the Project Technical Advisor for all marine biological studies associated with the USA Project. He has a Ph.D. in fisheries biology and thirty years experience in designing, implementing and interpreting environmental studies. He is responsible for designing the project field studies, supervising preparation of FSAPs, overseeing FSAP implementation, and supervising data

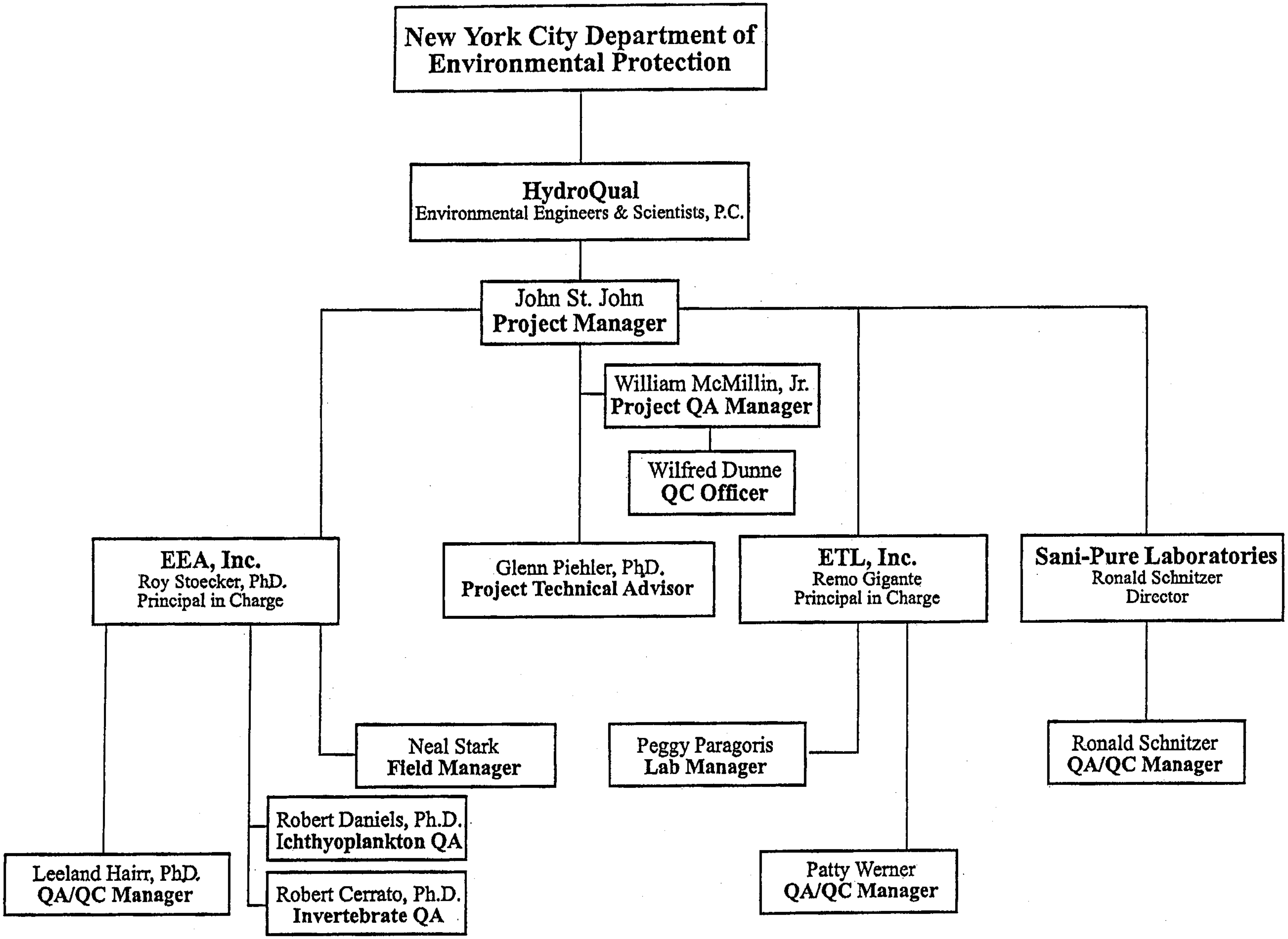

FIGURE 2-1. ORGANIZATION CHART OUTLINING PERSONNEL RESPONSIBLE FOR ACTIVITIES OF THE USA PROJECT

analysis and interpretation. Project field or lab technical and logistical changes must ultimately be cleared through him. His phone number is (201) 529-5151, or (201) 610-1425, and email address is gpiehler@hydroqual.com.

2.2.2 EEA Principal-in-Charge

The Vice President and Principal-in-Charge of EEA, Inc. is Dr. Roy Stoecker. Dr. Stoecker has a Ph.D. in marine biology and twenty-five years experience implementing and managing marine biological studies, mostly around New York City and Long Island. He is responsible for field and lab work performed by EEA, Inc. and should be contacted regarding field changes in situations where the Project Technical Advisor is unavailable. Dr. Stoecker's number is (516) 746-4400.

2.2.3 EEA Field Manager

Mr. Neal Stark, a licensed captain, has twenty years of experience and also holds a master's degree in fisheries biology. He is in charge of all field operations, including assurance that all methods and materials are properly implemented according to this FSAP and the USA Project SOP manual; the health and safety of the crew; and scheduling cruises to meet deadlines and completeness goals. His (cell) phone number is (516) 526-9671.

2.2.4 Outside QA

Dr. Robert Cerrato will perform independent identification of voucher specimens of epibenthic species. Representative "type" species will be forwarded to him for verification. Dr. Cerrato is Associate Professor in the Marine Science Research Center of the State University of New York at Stony Brook, where he specializes in benthos.

2.2.5 Project QC Officer

Mr. Wilfred Dunne is the Project QC Officer. He has thirty years of experience in field sampling and analysis, including water, sediment and biota. Mr. Dunne will provide QC services including but not limited to field and laboratory audits, recommendations concerning improved methods, and reports to management resulting from audits. His number is (201) 529-5151.

2.3 DISTRIBUTION LIST

Copies of this FSAP have been sent to the USA Project participants or reviewing organizations listed in Table 2-1. If changes are mandated during the conduct of the study, those changes will be incorporated and marked in a revised FSAP, and copies will be re-issued to distribution. In addition, up-to-date FSAPs and the USA Project SOP will be maintained in the offices of each participating subcontractor, and on the field research boat(s).

