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NEW JERSEY TOXICS REDUCTION WORKPLAN

VOLUME I

Table of Contents

Section I: Introduction	Page 5
Statement of the Problem	Page 5
Goals of the HEP CCMP and Joint Dredging Plan	Page 10
Objectives of the New Jersey Toxics Reduction Workplan	Page 14
Section II: HEP CCMP and Joint Dredging Plan Actions that NJDEP is Currently Implementing to Reduce Inputs of the Chemicals of Concern	Page 17
Section III: Actions to Identify and Eliminate Sources of the Chemicals of Concern to the NY-NJ Harbor Estuary	Page 28
Introduction/Summary	Page 28
Detailed Descriptions of the Workplan Studies and Investigations	Page 39

→

Appendices

Appendix A: Sampling Method Development Studies (1998-1999)

Appendix B: Description of Hydrologic Events

Appendix C: Workshop Proceedings – The Significance of Atmospheric Pollution Loadings to the New York-New Jersey Harbor Estuary and Watershed

Appendix D: Proposal – Pilot Study: GIS-Based Trackdown of Pollution Sources from Known Contaminated Sites to the New York-New Jersey Harbor Estuary.

VOLUME II: QUALITY ASSURANCE/QUALITY CONTROL PLAN

LIST OF TABLES

Table I-1: Chemicals of Concern in the NY-NJ Harbor Estuary and Bight Page 9

Table III-1: Summary Description of the Investigations and Monitoring Studies to be Undertaken as Part of the New Jersey Toxics Reduction Workplan Page 34

Table III-2: Target Analyte List for Studies I-C, I-D, I-E, and I-G Page 49

Table III-3: Types and Approximate Numbers of Samples to be Collected in Study I-C Page 55

Table III-4: Permanent Monitoring Stations for Study I-C Page 56

Table III-5a: Major and Minor Tributaries to be Monitored in Study I-D Page 60

Table III-5b: Initial Sampling Locations for Study I-D Page 61

Table III-6: Initial Sampling Locations in Study I-E Page 65

Table III-7: Summary Information on the Discharges from POTWs Owned and Operated by the NJHDG Page 70

Table III-8: Summary Information on the CSOs Initially Selected to be Sampled Page 72

Table III-9: Summary Information on the SWOs Initially Selected to be Sampled Page 74

LIST OF FIGURES

Figure I-1: New York/New Jersey Harbor Estuary Page 8

Figure I-2a: NY-NJ HEP "Management of Toxic Contamination Goals and Objectives Page 12

Figure I-2b: NY-NJ HRP "Rainfall-Induced Discharges" Goals and Objectives Page 13

Figure III-1: Schematic Diagram of the New Jersey Toxics Reduction Workplan Page 32

Figure III-2: Timeline for NJ Toxics Reduction Workplan Activities Page 33

Figure III-3: Initial Sampling Locations for Studies I-C, I-D and I-E Page 57

Figure III-4: Approximate Locations of the Discharges from the POTWs Owned and Operated by Members of the New Jersey Harbor Dischargers Group Page 71

Figure III-5: Sample Collection, Processing, and Analytical Approach to be Used in Study I-G Page 75

SECTION I: INTRODUCTION

STATEMENT OF THE PROBLEM

The New York-New Jersey Harbor estuary system and the New York Bight (see Figure 1-1) are of enormous and interdependent ecological and economic importance. The presence of toxic chemicals in the water and sediments results in reduced water quality, fisheries restrictions/advisories, reproductive impairments in some coastal species, and general adverse impacts to the estuarine and coastal ecosystems. The Port of New York and New Jersey is central to the economy of the region; it is the largest port on the East Coast of the United States. However, in recent years, problems associated with the management of contaminated dredged material, including high costs and the lack of suitable disposal/use alternatives, have impacted the volume of shipping in the harbor.

Continuing discharges of several chemicals, notably metals and polychlorinated biphenyls (PCBs), are contributing to violations of water quality standards, contamination of fish and shellfish, and other ecological impairments. The ecological and/or human health risks of other chemicals are not well defined, however the concentration of a number of these chemicals in the water, sediment, and tissue of fish/shellfish exceed various criteria and standards developed by regulatory agencies to protect biota and human health. Prudent measures must be implemented as soon as possible to eliminate/reduce the discharges of these chemicals to the Harbor/Bight.

The New York-New Jersey Harbor Estuary Program Comprehensive Conservation and Management Plan (HEP CCMP; March 1996) identified at least fifteen chemicals (or classes of chemicals) of concern, including PCBs, dioxins/furans, chlorinated pesticides, polycyclic aromatic hydrocarbons (PAHs), and metals (see Table I-1; note: this list of chemicals is currently being reviewed and updated by the HEP Toxics Work Group). Historically, much of the toxic chemicals discharged to NY-NJ harbor originated from uncontrolled discharges, particularly from industrial sources. Current sources include atmospheric deposition, municipal and industrial wastewater treatment facilities, combined sewer and stormwater outfalls, and rainfall-induced runoff (non-point sources). In addition, harbor sediments, which preferentially bind various toxic chemicals, can act as a continuing source as they are resuspended and moved throughout the system by both natural and man-made means.

It has been estimated that atmospheric deposition can contribute up to 70% of the loadings of some toxic chemicals to coastal areas. The NY-NJ Harbor estuary system may thus be subject to significant loadings of one or more of the identified chemicals of concern due to atmospheric deposition. However, the magnitude of such loadings to the estuary is largely unknown.

Twelve publicly owned treatment works (POTWs) currently discharge directly to New Jersey surface waters in the NY-NJ Harbor estuary system (see Table III-7). These discharges total approximately 610 million gallons per day (mgd) and account for about 30% of the total wastewater flow discharged by treatment facilities from New Jersey and New York to the Hudson River Basin below Troy Dam. In addition to treating residential and commercial sewage, many of the POTWs treat wastewater originating from a wide variety of industrial operations and processes. A large number of industrial wastewater treatment facilities also discharge directly to the harbor. Limited studies in the past have shown that discharges from municipal and industrial wastewater treatment facilities can contain measurable (and sometimes significant) concentrations of some of the chemicals of concern.

Combined sewerage systems transport both sanitary sewage and stormwater. During wet weather events, the capacity of sewage treatment plants can be insufficient, and the combined flows are diverted from the treatment facilities directly into the harbor. There are approximately 730 combined sewer outfalls (CSOs) in NY-NJ Harbor, including 239 in New Jersey. These CSOs could be significant sources of one or more of the identified chemicals of concern. Likewise, discharges from storm water (only) systems and direct (non-point source) runoff from the land during wet weather events are not treated, and contribute to the problem of toxic chemicals in the harbor and Bight.

Contamination of sediments with the various chemicals of concern interferes with dredging activities, and limits the available dredged material management/disposal alternatives. Sediments throughout the harbor and in some areas of the Bight are toxic to a variety of organisms, or contaminants bioaccumulate to unacceptable levels in laboratory tests required for ocean disposal. In general, sediment contamination is greatest within Newark Bay and its tributaries (including the Passaic and Hackensack Rivers), the Arthur Kill, and the Kill Van Kull. These sediments may also be acting as a continuing source for some of the chemicals of concern.

Although much information is currently available regarding potential sources of the chemicals of concern and the levels of contamination in sediments and biota in NY-NJ Harbor, there are significant gaps in existing data. For example, most current and past monitoring efforts have used analytical procedures with minimum detection limits greater than the concentrations of the contaminants -- thus, they are not routinely detected. However, large volume/very low concentration discharges could be significant sources of some of the chemicals of concern. In addition, trackdown efforts are needed to identify the specific source(s) of the contaminants within the service areas of the discharge points (POTWs, CSOs, and SWOs).

Despite years of abuse and mismanagement, the harbor and Bight are natural resources of unparalleled value, and improvements in water quality and ecosystem health have been observed. To quote from the Final HEP CCMP (page 5):

> *In the two decades since the passage of the Clean Water Act, investments in water pollution control programs have resulted in significantly improved water quality in the region. These improvements have occurred despite an ever-increasing number of people and activities in the Harbor/Bight. Obvious sources of pollution are now regulated through permit programs ... Industrial Pretreatment Programs have helped reduce discharges of industrial wastes to municipal sewage systems, resulting in substantial reductions in loadings of several toxic chemicals including metals. More recently, agencies have begun to focus on the ecosystem as a whole and on previously inadequately controlled sources, such as combined sewer overflows (CSOs), storm water, and non-point source runoff.*

The New Jersey Toxics Reduction Workplan is another effort, in cooperation with the State of New York, to build upon the successes of the Clean Water Act. The data, information, and analyses to be conducted will focus on the detection of trace amounts (i.e. low concentration discharges) of the chemicals of concern and will improve our understanding of the relative importance of these discharges. This will lead to a prioritization of the various alternative management actions that could be implemented to eliminate/reduce the input of these toxic chemicals to the NY-NJ Harbor and New York Bight.

This workplan will be funded, in part, by a grant of $9.5 million from the Port Authority of New York and New Jersey to the State of New Jersey.

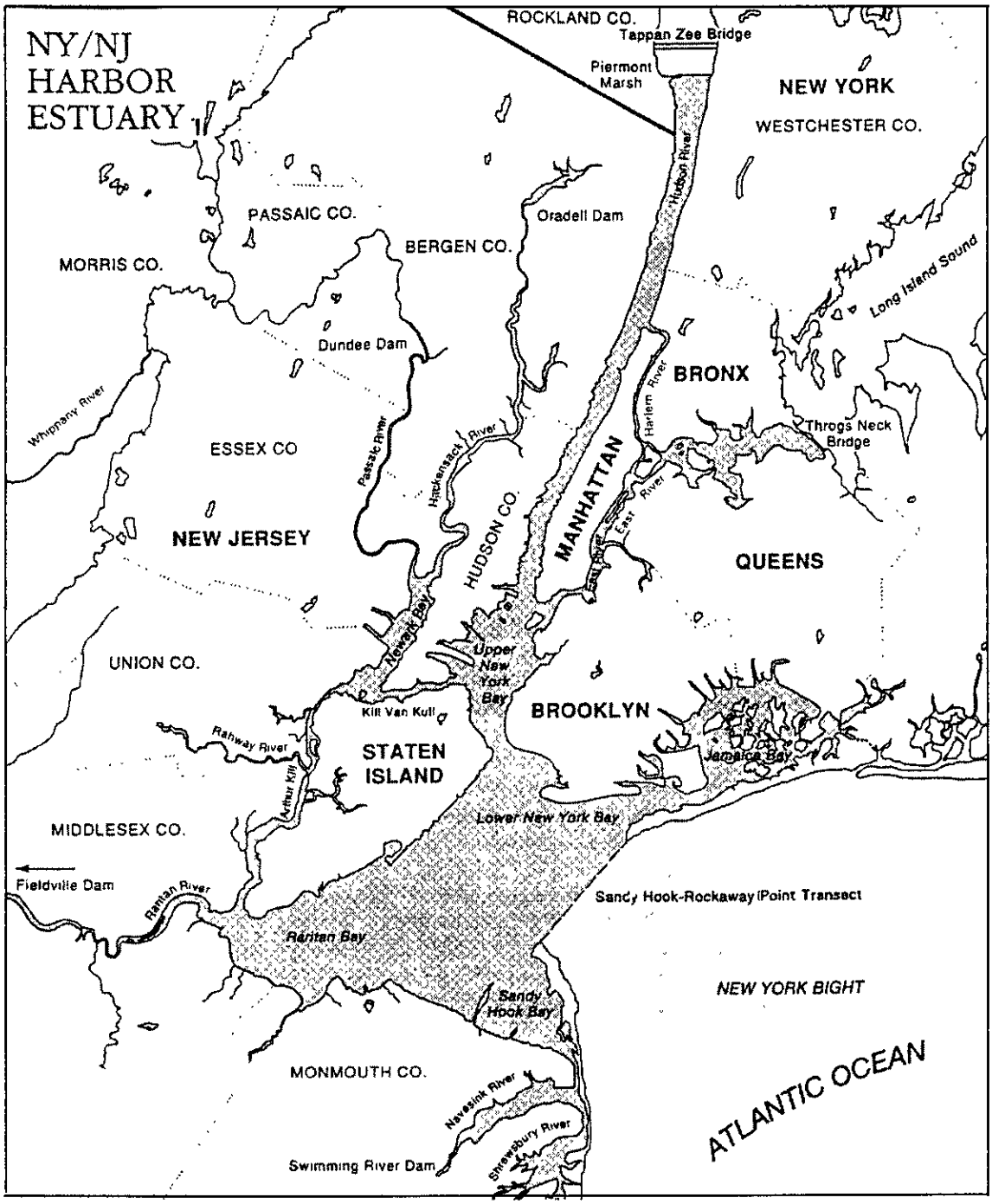

NY/NJ
HARBOR
ESTUARY
ROCKLAND CO.
Tappan Zee Bridge
Piermont
Marsh
NEW YORK
WESTCHESTER CO.
Hudson River
PASSAIC CO.
Oradell Dam
BERGEN CO.
MORRIS CO.
Long Island Sound
Dundee Dam
BRONX
Whippany River
Harlem River
Throgs Neck
Bridge
ESSEX CO
Passaic River
Hackensack River
HUDSON CO.
MANHATTAN
East River
NEW JERSEY
QUEENS
Newark Bay
Upper
New
York
Bay
UNION CO.
Kill Van Kull
BROOKLYN
Rahway River
STATEN
ISLAND
Jamaica Bay
Arthur Kill
Lower New York Bay
MIDDLESEX CO.
Fieldville Dam
Raritan River
Sandy Hook-Rockaway Point Transect
Raritan Bay
NEW YORK BIGHT
Sandy
Hook Bay
MONMOUTH CO.
Navesink River
Shrewsbury River
ATLANTIC OCEAN
Swimming River Dam

Table I-1: Chemicals of Concern in the NY-NJ Harbor Estuary and Bight

Chemical	Water	Biota	Sediments[a]
METALS			
Nickel[b]	*		
Cadmium		O	
Lead		O	O
Mercury	*	O	O
PCBs (total)	*	*	O
PAHs	*	O	O
DIOXIN		*	O
PESTICIDES			
DDT & metabolites		*	
Chlordane & met.		*	
Dieldrin		O	O
Tetrachlorethylene	*		

Note a: this table was developed by the Toxics Work Group of the New York-New Jersey Harbor Estuary Program. The work group is still evaluating the parameters of concern for sediments.

Note b: only for the Hackensack River.

O = exceedances of unenforceable criteria (i.e. published USEPA criteria or other criteria or screening values such as USEPA fish tissue concentrations), and are recommended for future study, but are not recommended for inclusion in the TMDL process at this time.

* = exceedances of enforceable standards (i.e. state water quality standards, New York State water quality guidance values, USEPA Toxics Rule criteria, and USFDA action levels and state advisory levels for fish tissue), and are recommended for consideration in the TMDL process.

GOALS OF THE HEP CCMP AND JOINT DREDGING PLAN

The overall vision of the NY-NJ Harbor Estuary Program CCMP is "to establish and maintain a healthy and productive Harbor/Bight ecosystem with full beneficial uses". The following general goals of the CCMP are directly related to the problem of contamination of the water and sediments with the identified chemicals of concern:

- Restore and maintain an ecosystem which supports an optimum diversity of living resources on a sustained basis;
- Ensure that fish and shellfish in the Estuary are safe for unrestricted human consumption;
- Actively address emerging issues that impact the Estuary;
- Manage and balance the competing uses of the Estuary to improve environmental quality -- in particular, ensure the continued economic viability of the Port to support safe and efficient waterborne commerce without adversely impacting the ecosystem;
- Manage pollutants within the Estuary so that they do not contribute to use impairments outside the Estuary.

The specific goals and objectives of the HEP CCMP as they relate to the "Management of Toxic Contamination" are reproduced here in Figure I-2a; those related to "Rainfall-Induced Discharges" are reproduced in Figure I-2b. In order to achieve these goals and objectives, the NY-NJ Harbor Estuary Program CCMP includes a number of actions to

(1) reduce continuing discharges of the chemicals of concern to the NY-NJ Harbor estuary and New York Bight systems;

(2) remediate selected contaminated sediments;

(3) minimize human health risks due to the consumption of fish, crustacea, and shellfish;

(4) better understand the problem of toxic contamination and take additional management actions as more is learned.

The Joint Dredging Plan for the Port of New York and New Jersey (October 7, 1996) stresses the economic importance of the port to the regional economy, and the associated need to dredge navigation channels and maintain port facilities. In addition, it recognizes that "the preservation, conservation, and restoration of the harbor's natural resources are critical to the quality of life in the metropolitan region" (page 1). Given these concerns, the Joint Dredging Plan has two major objectives:

- to promote greater certainty and predictability in the dredging project review process, and dredged material management;

- to facilitate effective long-term environmentally sound management strategies for addressing dredging and disposal needs for the region.

As part of the commitments included in the Joint Dredging Plan, the two States agreed to implement the HEP CCMP as it relates to a number of sediment and toxic contamination concerns. Specifically, the following actions included in the Joint Dredging Plan are directly related to the problem of the contamination of the water and sediments with toxic chemicals:

(1) to continue aggressive pursuit of point and non-point source pollution in the harbor;

(2) to fund the track down and clean-up recommendations in the CCMP;

(3) to continue the implementation and enforcement of The Combined Sewer Overflow (CSO) abatement controls of USEPA's national CSO Control Policy;

(4) to develop a workplan for additional studies in areas of highly contaminated sediments;

(5) to conduct Phase I and Phase II sediment Toxicity Identification Evaluations (TIEs) to identify the causes of sediment contamination; and

(6) to aggressively pursue the recovery of damages from the parties responsible for polluting the harbor, with any damage awards to be applied to harbor restoration including clean-up and disposal costs.

In a November 17, 1997 letter to the Department, the Office of Maritime Resources of the New Jersey Department of Commerce and Economic Development provided comments on a draft of the New Jersey Toxics Reduction Workplan. It was recommended that a phased approach be taken to implement the workplan, with the following actions being given immediate attention:

- prioritize sediment hot spots and clean-up projects;
- CSO prioritization and remediation;
- pollutant trackdown, prioritization, and clean-up;
- completion of NJDEP GIS database of pollution sources;
- prioritize non-point source pollution prevention/remediation projects.

Short-term research projects should include (a) TIEs to include a deliverable priority list of contaminants of concern, and (b) tributary loadings quantification and prioritization to include

Figure I-2a: NY-NJ HEP "Management of Toxic Contamination" Goals and Objectives

GOALS

To restore and maintain a healthy and productive Harbor/Bight ecosystem, with no adverse ecological effects due to toxic contamination.

To ensure fish, crustacea, and shellfish caught in the Harbor/Bight are safe for unrestricted human consumption.

To ensure that dredged sediments in the Harbor are safe for unrestricted ocean disposal.

OBJECTIVES

To reduce continuing inputs of toxic chemicals to the Harbor/Bight system:

T-1 Reduce municipal discharges of chemicals of concern.
T-2 Reduce industrial discharges of chemicals of concern.
T-3 Minimize the discharge of toxic chemicals from CSOs, storm water, and non- point sources.
T-4 Reduce air emissions of chemicals of concern.
T-5 Remediate identified solid and hazardous waste sites.
T-6 Track-down and clean-up other sources of chemicals of concern.
T-7 Improve chemical/oil spill response and prevention.
T-8 Focus pollution prevention activities on chemicals of concern.

To remediate selected contaminated sediments:

T-9 Identify and remediate selected contaminated sediments.

To minimize human health risks due to the consumption of fish, crustacea, and shellfish caught in the Harbor/Bight:

T-10 Establish consistent methodology to assess risks and improve communication of fish advisories.

To better understand the toxic contamination problem and take additional management actions as more is learned:

T-11 Review and develop criteria for copper and other priority chemicals.
T-12 Assess ambient levels, loadings, and effects of chemicals.
T-13 Develop mass balances for metals and organic chemicals.

Figure I-2b: NY-NJ HEP "Rainfall-Induced Discharges" Goals and Objectives

GOALS	To minimize the loads of pollutants entering the Harbor/Bight from combined sewer overflows, storm water discharges, and non-point source runoff.
	To eliminate the adverse environmental effects of combined sewer overflows, storm water discharges, and non-point source runoff on the Harbor/Bight.
OBJECTIVES	
CSO-1	Implement the nine minimum measures of the National CSO Control policy.
CSO-2	Implement additional CSO controls to meet water quality standards and restore beneficial uses.
SW-1	Implement measures to control municipal and industrial storm water discharges.
NPS-1	Focus Clean Water Act non-point source programs on Harbor/Bight watersheds.
NPS-2	Develop and implement coastal non-point source management programs under Coastal Zone Act reauthorization Amendments.
NPS-3	Focus the Urban Resources Partnership Initiative on Harbor/Bight watersheds.
NPS-4	Continue and enhance education programs for control of non-point source pollution.

remedial/management actions. Long-term research studies would include sediment transport modeling and human and ecological risk assessments.

Subsequent to the completion and signing of the HEP CCMP and Joint Dredging Plan, the federal government revised its policy for the use of the Mud Dump Site for the ocean disposal of dredged material from NY-NJ Harbor. The site was redesignated as the Historic Area Remediation Site (HARS); only dredged material that is found suitable for unrestricted ocean disposal (i.e. meets the current Category I criteria) may be placed at the HARS. This change in the use of the Mud Dump Site/HARS has resulted in modifications to the short-term priorities of the HEP CCMP and Joint Dredging Plan as they relate to the problem of toxic contamination.

OBJECTIVES OF THE NEW JERSEY TOXICS REDUCTION WORKPLAN

In consideration of the goals and objectives of the NY-NJ Harbor Estuary Program CCMP and the Joint Dredging Plan, the ultimate goals of New Jersey's toxics reduction activities in NY-NJ Harbor are as follows:

- to reduce/eliminate continuing and future inputs of toxic chemicals to the NJ-NY Harbor Estuary and the New York Bight;
- to minimize risks to human health due to the consumption of fish, crustacea, and shellfish caught in the estuary and Bight;
- to undertake studies to better understand problems associated with toxic contaminants, and implement additional management actions as appropriate;
- to identify selected contaminated sediments for future remediation activities.

As a first step in this effort, the New Jersey Toxics Reduction Workplan includes a series of studies designed to provide the Department with the data and information it needs to meet the following primary objectives:

- to identify sources of the chemicals of concern, and to prioritize these sources for appropriate action (management, regulatory, trackdown, clean-up).
- to identify selected contaminated sediments for future remediation and restoration activities.

The studies conducted as part of the New Jersey Toxics Reduction Workplan will be used to develop Draft and Final "Toxics Reduction Implementation Plan[s]". The implementation plans will identify actions that will result in the reduction/elimination of continuing and future inputs of the chemicals of concern. This will also ultimately result in reduced levels of sediment contamination, allowing the use of a wide variety of dredged material management alternatives, and thus contribute to the continuing economic development of the Port of New York and New Jersey.

The primary/initial objective of this workplan is to identify significant sources of the chemicals of concern; appropriate management actions can then be implemented to eliminate or reduce these discharges. The investigations included in the work plan will provide the following information and assessments:

(1) Studies I-C, I-D, and I-E: identify those tributaries to NY-NJ Harbor that are significant sources of the chemicals of concern -- where possible, inputs of the chemicals of concern from sources located in the watershed areas above the head of tide will be distinguished from those located within the tidal reaches of the tributaries;

(2) Study I-D: identify segments within the tidal reaches of the tributaries where the identification and control of sources of the toxic chemicals are most critical;

(3) Studies I-G and II-A: identify those point discharges (municipal and industrial wastewater treatment facilities, CSOs, storm water outfalls) which are significant sources of the chemicals of concern -- direct trackdown and clean-up activities as appropriate;

(5) Study III-B: evaluate the importance of non-point sources (i.e. direct wet weather runoff), hazardous and solid waste facilities, and existing contaminated sediments as sources for the chemicals of concern;

(4) Study I-A: develop and maintain a GIS-based database management system of the potential sources of the chemicals of concern within the NY-NJ Harbor and New York Bight systems, and use this database to evaluate alternative management actions;

(5) develop a Toxics Reduction Implementation Plan which identifies specific management actions required to eliminate/reduce discharges of the chemicals of concern and develop a long-term monitoring program to asses the effectiveness of these actions.