2.4 TASK DESCRIPTION AND SCHEDULE

The tasks associated with this FSAP included review of the available database, discussion with the USA Project Steering Committee, tentative selection of sampling stations based on existing data and models, and a preliminary field reconnaissance in February 2001 (during the reconnaissance to select epibenthic recruitment and ichthyoplankton FSAP sampling stations). Based on further discussion with the USA Project Team, the USACE and NPS, it was decided to limit this [Jamaica Bay] FSAP to subtidal benthos sampling at stations not included in the original Paerdegat Basin FSAP, and fish sampling in the Bay and all of its tributaries (including those sampled as part of the Paerdegat Basin FSAP). Both activities will occur during summer 2001, when bottom DO concentrations should be at their lowest levels of the year. Other tasks associated with these efforts will be measurement of in-situ water quality, laboratory identification of benthic organisms, and data reduction and analysis.

2.5 TRAINING REQUIREMENTS/CERTIFICATIONS

Field crews which participate in the USA Project are required to have demonstrated, though a combination of education and experience, their proficiency in the roles to which they have been assigned. In general, crew members will hold a Bachelor’s degree in biology or environmental science, and 1-10 years experience. At least one crew member shall have demonstrable education and/or experience in the identification of macro-organisms not retained for laboratory identification (e.g. fish). In addition, the boat captain shall hold a valid Captain’s license. These credentials will be maintained by the Human Resources departments of the participating companies, and be available on request to the Project QA/QC managers and officers.

Table 2-1. FSAP Distribution List

Recipient	Representing
HydroQual	
John P. St. John, P.E.	Prime Contractor
Charles L. Dujardin, P.E.	
William E. McMillin, P.E.	
James J. Fitzpatrick	
Patricia M. Kehrberger	
Richard Isleib	
Wilfred Dunne	
Glenn Piehler, Ph.D.	
Eileen LaRosa	
Kristin Rusello	
Eileen Lucier	
EEA, Inc.	
Roy Stoecker, Ph.D.	Field and Laboratory Subcontractor
Leeland Hairr, Ph.D.	
Neal Stark	
Tom Young	
Mary Beth Billerman	
Diane Moore	
Federal:	
Kevin Bricke, Deputy Director	U.S. Environmental Protection Agency, Region 2
Leonard Houston, Chief Technical Support Section, Planning Division	New York District U.S. Army Corps of Engineers
John T. Tanacredi, Ph.D., Chief Division of Natural Resources	Gateway National Recreational Area National Park Service
Interstate:	
Howard Golub, Executive Director & Chief Engineer	Interstate Environmental Commission
New York State:	
Philip DeGaetano, P.E., Associate Director, Division of Water	NYS Department of Environmental Conservation

Table 2-1. FSAP Distribution List

Recipient	Representing
New York City:	
Robert Gaffoglio, P.E., Director Bureau of Environmental Engineering	The City of New York Department of Environmental Protection
Wilbur L. Woods, Director Waterfront/Open Space	The City of New York Department of City Planning
Marc Matsil, Chief Natural Resources Group	New York City Department of Parks and Recreation
Citizens Advisory Committee on Water Quality:	
Deborah B. Beck, Executive Vice President	Real Estate Board of New York
James Tripp, General Council	Environmental Defense Fund

Crew members are allowed to gain experience and training as participants in the cruises, under the direct tutelage of senior staff. Prior to initiating performance of a FSAP, the crew members shall receive training and instructions from the Project Technical Advisor, and be required to demonstrate their independent and collective understanding of FSAP objectives and protocols, and familiarity with the Project SOP, including methods and materials to be used, documentation and QA/QC requirements.

Laboratory staff involved in organism identifications shall hold a Bachelors degree in biology, and at least 3 years of experience in the identification of organisms in samples to which they are assigned. These credentials will be maintained by the Human Resources departments of the participating companies, and be available on request to the Project QA/QC managers and officers.

2.6 DOCUMENTATION AND RECORDS

In addition to the documentation to be maintained on staff credentials, the USA Project requires that each data generating activity be thoroughly documented. Field data will be recorded by crews on hardcopy data sheets (Appendix A of this document), and in the captains log book. Additionally, photo documentation required for certain tasks (e.g. fish) will be maintained in the USA Project photographic [electronic] library. The information on the hardcopy data sheets will also be transcribed into an electronic format and database management file (see Section 5.7).

2.6.1 Field Activities

Field data sheets have been developed for each of the USA Project activities, including initial waterbody reconnaissance, in-situ water quality measurements, and biological sampling methods which are integral to this FSAP. These forms, as specifically referenced in Section 3.0 or 4.0 (below), appear in the USA Project SOP. As hardcopy forms are completed during the course of each cruise, the designated data recorder (as noted/initialed on the forms) will be responsible for returning, copying and filing them in the central Project files of the responsible team member (HydroQual and EEA). In general, HydroQual personnel will be responsible for recording and filing reconnaissance and other activities not requiring laboratory work. The EEA team leader will be responsible for hardcopy which must accompany samples slated for lab analyses (i.e. invertebrate identification). He/she will ensure that such forms are also copied and sent to the HydroQual Technical Advisor, and also filed internally. EEA will also be responsible for maintaining all records of instrument maintenance and calibration. All core data will be transcribed by HydroQual into the electronic database within a reasonable time (target 1 month). When field conditions suggest, or dictate, that a change in location or procedure should be required, the crew leader shall call either the Project Technical Advisor, QA Manager or QC Officer (depending upon availability) to explain the situation and gain their concurrence, and document the field change request and result in the field log book, and later via. memo for project management files.

2.6.2 Laboratory Analyses

Subtidal benthic samples scheduled for laboratory analyses will be labeled and preserved with 10% formalin solution in the field. Samples are then stained with Rose Bengal solution in the laboratory to facilitate sorting. That process, as well as major taxon group sorts, taxa identifications and counts, and QC checks will be documented, in addition to which voucher specimens/sample were sent to SUNY - Stony Brook. The laboratory identification lead will forward these data to the Project Technical Advisor, who in-turn will note receipt thereof on the data package, and forward it to database management staff who will retain the original in the project files and transmit a copy to the electronic data entry staff.

SECTION 3.0

QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

Each of the tasks associated with the USA Project FSAPs has been designed to produce data of known quality relative to specific objectives. Some data simply require a degree of confidence that the samples have been collected and identified properly (e.g. "Average Outgoing Quality Limit" [AOQL] $\geq$ 90%); others that the equipment has been calibrated to ensure minimum bias, or error; and still others to ensure that following collection, it is possible to calculate and understand the variability inherent to field measurements relative to statistical inferences which must be derived therefrom. General terms associated with data quality objectives are representativeness, completeness, comparability, accuracy and precision. They are defined in Section 3.1, whereas more specific quality criteria for individual processes/objective are presented in Section 3.2.

3.1 QUALITY ASSURANCE OBJECTIVES

The following subsections define general quality assurance objectives for the USA Project.

3.1.1 Representativeness

Representativeness is defined as "the degree to which the data accurately and precisely represent a characteristic of a population parameter (e.g. number of worms/m^2), variation of a property (e.g. DO), a process characteristic (e.g. trawling speed), or an operational condition (e.g. gill net depth)" (adapted from Stanley and Verner, 1985). For this FSAP, representativeness will be ensured by using the same kinds of gear at all stations, collected during the same index periods. Representativeness of water quality properties will be ensured by using instruments designed and calibrated to accurately and precisely measure those parameters. (Calibration procedures are found in Appendix B of the USA Project SOP.)

3.1.2 Completeness

Completeness is defined as "a measure of the amount of data collected from a measurement process compared to the amount that was expected to be obtained under the conditions of measurement" (Stanley and Verner, 1985). For this FSAP, the completeness goal is 100% of the samples and measurements scheduled to be collected, and 100% of the lab samples to be analyzed.

3.1.3 Comparability

Comparability is defined as "the confidence with which one data set can be compared to another" (Stanley and Verner, 1985). Comparability will be ensured by using the same kinds of gear at every station; calibrating the equipment prior to each cruise (or each day of each cruise); and using the exact protocols at every station (e.g. depth strata, and deployment/retrieval procedures).

3.1.4 Accuracy and Precision

Accuracy refers to the difference between a measured value of a parameter, and the true value of that parameter in the waterbody. For some estimators (e.g. lowest practicable identification of taxa), the goal is 90%. This goal will be ensured by internal EEA counts and recounts of 10% of the samples, as well as examination of voucher specimens by Dr. Cerrato of SUNY - Stony Brook. Ten (10) percent of samples will be randomly chosen and checked by outside personnel with extensive invertebrate identification experience. For any new employees who are identifying organisms in these samples, the first five samples will be QA/QC'd by an experienced taxonomist. A 90% AOQL (i.e. minimum 10% error) for identification and counts will be allowable. If the error is greater than 10% for any of these samples, instructions will be given as to which samples are being incorrectly identified, and the samples will continue to be QA/QC'd until five consecutive samples can be identified with less than a 10% margin of error. For calculations of taxa densities (number per square meter), the goal is to infer whether or not differences among stations are significant at the $\alpha = 0.05$ level of significance (i.e., unless a 1-in 20 chance of sampling "error" has occurred). Water quality measurements will be recorded as follows: temperature within ± 0.5C; salinity within ± 1.0 ppt; DO within ± 0.50 mg/L and Secchi disk readings within ± 0.5 ft. These levels of accuracy and precision will be ensured by proper instrument maintenance and calibration specified in Appendix B of the USA Project SOP.

3.2 CRITERIA FOR OBJECTIVE #1: SUBTIDAL BENTHOS

This objective is to determine benthic invertebrate community composition, species richness (S), and diversity (H) in subtidal sediments inside Jamaica Bay tributaries and compare them with (a) those of waterbodies that have substandard DO but better substrate, and (b) those of sites with similar substrate but higher DO concentrations.

3.2.1 Statement of Purpose

To evaluate whether the infaunal benthic invertebrate community is more limited by (a) physical habitat, or (b) DO concentrations in the water column.

3.2.2 Rationale

Infaunal benthic invertebrates, being relatively sessile and therefore incapable of moving from place-to-place when water quality conditions change, are good indicators of water quality impacts given that the required habitat (i.e. substrate) is available. The number of taxa and the numbers of individuals per taxa at one site can be related to habitat and/or water quality based on comparisons to other sites sharing some attributes but not others (e.g. good water quality/inferior substrate and vice versa).

3.2.3 Null and Alternative Hypotheses

H_O (Null Hypothesis): Species richness (S) and diversity (H) at sites with better (cleaner, more consolidated) substrates are higher, but S and H in similar substrates are not significantly different (i.e. not water quality-limited). H_A (Alternative Hypothesis): S and H at sites with similar waterbody DO conditions are not significantly different, but S and H at sites with similar substrates are higher at sites with higher DO levels.

3.2.4 Schedule

The sampling schedule is indexed to that period of time when bottom DO concentrations are expected to be at their seasonal lows (i.e. summer). A final reconnaissance will be performed in late July 2001 to measure DO at stations tentatively selected for sampling, and actual sampling will take place in August 2001. Completion of this objective will involve two "cruises". The first, performed by EEA in early August, will be done in the tributaries using a modified ponar sampler. The second, occurring in late August, will involve use of a vessel retained by the USACE to map Jamaica Bay substrates using a Shipek or Smith-MacIntyre grab sampler. HydroQual staff will be aboard to collect samples for benthic invertebrate identifications.

3.2.5 Sample Station Location

General sampling sites are shown on Figure 3-1. They will be finalized, and their latitudes and longitudes recorded and entered into Table 3-1 during a final reconnaissance in late July 2001. Positioning will be accomplished using the on-board Global Position Satellite (GPS) system, with an acceptable error of about 9-10 ft. (see Section 3.4.1 of the USA Project FSAP).

3.2.6 Field Sampling

Tributary stations (denoted by * in "Station Name" column of Table 3-1) will be sampled with a Young-modified ponar sampler (0.025 m^2 ponar with a frame around it for support), and Jamaica Bay "proper" samples will be taken from the USACE Shipek or Smith-MacIntyre grabs (which sample a surface area of 0.04 m^2 and 0.1 m^2, respectively). For tributary (ponar) sampling, four (4) replicates will be taken, sieved, labeled and preserved, and returned to the laboratory for invertebrate identifications and counts, and one (1) replicate will be sent to the ETL lab for grain size and total organic carbon (TOC) analyses. For Shipek stations, three (3) replicates will be taken and returned to the laboratory for invertebrate work (USACE will be handling the grain size and TOC analyses separately). Sampling protocols are described in Sections 6.1 (samples for grain size and TOC analysis) and 7.1 (subtidal benthos) of the USA Project SOP, and field data forms are included in Appendix A of this document.