This workplan incorporates the same generalized approach as that used to develop the NY-NJ Harbor Estuary Program CCMP:

(1) Use existing information to characterize the primary causes of human use and ecosystem health impairments (i.e. the chemicals of concern) and to identify the most significant sources contributing to these impairments.

(2) Act now, based on this information, and building upon existing programs to:

- eliminate/reduce the discharges of chemicals of concern;
- remediate problems due to past discharges;
- minimize the risk to human health and the environment;
- protect and restore ecosystem resources.

(3) Conduct research, monitoring, and modeling studies to better understand the functioning of the ecosystem.

(4) Take additional actions, as needed, based on this research, monitoring, and modeling.

SECTION 2: HEP CCMP AND JOINT DREDGING PLAN ACTIONS THAT NJDEP IS CURRENTLY IMPLEMENTING TO REDUCE OF THE CHEMICALS OF CONCERN

Section 2 of this workplan briefly discusses ongoing Departmental activities which address specific action items included in the NY-NJ Harbor Estuary Program Comprehensive Conservation and Management Plan (HEP CCMP) and the Joint Dredging Plan for the Port of New York and New Jersey. This includes a description of the various "commitments" made by the Department in the HEP CCMP, including funding recommendations, and those actions that require the cooperation/coordination of other agencies in order to be successfully implemented. All of these activities are currently funded through programs within the New Jersey Department of Environmental Protection.

Objectives T-1 through T-5, T-8, and T-11 of the HEP CCMP include a number of "action oriented" regulatory commitments made by the Department, including reducing air emissions and discharges of the chemicals of concern from municipal, industrial, and CSO sources. All of these actions are currently funded by the Department and have been integrated into the Department's overall watershed management program.

HEP CCMP OBJECTIVE T-1: Reduce Municipal Discharges of Chemicals of Concern

- HEP CCMP Action T-1.1: Control Discharges of Metals

Based upon an assessment of historical data, the HEP CCMP identified concerns that point source discharges were resulting in levels of metals in NY-NJ Harbor in exceedance of water quality criteria. Studies conducted under the auspices of HEP (using "clean" trace metal techniques) indicated significantly lower concentrations compared to historical data. Exceedances of water quality criteria were found only for mercury. Subsequently, water quality modeling predicted possible exceedances of chronic water quality criteria for copper, lead, and nickel.

Ten New Jersey sewerage authorities (the New Jersey Harbor Dischargers Group, NJHDG) have been working cooperatively to conduct studies to support and implement a phased Total Maximum Daily Load (TMDL) process. The data collected will be used to develop TMDLs for the water quality-limiting metals, which in turn will provide (1) Waste Load Allocations (WLA) for municipal and industrial point source discharges, and (2) Load Allocations (LA) for nonpoint source discharges.

Under Phase I of the TMDL process, New Jersey Pollutant Discharge Elimination System (NJPDES) permit limits, based upon existing effluent quality limits, were incorporated into draft permits harbor-wide for mercury. The Department will ensure compliance with these Phase 1 TMDLs by monitoring the Discharge Monitoring Reports (DMRs) submitted by the municipal and industrial dischargers.

The NJHDG has prepared a report entitled "Summary of the Phase I Metal Sampling and Analysis Program for the New Jersey Component of the New York/New Jersey Harbor Estuary Program" (March 1996, with supplement). This report -- for the Hackensack River below Oradel Dam, the Passaic River below Dundee Dam, Newark Bay, Raritan Bay, and the Raritan River below Fieldsville Dam -- indicated the following:

- none of these waterbodies are water quality-limited for copper or lead;
- all of these waterbodies are water quality-limited for mercury;
- the Hackensack and Passaic Rivers are water quality-limited for nickel.

As a result of these findings, the U.S. Environmental Protection Agency (USEPA) withdrew the Phase I copper TMDLs for the above referenced waters. In addition, the NJHDG, the Department, and the USEPA developed a Phase II Metals TMDL Monitoring and Modeling Program which focused on (1) nickel in the Hackensack and Passaic Rivers, and (2) copper and nickel in the Arthur Kill and Kill van Kull. This program was initiated in April 1997, and was completed in August 1998. Based upon ambient data collected in New Jersey waters and a revised modeling effort, it was concluded that the applicable copper criterion would not be exceeded in the Arthur Kill and the Kill Van Kull; thus, there is no need to develop TMDLs for these waterbodies.

Upon completion of this Phase II TMDL program, the Department [*will draft*] modifications to NJPDES permits *[during 1999]* as appropriate to address these metals of concern.

- HEP CCMP Action T-1.2: "Track-down and Clean-up" of Significant Discharges of Organic Chemicals of Concern (Dredging Plan: Pollutant trackdown, prioritization, and clean-up)

The initial list of the chemicals of concern was presented in the HEP CCMP, and included PCBs and dioxin. To date, efforts associated with this HEP CCMP Action have targeted the identification of the levels of PCBs (harbor-wide) and dioxin (in Newark Bay) in the discharges from municipal wastewater treatment facilities. Sampling for dioxin completed by the NJHDG indicated that the observed concentrations in the discharges were below the study's required reporting level of five parts per trillion (5 ppt).

The NJHDG, in cooperation with the USEPA Edison (New Jersey) Laboratory, initiated a pilot study at the Linden-Roselle facility to track-down source(s) of PCBs in its service area. This study had two main goals: (1) to determine if the trackdown of PCBs is feasible in a municipal sewer system, and (2) to provide the USEPA Edison Laboratory with samples for use

in gaining knowledge and experience with analytical protocols for PCBs. However, due to analytical difficulties, this pilot study produced only limited data.

Additional trackdown and source identification studies will be conducted as part of this toxics reduction workplan -- see Section III.

HEP CCMP OBJECTIVE T-2: Reduce Industrial Discharges of Chemicals of Concern

- HEP CCMP Action T-2.1: Continuing Compliance with Controls on Industrial Discharges

The NJPDES permits issued to direct industrial discharges to NY-NJ Harbor contain technology-based limits in order to minimize the discharge of toxic chemicals. These facilities are required to self-monitor effluent discharges so that compliance with the NJPDES permit conditions can be determined; the results of this monitoring are submitted to the Department on DMRs. The Department reviews the DMRs for violations, and then acts on any observed violations, as appropriate. The Department also conducts routine inspections on-site to verify the accuracy of the discharge monitoring reports.

- HEP CCMP Action T-2.2: Pretreatment Program Focus on Significant Industrial Users

The objective of this Action is to ensure that municipalities in NY-NJ Harbor focus their pretreatment programs on all significant industrial users, not just specific categorical industrial users. The facilities located in the harbor are delegated facilities for the pretreatment program. As part of the pretreatment program implementation requirements, the municipalities are required to look at both significant and categorical industrial users. The Department conducts annual reviews of the delegated facilities to ensure compliance with the pretreatment program.

- HEP CCMP Action T-2.3: Additional Requirements for Direct Industrial Discharges

See HEP CCMP Actions T-1.1 and T-1.2, above: direct industrial discharges will be subject to similar requirements. Also see Section III of this toxics reduction workplan.

HEP CCMP OBJECTIVE T-3: Minimize the Discharge of Toxic Chemicals from CSOs, Storm Water, and Non-point Sources

Full implementation of the Final National CSO Control Policy and currently planned New Jersey CSO abatement program is expected to reduce discharges of the chemicals of concern. See the discussions under the following HEP CCMP Actions:

- CSO-1.1: Assessment of Steps Necessary to Implement the Nine Minimum Measures
- CSO-1.2: Implementation of the Nine Minimum Measures
- CSO-2.2: New Jersey Long-Term CSO Abatement Program
- SW-1.3: Industry-specific General Permits for Pollution Prevention
- SW-1.5: Storm Water Projects Under the Intermodal Surface Transportation Efficiency Act
- NPS-1.1: New Jersey Focus on Harbor/Bight Watershed
- NPS-1.2: New Jersey Navesink River Project
- NPS-4.0: Ongoing Education Programs

HEP CCMP OBJECTIVE T-4: Reduce Air Emission of Chemicals of Concern

- HEP CCMP Action T-4.0: Implementation of Clean Air Act Requirements

The Department continues to enforce existing regulations that limit the emission of toxic pollutants to the air. In 1999, the Department reviewed and revised the USEPA Air Toxics Inventory for 1996, providing the State with its first comprehensive air toxics inventory. This inventory can be used to set priorities and determine where the Department's air toxic management efforts should be directed. A comparison of 1990 and 1996 emission inventory estimates has shown that emissions overall have decreased substantially.

An electronic emissions reporting system for criteria pollutants and their precursors has been implemented and is used by about seventy-five per cent of the State's industrial sources to transmit emissions monitoring data to the Department. New Jersey's open market emissions trading program has resulted in a reduction in the emissions of nitrogen oxides and volatile organic chemicals. Solid waste incinerators in New Jersey have been targeted for controls and reductions in mercury emissions; an eighty per cent reduction in mercury emissions has been achieved at the State's five mass burn recovery facilities.

HEP CCMP OBJECTIVE T-8: Focus Pollution Prevention Activities on Chemicals of Concern

- HEP CCMP Action T-8.2: Non-regulatory Pollution Prevention (Dredging Plan: Prioritize non-point source pollution prevention/remediation activities)

Pursuant to the New Jersey State Pollution Prevention Act, industrial facilities provide information to the Department in their annual Release and Pollution Prevention Report. The Department continually evaluates this information, looking for trends. In December 1996, the Department discussed the results of this trend analysis in a report entitled "Industrial Pollution Trends in New Jersey". *It is anticipated that an updated report will be available in the Fall of 1998.*

- HEP CCMP Action T-8.3: Facility-wide Permits

The Department was given permission to issue up to fifteen facility-wide permits statewide. These permits integrate the air, water, and hazardous waste permits for a facility with its pollution prevention plan. The Department has issued several facility-wide permits, and one is under development for a facility located in the NY-NJ Harbor area. As of the present date, the Department has not completed its evaluation of its facility-wide permit pilot project; it is anticipated that this evaluation will be completed by the Summer of 1999.

- HEP CCMP Action T-8.4: NPDES Pollution Prevention

As of the present date, it has not been determined that the state legislature has given the Department the authorization needed to add pollution prevention requirements to NJPDES permits.

- *[HEP CCMP Action T-8.5: RCRA Permitting and Enforcement]*

HEP CCMP OBJECTIVE T-10: Establish Consistent Methodology to Assess Risks and Improve Communication of Fish Advisories

- HEP CCMP Action T-10.1: Risk Assessment Methodology
- HEP CCMP Action T-10.2: Fish Tissue Criteria

The New Jersey Toxics in Biota Committee, consisting of representatives from the Department, the N. J. Department of Health and Senior Services, and the N. J. Department of Agriculture, meet periodically to review fish advisories for New Jersey waters. Contaminant data for fish and shellfish tissue and recent developments concerning risks are reviewed. A Risk Assessment Subcommittee evaluates risk methods and makes recommendations to the Toxics in Biota Committee concerning the methodology to use. The Toxics in Biota Committee will also be conducting a consistency review of adjoining States' advisories. This information will be used to assist in developing consistent advisories among these states.

- HEP CCMP Action T-10.3: Risk Communication Activities

In 1995, the Department conducted a survey of urban anglers in the Newark Bay Complex. This survey was conducted to develop a profile of urban anglers, learn angler's knowledge of and belief in advisories, perception of risk from consumption of contaminated fish and crabs, and consumption patterns. In a998, research was initiated to look at the relationship of culture, social networks, and income on perception of risk from contaminated fish and crabs. This research was conducted to determine if social indicators could be developed that would guide the Department in how to more effectively design and deliver risk information to subpopulations most at risk from contaminants. Year Two of the study will focus on designing and implementing an outreach program based on the indicators developed from Year One.

In 1999, the Division of Science, Research and Technology, in conjunction with the Division of Fish and Wildlife, New Jersey Sea Grant, New Jersey Community Water Watch, the Hackensack Riverkeeper, the Greater Newark Conservancy, and the Partnership for Youth, offered ten watershed education/urban fishing programs in five communities in the Newark Bay Complex. The programs seek to create an understanding of watershed issues in an urban environment and an appreciation of local natural resources. It was developed as part of the Community Outreach to Urban Anglers research conducted by the Department in the early 1990's, and was identified as a need by citizens in the region. The four day program includes lessons on fish consumption advisories, bioaccumulation, nonpoint source pollution, mapping and GIS, water quality monitoring, an ecocruise, and a day of fishing.

HEP CCMP OBJECTIVE T-12: Assess Ambient Levels, Loadings, and Effects of Chemicals

- HEP CCMP Action T-12.7: Modification of Advisories and Restrictions

The Department originally issued fish consumption advisories for the NY-NJ Harbor area in 1983. Based on additional information, these advisories were revised/amended in 1984, 1985, and 1994. The New Jersey Toxics in Biota Committee, which consists of representatives from the Department, the N. J. Department of Health and Senior Services, and the N. J. Department of Agriculture, was reconvened in Spring 2000. This committee will be reviewing new data during the Year 2000 to determine if any advisories need to be updated/revised.

HEP CCMP OBJECTIVE T-13: Develop Mass Balances for Metals and Organic Chemicals

- HEP CCMP Action T-13.1: Monitoring and Modeling for Metals Other than Mercury

See the discussion for HEP CCMP Action T-1.1: Control Discharges of Metals. Upon completion of the referenced Monitoring and Modeling Program, load estimates will be made and then used to develop the TMDLs.

HEP CCMP OBJECTIVE CSO-1: Implement the Nine Minimum Measures of the National CSO Control Policy

- HEP CCMP Action CSO-1.1: Assessment of Steps Necessary to Implement the Nine Minimum Measures

The Department requires that any person who owns and/or operates any portion of a combined sewer system obtain a NJPDES permit for that portion of the system. To date, all portions of the combined sewer systems and all CSO points are regulated by either an Individual Authorization under the General Permit for Combined Sewer Systems or an Individual NJPDES Permit. Each permit contains the necessary requirements of the National CSO Control Policy, including the nine minimum control measures, as applicable to the type of permitted facility.

There are ten Publicly Owned Treatment Works (POTWs) that receive wastewater from combined sewer systems and that discharge into the NY-NJ Harbor Estuary. The Department and the USEPA have agreed upon language to be used in the NJPDES permits to implement the intent of HEP CCMP Action CSO-1.1. In June 1996, the Department revoked and reissued, or modified, the NJPDES permits for the ten POTWs, so as to include the agreed upon permit language. Each permit action has required that, by January 1, 1997, each permittee submit documentation summarizing the actions taken regarding the permit conditions; this submission of documentation of compliance is consistent with the requirements of the National CSO Control Policy. However, these permit conditions are directives for continuous activities that permitees are obligated to implement beyond January 1, 1997.

- HEP CCMP Action CSO-1.2: Implementation of the Nine Minimum Measures

The purpose of this action is, through the use of enforceable instruments, require dischargers to implement the Nine Minimum Measures of the National CSO Control Policy. This objective has been achieved, and is documented in the various permit files for the dischargers.

HEP CCMP OBJECTIVE CSO-2: Implement Additional CSO Controls to Meet Water Quality Standards and Restore Beneficial Uses

- HEP CCMP Action CSO-2.2: New Jersey Long-Term CSO Abatement Program (Dredging Plan: CSO prioritization and remediation)

The Department's Statewide CSO Program consists of several regulatory efforts that have been unified into a single control strategy.

The New Jersey Sewerage Infrastructure Improvement Act provides, in part, planning and design grants for the development and implementation of Solids/Floatables Controls and Dry Weather Overflow identification and elimination. All CSO points are on enforceable compliance schedules to plan, design, construct, and operate Solids/Floatables Control facilities. Studies have indicated that Dry Weather Overflows are not a chronic problem nor source of toxic contamination in New Jersey. Any identified Dry Weather Overflows have either been eliminated or are on an enforceable compliance schedule for elimination.

The second track of the program is reflected in the General Permit for Combined Sewer Systems, and other similar enforceable commitments (Individual NJPDES Permits and Administrative Consent Orders). Permitees which own and/or operate any portion of a combined sewer system are required to develop and implement technology-based control measures, including the Nine Minimum Control Measures identified in the National CSO Control Policy. These enforceable commitments also initiate the first phase of the planning activities of the National CSO Control Policy Long-term Control Planning (LTCP) Process by the performance of significant land-side monitoring and modeling activities; this results in the development of Land-side Storm Water Management Models (SWMMs) called CSO Discharge Characterization Studies. These studies have proven to be an important tool in understanding the frequency, duration, and nature of pollutants from CSO discharges, including the loadings of toxic chemicals.

The Department intends to complete the remaining elements of the National CSO Control Policy LTCP Process by integrating the regulatory and facility planning obligations of the permitees with New Jersey's Watershed Management Framework planning process. Proposed activities include the development of water quality goals and concerns, identification of areas of non-attainment and other water quality concerns, identification of CSO and non-CSO sources of pollution causing these concerns, development of corrective action plans and/or Total Maximum Daily Loads (TMDLs), and development and implementation of CSO and non-CSO "system-wide" facility controls and performance assessments.

The Department is working with the New Jersey Attorney General's Office to develop enforceable commitments to achieve the goals of New Jersey's CSO abatement program. The Department has also worked with USEPA Region II to develop enforceable commitments from the owners/operators of the POTWs to implement their long-term CSO abatement responsibilities. The Department submitted its proposal to integrate the CSO-LTCP Process into the Statewide Watershed Management Planning Process to the USEPA Region II in September, 1997; *as of the present date, the USEPA has neither approved nor commented on the proposed strategy.* The Department will continue to meet with the owners/operators of combined sewer systems to develop consensus on long-term control planning approaches.

HEP CCMP OBJECTIVE SW-1: Implement Measures to Control Municipal and Industrial Storm Water Discharges

- HEP CCMP Action SW-1.2: NJDEP Municipal Storm Water Permit(s)

In a phased approach, the Department will negotiate permits with forty-six municipalities that drain to areas of NY-NJ Harbor where metals are water-quality limiting. On January 9, 1998, the USEPA proposed regulations requiring the municipalities to apply, by August 7, 2002, for a permit that contains best management practices to control stormwater runoff. The USEPA expects to make this rule final by the Fall of 1999.

- HEP CCMP Action SW-1.3: Industry-Specific General Permits for Pollution Prevention

In order to regulate storm water discharges associated with industrial activities, the Department has issued storm water general permits associated with industrial sites and construction activities. The Department has issued three general permits for specific industrial activities -- scrap metal processing, automotive dismantling, and concrete manufacturing operations; approximately 100 sites have been authorized under each of these general permits. Two more general permits are currently under development (asphalt and sand/gravel facilities).

HEP CCMP OBJECTIVE NPS-1: Focus Clean Water Act Non-Point Source Programs on Harbor/Bight Watersheds

- HEP CCMP Action NPS-1.1: New Jersey Focus on Harbor/Bight Watershed

  Barnegat Bay Watershed

  Since July 1995, approximately $600,000 of Section 319(h) funds have been appropriated to reduce non-point source pollution within the Barnegat Bay Watershed. Projects have included a home assistance guide for non-point source pollution control, stewardship of soil health, and an Integrated Pest Management education program. An additional $41,000 of Section 319(h) monies have been granted to the U.S. Geological Survey to develop a water quality model to estimate non-point source loads from different land uses.

  In addition, Barnegat Bay was added to the National Estuary Program in July 1995. Studies leading to a Characterization Report for the bay have been completed, and a Draft CCMP was released in May 2000. The goals of the National Estuary Program include improving water quality and maintaining overall ecosystem integrity, including the chemical, physical, and biological properties of the ecosystem, as well as its economic, recreational, and aesthetic values.

- HEP CCMP Action NPS-1.2: New Jersey Navesink River Project

  The purpose of the "Navesink Non-point Source Pollution Demonstration Project" was to identify simple Best Management Practices (BMPs) that could be implemented on a municipal level with relatively little burden placed upon the implementing agencies and local residents. This project was completed in March 1998 by the Monmouth County Planning Board, and was essentially a public education and outreach program.

HEP CCMP OBJECTIVE NPS-2: Develop and Implement Coastal Non-Point Source Management Programs Under Coastal Zone Act Reauthorization Amendment

- HEP CCMP Action NPS-2.0: Coastal Non-Point Source Programs

New Jersey received conditional approval of its Coastal Non-Point Program from the USEPA and National Oceanographic and Atmospheric Administration in November 1997; the State has three years from this date to comply with all of the conditions. To fulfill one of these conditions, a Memorandum of Agreement (MOA) has been finalized between the Department, the N.J. Department of Agriculture, and the Natural Resource Conservation Service. The MOA will implement part of New Jersey's Coastal Non-Point Source Program by utilizing the voluntary conservation program to encourage and assist implementation of Best Management Practices for non-point source pollution control by farmers. This effort will be backed by the

Department's enforcement action authorities for agricultural producers that are jeopardizing the State's water resources.

HEP CCMP OBJECTIVE NPS-4: Continue and Enhance Education Programs for Control of Non-Point Source Pollution

- HEP CCMP Action NPS-4.0: Ongoing Education Programs

The Department continues its non-point source pollution outreach and education programs by offering educational publications and programs, including the Clean Water Rangers program for elementary school children, the Watershed Focus newsletter, Beneath the Shell Teacher's Guide, and N.J. Water Photography Contest. These programs are currently underway, and are updated and revised on a regular basis.

SECTION III: ACTIONS TO IDENTIFY AND ELIMINATE SOURCES OF THE CHEMICALS OF CONCERN TO THE NY-NJ HARBOR ESTUARY

The overall goal of this workplan is to identify sources of the chemicals of concern discharged into the NY-NJ Harbor Estuary. Appropriate actions will then be developed and incorporated into a "Toxics Reduction Implementation Plan" in order to eliminate (or reduce to the greatest extent practicable) the input of these toxic chemicals to the NY-NJ Harbor Estuary. This will be accomplished, in large part, through the implementation of the NY-NJ Harbor Estuary Program CCMP and the Joint Dredging Plan for the Port of New York and New Jersey. In order to accomplish this goal in the most expeditious and efficient manner, a phased approach to the identification of the sources of toxic chemical has been developed (see Figure III-1). As information is collected and analyzed, significant sources will be identified; resources will then be directed towards implementing those site-specific actions needed to reduce or eliminate them.

Phase One of the work plan includes comprehensive water quality monitoring studies directed towards identifying those tributaries to the harbor estuary within which significant loadings of toxic chemicals originate. In addition, discharges of the chemicals of concern from all of the New Jersey POTWs, and selected CSOs and SWOs, discharging to the harbor will be monitored, and loadings estimated. Estimates of loadings due to atmospheric deposition will also be made (Study I-B, administered by the NJDEP Division of Science, research and technology and New Jersey Sea Grant). This will be accompanied by a review of existing data on potential sources of toxic chemicals (including municipal and industrial discharges, solid and hazardous waste facilities, and sediments) and the development of a GIS-based template to display this information. These GIS and database review studies will build upon work currently being implemented by the Department's Site Remediation Program. It is estimated that these Phase One Activities will take approximately two years to complete. However, it is also anticipated that the review of existing databases -- in combination with interim results of the tributary and POTW/CSO/SWO monitoring studies -- will enable the Department to preliminarily identify one or more tributaries and POTW/CSO/SWO service areas within which potential significant sources of toxic chemicals originate. The Department will then proceed to implement Phase Two and/or Phase Three Activities on a "fast-track" basis.

Upon the completion of the Phase One Activities, the tributaries to the harbor estuary will then be prioritized for the implementation of Phase Two and/or Phase Three activities on the basis of the relative concentrations of the various chemicals of concern originating within the watershed of each tributary. This prioritization will also consider the "identity" of the specific chemical(s) of concern identified for each tributary and its importance relative to (1) the sediment contamination problem, and (2) seafood consumption and fishery advisories, within the harbor estuary system. Factors to be considered when identifying priority tributaries and/or chemicals of concern include

- the number of contaminants present and their relative concentration/loading;
- the toxicity and/or bioaccumulation potential of the contaminants; and
- the distribution of the contaminants between the dissolved and sediment-bound phases.

Phase Two Activities (if needed) will be conducted within the prioritized tributary systems, and will seek to identify specific municipal wastewater treatment facilities, combined sewer overflows, and stormwater outfalls from which the toxic chemical(s) of interest are discharged. Alternatively, if this monitoring does not identify any such significant point source discharges, the Department will then investigate other potential point and nonpoint sources for the chemical(s) during Phase Three, including industrial wastewater treatment facilities, and solid and hazardous waste facilities. It is also anticipated that the review of existing databases -- in combination with interim results of the point source discharge monitoring studies -- will enable the Department to identify one or more point sources which potentially discharge significant loadings of toxic chemicals. The Department will then proceed to implement Phase Three Activities on a "fast-track" basis to trackdown the source(s) of the toxic chemical(s) within the service areas of these discharging facilities.

Upon the completion of the Phase One and Two Activities, the point source discharges will then be prioritized for the implementation of Phase Three activities on the basis of the estimated loadings of the various chemicals of concern originating within the watershed of each tributary and the service areas of the discharging facilities. Likewise, the importance of potential nonpoint sources of the various toxic chemicals of concern will be evaluated. This prioritization will also consider the "identity" of the specific chemical(s) of concern and its importance relative to (1) the sediment contamination problem, and (2) seafood consumption and fishery advisories, within the harbor estuary system. A "Draft Toxics Reduction Implementation Plan" will be developed and will include (a) an evaluation of the need for additional/focused studies within the tributaries, (b) plans for the actions required to reduce/eliminate significant discharges from identified point and nonpoint sources of toxic chemicals, and (c) a long-term water quality monitoring plan. A more detailed evaluation of the available data and information will require modeling studies (Phase Four Activities) to better understand the dynamics of the harbor estuary system and how it operates.

Phase Three Activities consist of studies to trackdown potential sources of toxic chemicals originating within the service areas of targeted municipal and industrial treatment facilities, combined sewer overflows, and stormwater outfalls. Additional studies will be conducted as needed to determine the significance of potential discharges from hazardous waste sites and nonpoint sources of pollution. As the data and information from these studies becomes available, the various contributing sources will be prioritized for actions to reduce or eliminate the discharge of toxic chemicals. This prioritization will consider the "identity" of the specific chemical(s) of concern and its importance relative to (1) the sediment contamination problem, and (2) seafood consumption and fishery advisories, within the harbor estuary system. A "Final Toxics Reduction Implementation Plan" will be developed upon the completion of the Phase Three Activities.

Modeling studies, included as Phase Four Activities, will be initiated in 2000-2001 through a Request for Proposal process to be administered by the Hudson River Foundation. Funding will be provided by New Jersey Maritime Resources directly to the foundation. This effort will also be coordinated with the NYSDEC and the NY-NJ HEP Contaminant Assessment and Reduction Program (CARP). A first task to be completed by the modeling contractor will be an evaluation of the data to be collected by the Department and NYSDEC and its adequacy in meeting the various objectives of the modeling activities. The role of the Phase Four modeling studies in meeting the objectives of the New Jersey Toxics Reduction Workplan will be addressed in greater detail in the Draft and Final "Toxics Reduction Implementation Plan [s]". Finally, an evaluation of a "No Further Action" scenario will be undertaken to evaluate the implementation of additional toxic chemical reduction efforts and the associated costs and anticipated benefits of such actions.

Figure III-2 shows an approximate timeline for the initiation and completion of the Phase One through Phase Four Activities and the development of the "Final Toxics Reduction Implementation Plan". Table III-1 is a summary of the investigations and monitoring studies to be undertaken. Studies I-C, I-D, and I-E were initiated on a "partial" basis in June 200, and "full-scale" in December 2000. Study I-G was initiated in October 2000.

The ultimate reduction and elimination of toxic chemical inputs to the Harbor estuary requires the implementation of site-specific source management alternatives. Different types of sources will require different management actions. These efforts could include active remediation of a site or the development and implementation of regulatory and enforcement actions. The integrated nature of this phased approach -- combining an evaluation of existing information with data from the various monitoring studies, continual prioritization and trackdown of potential sources, and ultimately the reduction/elimination of these sources -- will enable the Department to implement actions on a continual basis as new information is gathered and evaluated.

In addition to the Phase One through Four Activities, which directly address and target the elimination/reduction of the sources of toxic chemicals to the NY-NJ Harbor estuary and New York Bight systems, the following efforts will also be undertaken:

- the continuing evaluation of existing fishing/seafood consumption advisories in the NY-NJ Harbor estuary and New York Bight. This will include the development (in coordination with New York State) of a consistent regional method to assess risks to human health due to the consumption of seafood, determinations of appropriate fish tissue criteria, and the subsequent development of appropriate fishing/consumption advisories. [HEP CCMP Action T-10.1: Risk Assessment Methodology and HEP CCMP Action T-10.2: Fish Tissue Criteria]

- the evaluation of potential natural resource damage cases arising from the data collected by the various monitoring studies. This would include a determination of

the need for additional human health and ecological risk assessment studies. [Joint Dredging Plan]

- further study and the development/use of ecosystem indicators to better understand the effects of toxic chemicals on the harbor estuary and bight systems. [HEP CCMP Action T-12.1: Quantitative Ecosystem Goals and Biocriteria]

The data and information collected as part of the monitoring component of this Toxics Reduction Workplan will also be used to establish the existing baseline conditions for NY-NJ Harbor estuary system; the effectiveness of measures implemented to eliminate sources of the chemicals of concern will be evaluated by comparison with these baseline conditions. In addition, the data will be used to develop long-term monitoring plans for the harbor estuary.

The implementation of this New Jersey Toxics Reduction Workplan will be managed by the New Jersey Department of Environmental Protection. The Department will establish an internal team to coordinate workplan activities among the various monitoring studies and investigations and to evaluate data and information as it is collected. The principal investigators for the studies will comprise a scientific advisory team to the Department, and together with the NJDEP Workplan Team and additional consultants/advisors, will evaluate the data on a continual basis to (1) identify potential significant sources of chemicals of concerns, (2) prioritize the relative importance of these potential sources, (3) implement/modify the monitoring studies and investigations to target "high priority" areas/sources on a "fast-track" basis, and (4) determine the need to initiate additional monitoring/trackdown studies. The NJDEP will also coordinate directly with New York State (to ensure consistency and compatibility with its toxics reduction workplan) and with the CARP of the NY-NJ Harbor Estuary Program. The Department will report results of the workplan activities to the public at appropriate intervals and as decision-point milestones are reached.

FIGURE III-1: SCHEMATIC DIAGRAM OF THE NEW JERSEY TOXICS REDUCTION WORKPLAN

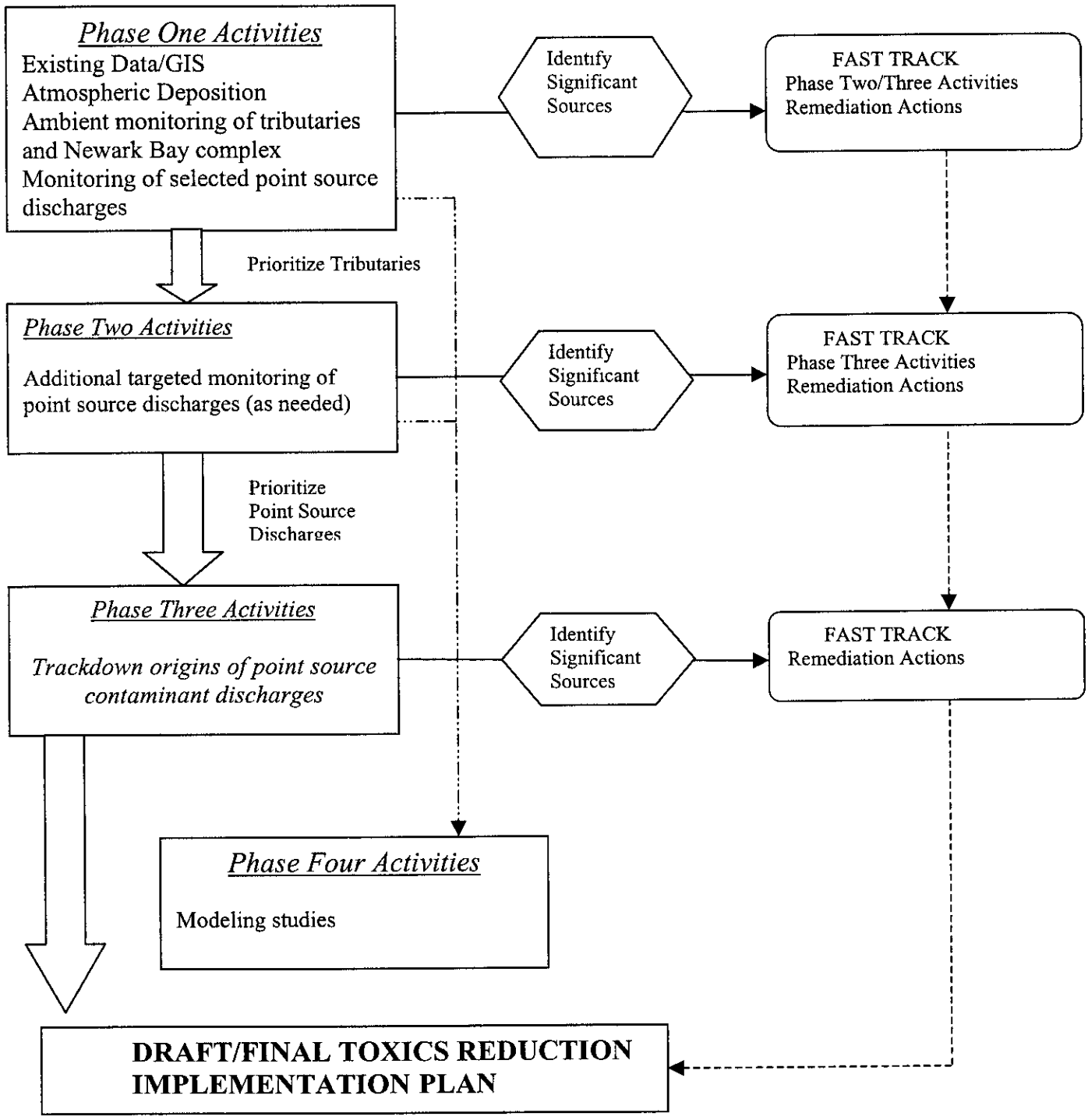


FIGURE III-2: TIMELINE FOR NJ TOXICS REDUCTION WORKPLAN ACTIVITIES

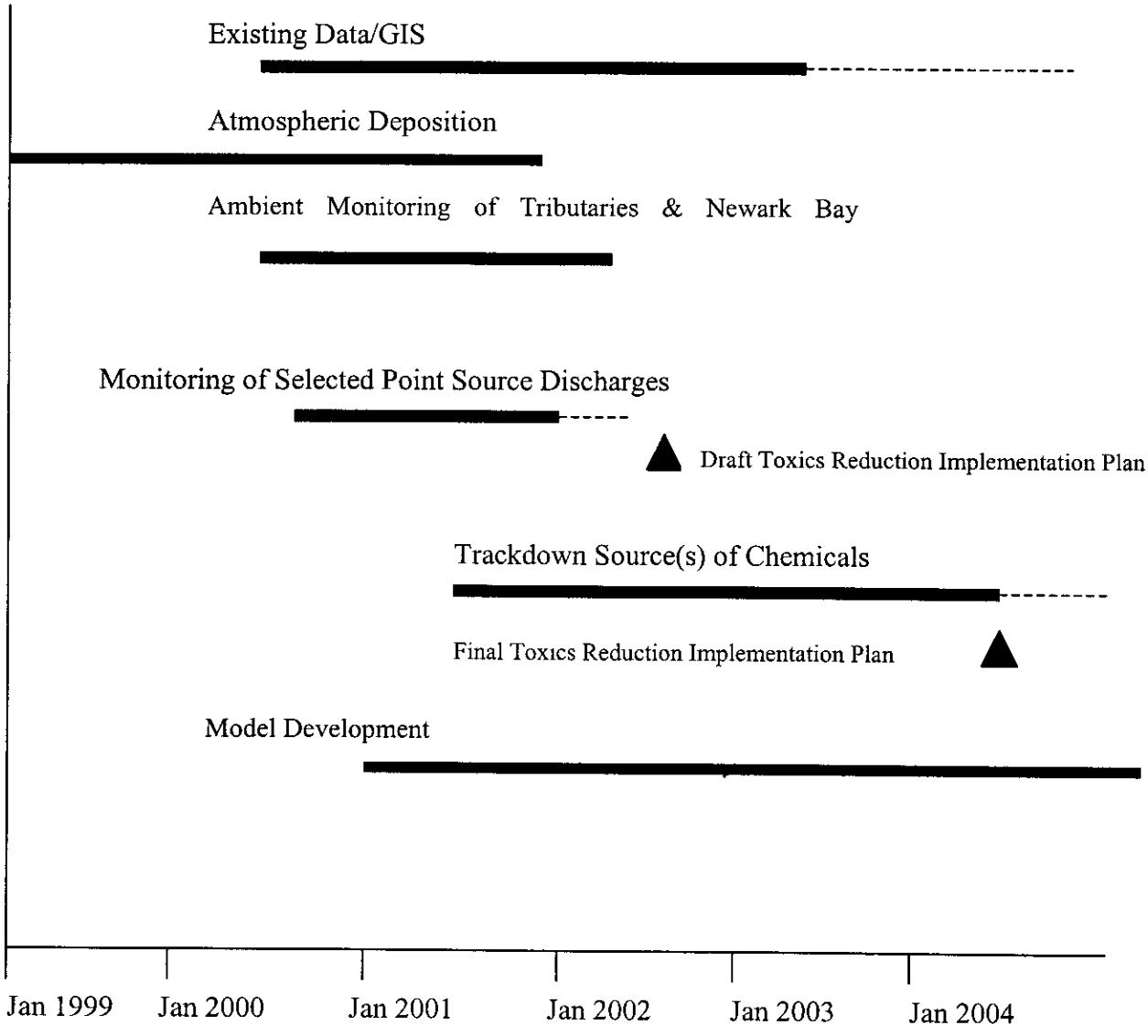


Table III-1: Summary Description of the Investigations and Monitoring Studies to be Undertaken as Part of the New Jersey Toxics Reduction Workplan.

Study/Investigation	*Data/Information Collected*	*Objectives of the Study/Investigation*	*Location of Study & Data Collection Methods*
PHASE ONE ACTIVITIES			
I-A Compile and synthesize existing information and data in NJDEP files; develop GIS template to display data.	1. Location of potential point source discharges of chemicals of concern. 2. Sediment and water quality data. 3. Preliminary identification of significant sources.	1. Develop and maintain a database and GIS template of known point sources of toxic chemicals and their status for remediation actions. 2. Determine/prioritize sampling locations for ambient monitoring and trackdown/cleanup studies.	Existing information and data from NJDEP files. All known sites/sources in the watersheds tributary to NY-NJ Harbor estuary: industrial and municipal wastewater treatment facilities, CSOs, storm sewers, RCRA, ECRA, Superfund, etc.
I-B Monitoring of the atmospheric deposition of selected toxic chemicals; estimate loading rates of the chemicals.	1. Seasonal patterns and deposition rates of nitrogen and selected trace metals. 2. Atmospheric deposition of hazardous pollutants, including PCBs, pesticides, dioxins/furans, and PAHs.	1. Determine seasonal patterns and atmospheric deposition rates for nitrogen and selected trace metals. 2. Generate total atmospheric deposition rates of target chemicals, and identify the sources of the chemicals. 3. Determine the direction, magnitude, and controls of air-sea fluxes of hazardous pollutants.	An initial sampling site will be established at Sandy Hook, NJ. Additional sampling sites have been established in Jersey City, and other locations as part of the NJ Atmospheric Deposition Network.
I-C Ambient monitoring of the loadings of sediments and chemicals of concern at the head-of-tide of major tributaries to the NY-NJ Harbor estuary.	1. Loadings of suspended sediment and selected toxic chemicals at the head-of-tide of major tributaries. 2. TSS, POC, and DOC concentrations as a function of streamflow. 3. Integrated and interval samples during storm events and low flow periods.	1. Determine which NJ tributaries above head-of-tide are important sources of sediment and chemicals of concern. 2. Develop baseline data for monitoring of remediation actions. 3. Provide data for Phase Four modeling activities.	Five permanent stations on the Hackensack, Passaic, Raritan, Rahway, and Elizabeth Rivers at USGS gauging stations near head-of-tide. TOPS and ISCO automatic samplers integrated over events & interval samples.

Study/Investigation	*Data/Information Collected*	*Objectives of the Study/Investigation*	*Location of Study & Data Collection Methods*
I-D Ambient monitoring of the levels of sediments and chemicals of concern from, and within, the tidal reaches of major and minor tributaries to the NY-NJ Harbor estuary.	1. Levels of suspended sediment and selected toxic chemicals within, and discharging from, major and minor tributaries. 2. TSS, POC, and DOC concentrations as a function of streamflow. 3. Integrated and interval samples during storm events and low flow periods.	1. Identify those major and minor tributaries/segments which are significant sources of sediment and chemicals of concern to NY-NJ Harbor. 2. Develop baseline data for monitoring of remediation actions. 3. Provide data for Phase Four modeling activities.	Permanent sites located at the "mouths" of the major tributaries: Hackensack, Passaic, Elizabeth, Raritan, and Rahway Rivers. Additional sites on various segments of these tributaries.
I-E Ambient monitoring of sediments and chemicals of concern within the Newark Bay Complex, including the Arthur Kill and the Kill van Kull.	1. Concentrations of suspended sediment and selected toxic chemicals throughout the Newark Bay Complex. 2. TSS, POC, and DOC concentrations as a function of streamflow. 3. Integrated and interval samples during storm events and low flow periods.	1. Provide information on the downstream transport and fate of suspended sediment and contaminants within the Newark Bay Complex. 2. Develop baseline data for monitoring of remediation actions. 3. Provide data for Phase Four modeling activities.	Three permanent stations at Kearny Point (Passaic and Hackensack Rivers), the Bayonne Bridge, and the Goethals Bridge. Transect sampling (along and across navigation channels) within the Newark Bay complex, the Arthur Kill, and Kill Van Kull.
I-F Pilot project: field testing the application and utility of the PISCES sampling devices for ambient monitoring of water quality.	Concentrations of mercury, dioxin, PCBs, PAHs, and pesticides in surface water.	To develop, evaluate, and implement a cost-effective approach to the trackdown of sources of toxic chemicals.	Completed: Hackensack River (part). Study area includes the Hackensack and Passaic Rivers and their tributaries, and tidal tributaries to the Arthur Kill.

Study/Investigation	*Data/Information Collected*	*Objectives of the Study/Investigation*	*Location of Study & Data Collection Methods*
I-G Monitoring of loadings of chemicals of concern discharged from selected point sources, including municipal wastewater treatment facilities, CSOs, and storm sewer outfalls.	Current loadings of solids and chemicals of concern from point source discharges.	1. Determine the significance of identified point source discharges of selected chemicals of concern. 2. Provide data for Phase Four modeling activities.	1. Selected municipal wastewater treatment facilities. 2. Selected CSOs and storm sewer outfalls representative of both residential and industrial service areas.
Sampling Method Development Studies: Collection of ambient surface water and municipal wastewater treatment facility effluent samples using TOPS and conventional grab techniques.	Concentrations of selected chemicals of concern in surface waters using different sampling techniques and procedures.	1. Compare the effectiveness of sampling using TOPS vs conventional grab samples. 2. Develop and test sampling protocols for TOPS. 3. Test the feasibility of point sampling vs transects.	1. Hackensack and Passaic Rivers, Newark Bay, Arthur Kill, and PVSC wastewater treatment facility. 2. TOPS automatic samplers and conventional grab sampling techniques.
PHASE TWO ACTIVITIES			
II-A Additional targeted monitoring of loadings of chemicals of concern discharged from selected point sources, including municipal wastewater treatment facilities, CSOs, and storm sewer outfalls (as needed). [Continuation of Study I-G]	Current loadings of solids and chemicals of concern from point source discharges.	1. Based on the results of the Phase One Activities, within the "prioritized" tributaries to the NY-NJ Harbor estuary, determine the significance of identified point source discharges of selected chemicals of concern. 2. Provide data for Phase Four modeling activities.	1. Prioritized selection of municipal wastewater treatment facilities. 2. Prioritized subsamples of CSOs and storm sewer outfalls representative of both residential and industrial service areas.

Study/Investigation	*Data/Information Collected*	*Objectives of the Study/Investigation*	*Location of Study & Data Collection Methods*
PHASE THREE ACTIVITIES			
III-A Trackdown of the sources of chemicals of concern within the service areas of selected point source discharges, including municipal wastewater treatment facilities, CSOs, and storm sewer outfalls.	1. Concentrations of chemicals of concern from specific sources within the service areas of selected point source discharges.	Based on the results of Phase One and Two Activities, within the service areas of the "prioritized" point source discharges, trackdown the source(s) of the chemicals of concern.	1. Within the service areas of prioritized selection of point source discharges: municipal wastewater treatment facilities, CSOs, and storm sewer outfalls. 2. PISCES and grab samples.
III-B Trackdown of the sources of chemicals of concern originating from other point and nonpoint discharges: industrial wastewater treatment facilities, hazardous waste sites, landfills, etc.	1. Concentrations of chemicals of concern in tidal tributaries to NY-NJ Harbor to further identify additional sources.	1. Based on the results of Phase One and Two Activities, within the "prioritized" tributaries to NY-NJ Harbor, determine the significance of other point and nonpoint sources of toxic chemicals. 2. Provide data for the Phase Four modeling activities.	Targeted deployment of PISCES, TOPS and/or grab samplers in the "prioritized" tributaries to further identify sources of chemicals of concern.

Study/Investigation	*Data/Information Collected*	*Objectives of the Study/Investigation*	*Location of Study & Data Collection Methods*
PHASE FOUR ACTIVITIES			
IV-A Modeling of surface water and sediment transport within NY-NJ Harbor estuary.	Model transport/flow paths for sediments and chemicals of concern.	1. Develop a tool to provide better understanding of the hydrodynamic functioning of the NY-NJ Harbor estuary. 2. To assess and predict the effects of actions to eliminate sources of toxic chemicals on sediment contamination. 3. To predict the transport and fate of contaminants in NY-NJ Harbor estuary. 4. To help guide the development of long-term monitoring programs.	NY-NJ Harbor estuary, with an emphasis on the Newark Bay Complex, the Arthur Kill, and Kill Van Kull.

DETAILED DESCRIPTIONS OF THE WORKPLAN STUDIES AND INVESTIGATIONS

PHASE ONE ACTIVITIES

There are four major objectives of the Phase One studies and investigations:

(1) to compile existing information and data on potential sources of chemicals of concern within the NY-NJ Harbor estuary region;

(2) to identify and evaluate the significance of point and nonpoint discharges of the chemicals of concern to the tributary systems of the NY-NJ Harbor;

(3) to develop and evaluate the efficacy of the use of PISCES sampling devices for more detailed trackdown studies;

(4) to obtain data on the loadings of the chemicals of concern from selected municipal wastewater treatment facilities, CSOs, and storm water outfalls.