Prior to taking the benthic samples, metadata (e.g. date, time, weather, crew names, etc.) will be recorded on a water quality data sheet (Form A in Appendix A of this document), and temperature/salinity/DO (surface, mid- and bottom depths) will be measured according to protocols in Section 4.2.3 of the USA Project SOP. These data will be recorded on the water quality data sheet (Form A). The instrument shall be calibrated according to instructions in Appendix B of the SOP.

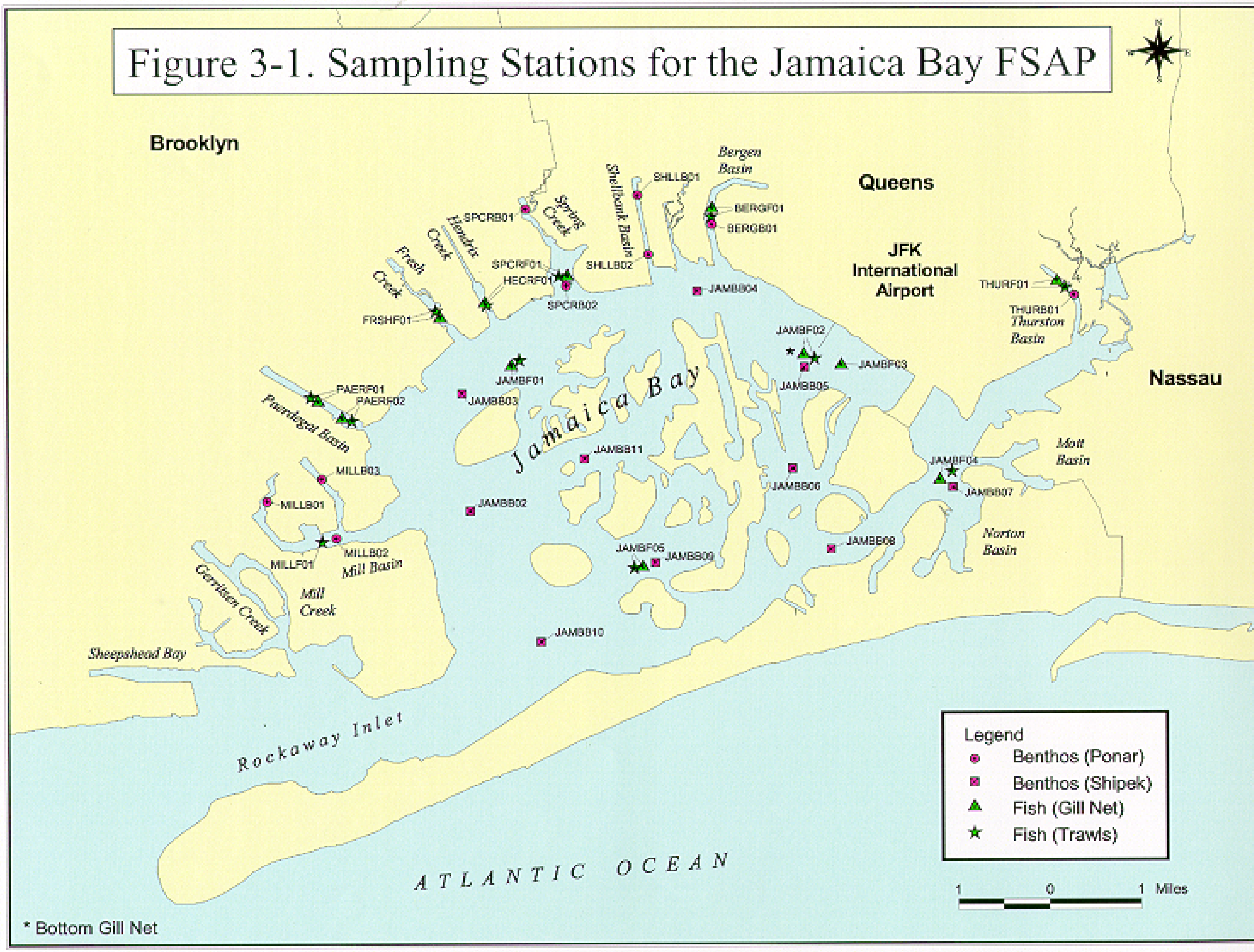

Figure 3-1. Sampling Stations for the Jamaica Bay FSAP

Table 3-1. Subtidal Benthos Sampling Station Names and Locations

Station ID	Station Name	Longitude	Latitude
BERGB01*	Bergen Basin	-73.823780	40.658430
JAMBB02	Big Channel - south of Canarsie Pol	TBD	TBD
JAMBB03	North of Canarsi Pol	TBD	TBD
JAMBB04	South of Hawtree Basin	TBD	TBD
JAMBB05	Grassy Bay (@JFK Pier)	-73.848320	40.583000
JAMBB06	Winhole Channel	TBD	TBD
JAMBB07	Outside Norton Basin	TBD	TBD
JAMBB08	Grass Hassock Channel	TBD	TBD
JAMBB09	The Raunt	-73.850830	40.582770
JAMBB10	Beach Channel/Rockaway Inlet	TBD	TBD
JAMBB11	Pumpkin Patch Channel	-73.853530	40.618480
MILLB01*	Mill Basin	TBD	TBD
MILLB02*	Junction of Mill Basin and East Mill Basin	TBD	TBD
MILLB03*	East Mill Basin	TBD	TBD
SHLLB01*	Head of Shellbank Basin	TBD	TBD
SHLLB02*	Mouth of Shellbank Basin	TBD	TBD
SPCRB01*	Head of Spring Creek	TBD	TBD
SPCRBO2*	Mouth of Spring Creek	TBD	TBD
THURB01*	Thurston Basin	-73.747380	40.641680

*Tributary Stations

This objective has a completeness goal of 100% of the stations to be occupied and the replicates to be collected.

3.2.7 Lab Analysis

Samples used for invertebrate analyses will be processed as described in Section 8.1 of the USA Project SOP, with an AOQL of 90% for sorting, identification and counts. Samples used for grain size and TOC analyses will be processed by ETL, Inc., a New York State Certified Lab, as indicated in Sections 9.1 and 9.2 of the SOP.

3.2.8 Data Reduction and Analysis

Species composition and taxa richness will be presented in tabular (e.g. lists and matrices of numbers per station) and graphical form (e.g. pie charts), and species diversity will be calculated per replicate and station. Counts/replicate (transformed [e.g. $\log_{10} X + 0.5$], if necessary) will be used in Analysis of Variance to detect differences among stations, and average counts and weights/taxa over the three to four replicates will be converted to numbers and weights/m^2. These standardized measures, as well as S and H, will be used in cluster analyses of station similarities, and correlations with grain size and/or TOC.

3.3 CRITERIA FOR OBJECTIVE #2: FISH

This objective is to inventory presence or absence of fish species in Jamaica Bay and its tributaries.

3.3.1 Statement of Purpose

To determine if representative species of juvenile and adult fish currently utilize the tributaries and representative areas of Jamaica Bay during summer, low DO conditions, and evaluate their relative abundance in comparison to habitat and varying degrees of water quality.

3.3.2 Rationale

Finfish, being motile organisms, choose which habitats they enter. Most species have distinct preference or avoidance responses to DO concentrations, temperature, salinity and turbidity, and their presence or absence can be used to evaluate differences among waterbodies. In addition, many species have well-known preferences for habitat types, those being related to their spawning and/or feeding behavior.

3.3.3 Null and Alternative Hypotheses

H_O (Null Hypothesis): Similar species of fish utilize all of Jamaica Bay and its tributaries during summer. H_A (Alternative Hypothesis): More fish species are found in Jamaica Bay during summer.

3.3.4 Schedule

The sampling schedule is indexed to that period of time when mid-depth and bottom DO concentrations are expected to be at their seasonal lows (i.e. summer). Completion of this objective will involve two "cruises". The first will be performed in mid- to late-July 2001, the second in mid-to-late-August 2001. This will provide two opportunities to observe fish distribution and abundance during the index period.

3.3.5 Sample Station Location

General sampling sites are shown on Figure 3-1. They will be finalized, and their latitudes and longitudes recorded and entered into Table 3-2 during a final reconnaissance in late June 2001. Positioning will be accomplished using the on-board Global Position Satellite (GPS) system, with an acceptable error of about 9-10 ft. (see Section 3.4.1 of the USA Project FSAP).

Table 3-2. Fish Sampling Station Names and Locations

Station ID	Station Name	Longitude	Latitude	Trawl and/or Gill Net
BERGF01	Bergen Basin			Trawl and Gill Net
FRSHF01	Near mouth of Fresh Creek	-73.528050	40.383920	Trawl and Gill Net
HECRF01	Near mouth of Hendrix Creek	-73.523360	40.386390	Trawl and Gill Net
JAMBF01	Channel between Canarsie Pol and Elder's Pond Marsh	-73.520140	40.377790	Trawl and Gill Net
JAMBF02	Grassy Bay (@JFK Pier)			Trawl and Gill Net
JAMBF03	Southeast of JFK Pier			Gill Net
JAMBF04	Outside of Norton Basin			Trawl and Gill Net
JAMBF05	The Raunt			Trawl and Gill Net
MILLF01	Mill Basin			Trawl
PAERF01	Head of Paerdegat Basin	-73.542920	40.375600	Trawl and Gill Net
PAERF02	Mouth of Paerdegat Basin	-73.540120	40.374060	Trawl and Gill Net
SHLLF01	Shellbank Basin			Trawl and Gill Net
SPCRF01	Spring Creek			Trawl and Gill Net
THURF01	Thurston Basin			Trawl and Gill Net

3.3.6 Field Sampling

Sampling will be conducted using both otter trawls and gill nets. The specifications and protocols for use of these gear types are described in Sections 7.5 and 7.6 of the USA Project SOP. All organisms collected (including fish, crabs, turtles, etc.) will be identified, photographed, and counted in the field. The total biomass of each of the species will be recorded (to the nearest gram), and all fish will be measured (nearest millimeter total length) and inspected for external parasites, diseases or tumors. Forms D and E of Appendix A of this document will be used to record the fish sampling data.

Prior to setting and retrieving the gill nets, and deploying the otter trawls, metadata (e.g. date, time, tide, weather, crew names, etc.) will be recorded on a water quality data sheet (Form A in Appendix A of this document), and Secchi depth, temperature/salinity/DO (surface, mid- and bottom depths) will be measured according to protocols in Sections 4.1.3 and 4.2.3 of the USA Project SOP. These data will be recorded on the water quality data sheet (Form A). The instrument shall be calibrated according to instructions in Appendix B of the SOP.

This objective has a completeness goal of 100% of the stations to be occupied and the samples to be collected, barring loss of gill nets due to vandalism or theft.

3.3.7 Lab Analysis

Not applicable. All identifications and measurements will be done in the field.

3.3.8 Data Reduction and Analysis

Tabular and/or graphical representation of species presence, numbers, catch per unit of effort, and length-frequency distributions will be presented, and differences among stations will be evaluated by Chi-square (X^2) and cluster analyses of presence/absence.

SECTION 4.0

MEASUREMENTS/DATA ACQUISITION

This section presents an overview of the Jamaica Bay sampling process design, and the tasks to be performed as part of each cruise. Reference to specific operating procedures and hardcopy data forms is included.

4.1 SAMPLING/PROCESS DESIGN

This FSAP has been designed to inventory fish and benthic invertebrates in representative areas of Jamaica Bay and its tributaries during summer 2001, and help evaluate differences among sites that may be related to habitat and/or DO profiles. As described earlier, samples will be taken throughout the study area, using standard methods for sampling and analysis. This section presents a summary of those tasks which are integral to this process.

4.2 SCHEDULED PROJECT ACTIVITIES

Project activities which will fulfill the objective described above include: (1) reconnaissance cruises to establish sampling locations and methods & materials; and (2) those cruises which have been scheduled to produce the required data. They are described herein.

4.3 FIELD RECONNAISSANCE SURVEYS

Field reconnaissance surveys are required prior to sampling to ensure that the stations have been selected to be representative of the communities to be sampled.

4.3.1 Objectives

The objective of the field reconnaissance is to ensure that the preliminarily-selected station locations are representative of the site to be sampled; that the methods and materials will work there; and [given that] to record the exact geographical positions (latitude and longitude) which will be occupied during conduct of the actual sampling cruises.

4.3.2 Station Selection

Stations were initially established on the basis of data gaps and historical water quality data, using navigation maps and USA Project-specific waterbody and CSO maps. To validate these locations, a site reconnaissance was performed on February 6, 7, 8 and 13, 2001.