PHASE TWO ACTIVITIES (if needed)

Within the prioritized tributary systems, the major objectives of the Phase Two studies and investigations are:

(1) to obtain additional data on the loadings of the chemicals of concern from selected municipal wastewater treatment facilities, CSOs, and storm water outfalls;

(2) to preliminarily evaluate the importance of nonpoint sources of the chemicals of concern.

****Develop Draft "Toxics Reduction Implementation Plan"****

PHASE THREE ACTIVITIES

There are three major objectives of the Phase Three studies and investigations:

(1) to trackdown the sources of the chemicals of concern originating within the service areas of "significant" point source discharges identified as a result of Phase One Two Activities;

(2) to identify specific industrial wastewater treatment facilities, solid and hazardous waste facilities, and other potential point sources from which the selected chemicals of concern are discharged;

(3) to determine the significance of nonpoint sources of the chemicals of concern.

****Develop Final "Toxics Reduction Implementation Plan"****

PHASE FOUR ACTIVITIES

At the present time, there appear to be four potential objectives for the Phase Four modeling studies and investigations:

(1) to develop a modeling tool which will provide a better understanding of the hydrodynamic functioning of the NY-NJ Harbor estuary;

(2) to assess and predict the effects of actions to eliminate the sources of the chemicals of concern on sediment contamination;

(3) to predict the transport and fate of contaminants in the NY-NJ Harbor estuary;

(4) to help guide the development of long-term monitoring programs.

Study I-A: Database of Contaminant Information & GIS Template

NY-NJ HEP CCMP and Joint Dredging Plan* Actions Addressed:

CCMP Action T-5.1: Waste Site Inventory
CCMP Action T-8.1: Identification of Large Emitters of Chemicals of Concern
CCMP Action T-9.2: Identification of Additional Areas (of contaminated sediments)
Dredging Plan: Complete NJDEP database of pollution sources
Dredging Plan: Pollutant trackdown, prioritization, and clean-up

[*Note: as detailed in a November 17, 1997 letter from Frank McDonough, Director, New Jersey Department of Commerce, Office of Maritime Resources to Mary Downes Gastrich, NJDEP.]

The New Jersey Department of Environmental Protection has amassed a substantial body of information and data concerning potential sources of the chemicals of concern within the NY-NJ Harbor estuary region. However, much of this information is dispersed throughout various elements of the Department, and exists in electronic and/or paper databases. This information needs to be compiled into a single database and made available in a useful format.

Since 1997, the Department's technical rules for site remediation require that all hazardous site investigations in New Jersey deliver data to the Department in a defined electronic (digital) format. This data includes detailed information about the spatial distribution and concentration of contaminants in groundwater and soil. This data will be merged and manipulated through the application of EquIS, the Site Remediation Program's (SRP) data management system. EQuIS is designed to interact with the Department's Geographic Information System (GIS) for visualization, distribution, and further analysis.

Using the SRP EquIS as a template database and GIS tool, and then building upon it, Study I-A has three basic objectives to:

(1) compile additional information and data within existing NJDEP files (and from other appropriate sources, where available) which is relevant to the successful implementation of the New Jersey Toxics Reduction Workplan;

(2) preliminarily identify potential significant sources of the chemicals of concern;

(3) coordinate database/GIS development and management activities with the NY-NJ Harbor Estuary Program Contaminant Assessment and Reduction Project (CARP).

At a minimum, it is expected that the following types of information and data will be incorporated into the database/GIS system:

- locations of hazardous waste facilities, solid waste landfills, and contaminated sites that could potentially be the source of discharges to surface and groundwaters in the NY-NJ Harbor estuary region;

- surface and groundwater quality data for the chemicals of concern and other important water quality parameters;

- locations of known point source discharges to surface waters (municipal and industrial wastewater treatment facilities, CSOs, and storm sewer outfalls) and available data on the quantity and quality of these discharges;

- sediment quality data (physical characteristics, bulk sediment chemistry, etc.).

This compilation, synthesis and evaluation of existing information will be used in conjunction with the Phase One, Two, and Three monitoring and trackdown efforts -- and the results of studies to be completed as part of the New York State toxics reduction workplan -- to identify potential significant sources of toxic chemicals, target particular chemicals of concern, and further focus and "prioritize" the study areas of these activities towards potential sources. This will result in a more efficient use of limited resources and a more effective process to identify -- and subsequently eliminate/reduce discharges from -- significant sources of the chemicals of concern.

In addition, the SRP and the Division of Science, Research and Technology Water Assessment Team have initiated a Source Trackdown Pilot Study to evaluate the potential for contaminant movement from contaminated sites into the water, sediment, and biota of NY-NJ Harbor (see Appendix D). This pilot study will focus on sites within 1,000 feet of any surface water body draining into the harbor, and sites within known flood zone areas. It is anticipated that the initial study area will be within the Hackensack River basin.

The NJDEP Toxics Reduction Workplan Team will assist in Study I-A and ensure that all existing information and data relevant to this project are identified and incorporated into the database and GIS template. In addition, the Workplan Team will use the database/GIS system, along with the results of the Phase One, Two and Three Activities to prioritize additional/focused monitoring and trackdown studies and to identify significant sources of the chemicals of concern.

This study will be initiated in Year One of the implementation of the New Jersey Toxics Reduction Workplan.

Study I-B: Estimation of Atmospheric Deposition Loadings

NY-NJ HEP CCMP and Joint Dredging Plan* Actions Addressed:

CCMP Action T-12.11: Atmospheric Loadings Under "Great Waterbodies" Program
Dredging Plan: Pollutant trackdown, prioritization, and clean-up.

Wet and dry atmospheric deposition, and gaseous air-water exchange, can be significant pathways for direct loadings of some toxic chemicals to coastal areas. For example, atmospheric deposition of mercury is the major source of this contaminant to many surface waters. In addition, atmospheric deposition to upstream watershed areas, and subsequent transfer of these contaminants into downstream waterbodies and the estuary, can be important. The NY-NJ Harbor estuary system may thus be subject to significant loadings of one or more of the identified chemicals of concern due to atmospheric deposition. Any plan to identify and eliminate/reduce potential sources of toxic chemicals to the estuary must consider nonpoint source inputs of these chemicals resulting from atmospheric deposition. However, the magnitude of direct atmospheric deposition to the NY-NJ Harbor estuary system, or indirect loadings *via* deposition to tributary watersheds and subsequent runoff, are largely unknown.

New Jersey Sea Grant currently supports a number of studies of atmospheric deposition by researchers from Rutgers University, including:

- Dr. Steven Eisenreich: *Air-Sea Exchange of PCBs and PAHs in New Jersey Coastal Waters* (Duration: March 1, 1997 to February 28, 1998; Funding: $114,682);
- Dr. Yuan Gao: *Atmospheric Deposition of Nitrogen and Trace Metals to the New York/New Jersey Harbor Estuary* (Duration: March 1, 1997 to February 28, 1998; Funding: $42,000);

New Jersey Sea Grant has requested a two-year extension/expansion of the NY-NJ Harbor Estuary study undertaken by Dr. Yuan Gao (Proposed Budget: $109, 477).

Air-Sea Exchange of PCBs and PAHs: it is hypothesized that atmospheric emissions of hazardous pollutants such as PCBs and PAHs result in enhanced depositional fluxes to coastal water by air-sea exchange. The overall objectives of this study are to determine the direction, magnitude, and controlling factors on the air-sea fluxes of these target chemicals.

Atmospheric Deposition of Nitrogen and Trace Metals to the NY/NJ Harbor Estuary: this is a continuation of the above referenced project, initiated in 1997 with funding provided by New Jersey Sea Grant. The primary objective of this study is to determine the seasonal patterns and rates of the atmospheric deposition of nitrogen and selected trace metals (Pb, Cd, Zn, Cr, Cu, and

Hg) to the NY-NJ Harbor estuary system. An air sampling station has been established at Sandy Hook and preliminary data obtained in Year 1; Years 2 and 3 of the study will expand the scale of the investigation. Specific objectives are to:

(1) continue collecting aerosol particulate and precipitation samples to determine the atmospheric concentration of the target chemicals;

(2) initiate the collection of size-differentiated aerosol samples to generate an estimate of the aerosol dry deposition velocity for dry deposition modeling purposes;

(3) generate an estimate of the total atmospheric deposition rates of the target chemicals to the NY-NJ Harbor estuary system through modeling, to identify the sources of these chemicals, and to identify the processes that control the atmospheric deposition of the chemicals.

The two principal investigators closely coordinate these research projects, and will develop a database critical to an understanding of the magnitude of nonpoint sources of the target chemicals to the NY-NJ Harbor estuary. The results of these studies will provide data that can be used to assess the importance of loadings of the target chemicals to the harbor estuary relative to other identified point and nonpoint sources. This information will be used to prioritize and direct the Phase Two and Three monitoring and trackdown activities (for example, to eliminate potential chemicals of concern from consideration in Studies II-A, III-A and III-B if relatively high loadings are due to atmospheric deposition), and to target remediation activities at identified sources.

These studies are currently underway; an additional two year extension of the *Atmospheric Deposition of Nitrogen and Trace Metals to the New York/New Jersey Harbor Estuary* study will be partly funded by the Department (NJDEP Partnering Share: $54,000). The Department has provided an additional $12,500 to New Jersey Sea Grant to coordinate these research efforts with the Department and to host a workshop at which preliminary results of the studies were presented and discussed (Total NJDEP Match: $66,500). This workshop was held on April 13, 2000 and a proceedings document published (see Appendix C). These funds will come from the monies provided by the Port Authority of New York and New Jersey and the studies will be conducted during Years One and Two of the implementation of the New Jersey Toxics Reduction Workplan.

In addition to these studies, in October 1997 the Department and Rutgers University have developed the New Jersey Atmospheric Deposition Network (NJADN). The NJADN has two major objectives: (1) to gain an understanding of the magnitude and potential impacts of air deposition throughout the State, and (2) to assess the relative contribution of various sources of pollutants, including out-of-state sources. The NJADN consists of ten (10) sites (including three in the NY-NJ Harbor region) where atmospheric deposition data (metals, toxic organics, nutrients) will be collected for three years. Atmospheric deposition of toxic chemicals is potentially an important nonpoint source of pollution for surface water bodies and ecosystems.

Phase One Activities I-C, I-D and I-E are monitoring studies of selected ambient water quality and suspended sediment parameters throughout various tributaries to the Newark Bay Complex and the NY-NJ Harbor estuary system. Study I-G consists of the monitoring of discharges from selected municipal wastewater treatment facilities, CSOs, and storm water outfalls (additional monitoring of point sources is discussed under Phase Two Activities). These four studies have been coordinated with each other -- and with various monitoring studies included in the New York State toxics reduction workplan -- in order to provide a synoptic "picture" of conditions in the estuary. The combined objective of these studies is to determine the relative significance of loadings of the chemicals of concern and sediment throughout the harbor estuary: from sources (1) above the head of tide of major tributaries, and (2) within the watersheds of the major and minor tributaries, including the Newark Bay Complex. This information will be used to identify potential sources of the chemicals of concern and to focus additional Phase Two and Three monitoring and trackdown activities.

The sampling/monitoring methods and analytical protocols selected for use will provide data which is directly comparable among the four studies and the work to be completed by New York State. This will enable the Department and the principal investigators to determine the relative significance of potential sources of the chemicals of concern with a greater degree of accuracy. It will also provide data that can be used to develop a better understanding of the hydrodynamic functioning of the NY-NJ Harbor estuary system and for the development of the Phase Four modeling studies. Finally, the data collected will serve as part of the existing "baseline" condition of the NY-NJ Harbor estuary which will used to evaluate the effectiveness of actions implemented to eliminate/reduce discharges of toxic chemicals.

The ambient monitoring studies are to be initiated in Year One of the implementation of the New Jersey Toxics Reduction Workplan, and will continue through Year Two. In order to evaluate the effects of seasonal/climatic conditions on the loading, transport, and fate of the chemicals of concern and sediments, it is presently planned that monitoring of 7 events will be undertaken in each tributary:

- 2 low flow/dry weather events -- will provide information on the concentrations and loading of the chemicals of concern due solely to continual point source discharges, relatively independent of precipitation and nonpoint source loadings from runoff;

- 4 high flow/wet weather events;

- 1 "contingent" event, either low flow/dry weather or high flow/wet weather, depending on the results and variability in the data collected during the first 6 events/periods.

For practical and logistical reasons, each event will consist of two surveys:

- Survey 1 (Northern) – Passaic and Hackensack Rivers, Newark Bay, Arthur Kill, and Kill Van Kull;

- Survey 2 (Southern) – Raritan, Rahway, and Elizabeth Rivers, Arthur Kill.

The actual "timing" and number of monitoring events/surveys during the two-year period are dependent on three factors: (1) regional climatic conditions relative to historical norms and trends, (2) geographic variability in precipitation within the various watersheds of the tributaries which discharge to the estuary, and (3) the results of the monitoring studies themselves, in combination with other Phase One activities, providing information which will enable the Department to preliminarily identify potential significant sources of the chemicals of concern, and thus refocus the monitoring studies and/or implement Phase Two and Three Activities on a "fast-track" basis. In addition, the studies may be extended beyond the initial two-year period (for example if suitable climatic conditions do not occur), and/or revised to focus on particular tributaries, or portions thereof.

The Study I-G monitoring activities will be conducted during Year One (2000-2001) of the implementation of this workplan, and will consist of seasonal sampling events for the selected point sources. To the greatest extent possible, the sampling for CSOs and SWOs will be coordinated with the ambient monitoring studies.

The New Jersey office of the United States Geological Survey (USGS; principal investigator for Study I-C) will coordinate initiation of the monitoring activities during a single event/survey. The USGS will be responsible for identifying and selecting the appropriate low flow/dry weather and high flow/wet weather events to be monitored and directing the principal investigators for Studies I-D and I-E (and I-G as appropriate) to implement their investigations.

To the greatest extent possible, each individual study will utilize the same or comparable sampling/monitoring methodologies, analytical protocols and QA/QC procedures; these protocols and methods will also be directly comparable to those to be used by New York State for its toxics reduction workplan. Table III-2 is the initial list of the target chemicals of concern for the four studies; the development of this list has been coordinated with New York State and the NY-NJ Harbor Estuary Program. As the studies progress and potential sources of these chemicals are identified, additional focused monitoring efforts could include analytical testing for only a subset of them (for example, if a tributary was initially observed to only have high levels of chlordane, testing for the other analytes on the target list may not be undertaken). [Note: a similar approach will be used for the Phase Two and Three Activities.]

NY-NJ HEP CCMP and Joint Dredging Plan* Actions Addressed:

CCMP Action T-6.1: Organic Chemical and Mercury Screening
CCMP Action T-6.2: Tracking and Elimination of Chemicals of Concern
CCMP Objective T-12: Assess Ambient Levels, Loadings, and Effects of Chemicals
CCMP Action T-12.12: Low-Level Detection Methods for Loadings
Dredging Plan: Pollutant trackdown, prioritization, and clean-up.
Dredging Plan: Tributary loadings quantification and prioritization to include remedial/management actions.

Table III-2: Target Analyte List for Studies I-C, I-D, I-E, and I-G

PCB Congeners

3	4	5	8	10	11	15	16	17	18	19
22	25	26	27	28	31	33	37	40	42	43
44	45	46	47	48	49	50	52	53	56	59
60	62	63	64	66	70	74	75	77	81	82
84	85	86	87	91	92	95	97	99	101	104
105	110	114	118	119	123	126	128	132	134	135
136	137	138	141	146	149	151	153	154	156	157
158	166	167	168	169	170	171	172	174	177	178
179	180	183	185	187	189	190	191	194	195	196
198	200	201	203	205	206	207	208	209		

PAHs	Pesticides	Dioxins/Furans
Acenaphthene	Aldrin	2,3,7,8-TCDD
Acenaphthalylene	alpha-BHC	1,2,3,7,8-PCDD
Anthracene	beta-BHC	1,2,3,4,7,8-HCDD
Benzo(a)anthracene	gamma -BHC (Lindane)	1,2,3,6,7,8-HCDD
Benzo(a)pyrene	alpha-Chlordane	1,2 3,7,8,9-HCDD
Benzo(b)fluoranthene	gamma-Chlordane	1,2,3,4,6,7,8-HCDD
Benzo(e)pyrene	oxy-Chlordane	OCDD
Benzo(ghi)perylene	2, 4'-DDD	2,3,7,8-TCDF
Benzo(k)fluoranthene	4, 4'-DDD	1,2,3,7,8-PCDF
Biphenyl	2, 4'-DDE	2,3,4,7,8-PCDF
Chrysene	4, 4'-DDE	1,2,3,4,7,8-HCDF
Dibenz(ah)anthracene	2, 4'-DDT	1,2,3,6,7,8-HCDF
2,6-Dimethlnaphthalene	4, 4'-DDT	2,3,4,6,7,8-HCDF
Fluoranthene	Heptachlor	1,2,3,7,8,9-HCDF
Fluorene	Hexachlorobenzene	1,2,3,4,6,7,8-HCDF
Indeno(1,2,3-cd)pyrene	Mirex	1,2,3,4,7,8,9-HCDF
1-Methylnaphthalene	cis-Nonachlor	OCDF
2-Methylnaphthalene	trans-Nonachlor	T4CDD Total
1-Methylphananthrene	alpha-Endosulfan	P5CDD Total
Naphthalene	beta-Endosulfan	H6CDD Total
Perylene	Dieldrin	H7CDD Total
Phenanthrene	Endosulphan sulphate	T4CDF Total
Pyrene	Endrin	P5CDF Total
2,3,5-Trimethylnaphthalene	Endrin aldehyde	H6CDF Total
C1 Phananthrenes/Anthracenes	Endrin ketone	H7CDF Total
C2 Phenanthrenes/Anthracenes	Heptachlor epoxide	
Total C2 Napthalenes	Methoxychlor	
Total C3 Napthalenes		

Metals

Mercury (dissolved)
Methyl-mercury (dissolved)
Total mercury
Cadmium (dissolved)
Total cadmium
Lead (dissolved)
Total lead

Miscellaneous

Total Suspended Solids
Particulate Organic-C
Dissolved Organic-C

Note: only the suspended solids fraction of most samples will be analyzed for dioxins/furans.

Study I-C: Ambient Monitoring of Loadings to Major Tributaries at the Head of Tide

The primary objective of Study I-C is to determine the loadings of suspended sediment and selected organic and inorganic contaminants (see Table III-2) originating above the head of tide of the major tributaries to the Newark Bay Complex, the Arthur Kill, and Raritan Bay. These discharges represent the loadings of sediment and the chemicals of concern from upstream sources that enter the tidal portions of these major tributaries under low flow/dry weather conditions and as a result of storm events. The monitoring data generated by this study will provide information needed to trackdown and potentially reduce or eliminate sources of the chemicals of concern and will benefit the long-term management of the NY-NJ Harbor estuary system. Specifically, Study I-C will

- provide measurements of the suspended sediment and contaminant loads entering the tidal portions of the estuary at the head of tide;
- provide information that will be used to identify those tributaries that are significant sources of suspended sediments and toxic chemicals;
- characterize how the suspended sediment and contaminant loads vary during low/high (dry/wet weather) flow events and seasonally; and
- provide baseline information which will be used in an evaluation of the effectiveness of actions taken to eliminate upstream sources of the chemicals of concern and long-term monitoring programs.

Study I-C will provide data that can be used to develop an understanding of the relative importance of the loadings of the chemicals of concern associated with the dissolved aqueous phase compared with that bound to suspended sediments. In addition, this study will provide a basic understanding of the relationships between stream flow, stage, and suspended sediment transport dynamics at fixed points in the tributaries. The data and information collected during this study will also be used in the development of the modeling initiatives discussed under Phase Four Activities.

Methods: Study I-C includes the installation of automatic sampling equipment near existing U.S. Geological Survey (USGS) river-stage gauging stations located near the head-of-tide on the Raritan, Passaic, Rahway, Hackensack, and Elizabeth Rivers (see Figure III-3). The sampling devices will collect both event integrated and interval samples during various hydrologic events:

(1) low flow/dry weather conditions,
(2) moderate storm discharges (the discharge that has been exceeded 10% of the time during the period of record), and

(3) extreme storm events.

A wet weather/high flow hydrologic event is defined as a rain storm or snow-melt that causes the river discharge to exceed the 10% exceedance level of flow, as established by the USGS historic discharge record for the gaging station at the head-of-tide on each tributary. The baseflow (90% exceedance level) and 10% exceedance levels are as follows:

River Tributary	10% Exceedance Level	90% Exceedance Level
Hackensack River	276 cfs	0 cfs
Passaic River	2770 cfs	125 cfs
Rahway River	100 cfs	3.4 cfs
Elizabeth River	51 cfs	5.5 cfs
Raritan River	2620 cfs	170 cfs

It is expected that a wet weather/high flow event will be sampled only if precipitation or snow melt has not occurred within the previous seven (7) day time period and the discharge had been relatively steady at approximately the baseflow level.

As implementation of the workplan progresses, this definition of a high flow/wet weather event may have to be changed in order to sample the planned number of events during the study period. For example, because the larger tributaries in the study area are damned (for water supply purposes), the occurrences of large hydrologic events that affect the rivers may be "disturbed" from "normal/expected" conditions unless the upstream reservoirs are near capacity.

The actual "timing" and number of monitoring events during the two-year period are dependent on two factors: (1) regional climatic conditions relative to historical norms and trends, (2) geographic variability in precipitation within the various watersheds of the tributaries which discharge to the estuary. Given this variability, it is doubtful that large-scale/regional wet weather events will occur that simultaneously effect all five tributary watersheds. There are also logistical difficulties in coordinating and implementing Studies I-C, I-D and I-E in a "regionally" synoptic fashion. Thus, each event will consist of two surveys, as follows:

- Survey 1 (Northern) – Passaic and Hackensack Rivers
- Survey 2 (Southern) – Raritan, Rahway, and Elizabeth Rivers

In practice, therefore, "event" is used essentially as a bookeeping tool, and surveys represent the actual sampling activities. It is expected that, although only seven events/surveys will be

monitored for each tributary, a total of more than seven events (particularly wet weather/high flow events) will be monitored during the course of this study.

In order to accomplish event-based sampling, the relationship between precipitation and resulting river flow must be understood. In this way, U.S. Weather Bureau predictions on storm occurrences can be used to prepare for sampling an event. The results of an analysis of this relationship generally show that precipitation between 0.5 and 1 inch is needed for the rivers to reach the event threshold criteria during the winter months, while between 1 and 3 inches is needed in the summer. This is approximately equivalent to rainfall intensities of 0.05 inches per hour during the winter, and 0.2 inches per hour in the summer. For a more detailed discussion, see Appendix B.

The sampled weather conditions will span all four seasons over a two-year period, with particular emphasis on storm/wet weather events occurring in late winter/early spring. This will provide data on the loadings of the chemicals of concern and suspended sediments that span a wide range of hydrologic conditions, including the "Spring flush". The sampling/analytical methods will be consistent with those to be used by the New York State Department of Environmental Conservation (NYSDEC) and New York USGS for similar work on the Hudson River system in the State of New York.