4.3.3 Documentation Requirements

Site reconnaissance documentation requirements include photo documentation of the area to be sampled; the Captain's log book concerning areas surveyed and those chosen for ultimate sampling; and the site reconnaissance data forms included in Appendix A.

4.4 SAMPLING REQUIREMENTS

4.4.1 "Objective/Cruise #1"

The objective of this cruise is to finalize station coordinates for benthos and fish sampling based on DO profiles and efficacy of using the fish sampling gear. It will take place early- to mid-July 2001, in conjunction with ichthyoplankton sampling scheduled to be performed as part of that FSAP (HydroQual, 2001a).

- Read and re-read the USA Project SOP and this FSAP focusing on objectives and methods for reconnaissance, subtidal benthos, gill nets and trawls
- Calibrate YSI Model 85 per instructions in Appendix B of the SOP
- Assemble forms (Form A) and maps (including navigational maps, Figure 3-1 of this FSAP, and Tables 3-1 and 3-2 [which will be completed during this cruise])
- Make sure you have the appropriate DEC and NPS Permits
- Check with all scheduled crew members re. time, place, personal gear, phone numbers, etc.
- Meet at appointed place
- Review plan for general areas to be visited (see Figure 3-1) for the purpose of making final determinations of station coordinates **[<u>Remember</u> - For benthic stations near the heads of the waterbodies, you're looking for places with very low bottom DO; for stations near the mouths, you're looking for places with**

either higher DO (if same substrate) or less silty/black substrate (if higher DO). For fish, in the tributaries, you're looking for places where the gear will work and will be representative of the average condition of that waterbody, i.e. sufficiently inside so as to be representative of the "typical" habitat and DO (S,M,B) there (neither too close to the head nor too close to the mouth, sampling conditions permitting)]

- Go to first waterbody, record metadata, including coordinates, tide, weather, etc.
- Do in-situ water quality profile at a series of stations form head to mouth, according to Section 4.1 of the USA Project SOP, record on Form A
- Make a determination as to which station(s) should be the final one(s), note on forms and map, and enter coordinates on Tables 3-1 and 3-2

4.4.2 "Objective/Cruise #2"

The objective of this cruise is to sample fish during mid- late-July 2001.

- Read and re-read the USA Project SOP and this FSAP
- Calibrate YSI Model 85 per instructions in Appendix B of the SOP
- Assemble paperwork and instructions needed for the cruise (including forms A, D and E, and a complete copy of this FSAP)
- Make sure you have the appropriate DEC and NPS Permits
- Check with all scheduled crew members re. time, place, personal gear, phone numbers, etc.
- Meet at appointed place
- Check, repair as necessary, and stow gear
- Review plan for stations to be occupied each day, and samples to be taken
- Go to first station, record metadata, including coordinates, tide, weather, etc.
- Do Secchi disk measurement and in-situ water quality profile according to Section 4.1 of the USA Project SOP, record on Form A
- Perform trawl sample and process fish as prescribed in Section 7.5 of SOP, recording data on Form E of Appendix A of this FSAP
- Deploy gill net

- Continue to the next station and repeat the sampling process (metadata, in-situ measurements, trawling, setting gill net) until as many as possible of the total number of stations have been done through gill net deployment that day
- Finish the process for the remainder of the stations (if any) the following morning, and retrieve the gill nets set the previous day, processing the catch according to instructions in Section 7.6 of the SOP, and recording data on Form D of Appendix A
- Return the next day to retrieve and process contents of the last of the gill nets (if any)

4.4.3 "Objective/Cruise #3"

The objective of this cruise is to collect ponar samples in the tributaries of Jamaica Bay during early August.

- Read and re-read the USA Project SOP and this FSAP
- Calibrate YSI Model 85 per instructions in Appendix B of the SOP
- Assemble paperwork and instructions needed for the cruise (including form A, and a complete copy of this FSAP)
- Make sure you have the appropriate DEC and NPS Permits
- Check with all scheduled crew members re. time, place, personal gear, phone numbers, etc.
- Meet at appointed place
- Check and stow gear (including ponar, sieve, sample containers, formalin, etc.)
- Review plan for stations to be occupied each day, and samples to be taken
- Go to first station, record metadata, including coordinates, tide, weather, etc.
- Do in-situ water quality profile according to Section 4.1 of the USA Project SOP, record on Form A
- Perform ponar sampling as prescribed in Section 7.1 of SOP, taking four (4) replicates per station
- Preserve and label samples for invertebrate identifications, and take a fifth (5th) grab to send to ETL for analysis of grain size and TOC according to instructions in Section 6.1 of the SOP (using the required chain-of-custody form)
- Continue to the next station and repeat the sampling process
- Return samples to the lab at the end of each day, and data to the office

4.4.4 "Objective/Cruise #4

The objective of this cruise is to sample fish during mid- late-August 2001.

- Read and re-read the USA Project SOP and this FSAP
- Calibrate YSI Model 85 per instructions in Appendix B of the SOP
- Assemble paperwork and instructions needed for the cruise (including forms A, D and E, and a complete copy of this FSAP)
- Make sure you have the appropriate DEC and NPS Permits
- Check with all scheduled crew members re. time, place, personal gear, phone numbers, etc.
- Meet at appointed place
- Check, repair as necessary, and stow gear
- Review plan for stations to be occupied each day, and samples to be taken
- Go to first station, record metadata, including coordinates, tide, weather, etc.
- Do Secchi disk measurement and in-situ water quality profile according to Section 4.1 of the USA Project SOP, record on Form A
- Perform trawl sample and process fish as prescribed in Section 7.5 of SOP, recording data on Form E of Appendix A of this FSAP
- Deploy gill net
- Continue to the next station and repeat the sampling process (metadata, in-situ measurements, trawling, setting gill net) until as many as possible of the total number of stations have been done through gill net deployment that day
- Finish the process for the remainder of the stations (if any) the following morning, and retrieve the gill nets set the previous day, processing the catch according to instructions in Section 7.6 of the SOP, and recording data on Form D of Appendix A
- Return the next day to retrieve and process contents of the last of the gill nets (if any)

4.4.5 "Objective/Cruise #5"

The objective of this cruise is to collect, aboard the USACE research vessel, benthic invertebrate samples taken by their Shipek or Smith-MacIntyre grab samplers. This will be performed during the week of August 20, 2001.

- Read and re-read the USA Project SOP and this FSAP
- Assemble paperwork and instructions needed for the cruise (including form A, and a complete copy of this FSAP)
- Check with all scheduled crew members re. time, place, personal gear, phone numbers, etc.
- Meet at appointed place
- Check and stow gear (including forms, sieves, sample containers, formalin, etc.)
- Review plan with USACE for stations to be occupied each day, and samples to be taken
- Go to first station, record metadata, including coordinates, tide, weather, etc.
- Do in-situ water quality profile according to Section 4.1 of the USA Project SOP, record on Form A
- Assist USACE in collection of Shipek **[or Smith-MacIntyre]** sampling, taking three (3) replicates per station
- Sieve, preserve and label samples for invertebrate identifications
- Continue to the next station and repeat the sampling process
- Ship samples to Ms. Diane Moore at the end of each day, and return field data and notes to the office

SECTION 5.0

QUALITY CONTROL

Each field, lab and data reduction activity conducted for the USA Project has prescribed QC checks. These are specified in the USA Project SOP as referenced in Sections 3.0 and 4.0 of this FSAP, and summarized in this section. Attainment of project-specific QC criteria will be the responsibility of all field, laboratory and data management personnel, as well as the HydroQual Project Technical Advisor, QC Officer and Manager, and the QA Managers of the team subcontractors (as appropriate).

5.1 FIELD ACTIVITIES

Field sampling activities will follow protocols described in Sections 4.1, 4.2, 7.1,7.5 and 7.6 of the USA Project SOP (secchi disk, in-situ water quality, subtidal benthos, trawls, and gill nets, respectively). Data will be entered in Forms A, D and E (see Appendix A). A Chain of Custody will accompany all samples returned to the laboratory. It will include, in addition to sample identification information, the signature of the person releasing the sample to the laboratory.

Key QC criteria for this FSAP include:

- Location - position vessel on station ± 9-10 feet.

- Secchi Disk - avoid sun glare on water; do not wear sun glasses

- YSI 85 - check once/day against winkler method for DO, air calibrate per manufacturers specifications (Appendix B of SOP) 3-4 times per day; check salinity daily against a known standard to ensure accuracy of ± 1.0 ppt; check temperature against an NBS-certified glass thermometer daily (± 0.5 C).

- Ponar samples - clean ponar and sieves before taking each sample; check each grab for fullness and leakage; check ponar and sieve to make sure all organisms have been extracted and placed in the sample containers.

- Otter trawls - check for holes; check connections; ensure that net does not twist on deployment; tow at standard speed for standard time; make sure to pick all organisms, including crabs, turtles, etc., from net.

- Gill nets - check for holes; check buoy and anchor connections; set at prescribed depth and orientation; record species by mesh size.

- Records - check for legibility and completeness after each station.

To the extent possible, utilize the same key personnel on every cruise.

5.2 LABORATORY ANALYSES

Laboratory analysis will follow protocols described in Section 8.1 of the USA Project SOP. The AOQL for sorts, identification and counts is 90%. Records must show detail of subsampling fractions (if any), QC checks, and initials of the sorter, counter and checker. If error exceeds 10% the responsible personnel will be given specific instructions or additional training, and QC will continue until five consecutive samples are processed with an AOQL of at least 90%.

5.3 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE

Instrument and equipment maintenance will be performed following protocols listed in Section 3.2.5. For quality control purposes, personnel will be trained consistently regarding instrument and equipment maintenance. Instruments will be stored as per manufacturer's guidelines. The quality control officer will oversee all care and maintenance of field equipment and instruments.

5.4 INSTRUMENT CALIBRATION AND FREQUENCY

The YSI 85 meter will be air calibrated against manufacturer's instructions (Appendix B of the USA Project SOP) 3-4 times/day, and against a Winkler method daily.

5.5 DATA MANAGEMENT

All water quality, sediment quality, and biological data will be retained in their original hardcopy form (field data sheets, field notes, and laboratory reports). In addition, these data will be entered into a relational database management system. A database system has been created, using Microsoft Access Version 97, which contains water quality data from other past and ongoing programs as well as the USA Project. Additionally, a second database for the USA Project biological data has also been developed. A data entry system has been implemented to facilitate transfer of field- and laboratory-generated data into the databases. The system has been designed to minimize data entry errors as well as to adequately record station and project metadata. For example, look-up tables of important information such as station names, method codes, and taxonomic names are employed to avoid typographical input errors. For species identifications, the database uses a nationally recognized nomenclature and tracking system, which contains unique taxonomic serial numbers (TSNs) in addition to accepted scientific and common names of organisms.

As noted in Section 3.2.7 (above), staff members involved in the field collection activities, as well as the Project Technical Advisor, will be intimately involved in data and analytical computation quality assurance activities. This, along with measures integral to the database management system, will ensure an AOQL for all data of ≥90% (i.e. fewer that 10% non-conforming data).

SECTION 6.0

ASSESSMENT/OVERSIGHT

Assessment and oversight will be provided by the Project Technical Advisor, the QA Managers for all team organizations, the QC Officer, and the independent voucher (type) species expert. Routine performance assessments are provided by the Project Technical Advisor and QA Managers, whereas system audits of field and laboratory activities are performed by the QC Officer.

6.1 ASSESSMENT AND RESPONSE ACTIONS

The Project Technical Advisor will provide continuous assessment/oversight of all activities, delegating particular tasks (e.g. trouble-shooting, corrective measures, feedback, audits) to subcontractor QA Managers or Principals in Charge, and audits to the QC Officer. Subcontractor Principals in Charge shall ensure that the quality criteria and measures described in this FSAP are being property and consistently implemented and documented.

6.1.1 Field Monitoring

Field sampling activities will be directly observed by the QC officer at a frequency of at least once per Objective (e.g. "Subtidal Benthos Studies"), over the course of the activity. He will check all equipment and procedures against materials and methods presented in this FSAP, and will provide immediate feedback to the field crew when immediate corrective measures are deemed appropriate. The QC Officer will inspect data sheets and log books for legibility, accuracy and completeness at the end of the cruise, and provide a post-cruise briefing to the crew.

6.1.2 Laboratory Activities

Laboratory activities will be overseen by subcontractor QA Managers, and audited once per Objective by the Project QC Officer. If major deviations from protocols in this FSAP are observed, the QC Officer will repeat his audit to verify corrective measures. The audit will include observation of operational techniques, as well as review of records.