Each monitoring site will be equipped with a Trace Organic Platform Sampler (TOPS) and two ISCO automatic samplers that can collect event integrated or interval samples. The ISCO samplers are standard automatic grab samples that use a peristaltic pump and sample bottles on a rotating platform. The TOPS samplers employ metered peristaltic pumps, a series of glass-fiber filters for collecting suspended sediments, and a standard XAD column for capturing and concentrating organic compounds from filtered water. Two XAD columns are used in series -- the first column collects the organic compounds from the water, and the second provides backup for any compounds that may not be sorbed on the first XAD column, thus preventing potential compound loss by carryover (if it is determined that carryover is not a problem, the number of XAD columns may be reduced). Both types of samplers can be configured to collect samples at discrete time intervals and/or flow conditions. They can also be interfaced with telemetry equipment present in the USGS stage-gauging stations. One TOPS and one ISCO sampler will collect **event-integrated samples** (one sample per station per event) for dissolved and suspended sediment-associated chemicals of concern. The second ISCO sampler will collect **interval samples** during each event (ten samples per station per event) for the analysis of total suspended solids (TSS), particulate organic carbon (POC), and dissolved organic carbon (DOC). These interval samples will represent stream conditions ranging in duration from 2 to 8 hours.

Table III-2 lists the compounds and parameters that will be monitored in this study; the chemicals of concern will be measured in both the dissolved aqueous phase and bound to suspended sediments. At each event, integrated samples of water and suspended sediment will be analyzed for the chemical parameters listed in Table III-2, and interval samples will be analyzed only for TSS, POC, and DOC (termed "Chemical Samples" and Sediment Samples", respectively, in Table III-3).

In contrast to traditional sampling methods that produce an "average" sample of water or sediment from the stream cross-section, automatic samplers collect water and suspended sediments from a single point in the stream profile. In order to relate the data from the automatic samplers to results that would be obtained using traditional methods, the "representativeness" of the automatic samplers must be determined. In this study, monitoring for conductivity and TSS will also be conducted concurrently using both sampling methods over a range of flow conditions. The TSS and conductivity data will serve as calibration parameters to provide a relationship between the "average" sample value and the "point" sample (it is assumed that this relationship is "transferable" and valid for all the parameters in Table III-2). Each sampling station will be calibrated using TSS and specific conductance measurements collected in equal width and equal depth profiles; the total number of samples collected will depend upon the width and depth of the tributary.

Monitoring Locations: The monitoring locations are identified in Figure III-3 and Table III-4, which also includes a summary of flow conditions at the sites. These locations are

- the Passaic River at Little Falls, NJ
- the Hackensack River at New Milford, NJ
- the Raritan River at Bound Brook, NJ
- the Elizabeth River near Elizabeth, NJ
- the Rahway River near Rahway, NJ.

The data generated in this study will be tabulated and presented in a manner consistent with the HEP CARP data management plan and will also be incorporated into the NJDEP database/GIS system developed as a part of Study I-A. The principal investigator will submit two interim reports and a final report to the NJDEP, and will serve on the scientific advisory team established by the Department to evaluate the data on a continual basis.

Table III-3: Types and Approximate Numbers of Samples to be Collected in Study I-C

Sample Type	Sample Phase	Parameters Analyzed	Total Number of Samples
CHEMICAL SAMPLES			
XAD Column	Aqueous	Organic Compounds	35[a]
TOPS Filter	Suspended Sediment	Organic Compounds	35
Whole Water Composite	Aqueous	Metals-Total, Metals-Species, PAHs	35
Whole Water Composite	Suspended Sediment	Metals-Total, Metals-Species, PAHs	35
SEDIMENT SAMPLES			
Whole Water	Suspended Sediment & Aqueous	SS DOC,POC	2,135 1.050

All "Chemical Samples" are "event integrated" samples; all "Sediment Samples" are "event interval" samples.

Note a: the total number of samples accounts for each TOPS sampler containing two XAD columns connected in series.

Table III-4: Permanent Monitoring Stations for Study I-C

(1) Passaic River at Little Falls, NJ (01389500) Lat. 40°53'05", Long. 74°13'35"; Passaic County, Hydrologic Unit 02030103, on left bank 0.6 mile downstream from Beatties Dam in Little Falls, and 1.0 mile upstream from Peckman River.

Drainage area is 762 mi^2. Period of Record September 1897 to present. Baseflow is approximately 50 cubic feet per minute (cfm), mean average flow is 1143 cfm, 10% exceeds 2770 cfm.

(2) Hackensack River at New Milford, NJ (01378500) Lat. 40°56'52", Long. 74°01'34"; Bergen County, Hydrologic Unit 02030103, on right bank upstream from two masonry dams and two lift gates at the former pumping plant of United Water New Jersey (formerly Hackensack Water Company), New Milford, 4.0 miles downstream from Pascack Brook, 0.6 miles downstream from Oradell Reservoir Dam, and 21.8 miles upstream from mouth.

Drainage area is 113 mi^2. Period of Record October 1921 to present. Baseflow is approximately 15 cfm, mean average flow is 94.4 cfm, 10% exceeds 277 cfm.

(3) Raritan River at Bound Brook, NJ (0103300) Lat. 40°33'34", Long. 74°31'41"; Somerset County, Hydrologic Unit 02030105, at Queens Bridge on Main Street in Bound Brook, 1.7 miles upstream of Fieldsville Dam.

Drainage area is 804 mi^2. Period of Record 1964 to present (gauge was previously below Calco Dam). Baseflow is approximately 300 cfm, mean average flow is 1202 cfm, 10% exceeds 2600 cfm.

(4) Elizabeth River at Ursino Lake (01393450), Elizabeth, NJ. Lat. 40°40'30", Long. 74°13'20"; Union County, Hydrologic Unit 02030104, on left bank at Ursino Lake Dam in Elizabeth, 75 feet upstream of bridge on Trotters Lane, and 3.8 miles upstream from mouth.

Drainage area is 16.9 mi^2. Period of Record October 1921 to present. Baseflow is approximately 8 cfm, mean average flow is 25.7 cfm, 10% exceeds 51 cfm.

(5) Rahway River (01395000) at Rahway, NJ. Lat. 40°37'05", Long. 74°17'00"; Union County, Hydrologic Unit 02030104, on left bank 100 feet upstream from St. Georges Avenue bridge in Rahway, and 0.9 miles upstream from Robinson Branch,

Drainage area is 40.9 mi^2. Period of Record July 1908 to present. Baseflow is approximately 15 cfm, mean average flow is 48.2 cfm, 10% exceeds 99 cfm.

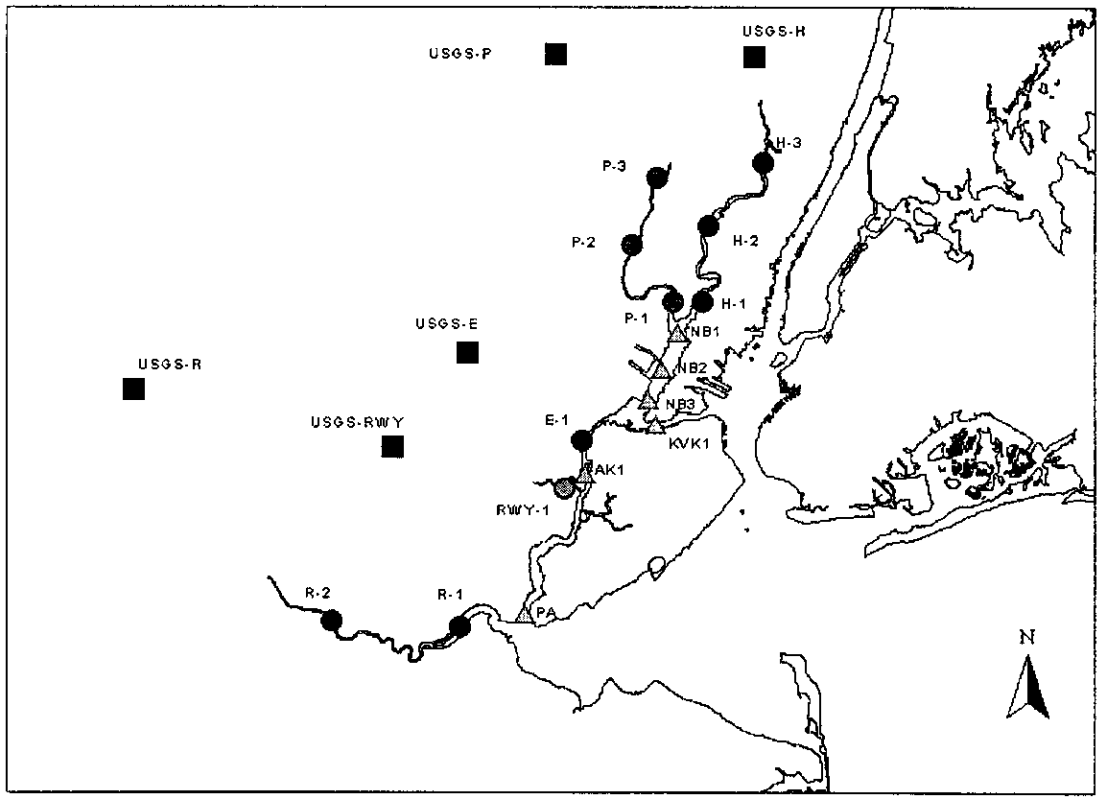


Figure III-3 Initial sampling locations for Studies I-C, I-D and I-E.

■ Study I-C USGS Head-of-Tide

● Study I-D Major tributaries

▲ Study I-E Newark Bay Complex, Arthur Kill, and Kill Van Kull

H - Hackensack River
P - Passaic River
E - Elizabeth River
RWY - Rahway River
R - Raritan River
NB - Newark Bay
KVK - Kill Van Kull
AK - Arthur Kill
PA - Perth Amboy

Study I-D: Ambient Monitoring Within Major and Minor Tributaries

The primary objective of Study I-D is to determine the relative importance of discharges of suspended sediment and selected organic and inorganic contaminants (see Table III-2) originating within the watersheds of the major and minor tributaries to the Newark Bay Complex, the Arthur Kill, and Raritan Bay. These discharges represent the loadings of sediment and the chemicals of concern from all sources that enter the tidal portions of these tributaries under low flow/dry weather conditions and as a result of storm events. The monitoring data generated by this study will provide information needed to trackdown and eliminate sources of the chemicals of concern and will benefit the long-term management of the NY-NJ Harbor estuary system. Specifically, Study I-D will

- provide estimates of the levels of suspended sediment and contaminants entering the tidal portions of the major and minor tributaries of the estuary system;
- provide information that will be used to identify the watersheds of major and minor tributaries that are significant sources of suspended sediments and toxic chemicals;
- provide information on how the sources of the chemicals of concern and suspended sediment are distributed within the tributaries, which can then be used to focus subsequent monitoring and trackdown activities;
- characterize how the suspended sediment and contaminant levels vary during low/high (dry/wet weather) flow events and seasonally; and
- provide baseline information that will be used in an evaluation of the effectiveness of actions taken to eliminate upstream sources of the chemicals of concern and long-term monitoring programs.

Study I-D will provide data that can be used to develop an understanding of the relative importance of the loadings of the chemicals of concern associated with the dissolved aqueous phase compared with that bound to suspended sediments. The data and information collected during this study will also be used in the development of the modeling initiatives discussed under Phase Four Activities.

Methods: The Study I-D efforts will be coordinated with those undertaken in Studies I-C, I-E, and I-G, and will target the same seven low flow/dry weather and high flow/wet weather events. The five major tributaries have been grouped into two surveys: (1) "Northern" - Passaic and Hackensack Rivers, and (2) "Southern" - Raritan, Elizabeth, and Rahway Rivers. In consideration of expected geographic variability in precipitation within the watersheds of these tributaries and logistical difficulties in conducting synoptic sampling, only one of these surveys

will be monitored during a particular high flow/wet weather event. Both surveys could be conducted during the same low flow/dry weather event, if it was of suitable duration. Water and suspended sediment samples will be collected at stations within the selected tributaries. Table III-5a lists the tributaries to be studied and the anticipated number of sampling stations to be used in each waterbody; Table III-5b and Figure III-3 provide preliminary location data for some of these stations. The stations will include locations at the "mouths" of each of the five major New Jersey tributaries to the estuary and at a few additional selected locations in the Hackensack, Passaic, and Raritan Rivers (a total of ten stations) These locations may be altered during subsequent sampling events based on the results of prior sampling, including the presence/absence of any of the chemicals of concern and a preliminary analysis of the significance of the tributaries as sources of contaminants and/or suspended sediments to the estuary system.

In addition, at transects associated with each sampling station, the cross-sectional profile of water velocity will be measured using a towed Acoustic Doppler Current Profiler. The cross-sectional distribution of suspended sediment concentration and particle size distribution will be measured using a towed laser-based diffraction profiler. The instrument will continuously measure suspended sediment concentration and size distribution as a function of time and space (width and depth of the tributary). Conductivity and temperature profiles will be obtained using a towed undulating CTD recorder.

Water and suspended sediment samples will be obtained for each station using a combination of a Trace Organic Platform Sampler (TOPS) and grab samples. The TOPS instrument will be configured to allow for continuous, constant-rate pumping during each monitoring event. Grab samples will also be obtained at each monitoring station. The TOPS water and suspended sediment samples will be analyzed for the chemicals of concern listed in Table III-2. The grab samples will only be analyzed for Total Suspended Solids (TSS), Dissolved Organic Carbon (DOC), Particulate Organic Carbon (POC), PAHs, and the metals listed in Table III-2. A total of 70 TOPS and 70 grab samples will be obtained during this study.

The data generated in this study will be tabulated and presented in a manner consistent with the HEP CARP data management plan and will also be incorporated into the NJDEP database/GIS system developed as a part of Study I-A. The principal investigator will submit two interim reports and a final report to the NJDEP, and will serve on the scientific advisory team established by the Department to evaluate the data on a continual basis.

Table III-5a: Major and Minor Tributaries to be Monitored in Study I-D

Major or Minor Tributary	Potential No. of Stations[a]
Hackensack River	3
Sawmill Creek	1
Penhorn Creek	1
Kingsland Creek	1
Cromakill Creek	1
Bellmans Creek	1
Overpeck Creek	1
Berrys Creek	2
Passaic River	3
Second River	1
Raritan River	2
South River	1
Lawrence Brook	1
Washington Canal	1
Red Root Creek	1
Elizabeth River	1
Rahway River	1
Other Tributaries	
Morses Creek	1
Newark Airport Canal	1
Woodbridge Creek	1
Piles Creek	1
Smith Creek	1

Note a: initially, stations will be sampled only within the five major New Jersey tributaries (see Figure III-3) -- the locations of subsequent transects will be determined based on the data collected during the Phase One monitoring studies.

Table III-5b: Initial Sampling Locations for Study I-D

Transect ID	Location	Latitude	Longitude	Survey
P-1	0.5 mile north of confluence with Newark Bay	40° 44.5' N	74° 07.7' W	1
P-2	near Route 280 bridge	40° 47.1' N	74° 08.8' W	1
P-3	south of Avondale Swing Bridge	40° 50.8' N	74° 07.2' W	1
H-1	0.5 mile north of confluence with Newark Bay	40° 44.1' N	74° 05.7' W	1
H-2	Buoy 15	40° 47.9' N	74° 04.0' W	1
H-3	near Turnpike bridge	40° 50.6' N	74° 01.8' W	1
R-1	near Victory Bridge	40°30.5' N	74°17.4' W	2
R-2	Donaldson County Park	40°29.3' N	74°25.4" W	2
RWY-1	Joseph Medwick Memorial Park	40°36.9' N	74°13.08' W	2
E-1	Elizabeth City Marina	40°38.6' N	74°11.4' W	2

Note: "P" denotes Passaic River
"H" denotes Hackensack River
"R" denotes Raritan River
"RWY" denotes Rahway River
"E" denotes Elizabeth River

Study I-E: Ambient Monitoring of the Newark Bay Complex and the Kills

The primary objective of Study I-E is to determine the relative importance of discharges of suspended sediment and selected organic and inorganic contaminants (see Table III-2) originating within the watersheds of the Newark Bay Complex, the Arthur Kill, and the Kill Van Kull. In addition, data will be gathered to characterize the transport patterns of suspended sediments and the chemicals of concern within these waterbodies. Study I-E may also enable the NJDEP and its scientific advisory committee to establish linkages between upstream flows and loadings (monitored in Studies I-C, I-D, and I-G) and downstream suspended sediment and water column contaminant concentrations. The monitoring data generated by this study will provide information needed to trackdown and eliminate sources of the chemicals of concern and will benefit the long-term management of the NY-NJ Harbor estuary system. Specifically, Study I-E will

- provide estimates of the levels of suspended sediment and contaminants entering the Newark Bay Complex, Arthur Kill, and Kill van Kull;
- provide information on how the sources of the chemicals of concern and suspended sediment are distributed within these waterbodies, which can then be used to focus subsequent monitoring and trackdown activities;
- provide data which can be used to characterize and understand the transport and fate of suspended sediments and the chemicals of concern within the Newark Bay Complex, Arthur Kill, and Kill Van Kull;
- characterize how the suspended sediment and contaminant loads vary during low/high (dry/wet weather) flow events and seasonally; and
- provide baseline information that will be used in an evaluation of the effectiveness of actions taken to eliminate upstream sources of the chemicals of concern and long-term monitoring programs.

Study I-E will provide data that can be used to develop an understanding of the relative importance of the loadings of the chemicals of concern associated with the dissolved aqueous phase compared with that bound to suspended sediments. The data and information collected during this study will also be used in the development of the modeling initiatives discussed under Phase Four Activities.

Methods: The Study I-E efforts will be coordinated with those undertaken in Studies I-C, I-D, and I-G, and will target the same seven low flow/dry weather and high flow/wet weather events. These events consist of two surveys, as follows: (1) "Northern" – Newark Bay, Arthur Kill, and Kill Van Kull, and (2) "Southern" – Arthur Kill and Raritan River/Bay.

For the "Northern" survey area, monitoring activities will include three permanent stations at the following locations (see Figure III-3):

- NB1 - the confluence of the Passaic and Hackensack Rivers (Lat. 40.7° N, Long. 74.1° W)
- KVK1 - the Bayonne Bridge (Lat. 40.64° N, Long. 74.12° W)
- AK1 - the Goethals Bridge (Lat. 40.6° N, Long. 74.2° W)

For the "Southern" survey, the NB1 station will be replaced with:

- PA – Perth Amboy (Lat. 40.51° N, Long. 74.26° W).

Instrumentation will be installed at each of the three permanent stations approximately two days prior to a sampling event, and will be retrieved approximately one week after completion of the ship-based sampling for the event. The following instrumentation will be placed at each of the three permanent stations:

- an Acoustic Doppler Current Profiler
- a laser-based diffraction profiler for the measurement of suspended sediment concentration and particle size distribution
- a conductivity-temperature sensor
- a high resolution pressure sensor
- an optical back scatter sensor (turbidity)

In addition, tide gauges will be deployed at the boundaries of the study area at NB1, PA, and CH (Constable Hook; Lat. 40.65° N, Long. 74.09° W).

Water and suspended sediment samples will be collected at fixed stations within the study area. The locations of these sampling sites are listed in Table III-6, and shown in Figure III-3. The sampling locations may be altered during subsequent sampling events based on the results of prior sampling. Three vessels will be used in this study, two to collect the water quality data, and the other to collect the hydrodynamic data.

In addition, transects to obtain hydrodynamic measurements will be conducted within each survey area. For each transect, the cross-sectional profile of water velocity will be measured using a towed Acoustic Doppler Current Profiler. The cross-sectional distribution of suspended sediment concentration and particle size distribution will be measured using a towed laser-based diffraction profiler. The instrument will continuously measure suspended sediment concentration and size distribution as a function of time and space (width and depth of the tributary). Conductivity and temperature profiles will be obtained using a towed undulating CTD recorder.

Water and suspended sediment samples will be obtained at each sampling location using a combination of a Trace Organic Platform Sampler (TOPS) and grab samples. The TOPS instrument will be configured on board the vessel to allow for continuous, constant-rate pumping. Samples will be collected in the navigation channels at a depth of approximately 5 feet below the surface. At stations NB1, AK1, and PA, samples will also be collected at a depth of 5 feet above the bottom of the channel. For each survey, samples will be initially collected as follows:

- Survey 1 "Northern") – NB1 (2 depths), NB3, AK1, PA, KVK
- Survey 2 ("Southern") – PA (2 depths), AK1 (2 depths)

The TOPS water and suspended sediment samples will be analyzed for the chemicals of concern listed in Table III-2. The grab samples will only be analyzed for Total Suspended Solids (TSS), Dissolved Organic Carbon (DOC), Particulate Organic Carbon (POC), PAHs and the metals listed in Table III-2. A total of 54 TOPS and 54 grab samples will be obtained during this study; thus, the initial sampling plan will be revised as the study proceeds and data is collected.

The data generated in this study will be tabulated and presented in a manner consistent with the HEP CARP data management plan and will also be incorporated into the NJDEP database/GIS system developed as a part of Study I-A. The principal investigator will submit two interim reports and a final report to the NJDEP, and will serve on the scientific advisory team established by the Department to evaluate the data on a continual basis.

Table III-6: Initial Sampling Locations in Study I-E

Transect ID	Location	Latitude	Longitude
NB1[a]	Confluence of Passaic & Hackensack Rivers	40.7° N	74.1° W
NB2[b]	North end of Port Newark/Red Buoy 14	40.67° N	74.13° W
NB3	North of Shooters Island/Buoy 16	40.65° N	74.16° W
AK1[a]	Near Goethals Bridge	40.6° N	74.2° W
PA[a]	Perth Amboy/Red Buoy 60	40.51° N	74.26° W
KVK1	Near Bayonne Bridge	40.64° N	74.12° W

Note: "NB" denotes Newark Bay, "AK" denotes Arthur Kill, and "KVK" denotes Kill Van Kull.

Note a: two samples will be collected at these sites, one 5 feet below the water surface, and the other 5 feet above the bottom of the navigation channel.

Note b: this sampling location will not be used in the initial Phase One studies.

Study I-F: Pilot Project -- Field Testing of PISCES Sampling Device

NY-NJ HEP CCMP and Joint Dredging Plan* Actions Addressed:

CCMP Action T-6.1: Organic Chemical and Mercury Screening
CCMP Action T-6.2: Tracking and Elimination of Chemicals of Concern
CCMP Action T-12.12: Low-Level Detection Methods for Loadings
Dredging Plan: Pollutant trackdown, prioritization, and clean-up

The NY-NJ Harbor Estuary Program has recommended that the U.S. Environmental Protection Agency (USEPA), the New York State Department of Environmental Conservation (NYSDEC), and the NJDEP conduct screening for ambient levels of the chemicals of concern, in proximity to potential sources, using sensitive monitoring techniques. The objectives of this pilot project are to develop and implement a cost-effective approach to trackdown the sources of the chemicals of concern. Study I-F will include field testing the application and utility of Passive In-Situ Extraction Samplers (PISCES) to monitor for organic chemicals dissolved in surface waters.

This study, also known as the "Hudson River Toxics Trackdown Project", is supported solely by USEPA grant funding. It is described in greater detail in a Quality Assurance Project Plan prepared in 1997. The NJDEP Division of Science, Research and Technology was approved to proceed with this study, effective January 20, 1998. This work is ongoing, and is expected to continue through 2001.

PISCES are innovative passive sampling devices that incorporate a semi-permeable membrane device (SPMD). The samplers are loaded with solvent (hexane) and placed within a waterbody, for up to two weeks, to allow contaminants to concentrate in the solvent. The solvent is later analyzed for the selected chemicals of concern. The ambient monitoring utilizing PISCES in this study will provide concentration data for PCB congeners, PAH compounds, organochlorine pesticides, and dioxins. Sediment samples will also be collected at selected locations to complement the PISCES data.

Preliminary fieldwork to test deployment and recovery procedures for the PISCES equipment was conducted in the Fall of 1997. Analytical data has been collected for the Hackensack River and its tributaries from Marion Reach to Overpeck Creek. Subsequent work focused on the Arthur Kill, and the Rahway and Raritan Rivers. In addition, a pilot trackdown project was conducted on the lower Passaic River, which included the P450-RGS assay for dioxin screening, utilizing the PISCES. Initial results are currently subject to Quality Assurance review and data assessment.

Subsequent activities, based on the initial work, will test the PISCES trackdown methodology on various tributaries highlighted by the initial analytical data. Additional sampling is also planned in 2000 for the Raritan River, Rahway River, and the Newark Bay complex.

Study I-G: Monitoring of Selected Point Source Discharges

NY-NJ HEP CCMP and Joint Dredging Plan* Actions Addressed:

HEP CCMP Action T-1.2: "Track-down" and "Clean-up" of Significant Discharges of Organic Chemicals of Concern
Dredging Plan: CSO prioritization and remediation
Dredging Plan: Pollutant trackdown, prioritization, and clean-up

Potential major sources of the chemicals of concern include discharges from municipal wastewater treatment facilities (POTWs), combined sewer overflows (CSOs), and stormwater outfalls (SWOs). A key objective of Study I-G is to determine the loadings of the chemicals of concern discharged from all of the New Jersey POTWs into the NY-NJ Harbor estuary, as well as to estimate the loadings from a selected sample of CSOs and SWOs. If Study I-G does not identify any of these selected discharges to be "significant", Phase Three Activities will then investigate other potential point and nonpoint sources for the chemical(s), including industrial wastewater treatment facilities, and solid and hazardous waste facilities. A second use of the data collected in Study I-G will be to provide the necessary background information to initiate the trackdown efforts that will identify the ultimate sources of the chemicals of concern.

Specifically, Study I-G will

- provide measurements of the contaminant loads (and related water quality parameters) discharged from the New Jersey municipal wastewater treatment facilities discharging to NY-NJ Harbor;
- provide measurements of the levels of contaminants (and related water quality parameters) associated with discharges from selected combined sewer and stormwater systems discharging to NY-NJ Harbor;
- provide the data for POTW, CSO and SWO discharges necessary to initiate trackdown efforts to identify the ultimate sources of the chemicals of concern;
- provide baseline information that will be used in an evaluation of the effectiveness of actions taken to eliminate sources of the chemicals of concern within the service areas of the New Jersey point source discharges;
- provide the basis for a long-term monitoring program of the chemicals of concern in the NY-NJ Harbor system.

Using the information collected in Study I-G (and Study II-A, if needed), trackdown activities within the service areas of identified "significant" point sources will be pursued in Study III-A. The data and information collected during Study I-G will also be used in the development of the modeling initiatives discussed under Phase Four Activities.

Study I-G will be implemented by the New Jersey Harbor Discharges Group (NJHDG), a coalition of New Jersey municipal wastewater treatment authorities which has jurisdiction over the publicly owned treatment works (POTWs), and some of the CSOs which discharge to the NY-NJ Harbor estuary. The NJHDG also has working relationships with the municipalities who have responsibility for many of the CSO and SWO outfalls. Table III-7 identifies the members of the NJHDG and provides summary information on the discharges from their respective POTWs; Figure III-4 shows the approximate locations of these POTW discharges. Tables III-8 and III-9 provide the preliminary CSO and SWO sampling locations, respectively, to be sampled by Study I-G; these locations are subject to change, based upon the ability to actually collect samples at those locations during storm events. If a sample(s) cannot be obtained at a particular location, an alternate sampling location will be selected.

Methods: Table III-2 lists the contaminants and related parameters that will be monitored in this study.

For the organic chemicals of concern, a 20-liter composite grab sample of effluent will be collected and used in the field to create four 1-gallon subsamples. The existing composite samplers at each POTW will be used to collect the POTW samples. Grab samples of the SWO and CSO discharges will be collected at each location over the duration of the selected discharge events. A 2.5-liter aliquot of each 1-gallon subsample will be filtered, extracted, and analyzed separately for dioxins/furans, PCBs, pesticides, and PAHs. The filters will be extracted using either sonication and mechanical agitation techniques (PAHs), or Soxhlet extraction (dioxins/furans, pesticides, and PCBs). The filtrates (2.5-liter volume) will also be extracted separately using liquid/liquid extraction techniques, and the extracts will be concentrated. The concentrated filter and filtrate extracts for each 2.5-liter aliquot will be combined for analysis (except that for the first set of 6 POTW samples, the extracts will be analyzed separately). This sampling/processing/analytical approach is presented in Figure III-5.

For metals analysis, three 500-milliliter subsamples of the 20-liter composite grab sample will placed in separate bottles and analyzed as specified in the QAPP (see Volume II).

Total Suspended Solids, Dissolved Organic Carbon, and Particulate Organic Carbon will also be measured in the collected samples.

The municipal wastewater treatment facilities to be monitored are identified in Table III-7. The discharge from each facility will be sampled either two or four times during this study, depending on the discharge volume from the facility and the relative volume of industrial input to each POTW. The sample collection events will be distributed throughout the year, quarterly for the larger/more complex POTWs, and summer and winter for the smaller/less complex facilities. The POTWs will be sampled during dry weather according to a

predetermined schedule. If there is a wet weather event at the time of a scheduled sampling activity, the sampling activity will be rescheduled. Thus, a total of thirty-six samples will be collected from the selected municipal wastewater treatment facilities over a one-year period beginning in the fall of 2000. If the initial sampling and analysis efforts demonstrate that a POTW discharge contains relatively high concentrations of one or more of the chemicals of concern, additional samples may be collected to gain a better perspective on effluent variability.

A total of forty samples will be collected from representative CSO and SWO sites. To the greatest extent possible, the CSO and SWO sampling will be conducted concurrent with the wet weather/high flow events monitored in Studies I-C, I-D, and I-E. The selection of the CSO and SWO monitoring sites was made by evaluating the types of industries and land uses in each of the CSO and SWO service areas, and by using sampling sites that were previously utilized in a nickel/zinc monitoring/modeling study conducted by the NJHDG. Those CSO and SWO sampling locations which are least likely to be responsible for contributing meaningful loads of the contaminants of concern will not be considered in this initial sampling effort (additional CSO and SWO sampling is planned under Study II-A). It was important to consider CSO and SWO sampling sites that are representative of major drainage areas for two reasons: (1) the samples collected should be representative of as large a number of CSO/SWO discharges as possible, and (2) the collection of samples at relatively "downstream" stations and near the actual CSO/SWO discharge locations will be particularly useful for the subsequent trackdown portion of the New Jersey Toxics Reduction Workplan (see Study III-A). As with the POTW sampling, if the initial sampling and analysis efforts demonstrate that a CSO or SWO discharge contains relatively high concentrations of one or more of the chemicals of concern, additional samples may be collected to gain a better perspective on effluent variability.

The data generated in this study will be tabulated and presented in a manner consistent with the HEP CARP data management plan and will also be incorporated into the NJDEP database/GIS system developed as a part of Study I-A. The principal investigators will submit one interim report and a final report to the NJDEP, and will serve on the scientific advisory team established by the Department to evaluate the data on a continual basis.

As shown in Figure III-I and III-2, Study I-G is to be conducted in coordination with Studies I-C, I-D, and I-E; to the greatest extent possible, the Study I-G CSO/SWO sampling will be conducted during the same climatic "events" monitored in these three studies. Thus, Study I-G would be initiated during Year One of the implementation of the New Jersey Toxics Reduction Workplan. It is currently planned that the Study I-G monitoring activities will have a duration of approximately twelve months.

Table III-7: Summary Information on the Discharges from POTWs Owned and Operated by the NJHDG

POTW	LOCATION	DISCHARGE RATE[a]	NJPDES Permit No.
Passaic Valley Sewerage Com.[b]	Long. 74° 03' 42" Lat. 40° 39' 16"	283 mgd	NJ0021016
Middlesex County Utility Authority[b]	Long. 74° 15' 12" Lat. 40° 28' 51"	115 mgd	NJ0020141
Bergen County Utility Authority[b]	Long. 74° 01' 57" Lat. 40° 49' 54"	81 mgd	NJ0020028
Joint Meeting of Essex/Union[b]	Long. 74° 11' 51" Lat. 40° 38' 17"	59 mgd	NJ0024741
Rahway Valley Sewerage Authority[b]	Long. 74° 12' 35" Lat. 40° 35' 13"	26 mgd	NJ0024643
North Hudson S.A. (Hoboken/North Hudson/Tri City)[c]	Long. 74° 01' 10" Lat. 40° 45' 11"	21 mgd	NJ0026085
Linden Roselle Sewerage Authority[b]	Long. 74° 12' 23" Lat. 40° 36' 25"	13 mgd	NJ0024953
North Bergen MUA (Central)[c]	Long. 74° 02' 15" Lat. 40° 47' 05"	6.8 mgd	NJ0034339
North Bergen MUA (Woodcliff)[c]	Long. 73° 59' 59" Lat. 40° 47' 28"	2.9 mgd	NJ0029084
Edgewater Municipal Utilities Authority[c]	Long. 73° 58' 54" Lat. 40° 49' 15"	3 mgd	NJ0020591
North Hudson S.A. (West New York)[c]	Long. 74° 00' 03" Lat. 40° 47' 16"		NJ0025321
Secaucus Municipal Utility Authority[c]	Long. 74° 02' 54" Lat. 40° 47' 55"	3 mgd	NJ0025038

Note a: taken from "Workplan - Sources and Loadings of Toxics Substance to New York Harbor", NYSDEC, January 28, 1998; mgd = million gallons per day.

Note b: four quarterly samples are scheduled for collection. Additional samples may be collected during Study I-G (see text) and/or in Study II-A.

Note c: two seasonal samples are scheduled for collection. Additional samples may be collected during Study I-G (see text) and/or in Study II-A.

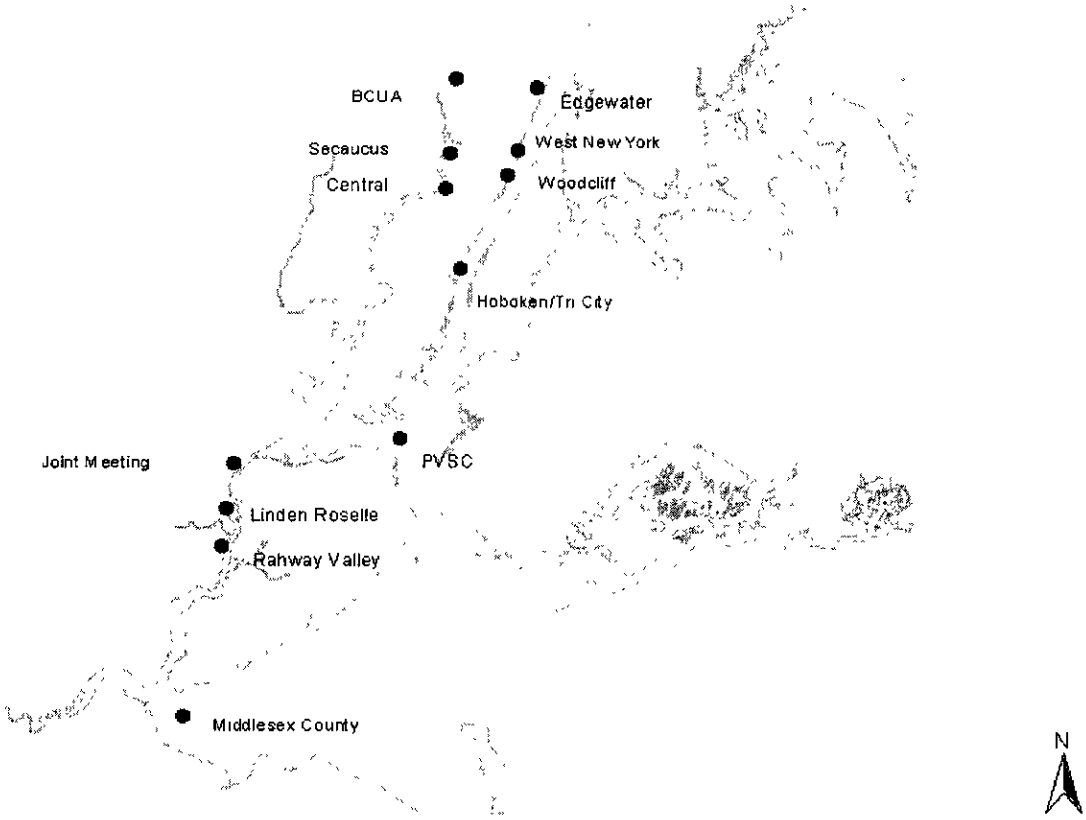


Figure III-4 Discharge locations for the POTW's owned and operated by the New Jersey Harbor Dischargers Group

TABLE III-8: Summary Information on the CSOs Initially Selected to be Sampled

CSO NAME/LOCATION (ASSOCIATED WATERBODY AND UTILITIES AUTHORITY)	NUMBER OF SAMPLES
Jersey City Intersection (PVSC)	2
Bayonne Intersection (PVSC)	2
MCUA/Thramboy	2
Joint Meeting/Elizabeth	2
Newark Alkalai	2
Ivy Street (Passaic River, PVSC)	2
Christie Street (Hackensack River, BCUA)	2
Court Street (Hackensack River, BCUA)	2
Livingston and Front Streets (Arthur Kill, Joint Meeting)	2
Worthington Avenue	2
Henley Road	2
Elm Street	2
Anderson Street	2
West Side Road	2
TOTAL	28

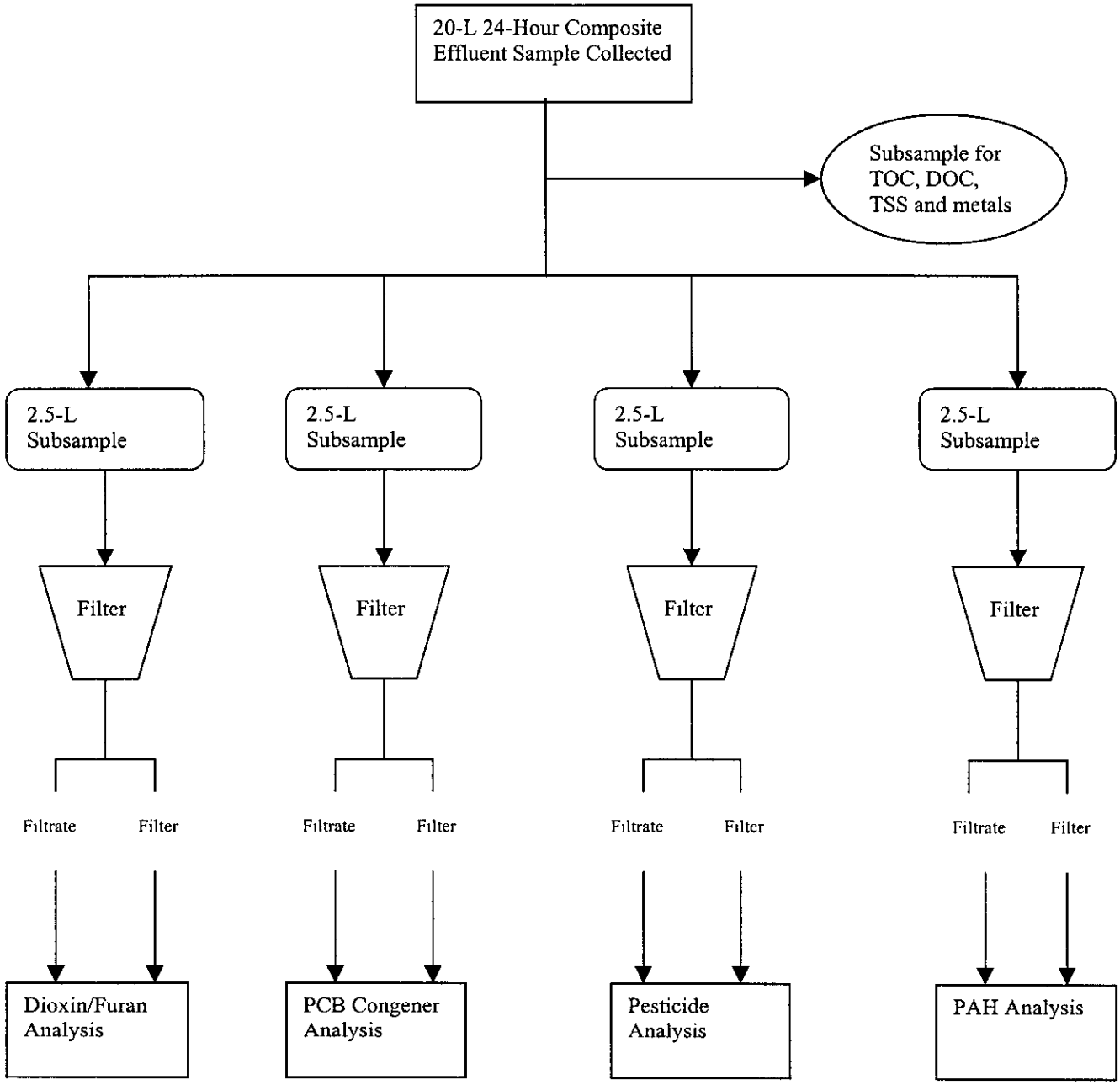
TABLE III-8, cont.: Summary Information on the CSOs Initially Selected to be Sampled

ALTERNATES: CSO NAME/LOCATION (ASSOCIATED WATERBODY AND UTILITIES AUTHORITY)	NUMBER OF SAMPLES
Campbell Foundry (Passaic River, PVSC)	
Jackson Street (Passaic River, PVSC)	
Johnston Road (Passaic River, PVSC)	
Herbert Place (Passaic River, PVSC)	
91st Street Bellman's Creek (Hackensack River, North Bergen)	
Fourth and Hackensack Streets (Hackensack River, BCUA)	
Overpeck Creek (Hackensack River, BCUA)	
Elizabeth Avenue at Memorial Park (Arthur Kill, Joint Meeting)	
Front Street and Bay Way (Arthur Kill, Joint Meeting)	

TABLE III-9: Summary Information on the SWOs Initially Selected to be Sampled

CANDIDATE SWO NAME/LOCATION (ASSOCIATED WATERBODY AND UTILITIES AUTHORITY	NUMBER OF SAMPLES
Peripheral Ditch /Newark Airport	2
Diamond Alkalai (Blanchard Street, Passaic River)	2
CCI	2
Smith Marina	2
City of Rahway (outfall 003) RUA-SSA	2
Henley Road (Hackensack River, BCUA)	2
TOTAL	12
Alternates	
Anderson Street (Hackensack River, BCUA)	
Elm Street (Hackensack River, BCUA)	
West Side Road/Cromakill Creek (Hackensack River, North Bergen)	
NAPP-GRECO	
Third Street Drainage Ditch (Hackensack River, BCUA)	
East Jersey and Front Streets (Arthur Kill, Joint Meeting	

Figure III-5: Sample Collection, Processing, and Analytical Approach to be Used in Study I-G.



Study II-A: Monitoring of Additional Targeted Point Source Discharges

NY-NJ HEP CCMP and Joint Dredging Plan* Actions Addressed:

HEP CCMP Action T-1.2: "Track-down" and "Clean-up" of Significant Discharges of Organic Chemicals of Concern
Dredging Plan: CSO prioritization and remediation
Dredging Plan: Pollutant trackdown, prioritization, and clean-up

The data and information collected in the Phase One studies will be used to identify (1) those tributaries to the NY-NJ Harbor estuary into/from which significant levels of the chemicals of concern are discharged, (2) the specific chemical(s) of concern originating within the watershed of each tributary, and (3) potential sources for these chemicals of concern. Potential major sources of the chemicals of concern include discharges from municipal wastewater treatment facilities, combined sewer overflows (CSOs), and stormwater outfalls (SWOs). Initial monitoring of a number of these point sources will be conducted in Phase One -- see Study I-G, Tables III-7 and III-8; some of these point sources may be monitored again in Study II-A. The objectives of Study II-A are (1) to identify additional point source discharges that may be significant sources of the chemicals of concern (particularly CSOs and SWOs), and (2) to determine the levels of suspended solids and the selected chemical(s) of concern discharged from these point sources. Study II-A is essentially a more focused continuation of Study I-G, targeting specific sewerage systems and/or chemicals of concern. Alternatively, if Study I-G and Study II-A do not identify any of these types of discharges to be "significant", Phase Three Activities will then investigate other potential point and nonpoint sources for the chemical(s), including industrial wastewater treatment facilities, and solid and hazardous waste facilities.

Specifically, Study II-A will

- identify specific point source discharges (or types of point source discharges) within the prioritized tributary systems which are significant discharges of suspended sediment and the chemicals of concern;

- provide measurements of the levels of suspended sediment and contaminants associated with discharges from these point sources;

- provide baseline information that will be used in an evaluation of the effectiveness of actions taken to eliminate sources of the chemicals of concern within the service areas of the point source discharges and long-term monitoring programs.

Using the information collected in Study I-G and Study II-A, trackdown activities within the service areas of identified "significant" point sources will be pursued in Study III-A. The data

and information collected during Study II-A will also be used in the development of the modeling initiatives discussed under Phase Four Activities.

Study II-A will be implemented by the New Jersey Harbor Discharges Group (NJHDG), which has jurisdiction over the publicly owned treatment works (POTWs), and some of the CSOs which discharge to the NY-NJ Harbor estuary (see Study I-G).

The first task to be completed as part of Study II-A is to identify those point sources from which potentially significant discharges of the chemicals of concern originate. Using the data and information collected in the Phase One studies (particularly Study I-G), the NJDEP -- in cooperation with the principal investigators from Studies I-A, I-C, I-D, and I-E, the NJHDG, and the NY-NJ Harbor HEP CARP -- will identify these potential point sources. In addition, potential sources not monitored in Study I-G may be targeted in Study II-A. A variety of methods will then be used to further screen and monitor the discharges from these point sources.

Methods: See Study I-G. Table III-2 lists the compounds and parameters that will be monitored in this study; the chemicals of concern will be measured in both the dissolved aqueous phase and bound to suspended sediments. However, within a specific tributary or for a specific POTW, CSO, or SWO system, the results of the Phase One studies may result in the monitoring conducted in Study II-A focusing on only a subset of the chemicals of concern.

This sampling will include an additional subset of the combined sewer and stormwater systems within each tributary. The combined sewer and stormwater systems to be monitored will be selected by evaluating the types of land uses and industries within the service areas of these facilities and identifying those areas most likely to contain sources of the chemicals of concern (see Study I-G). In addition, the data collected from Study I-G will be used in the process to select the systems to be monitored in Study II-A.

The data generated in this study will be tabulated and presented in a manner consistent with the HEP CARP data management plan and will also be incorporated into the NJDEP database/GIS system developed as a part of Study I-A. The principal investigators will submit two interim reports and a final report to the NJDEP, and will serve on the scientific advisory team established by the Department to evaluate the data on a continual basis.

As shown in Figure III-I and III-2, Phase Two Activities are to be conducted following the completion of the Phase One Activities and the prioritization of the tributaries for additional investigation. Thus, Study II-A would be initiated during Year Two of the implementation of the New Jersey Toxics Reduction Workplan. However, the data and information collected during the Phase One studies will be evaluated on a continual basis, and Study II-A may be implemented within selected tributaries on a "fast-track" basis.

It is currently planned that the Study II-A monitoring activities will have a duration of approximately twelve months. However, Study II-A may be extended and/or phased over a

longer period of time, depending on the results of other activities to be implemented as a part of this workplan.

Study III-A: Trackdown of the Chemicals of Concern Within the Service Areas of Identified Point Sources

NY-NJ HEP CCMP and Joint Dredging Plan* Actions Addressed:

HEP CCMP Action T-1.2: "Track-down" and "Clean-up" of Significant Discharges of Organic Chemicals of Concern
HEP CCMP Objective T-3: Minimize the discharge of toxic chemicals from CSOs, storm water, and non-point sources
HEP CCMP Action T-6.2: Tracking and Elimination of Chemicals of Concern
Dredging Plan: CSO prioritization and remediation
Dredging Plan: Pollutant trackdown, prioritization, and clean-up

The data and information collected in Study I-G and Study II-A will be used to identify significant point source discharges of the chemicals of concern and suspended sediments originating within the service areas of municipal wastewater treatment facilities, CSOs, and storm sewer systems. The primary objective of Study III-A is to trackdown the specific sources of the chemicals of concern within the identified service areas. Once located, actions can be initiated, as appropriate, to eliminate or reduce to the greatest extent practicable these sources. Alternatively, if Study II-A and Study I-G do not identify any of these types of discharges to be "significant" within a particular tributary, Study III-B will investigate other potential point and nonpoint sources for the chemical(s), including industrial wastewater treatment facilities, and solid and hazardous waste facilities.

Specifically, Study III-A will:

- identify the specific source(s) of the chemicals of concern originating within the service areas of municipal wastewater treatment facilities, CSOs, and storm water systems that are significant discharges of these contaminants;

- provide baseline information that will be used in an evaluation of the effectiveness of actions taken to eliminate these specific sources.

The data and information collected during Study III-A will also be used in the development of the modeling initiatives discussed under Phase Four Activities.

Study III-A will be implemented by the New Jersey Harbor Discharges Group (NJHDG), which has jurisdiction over the publicly owned treatment works (POTWs), and some of the CSOs, that discharge to the NY-NJ Harbor estuary. Table III-7 identifies the members of the NJHDG.

Methods: Table III-2 lists the compounds and parameters that will be monitored in this study; the chemicals of concern will be measured in both the dissolved aqueous phase and bound to suspended sediments. However, within the service area of a specific point source discharge, the results of Study I-G and Study II-A may result in the monitoring conducted in Study III-A focusing on only a subset of the chemicals of concern.

The NJHDG, in cooperation with the Department, its scientific advisory team, and the NY-NJ Harbor Estuary Program CARP, will select the POTW, CSO, and SWO systems to be investigated in Study III-A. These selections will be made by evaluating the data collected during the Phase One and Two investigations, and other relevant information. Priority will be given to those systems that most likely contribute meaningful levels of the contaminants of concern to NY-NJ Harbor.

The Study III-A investigators will utilize a variety of procedures, coupled with targeted chemical analyses (based upon the results of Studies I-G and II-A) as they move "upstream" within the service area piping systems. The monitoring sites within the service areas will be selected based on the results of Study I-G and Study II-A, the results of prior Study III-A sampling activities, and relevant information on the service areas and associated land uses (including data and information synthesized in Study I-A).

The data generated in this study will be tabulated and presented in a manner consistent with the HEP CARP data management plan and will also be incorporated into the NJDEP database/GIS system developed as a part of Study I-A. The principal investigators will submit one interim report (for each point source service area) and a final report to the NJDEP, and will serve on the scientific advisory team established by the Department to evaluate the data on a continual basis.

As shown in Figures III-I and III-2, Phase Three Activities are to be conducted following the completion of the Phase Two Activities and the identification of significant point source discharges of the chemicals of concern for additional investigation. Thus, Study III-A would be initiated during Year Three of the implementation of the New Jersey Toxics Reduction Workplan. However, the data and information collected during Study II-A will be evaluated on a continual basis, and Study III-A may be implemented within selected service areas on a "fast-track" basis. It is currently planned that the Study III-A monitoring activities will have a duration of approximately twenty-four months. However, Study III-A may be extended and/or phased over a longer period of time, depending on the results of other activities to be implemented as a part of this workplan.

Study III-B: Monitoring of Other Point and Nonpoint Source Discharges

NY-NJ HEP CCMP and Joint Dredging Plan* Actions Addressed:

HEP CCMP Action T-1.2: "Track-down" and "Clean-up" of Significant Discharges of Organic Chemicals of Concern
HEP CCMP Action T-2.3: Additional Requirements for Direct Industrial Dischargers
HEP CCMP Objective T-3: Minimize the discharge of toxic chemicals from CSOs, storm water, and non-point sources
HEP CCMP Action T-5.2: Remediation of Sites Contributing Significant Contamination to the Harbor/Bight
HEP CCMP Action T-6.2: Tracking and Elimination of Chemicals of Concern
HEP CCMP Action T-9.2: Identification of Additional Areas [of contaminated sediments]
Dredging Plan: Pollutant trackdown, prioritization, and clean-up
Dredging Plan: Prioritize non-point source pollution prevention/remediation projects
Dredging Plan: Prioritize sediment hot spots and clean-up projects

The chemicals of concern identified in the New York-New Jersey Harbor Estuary Program CCMP (see Table III-2) can be discharged into the estuary system from a variety of sources. Study I-B investigates the inputs of the chemicals of concern resulting from atmospheric deposition, while Studies I-G, II-A and III-A target a variety of point source discharges. Study III-B will be implemented within selected tributaries as needed to evaluate the significance of additional point and nonpoint source discharges of the chemicals of concern, including:

- industrial wastewater treatment facilities which discharge directly into the harbor estuary system;
- surface and groundwater discharges from hazardous waste facilities (both Superfund/NPL and non-Superfund sites);
- surface and groundwater discharges from solid waste landfills;
- contaminated sediment "hot spots" within the harbor estuary system, including tributaries;
- nonpoint sources resulting from rainfall-induced runoff.

Using the data and information collected from the Phase One and Two Activities, particularly Studies I-A, I-B, I-G and II-A, the significance of these potential additional sources of the chemicals of concern within a specific tributary will be evaluated. Initially, by using the process of elimination, the potential importance of these types of discharges can be determined. The data and information synthesized in Study I-A can then be used to identify specific potential sources of the discharges within the watershed of each tributary; if there are no large point sources present (i.e. industrial wastewater treatment facilities, solid and hazardous waste facilities), the

importance of nonpoint sources and contaminated sediment "hot spots" will be investigated further.

The investigations conducted as part of Study III-B will, in part, evaluate the significance of these potential sources in a manner analogous to that used in Studies I-D, I-E, I-G and II-A. The modeling activities discussed under Phase Four Activities may be needed to identify significant discharges of the chemicals of concern. Finally, trackdown activities similar to those conducted in Study III-A will be used to identify the specific sources of the chemicals of concern within the service area(s) of selected point source discharges.

Specifically, the objectives of Study III-B are to

- identify specific point source discharges from industrial wastewater treatment facilities, solid and hazardous waste facilities, within the prioritized tributary systems which are significant sources of suspended sediment and the chemicals of concern; provide measurements of the suspended sediment and contaminant loads discharged from these point sources;

- evaluate the significance of (and identify) nonpoint sources of the chemicals of concern within the prioritized tributary systems and estimate the loadings of suspended sediment and contaminants from these sources;

- evaluate the significance of known potential "hot spots" of contaminated sediments within the prioritized tributary systems as potential sources of the chemicals of concern;

- provide baseline information that will be used in an evaluation of the effectiveness of actions taken to eliminate these specific sources.

Methods:

Industrial Wastewater Treatment Facilities

The GIS database developed in Study I-A will include all known industrial discharges in the NY-NJ Harbor estuary. Studies I-G and II-A discuss the methods used to sample the discharges from municipal wastewater treatment facilities -- the same methods will be used to monitor direct industrial discharges to the tributaries. Screening evaluations for the chemical(s) of concern may be conducted using PISCES, with grab samples collected for metals analyses. Quantitative measurements of the loadings will then be obtained by monitoring the discharges using TOPS and/or grab samples, as appropriate.

Solid and Hazardous Waste Facilities

Chemicals of concern may be discharged to the tributaries from these potential sources by two routes: direct discharges from a pipe/outfall and/or in a "nonpoint" fashion due to leaching and groundwater discharges. Initially, the Study I-A GIS database and knowledgeable individuals (for example, local public works employees) will be consulted to determine the locations of any known point source discharges (i.e. pipes/outfalls) associated with such facilities; field visits to potential sites may also be needed. If such discharges are identified, procedures can be implemented as described above for *Industrial Wastewater Treatment Facilities*.

Where specific discharge points can not be identified, the prioritized tributaries can then be further divided into more "segments" (see Study I-D); a targeted sampling program using PISCES (for organic contaminants) and grab samples (for metals) will then be implemented. The objective of this program is to identify those tributary segments into which the chemical(s) of concern are discharged in the largest amount/concentration. This could consist of a series of sampling efforts, continually focusing on smaller segments of the tributary. A search for the leaching/groundwater discharges associated with the "significant" tributary segment(s) will then be implemented.

Nonpoint Source Discharges

Chemicals of concern originating from nonpoint sources would be the result of rainfall-induced discharges from contaminated upland sites. The importance of nonpoint source pollutant inputs would be evaluated by using the process of elimination -- once all the other potential sources (including contaminated sediment "hot spots", see below) have been investigated, it would thus appear that the only remaining possible source(s) would be nonpoint. The GIS database developed in Study I-A would be consulted and all known contaminated sites within the watershed of the tributary (or tributary segment, if such a deduction can be made) which could be the source of the chemical(s) of concern will be identified. Field visits will then be conducted to evaluate the potential for nonpoint source discharges to originate from these sites.

Contaminated Sediment "Hot Spots"

A final potential source of the chemical(s) of concern within a specific prioritized tributary would be existing contaminated sediments deposited on the bottom of the waterbody. Inputs of the chemical(s) of concern from "hot spots" of contaminated sediments could occur in a variety of ways:

- sediment-water fluxes of the chemical(s) of concern;
- disturbance and resuspension of the sediments due to elevated current velocities (resulting from severe weather conditions, boat/vessel traffic, or construction/dredging operations);
- disturbance and resuspension of the sediments due to bioturbation;
- uptake by benthic organisms and subsequent food chain transfer/bioaccumulation and/or excretion into the water column.

The GIS database developed in Study I-A will include all available data on sediment contamination in the NY-NJ Harbor estuary. Initially, this database will be consulted in order to identify any known areas of sediments in the tributary of interest contaminated with high levels of the chemical(s) of concern. If any such areas are identified, more detailed information on the size and degree of contamination of these potential "hot spots" of contaminated sediments will be obtained by implementing an appropriate sampling program. This could consist of both grab and core samples of the sediments and bulk sediment chemistry analyses.

If the presence of a contaminated sediment "hot spot" is verified, additional studies to investigate possible mechanisms which could disperse the contaminants into the water column would be considered and prioritized. This could include an evaluation of the hydrodynamics of the tributary (including a monitoring program as well as modeling activities) and an analysis of the potential impacts of boat/vessel traffic and construction/dredging activities. In addition, a literature search will be implemented to evaluate the potential for direct sediment-water column flux of the chemical(s) of concern, and/or this flux could be measured directly.

Biological mechanisms through which sediment-bound contaminants could be distributed throughout the NY-NJ Harbor estuary will be considered further as part of the Phase Four modeling activities.

The data generated in this study will be tabulated and presented in a manner consistent with the HEP SCRWG-CARP data management plan and will also be incorporated into the NJDEP database/GIS system developed as a part of Study I-A. The principal investigators will submit one interim report for each tributary and a final report to the NJDEP, and will serve on the scientific advisory team established by the Department to evaluate the data on a continual basis.

As shown in Figures III-I and III-2, Phase Three Activities are to be conducted following the completion of the Phase Two Activities and the identification of significant point source discharges of the chemicals of concern for additional investigation. Study III-B would be initiated on an as needed basis, most likely during Year Four of the implementation of the New Jersey Toxics Reduction Workplan. However, the data and information collected during Phases One and Two will be evaluated on a continual basis, and Study III-B may be implemented within selected tributaries on a "fast-track" basis. It is currently planned that the Study III-B monitoring activities will have a duration of approximately twenty-four months. However, Study III-B may be extended and/or phased over a longer period of time, depending on the results of other activities to be implemented as a part of this workplan.

Study IV-A: Modeling Studies

NY-NJ HEP CCMP and Joint Dredging Plan* Actions Addressed:

HEP CCMP Action T-13.2: Comprehensive System-wide Model for Mercury and Organic Chemicals
HEP CCMP Action T-13.3: Simple Mass Balance for Mercury and Organic Chemicals
Dredging Plan: Sediment transport modeling.

In order to better understand the hydrodynamic functioning of the NY-NJ Harbor estuary and to predict the fate and transport of contaminants within it, development of an appropriate model(s) will be needed. This model(s) could also be used to assess and predict the effects of remedial actions taken to eliminate/reduce the discharges of the chemicals of concern from the sources identified in the Phase One, Two, and Three Activities. These modeling studies, included as Phase Four Activities, will be initiated in 2000 through a Request for Proposal process to be administered by the Hudson River Foundation. Funding will be provided directly to the foundation by New Jersey Maritime Resources. This effort will also be coordinated with the NYSDEC and the NY-NJ HEP CARP. A first task to be completed by the modeling contractor will be an evaluation of the data to be collected by the Department and NYSDEC and its adequacy in meeting the various objectives of the modeling activities. The role of the Phase Four modeling studies in meeting the objectives of the New Jersey Toxics Reduction Workplan will be addressed in greater detail in the Draft and Final "Toxics Reduction Implementation Plan [s]".

APPENDIX A

SAMPLING METHOD DEVELOPMENT STUDIES (1998-1999)

(In Preparation)

Preliminary Study of TOPS Methodology (fall 1998)

New Jersey Toxics Reduction Workplan TSS Mass Balance Study
for TOPS - Executive Summary

A Comparison of TOPS vs. Grabs for Collecting Point Source Discharges
[not available in electronic format]

November 9, 1998

Preliminary Study of TOPS Methodology (Fall 1998)

Purpose: the purpose of this study is to collect ambient surface water samples from the Newark Bay Complex (including the Arthur Kill and Kill Van Kull), two of its major tributaries (the Hackensack and Passaic Rivers), and the head of tide of the Passaic River, using Trace Organic Platform Samplers (TOPS) and grab samples. Samples will also be collected from the outfall of the Passaic Valley Sewerage Commissioners wastewater treatment facility. The information and knowledge gained from this study will be used to develop the detailed sampling protocols for Studies I-C, I-D, I-E, I-G, and II-A of the New Jersey Toxics Reduction Workplan. Specifically, the objectives of this study are to

- compare the effectiveness of grab sampling with that of TOPS;
- develop and test protocols for the use of TOPS in the studies referenced above;
- ensure that all field personnel are capable of operating, maintaining, and repairing the instrumentation to be used in the studies referenced above;
- test the feasibility of using a depth averaged sample collected at one location of a tributary transect to represent an average over the cross section of the transect.

Contractor: Dr. Michael Bruno
Davidson Laboratory
Stevens Institute of Technology
Castle Point on the Hudson
Hoboken, NJ 07030

Phone: 201- 216-5338
FAX: 201-216-8214

Sub-Contractors: George P. Korfiatis and Richard I. Hires
Stevens Institute of Technology

Analytical Laboratory (To Be Determined - costs to be funded under a separate contract)

Duration: approximately 3 months (1 week field work, 11 weeks analytical work and report preparation)

Deliverables: interim report and meeting (summary of field work and initial observations, problems, and recommendations)
final report and meeting (including results of sample chemical analysis, recommendations, and draft detailed sampling protocols)

Costs: see attached draft budget

Methods: a total of six samples will be collected along transects using TOPS configured for use on board ships (1 in the Passaic River, 1 in the Hackensack River, and 4 [2 transects] in the Newark Bay Complex). One TOPS sample will also be collected at the head of tide of the Passaic River, and two TOPS samples will be collected at the outfall of the PVSC wastewater treatment facility. The XAD column components of these samples (2 XAD columns per sample) will be analyzed separately for the chemicals of concern identified in the New Jersey Toxics Reduction Workplan (excluding metals and PAHs). Variables of interest in developing detailed sampling protocols for the TOPS include pumping rate and duration (sample volume) *vis-a-vis* suspended sediment levels and concentrations of the chemicals of concern, sampling locations, and the use of multiple sampling instruments on board a single ship. Results from the TOPS will be compared with grab samples collected at the same locations and times to evaluate the efficacy of these alternative sampling approaches.

TASK 1/Objective (Bruno/Korfiatis/Hires): to acquire and modify TOPS devices for use in this Preliminary Study.

Methodology: obtain TOPS from NYSDEC and modify the devises for shipboard use. For field use of the TOPS, it appears useful to install a second filter in parallel with the first filter (in the unmodified TOPS). The first filter may clog, causing the pressure in the system to rise sufficiently so that the TOPS pump will ultimately shut down. In order to avoid such a shut down, it is intended to automatically switch to the second (parallel) filter when the shutdown pressure is reached. This will preempt the need to manually replace the filters in the field.

TASK 2/Objective (Bruno/Korfiatis/Hires): to train the field crews in the operation, maintenance and repair of the sampling equipment to be used for the full-scale sampling program, and to evaluate ship board sampling protocols.

Methodology: the full-scale sampling programs to be implemented by Stevens Institute of Technology anticipate the use of LISST devices (to obtain observations of suspended sediments), an ADCP (currents), and a CTD (temperature and salinity) along transects in the tidal tributaries, the Newark Bay Complex, and the Kills. These sampling activities will be conducted concurrently with the use of TOPS. The staffing requirements for each type of sampling will be evaluated on the basis of these trial runs. The protocols for

conducting these sampling operations will be modified and refined as experience is gained in these preliminary trials.

TASK 3/Objective (Bruno): to determine the TOPS sampling time (pumping rate).

Methodology: the TOPS devices are used in order to process a sufficient volume of water such that detectable quantities of dioxin, PCBs, etc. are adsorbed on to the XAD columns. It is important that sampling be of sufficient duration to insure against a "non-detectable" result from the laboratory analyses. It is presently planned to use the TOPS in the tidal tributaries and Newark Bay Complex to sample over the 3 to 5 hour period of an ebb tidal current. However, it is not clear if this is a sufficient amount of time to avoid "non-detectable" results.

It is proposed that in this Task, two TOPS be deployed side-by-side: the first device will pump at one-half the flow rate of the second. Each TOPS will pump for a six-hour period, thus sampling essentially the same ambient water. The second TOPS operating at the high sampling rate will process twice the volume of water as the first TOPS (in effect, the first TOPS will have collected a sample equivalent to three hours of operation at a normal pumping rate). Comparison of the two samples should assist in the assessment of sampling times less than six hours. A grab sample will also be collected in a fashion that will provide a representative sample over the six-hour period.

The Task 3 field trials will be repeated on two separate days along two different transects (a total of four TOPS samples and 2 grab samples), one spanning the center portion of Newark Bay and one spanning the Arthur Kill near Fresh Kills Landfill.

TASK 4/Objective (Korfiatis/Hires): to compare analytical results using TOPS and grab samples for a 6-hour sampling event at two transect locations, one in the Passaic River, and the other in the Hackensack River.

Methodology: at each of the transects, two samples will be obtained simultaneously. The first sample will be pumped through a TOPS moored at a single location; the sampling hose of the TOPS will be systematically varied over depth to ensure a representative depth-averaged sample. The second sample will be a grab sample composited over time by pumping continuously at a rate of 10-20 ml/min; this sample will be obtained over depth following the same procedure as the TOPS sample.

TASK 5/Objective (Korfiatis/Hires): to compare analytical results from a depth-averaged, time composited sample at one location in a transect with a cross-sectionally averaged time-composited sample for the same sampling event.

Methodology: two transect locations in the Hackensack and Passaic Rivers will be selected, to encompass the range of transect characteristics anticipated in the full-scale sampling program. Each sampling event will be three hours in duration. One boat will be moored at a fixed location along the transect and will obtain a depth averaged, time composited grab sample. A second boat will move continuously between four stations distributed over the transect, obtaining depth-averaged composite samples repeatedly at each station. The grab samples will be analyzed for POC, DOC, TSS, and PAHs.

TASK 6/Objective-Methodology (Others): analogous to Tasks 2, 3 and 4, TOPS and grab samples will be collected by USGS staff at the head of tide of the Passaic River (one TOPS and one grab sample) and by the New Jersey Harbor Dischargers Group at the outfall of the PVSC wastewater treatment facility (two TOPS and one grab sample collected concurrently). Analytical and labor costs for collecting these samples will be funded under separate contracts.

Draft -- 13 April 2000

NEW JERSEY TOXICS REDUCTION WORKPLAN

TSS MASS BALANCE STUDY FOR TOPS

EXECUTIVE SUMMARY

In the Fall 1998, the principal investigators for the NJ Toxics Reduction Workplan undertook a short sampling methodology development and training program to evaluate the use of Trace Organics Platform Samplers (TOPS) in various areas of NY-NJ Harbor. Analysis of the data collected during this study identified potentially significant problems with the use of the TOPS as then configured. The major concern identified was that the glass fiber filter (GFF) used in the TOPS was not capturing all of the suspended sediment in the water samples. This would then result in an overestimation of contaminant concentrations adsorbed onto the XAD resin (i.e. the dissolved fraction), and an accompanying underestimation of the contaminant levels associated with the sediment fraction. In addition, there is a potential loss of contaminant mass as a result of sediments passing through the XAD columns. Errors of this type are particularly troublesome for modeling and risk assessment activities.

To further evaluate these potential problems, a number of additional studies were implemented during 1999:

- Phase 1 Studies (June 1999) used the "standard" TOPS configuration with one 1 um 10-inch canister GFF. Samples were collected in the Hudson and Raritan Rivers, and at the PVSC wastewater treatment facility.

- Phase 2 Studies (July - October 1999) used a modified TOPS configuration consisting of one 0.5 um 4-inch canister GFF, followed by an additional in-line plate filter consisting of one 0.45 □m Teflon filter membrane (TFM; 90mm) and one 0.7 □m flat GFF filter (F-GFF). Samples were collected as in Phase 1, with samples also collected in the Passaic River.

- Phase 3 Studies (December 1999) used a modified TOPS configuration consisting of one 0.5 um 4-inch canister GFF, followed by an additional inline 0.7 um AE filter (of 90 mm or 142 mm diameter). Samples were collected in the Hudson and Passaic Rivers.

Data from the Phase 1 Studies showed that the single filter used in the "standard" TOPS configuration produced the following average TSS removal efficiencies in the water samples (% TSS removal):

	# Samples	Mean	Range

Hudson River	6	27	6 - 54
Raritan River	4	74	67 - 79
PVSC	5	59	41 - 87

After careful evaluation, it was determined that there was a quality control problem with the 1 um 10-inch canister GFF: some of the filters can be too short to properly fit into the filter housing, resulting in substantial bypassing of suspended sediments into the XAD columns. In addition, further consultation with the filter manufacturer revealed that the filters were designed to collect only 80-85% of the suspended sediment at the 1 um size. It was therefore concluded that use of these GFF would be inappropriate for the NJ Toxics Reduction Workplan studies.

The Phase 2 studies substituted a 0.5 um 4-inch GFF, and used an additional 90 mm inline flat 0.45 um Teflon filter membrane, followed by one 0.7 um flat GFF. This configuration produced the following overall average TSS removal efficiencies in the water samples (% TSS removal):

	# Samples	Post-GFF	Post-In-Line
Hudson River #1	3	92.3	99.7
Hudson River #2	4	92.3	99.3
Raritan River	3	93.0	100
Passaic River	1	71.2	98.3
PVSC#1	4	77.6	84.3
PVSC#2	3	75.5	57.9
PVSC#3	3	86.7	84.8

The Phase 2 study results confirmed the conclusions of the Phase 1 studies for the river water samples, and demonstrated the need to use two filters in a "modified" TOPS configuration. However, due to filter clogging, flow rates to the XAD resin generally declined after approximately one hour of sampling. Thus, the filters will require frequent changing when sampling water with high TSS levels. This was seen as a particularly important issue for the New Jersey program, given the event-based nature of the sampling and the anticipated high ambient TSS levels during wet weather events.

For the PVSC effluent samples, the results were different, and appeared to show that the addition of the in-line flat filters did not provide for additional removal of suspended solids.

In order to avoid the abrupt decline in flow rates observed in the Phase 2 studies, the TOPS was further modified by eliminating the Teflon filter membrane, and substituting a 0.7 um AE filter (90 mm or 142 mm diameter) after the canister GFF. This configuration used in the Phase 3 studies produced the following overall average TSS removal efficiencies in the water samples (% TSS removal):

	# Samples	Post-GFF	Post-In-Line	Post XAD
Hudson River (90mm)	3	94.2	91.7	96.6
Hudson River (142 mm)	3	93.1	94.4	97.3
Passaic River (90 mm)	4	74.5	93.2	76.8
Passaic River (142 mm)	4	71.6	88.9	90.5

Dissolved Organic Carbon (DOC) was also sampled in the Hudson River in the Phase 3 studies. Figure 1 presents the results for one of the samples (the other was similar): there was little reduction in DOC observed, indicating that neither the filters nor the XAD resin effectively reduced the DOC present in the water samples.

Results of all the TSS studies are summarized in Table 1.

The overall ramifications of the TSS studies are as follows:

(1) TOPS will be modified to use a 0.5 um 4-inch canister GFF, followed by a 0.7 um AE filter (142 mm diameter). This filter configuration should effectively capture 89-95% of the TSS in the water samples. In addition, it is expected that use of the 142 mm diameter AE filter will require less changing (due to clogging) compared to the other filter configurations evaluated.

(2) Even with the modified configuration, it is estimated that 5-11% of the ambient TSS in the water samples will pass through the filters and either be trapped on, or pass through, the XAD resin. Thus, the dissolved contaminant fraction will be overestimated, the suspended sediment fraction will be underestimated, and some contaminant mass may be lost. This inaccuracy will vary with ambient TSS and sediment grain size distribution.

(3) In order to have an accurate understanding of TSS mass balance/distribution within the TOPS, TSS samples will be collected every hour during sampling at the TOPS intake, after the canister GFF, after the in-line AE filter, and after the XAD columns. These TSS samples will be collected for every TOPS sample.

(4) TOPS does not appear to be an effective device to sample wastewater treatment plant effluent. Use of additional in-line filters was cumbersome (i.e. required frequent changing) and did not provide additional suspended solids removal. POTW and CSO/SWO samples will be collected using standard whole water grab sampling techniques.

Table 1: Overview of TSS Studies

Study	Date	Comments	Average TSS concentration (mg/l)				Average TSS removal (%)		
			Inflow	Post-Canister	Post-Flat	Post-XAD	Post-Canister	Post-Flat	Post-XAD
Hudson	6/16/99	1um GFF	64.8	45.4			27		
PVSC	6/23/99	1um GFF	27.2	11.4			59		
Raritan	6/30/99	1um GFF	10.24	2.43			76		
Raritan	7/22/99	1um GFF + flat filter (0.45um 90mmTFM +0.7 um 90mm GFF)	4.41	0.31	0		93	100	
Hudson	9/17/99	0.5um GFF + flat filter (0.45um 90mm TFM +0.7 um 90mm GFF)	44.63	3.37	0.13		92	100	
PVSC	9/15/99	0.5um GFF + flat filter (0.45um 90mm TFM +0.7 um 90mm GFF)	25.85	5.8	4.05		77.6	84.3	
PVSC	9/30/99	0.5um GFF + flat filter (0.45um 90mm TFM +0.7 um 90mm GFF)	15.2	3.73	6.4		75.5	57.9	
PVSC	10/12/99	0.5um GFF + flat filter (0.45um 90mm TFM +0.7 um 90mm GFF)	12.17	1.62	1.84		86.7	84.8	
Passaic	10/25/99	0.5um GFF + flat filter (0.45um 90mm TFM +0.7 um 90mm GFF) (only one sample was taken)	41	11.8	0.7		71	98	
Hudson	10/29/99	0.5um GFF + flat filter (0.45um 90mm TFM +0.7 um 90mm GFF)	82.6	5.7	0.9	0.55	93	99	99
Hudson	10/29/99	0.5um GFF	82.6	7.1		1.2	91		99

Hudson	12/9/99	0.5um GFF + flat filter (0.7 um 90mm AE) (high variation in TSS ambient concentration over 4h sampling)	34.00	1.83	2.80	1.16	95	92	97
Study	**Date**	**Comments**	**Average TSS concentration (mg/l)**				**Average TSS removal (%)**		
			Inflow	**Post-Canister**	**Post-Flat**	**Post-XAD**	**Post-Canister**	**Post-Flat**	**Post-XAD**
Hudson	12/9/99	0.5um GFF + flat filter (0.7 um 142mm AE) (high variation in TSS ambient concentration over 4h sampling)	34.00	2.18	1.76	0.71	94	95	98
Passaic	12/17/99	0.5um GFF + flat filter (0.7 um 90mm AE)	14.34	2.99	1.05	2.51	79	93	83
Passaic	12/17/99	0.5um GFF + flat filter (0.7 um 142mm AE)	14.34	3.20	1.38	1.12	78	90	92

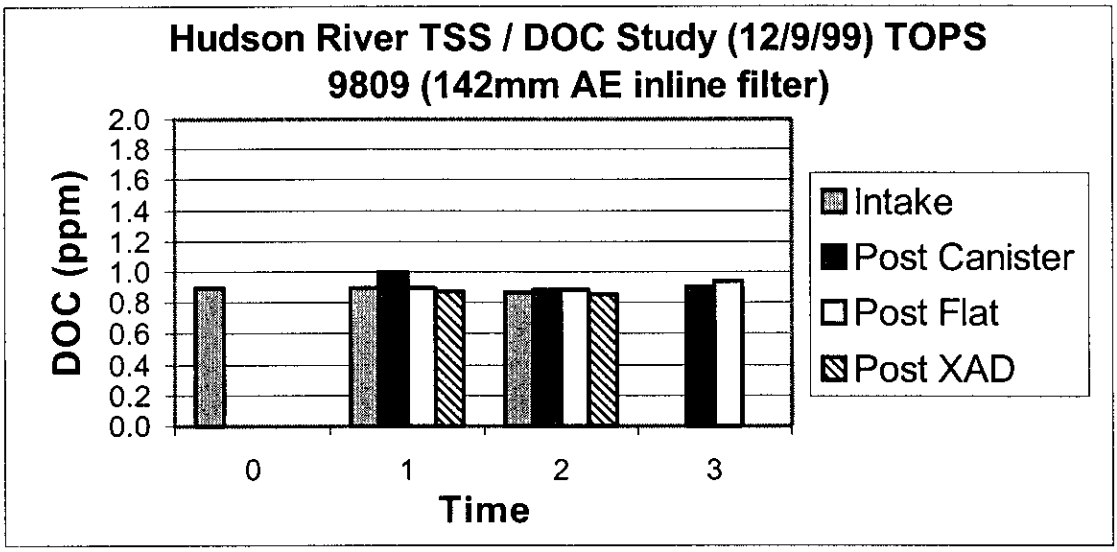


Figure 1: DOC concentrations (ppm). Hudson River Study - December 9, 1999 (142mm AE inline filter).

APPENDIX B

DESCRIPTION OF HYDROLOGIC EVENTS

NJ Toxic Reduction Workplan
Description of Hydrologic Events

Definition of an Hydrologic Event: One goal of the NJ Toxic Reduction Workplan is to determine the loads of suspended sediment and sediment-bound contaminants, along with loads of dissolved contaminants, discharged to the NY-NJ Harbor estuary. The field sampling program is designed to characterize the loads of suspended sediment, and chemicals transported by the suspended sediment and dissolved phases, during 5 hydrologic "events" and 2 "base flow" events occurring in the 5 main tributaries to the estuarine system (the Hackensack, Passiac, Raritan, Elizabeth, and Rahway Rivers), together with the Arthur Kill, Kill Van Kull, and Newark Bay. Ideally, the sampled events will be spread throughout 4 seasons of a single year. This document describes the criteria for these hydrologic events.

A hydrologic "event" is defined as a rain storm or a snow-melt that causes the river discharge to exceed the 10% exceedance level of flow, as defined by the historic discharge record developed by the USGS gaging station that exists at the head-of-tide on each river. The USGS hydrologic data is extensive for the rivers of interest in this study; some have been measured since the late 1800's. The 10% exceedance levels are listed in Table 1.

Typically, it is expected that an event will sampled only if precipitation/snow melt has not occurred within the previous 7 days time and the discharge had been relatively steady and near the baseflow level. Baseflow levels are defined as the 90% exceedance level for each river, and are listed in Table 1.

The event criteria were originally set by the NYSDEC and NY-USGS (S. Litten). It is considered tentative in the NJ work, and as the sampling progresses, the criteria may have to be raised or lowered. During the last half of 1998, the NJ region experienced below-normal precipitation amounts. As a result, reservoir levels at the beginning of 1999 were well below their normal fill levels, and the region was considered to be in a drought. Because the larger tributaries that are being sampled in this study are dammed (for water supply purposes), the occurrences of large hydrologic events that affect the rivers may be disturbed from "normal" (expected) conditions -- i.e. there may not be any such large events this year unless the reservoirs are filled rapidly. This suggests that modifications to this plan will be necessary in order to complete the proposed work in a reasonable time period.

Relating Precipitation to Stream Flow. In order to accomplish event based sampling, the relation between precipitation and resulting stream flow must be understood. In this way, predictions on storm occurrences, available from the U.S Weather Bureau, can be used to prepare for event sampling. The information that is needed includes rainfall timing and amounts from stations within each river basin, and the resulting stream flow (gaging data) for the time period before, during, and after the precipitation occurred.

Available USGS hydrographs were examined to find isolated events in which river stage approximately reached the discharge level required for an event. As best as possible, two events were selected for each river tributary, one that occurred during the winter or early spring, and a second during the summer or early fall. An "isolated "event means that the baseflow was low and steady for a period of time before the precipitation and rise in stage occurred. US. Weather Bureau precipitation records for stations located in each basin were then obtained for the time period of at least two weeks proceeding and two weeks after the selected event. Listed in Table 1 are the rainfall stations used for each tributary gaging station, the baseflow and event criteria, and a qualitative measure of the flow regulation in each stream.

Table 1. River Sampling Stations and Precipitation Stations

River Tributary	**USGS gaging station identifiers, gage elevation**	**Flow Regulated?**	**10% exceedance level (event criteria) in cfs**	**90% exceedance level (baseflow) in cfs**	**Precipitation Station.**
Hackensack at New Milford	01378500, 6.25ft. asl	1 (most)	276	0	6120-Woodcliff Lake
Rahway at Rahway	01395000, 8.77 ft asl	2	100	3.4	6233 Newark Airport/Essex Falls, 6920-Canoe Brook
Passaic at Little Falls, N.J	01389500, 120.00 ft asl	3	2770	125	6223-Newark Airport/Essex Falls, 6873-Little Falls
Raritan at Bound Brook, N.J.	01403060, Calco Dam, sea level, 01403300, Queens Bridge	4	2620	170	6500-Readington-Holland (west), 6403-Clinton, 6533 Bound Brook, 6553-Sommerville (east)
Elizabeth at Ursino Lake, Elizabeth, N.J.	01393450, sea level	5 (least)	51	5.5	6920-Canoe Brook, 6233-Newark Airport/Essex Falls

Generally, the flow in the Hackensack and Rahway Rivers is highly regulated, and flow in the Passaic is moderately regulated. This implies that, at least in the first two rivers, reservoirs will need to be filled before precipitation events will affect the flow in these tributaries. Although the flow in the Passaic and Raritan Rivers is regulated, the controlling structures (dams and reservoirs) are located sufficiently upstream of the head-of-tide gaging/sampling stations so that the flow in these rivers responds to local precipitation events. That is, these rivers act sufficiently like unregulated streams to allow event based sampling to be planned.

Table 2. Precipitation-Flow Data from Selected Events

River	Flow Regulated?	Event Criteria (cfs)	Storm Date	Precipitation (in inches and duration)	Precipitation (in/hour)	Max. Daily Average Discharge in CFS	Stage Reached feet and elevation	Duration of hydrologic event
Hackensack River at New Milford	Yes 1 (most regulated)	277	WINTER 3/14/97-3/19/97	1.04 inches, 8.75 hours	0.12	341 cfs	2.40, 8.65 ft asl	5 days
		277	WINTER 3/16/96	0.36-in, 23.25 hours	0.015	189 cfs	2.08, 8.33 ft asl	1 days
		277	SUMMER 6/2/96-6/9/96	3.52 inches, 41.25 hours	0.085 in/hour	278 on 6/8/96	2.18 , 8.43 ft asl	
Rahway River at Rahway	Yes 2	100	WINTER 3/25/97	3 hours, 0.52 inches	0.17	81 cfs	1.85, 10.62 ft asl	2 days
		100	SUMMER 7/17/97-7/19/97	0.12 inches, 0.5 hours	0.24 in/hr	81 cfs on 7/19	1.85, 10.62 ft asl	
			WINTER 3/9/97-3/13/97	0.93 inches, 20.75 hours	0.044 in/hr	86 cfs on 3/10/97	1.885, 10.66 ft asl	
			SUMMER 7/21/97-7/23/97	1.66 inches 8.75 hours	0.19 in/hour	150 cfs on 7/22	2.135, 10.91 ft asl	
Passaic River at Little Falls	Yes 3	2775	WINTER 3/19/96-3/20/96	0.93 inches, 10 hours	0.09	2690 cfs	4.39, 124.39 ft asl	8 days
			SUMMER 6/3/96-6/5/96	3.04 inches, 45 hours	0.07	2100 cfs	3.81, 123.81 ft asl	8 days
Raritan River at Bound Brook	Yes 4	2620	SUMMER 9/17/96-9/18/96	1.6 inches, 9.25 hours	0.17	2760 cfs	19.79, 19.79 ft asl	4 days
		2620	FALL 11/08/96-11/09/96	1.4 inches, 6.25 hours	0.22	2200 cfs	19.28, 19.28 ft asl	5 days

River	Flow Regulated?	Event Criteria	Storm Date	Precipitation (in inches and	Precipitation (in/hour)	Max. Daily	Stage Reached	Duration of

		(cfs)		duration)		Average Discharge in CFS	feet and elevation	hydrologic event
Elizabeth River at Elizabeth	No 5 (least regulated)	51	SUMMER 7/18/97-7/19/97	0.78 inches, 6.75 hours	0.12	53 cfs	13.98, 13.98 ft asl	1 day
		51	WINTER 3/26/97	0.12 inches, 1.25 hours	0.10	58 cfs	14.06, 14.06 ft asl	2 days

The precipitation and discharge data for selected storm events are listed for each tributary in Table 2. The results generally show that precipitation of between 0.5 inches and 1 inch is necessary for the rivers to reach the threshold criteria during the winter months, and between 1 and 3 inches is necessary in the summer months. Additional events should be studied before firm conclusions can be reached, but these results generally agree with the rainfall/discharge relation expected by other USGS workers knowledgeable with New Jersey streams (Bill Schopp, personal communication). Additionally, it should realized that the rain/discharge relation is better defined when rainfall intensity is used as a measure of precipitation. Generally, this data indicates that rainfall intensities of 0.05 inches/hour and 0.2 inches/hour are required to force these streams to reach event criteria levels in the winter and summer months, respectively.

APPENDIX C

Workshop Proceedings – The Significance of Atmospheric Pollution Loadings to the New York-New Jersey Harbor Estuary and Watershed

[Not Available in Electronic Format]

APPENDIX D

Proposal – Pilot Study: GIS-Based Trackdown of Pollution Sources from Known Contaminated Sites to the New York-New Jersey Harbor Estuary.

Proposal

Pilot Study: GIS-Based Trackdown of Pollution Sources from Known Contaminated Sites to the New York–New Jersey Harbor Estuary

Principal Investigators:

John DeFina, Site Remediation Program
Thomas Belton, Division Science, Research and Technology
Mike Moore, Site Remediation Program

May 18, 2000

New Jersey Department of Environmental Protection
401 East State Street, 1st Floor
P.O. Box 409
Trenton, NJ 08625

1.0 Introduction

There is strong potential for uncontrolled and unmeasured toxic substance discharges from contaminated sites to surrounding properties, surface waters and sediments in the New York–New Jersey Harbor Estuary (Harbor). The media for transport of these toxics includes groundwater transfer of contaminants to surface water bodies, surface runoff and weathering from contaminated soils. Using existing data compiled by the New Jersey Department of Environmental Protection's (DEP) Site Remediation Program (SRP), and in conjunction with the Division of Science, Research and Technology's Water Assessment Team's (WAT) watershed characterization and assessment activities, a Source Trackdown Pilot Study will be performed at a selected location within the Harbor. This Pilot will be used to assess the potential for contaminant movement from contaminated sites into the waters, sediments and biota of the Harbor.

2.0 Background

This Project will build upon preliminary efforts carried out by DEP in 1996. At that time, as part of the NY/NJ Harbor Estuary Program (HEP) site trackdown efforts, SRP participated in the development of information intended to identify sources of soil and groundwater contamination discharging to the estuary from Known Contaminated Sites (KCS) and Landfills. Using GIS as the central methodology, criteria were developed designed to identify which sites might pose the greatest risk for contamination or recontamination of the estuary sediments. As defined by the HEP CCMP, the estuary includes all open water to head of tide in both New York and New Jersey. This includes all New Jersey coastal and interior waters extending from an imaginary transect between Sandy Hook and Rockaway Point and extending upstream to the New York-New Jersey State line along the Hudson River. The criteria for site selection were as follows (same criteria will be used for this Pilot):

- Sites within 1000 feet of any stream, creek, and river or water body below head of tide draining into the harbor basin.
- Sites within a known flood zone areas.

The 1996 Known Contaminated Sites list (KCSL) contained approximately 9,000 sites statewide of which 1,400 potential sites and landfills were identified as meeting the criteria for inclusion noted above (i.e., in proximity to water and a potential contaminant source). The 1996 KSCL has changed significantly due to a number of additions and deletions of sites. There has been one update to the KCSL since completion of the project with two notable improvements to list including:

- Improved spatial accuracy using global positioning system (GPS) coordinates
- Increasing the number sites where address matching was accomplished.
- Remedial level coding reflecting relative complexity of the remedial action (e.g. distinguishes between sites with or without groundwater contamination).

2.0 Digital Data Requirements

In 1997 the SRP engaged in a regulatory process intended to define the minimum technical requirements necessary to conduct contaminated site remedial activities. At that time technical rules for site remediation (NJAC 7:26E) were adopted with requirements that all hazardous site investigations in the State (i.e., public and private) must deliver investigative data in a DEP defined electronic (digital) format. For the past 3 years the SRP has worked with the regulated community to insure that these digital data requirements are met. Presently over 7000 data sets have been submitted to the Department with almost 1500 inputs to the SRP data management repository. Preliminary analysis of the data reveals that the majority of this information is spatially accurate and contains a wealth of detail about the spatial distribution and concentration of different contaminants in groundwater and soils.

4.0 Methods and Approach

Inclusion of digital data will provide a new, more accessible dimension to identifying contaminated sites posing the greatest threat the Estuary basin. The digital data will be analyzed and manipulated through the application of EQuIS, the SRP's data management system and repository. EQuIS is designed to enable the importation of site data to the NJDEP's GIS for visualization, distribution and further analysis. Data will be summarized and displayed cartographicaly using a Geographic Information Systems (GIS) technology and digital environmental data collected as part of NJDEP's Site Remediation Programs (SRP) remedial investigation and clean up process (pursuant to NJAC 7:26E).

5.0 Anticipated Schedule of Tasks

Formal project kick off is expected on June 2000. Duration of the pilot project is expected to be 1 year and will be completed May 31, 2001.

5.1 Pilot Project

The Pilot Project will consist of a series of specific tasks as outlined below:

1. Development of a strategy for integration of EQuIS and GIS with a pilot study area
2. Selection of a pilot study area(s): This will be dictated by where the best digital information exists within the Department's EQuIS database.
3. Identification of the specific geographic extent of the pilot area: Where possible we anticipate selecting sites in the HEP Core area surrounding the Hackensack

Meadowlands (i.e., lower Hackensack River Watershed). A number of reasons favor this selection including: extensive characterization data and reports associated with the Meadowlands Management Area; the existence of a Special Area Management Plan (SAMP); and the potential for recruiting local partners and stakeholders in any Phase Two activities that may evolve (See Section 5.2 below). Partners might include the HEP Trackdown Committee, the Hackensack Meadowlands Development Commission (HMDC) and the Rutgers University Meadowlands Environmental Research Institute (MERI).

4. Collection of site data and its incorporation in to the EQuIS data repository.

5. Update of the DEP known contaminated sites list (KCSL) from 1997 to 2000 for those sites in the study area.
6. Reassessment and update of the remedial level codes for the sites in the pilot study area to distinguish between sites with and without groundwater contamination, sediment contamination and ongoing ecological risk assessments.
7. Identification and collection of detailed remedial data (electronic data) for sites in the study area.
8. Comparing other departmental databases with hazardous site locations (contaminated sediments) such as discharger locations (water), solid waste landfills (leachate) and lagoons.
9. Acquire and review ancillary data, DEMs (Digital Elevation Models).
10. Selection and establishment of criteria to identify those KCSL sites in the study area posing the greatest contaminant transport risk to the estuary's receiving water, sediments and biota.
11. Possibly identify fast track actions for remediation at some of these locations (e.g., expedite PCB contaminated creek sediments remediation in a Focused Feasibility Study (FFS) rather than wait for full site FS which usually emphasizes terrestrial clean up first).

5.2 Potential Phase II Activities

1. Identification, selection, calibration and validation of a reliable numeric steady state model to assess degree and kinds of contaminants impacting receiving media (i.e., water, sediments, and biota). Preliminary evaluation of simple static models using this data to investigate whether sites can be identified with ongoing, unpermitted discharges to surface waters. If useful model(s) are identified their application (i.e., more predictive) can be evaluated to future discharges from KCSL might occur.
2. Extension to other National Estuary Program areas: DSRT is facilitating a source trackdown project in the Delaware Estuary Program (DelEP) focusing on endangered species impacts due to the presence of persistent bioaccumulative toxics in forage fish (PCBs). We are investigating bald eagle nest failures at the three or four critical areas

whereas other nests are productive. The universal source of PCBs for these eagles is through diet (primarily fish). The HEP Pilot approach might be applied in DelEP to overlay Hazmat data on DEP's Endangered Species Program's landscape maps showing habitat areas where endangered species will preferentially live and forage. Conjoining these tools might prove advantageous in looking through forage areas of eagles' nests at risk to determine any outstanding potential sources.

3. Extrapolate pilot procedures as long-term monitoring tools (i.e., NEPPS Indicator) in establishing reachable goals and milestones for removing non-point source discharges to Harbor.
4. Investigate communicating the results of this analysis in a more intuitive visual manner for both internal regulatory staff and external stakeholders via web technology.

6.0 Deliverables

1. One interim and one final report of project results
2. Maps/hardcopy and digital data (as required) of pilot results
3. Recommendations for further actions such as:

a) Expansion to other areas within the Harbor Estuary

b) Development of a web based application (consistent with NJDEP's ENDEX Strategy) for providing information access to public/stakeholders (e.g., CARP constituency). Features might include password restrictions for security; data transfer and download capability; metadata compliant with NJDEP's ENDEX; interactive mapping capability (analysis templates); and incorporation of non-spatial info to ENDEX digital library.

7.0 Budget

Personnel	$25,000
Computer	3000
Commercial data software	4000
Travel	3000
Total	$35,000

VOLUME II

QUALITY ASSURANCE/QUALITY CONTROL PLAN

[Under Development]

SAIC → dbase CARP.

Battelle → expensive