6.2 REPORTS TO MANAGEMENT

Reports to management will include day-to-day communications with the Project Technical Advisor and/or the EEA, Inc. Principal in Charge; periodic reports to the Project Manager and QA Manager, including records of exception, field change reasons and resolution, and general progress relative to completeness goals; and audit reports. Results of the audit reports will be reviewed by the Project and subcontractor Managers, who will report his/her conclusions and recommendations on activity acceptability or corrective actions required. Major deviations from project protocols must be addressed in a detailed report to the Project Manager, who will take the appropriate actions necessary to ensure attainment of data quality objectives.

SECTION 7.0

DATA VALIDATION/USE OF OTHER PARTY DATA

The data generated by the USA Project will be reviewed and validated at many intervals during the conduct of the project. First, the quality criteria and audits described in this FSAP will serve to provide data with an AOQL of $\geq$90%. Next, the Project Technical Advisor's review of incoming data will include validation of completeness, comparability, etc., before the data are given to the database management staff. Any qualifying information or codes will be noted on the data sheets, and any questions the Project Technical Advisor has will be checked and validated by staff participating in the particular cruise or laboratory activity. The database management system has its own built-in checks and balances, but the Project Technical Advisor will also inspect all outgoing tables, figures and calculations prior to issuing them for inclusion and interpretation in reports or presentations. Once draft reports are available, the Project QA Manager will review them, and, passing his approval, they will be submitted to the Project Manager for review, discussion and approval.

Use, in statistical tests or mathematical models, of data generated by other parties is limited to the DEP Harbor Survey (HS) monitoring program field and lab data, and the grain size and TOC data that USACE will be gathering this year. HydroQual has been using the HS data for years, and is thoroughly familiar with the QA/QC processes associated with their measurement. Similarly, USACE will be adhering to strict QA/QC standards for the sediment data. Although HydroQual does not expect to be relying (quantitatively) on any other party's data, naturally the project will be depending upon numerous reports (e.g. those cited in Section 1.1.2) in order to complete the description of Jamaica Bay and its tributaries over the years, and complete the use and standards assessment. Like any scientific assessment, the USA Project team will apply a standard of due diligence in the degree to which these data and reports factor into the project's ultimate conclusions and recommendations.

SECTION 8.0

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APPENDIX A

FIELD FORMS

HydroQual

Environmental
Engineers & Scientists

WATER QUALITY DATA SHEET

Date: ______________

Station ID: ______________

Time: ______________

Crew: ______________

GPS Coordinates

N	W

Sampling Activities:

Water: Pathogen Toxicity Residual Chlorine

Sediment: Benthos Grain Size/TOC SOD

Fish: Start Trawl End Trawl Gill Net (Set) Gill Net (Retrieve)

Artificial Substrates: Set Retrieve

Ichthyoplankton: Tow

Tide: Flood High Ebb Low

Waterbody Stratum	Sample Depth (ft.)	Temp (°C)	DO (%)	DO (mg/L)	Conductivity (Ms/cm)	Salinity (ppt)	Secchi Depth (ft.)

Total Depth (ft.): ___________

Sample Analysis:

Analysis Type	Replicate No.	Chain of Custody No.	Sample ID	Laboratory

Notes: ____

FORM-D **GILL NET, CRAB TRAP AND KILLI POT DATA SHEET** Page __ of __

Date: ______________

Station ID: ______________

Time: ______________

Crew: ______________

Fixed Gear GPS Coordinates

N	W

Replicate Number: ________

Gear	Panel	Species	TOTAL Weight (g)	TOTAL No.	Individual Length (mm)	Individual Weight (g)	Individual Length (mm)	Individual Weight (g)

Other Species/ Comments: ____

FORM-E

FISH TRAWL DATA SHEET

Date: ______________

Station ID: ______________

Time: ______________

Crew: ______________

GPS Coordinates

Start:	N	W
End:	N	W

Start Trawl Time :______________

End Trawl Time : ______________

Replicate Number: _______

	TOTAL		Individual			
Species	**Weight (g)**	**No.**	Length (mm)	Weight (g)	Length (mm)	Weight (g)

Other Species/Comments:____

____

____

____

____

FORM-F **SAMPLING PHOTOGRAPH LOG**

Date: ____________________
Project No: ______________

Waterbody/ Station ID	No.	Digital (D) or Film (F)	Description of Photo	Photo-grapher

Comments: ____

____

FORM-G **RECONNAISSANCE PHOTOGRAPH LOG** Page __of __

Date: ________________

Photo-grapher	Waterbody/ Station ID	No.	Digital (D) or Film (F)	Description of Photo

Comments: ____

____

FORM-H RECONNAISSANCE OBSERVATION SHEET Page __of __

Date: ______________

Station ID: ______________

Time: ______________

Rep No: _______

Crew: ______________

GPS Coordinates

N	W

Tide: Flood High Ebb Low

Water Quality:

Waterbody Stratum	Sample Depth (ft.)	Temp (°C)	Conductivity (Ms/cm)	Salinity (ppt)	DO (%)	DO (mg/L)

Total Depth (ft.): __________

Substrate Observations:

Texture: ____________________________________

Appearance: ________________________________

Odor: ______________________________________

Organisms Observed: __________________________

General Observations (land use, CSOs, pilings/bridges, etc.):

Sample Analysis:

Analysis Type	Replicate No.	Sample ID	Chain of Custody No.	Laboratory

ETL
Environmental Testing Laboratories, Inc.
208 Route 109 • Farmingdale • New York 11735
516-249-1456 • Fax: 516-249-8344

CHAIN OF CUSTODY DOCUMENT

J 9958

OFFICE COPY

Project Name:	Project Manager:
Project Address:	
Client J/N:	☐ Rush by / /
SAMPLE INFO Type SS = Split Spoon, G = Grab; C = Composite; B = Blank Matrix. L = Liquid, S = Soil; SL = Sludge, A* = Air; W = Wipe	*Air - Vol (Liters) include Flow (CFM)

Sampler (Signature): (Print):

ID	Date	Time	Type	Matrix	Sample Location	Total. # Cont.	601/602	BTX/BTEX	MTBE	624/8260/8021	625/8270/BN	PCB/Pesticides	Pet.Prods./8100M	RCRA Metals	pH/Flash/React	418.1 - TRPH									
1																									
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									
13																									
14																									
15																									

Relinquished by (Signature):	Date Time	Printed Name & Agent:	Received by (Signature):	Date Time	Printed Name & Agent
Relinquished by (Signature):	Date Time	Printed Name & Agent:	Received for Lab by (Signature):	Date Time	Printed Name
Comments & Special Instructions		QA/QC Type:	Number & Type of Containers:	Preservatives:	Temp: