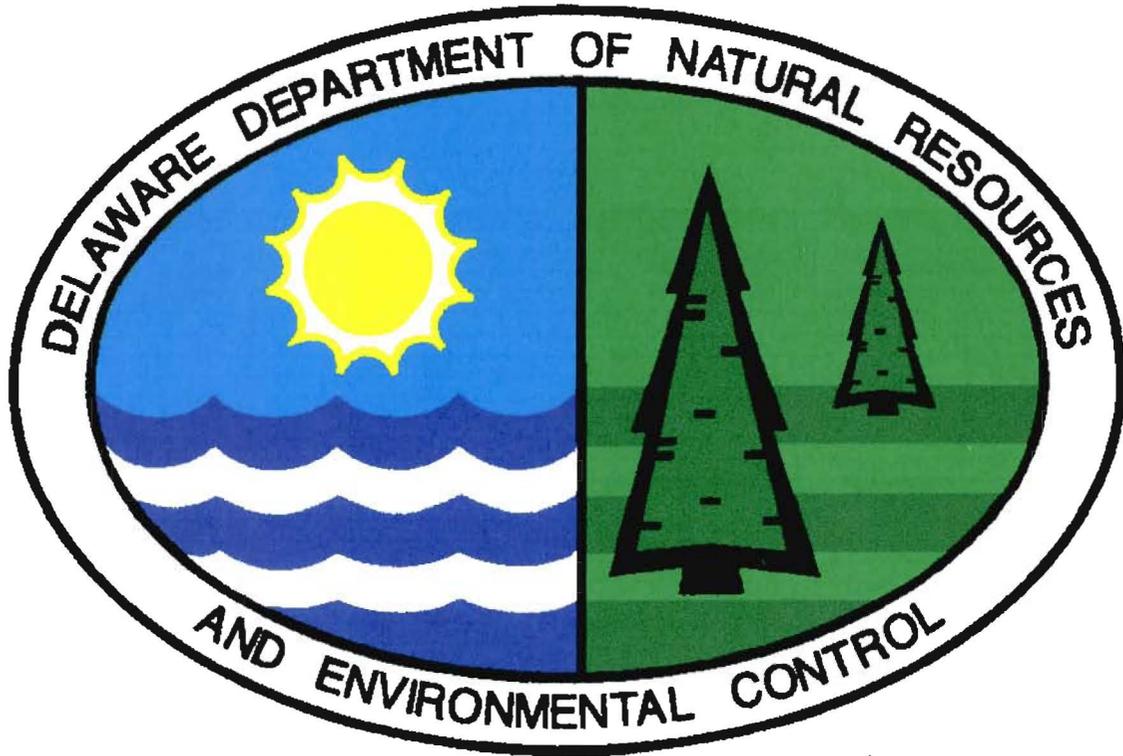


**AMENDED FINAL PLAN
OF REMEDIAL ACTION**



CHRISTINA RIVER PEDESTRIAN WALKWAY
Phases III & IV
Wilmington, Delaware

DNREC Project No. DE-1139

August 1999
Amendment June 2000

Department of Natural Resources and Environmental Control
Division of Air and Waste Management
Site Investigation and Restoration Branch

TABLE OF CONTENTS

I	INTRODUCTION	1
II	PURPOSE	1
III	SITE DESCRIPTION AND HISTORY	2
	Site Location	2
	Site History	2
IV	INVESTIGATION RESULTS	2
V	REMEDIAL ACTION OBJECTIVES	3
	Qualitative Remedial Objectives.....	3
	Quantitative Remedial Objectives	4
VI	FINAL PLAN OF REMEDIAL ACTION.....	4
VII	PUBLIC PARTICIPATION.....	6
VIII	DECLARATION	6

I INTRODUCTION

As part of the redevelopment of the Christina Riverfront Area in Wilmington, Delaware a walkway was constructed to provide additional pedestrian access to improvements to the Christina River. This Amended Final Plan of Remedial Action covers Phases III and IV of the Walkway Project. The Project area is defined by Figure 3. The outer sediment limit of the project area is the low water limits identified in Figure 3. The dash line on Figure 3 defines the upland extent of the project. Phases III & IV of the walkway will extend from the Tubman-Garrett Riverfront Park at Market Street to the Delaware Transit Corporation. The approximate distance of this portion of the walkway is 1,750 feet.

Because of past industrial uses in the Christina Riverfront Area the soil and riverbank sediment have been impacted by a variety of industrial residues, including petroleum hydrocarbons, other organic compounds and metals. The Riverfront Development Corporation entered into a Voluntary Cleanup Program Agreement with the Department of Natural Resources and Environmental Control's Site Investigation and Restoration Branch ("Department" or "DNREC-SIRB"). The purposes of the Voluntary Cleanup Program Agreement were to:

1. Identify potential sources of contamination within the improvement area.
2. Develop remedial alternatives for the detected contamination that would protect human health and the environment during and after construction of the walkway.

To accomplish these purposes the Riverfront Development Corporation contracted EA Engineering, Science, and Technology, Inc. to characterize the existing levels of contaminants from past industrial practices by performing soil drilling, sampling and analysis in and along the planned walkway and river bank. The collection and analysis of these soil samples were performed in accordance with the Hazardous Substance Cleanup Act ("HSCA"), the Delaware Regulations Governing Hazardous Substance Cleanup ("Regulations"), Delaware Standard Operating Procedures for Chemical Analytical Programs, guidance documents, and other Department policies and procedures.

II PURPOSE

This document is the Department's Amended Final Plan of Remedial Action for the site. It is based on the technical reports of sampling and the Remedial Investigation/Feasibility Study and the Proposed Plan of Remedial Action, which was issued under the provisions of HSCA and the Regulations. The Amended Final Plan presents the Department's assessment of human health and environmental risks associated with the site.

The Department provided the public with notice and opportunity to comment on the Proposed Plan of Remedial Action in accordance with Section 12 of the Regulations. At the conclusion of the comment period, the Department reviewed and considered of the comments received and issues this Final Plan of Remedial Action which designates the remedial action and the selected procedures and stipulations concerning future activities within the site. The Proposed Plan of

Remedial Action, the comments received from the public, the Department's response to the comments, the Final Plan of Remedial Action, and all of the documents which formed the basis for the Proposed and Final Plans of Remedial Action will constitute the "Remedial Decision Record."

III SITE DESCRIPTION AND HISTORY

Site Location

The project area is located in the South Wilmington area adjacent to the northwest side of the Christina River. It extends from the Tubman-Garrett Riverfront Park at Market Street to the Delaware Transit Corporation. The approximate distance of this portion of the walkway is 1,750 feet.

Site History

Based on a review of historical directories, maps, existing environmental reports and interviews, several possible sources of historic contamination were identified on the subject property and in the immediate vicinity of the site. These include the Harlan & Hollingsworth shipyard and the Gates Engineering property.

The area of the improvements was historically the site of shipbuilding and other heavy industrial activities. Much of the area was initially marshland that had been filled with slag and other industrial waste products. Because of its previous industrial use, much of the soil in the area has been impacted by environmental contaminants, including total petroleum hydrocarbons (TPH), heavy metals (i.e., lead, arsenic), polychlorinated biphenyls ("PCBs") and polynuclear aromatic hydrocarbons ("PAHs").

IV INVESTIGATION RESULTS

The Remedial Investigation conducted by EA Engineering, Science, and Technology, Inc. included surface soil, subsurface soil, ground water, and sediment sampling. The sample collection was performed in a phased approach that was integrated into engineering assessments being conducted for the improvements.

The findings of the environmental investigation showed that all media (soil, sediment and groundwater) were impacted above DNREC-SIRB Uniform Risk Based Remediation Standards ("URS") for unrestricted use surface and subsurface soil, and URS values for protection of the environment for sediment. The contaminants included metals (particularly lead and arsenic), PCBs, PAHs and volatile organic compounds ("VOCs").

The potential exposure pathways evaluated were air, contact with soil, ground water, and surface water. The receptors considered were on-site workers during construction and the general public. Ecological risks posed to the Christina River were also considered.

The information gathered during the environmental investigations was used to develop this Amended Final Plan of Remedial Action.

V REMEDIAL ACTION OBJECTIVES

According to HSCA regulation 8.4(1), during a remedial investigation, remedial action objectives must be established. For the Christina River Pedestrian Walkway Phases III & IV, remedial action objectives were designed based on the following factors:

- The site is currently in an area zoned as commercial and industrial land and numerous vacant lots and former industrial buildings are adjacent to the site.
- The future site use is to be a walkway and meeting place similar to a park.
- The site is adjacent to the Christina River.
- Various chemical constituents have impacted the Site's soil and riverbank sediment. Based on the nature and extent of the contaminants, arsenic, lead, PAHs, PCBs and VOCs have been chosen as the primary contaminants of concern.
- The ground water media has been impacted by PAH's, VOC's, and petroleum compounds.
- The primary exposure pathways are air inhalation, direct contact and incidental ingestion with/of impacted soil and erosional transport to the Christina River.
- The major risk associated with the site is potential human contact with impacted soil and ecological risks to the river system.

Qualitative Remedial Objectives

Based on the above factors, the following qualitative remedial action objectives were developed:

- Control potential human contact (dermal and ingestion) with contaminated soil.
- Control potential contaminated soil erosion to the Christina River.
- Remove any highly contaminated material (Category Z in the reuse decision criteria) prior to or during construction.
- Mitigate erosion and release of contaminated soil and riverbank, and sediment ground water discharge to the Christina River to protect aquatic biota.

Quantitative Remedial Objectives

Based on the above qualitative remedial action objective, the following quantitative remedial action objectives were developed:

- Prevent human contact with soil having an arsenic concentration greater than 3 mg/Kg.
- Prevent human contact with soil having a lead concentration greater than 400 mg/Kg.
- Prevent human contact with soil having a PAH concentration greater than 1 mg/Kg.
- Prevent human contact with soil having a PCB concentration greater than 0.5 mg/Kg.
- Prevent human contact with ground water having concentrations over respective Safe Drinking Water Act Maximum Contaminant Levels (MCLs).
- Prevent aquatic biota contact with contaminated riverbank sediment above DNREC-SIRB URS values for the protection of the environment.
- Prevent discharge of ground water contaminants to surface water in excess of the Delaware surface Water Quality Standards.
- Prevent human contact with contaminated ground water in excess of DNREC-SIRB values for protection of human health.

The quantitative remedial action objectives are based on the Department's "Remediation Standards Guidance Under the Delaware Hazardous Substance Cleanup Act" (February 1998) and Soil Reuse criteria developed by the Department for use at the adjacent West Street Connector project. These objectives are protective of potential human and environmental receptors including surface water and ground water.

VI FINAL PLAN OF REMEDIAL ACTION

Alternative 2, a combination of removal and disposal of contaminated soil and riverbank sediments and containment remedies, will provide the protection the Department requires and can be implemented during the construction of the walkway. This alternative also is a cost-effective means of meeting all the remedial objectives while satisfying the evaluation criteria.

This option involved containing and selected removal of soil and riverbank sediment to prevent:

1. Migration of the contaminants to areas around the construction and to the Christina River, and;
2. The exposure of the contaminants to the public.

Under this alternative excavated soil will be handled in accordance with the DNREC-SIRB Riverbank Sediment/Soil Re-Use Levels (Table 1). Based on the laboratory analysis of environmental media samples, the soil and riverbank sediment will be placed into one of four categories for either selective reuse during the transportation project or for testing and off-site disposal at an appropriate facility. These categories of possible soil and riverbank sediment reuse have been developed by the Department to be protective of public health, welfare and the environment based upon land use. And/or the need to either remove and dispose of soil/riverbank sediment or effectively engineer an acceptable containment of the contaminated material. The categories of soil and riverbank sediment reuse begin with unlimited use (i.e., uncontaminated) to no reuse (highly contaminated sediment and/or soil for off-site disposal). These categories include:

A - Unlimited Contractor re-use Outside of Riverfront Redevelopment Area. (This category has low or no concentration of contaminants which are at levels suitable for unrestricted residential use).

B - Construction Re-use within Walkway Project and covered with a minimum of Amoco ACF 4508 fabric or equivalent as determined by the Department and a minimum of one foot of fill over soil. Riverbank sediments will be covered with the Department approved fabric and clean fill or stone as described in the approved sub-aqueous lands permit and erosion control permits, as applicable.

C - Re-use Limited to under the planned Walkway.

Z - Off-Site Treatment or Disposal (i.e., Highly contaminated).

In addition to the soil/riverbank sediment reuse restriction identified above, the Christina River bank will be stabilized by a combination of upland storm water controls, marsh plantings, geotextile and stone. Deleterious debris will be removed prior to stabilization. Figure 3 from Section 7.2.2 of the report "Remedial Investigation/Feasibility Study, Christina River Pedestrian Walkway, Berger Building to Delaware Transit Center, Wilmington, Delaware" dated May, 1999 by EA Engineering, Science, and Technology, Inc. is incorporated by reference to demarcate areas requiring remediation.

A deed restriction will be placed on the property indicating the project area is limited to non-residential use. This project area is located in an area that will have a regional Groundwater Management Zone established to preclude the installations of wells for potable water usage. In addition to the Groundwater Management Zone, the Department shall require all free product petroleum and/or any contaminant in the ground water with a risk-based concentration value in excess of 1×10^{-5} cancer risk be extracted and treated to DNREC URS standards for protection of human health. The Riverfront Development Corporation shall provide sufficient space in their Remedial Action Plan to implement this activity.

The Department will require an Operations and Maintenance Plan to be developed for the containment and the ground water management portion of this remedy.

AMENDMENT

In January 2000, EA Engineering, Science, and Technology, Inc. approached the Department and requested relief from using the marker fabric requirement for use in Alternative 2. They indicated that the original intent of the marker fabric was to protect future construction workers from human health risks associated with soil to remain in place at the site. In order to receive a waiver for use of the marker fabric from the Department, they were instructed to perform a human health risk assessment based on the calculated risks of exposure to total soil contaminant concentration values. Based on the risk assessment, carcinogenic and non-carcinogenic risks to construction workers from incidental ingestion of chemicals of concern (arsenic, iron, and benzo(a)pyrene) in total soil and dermal contact were proven to be acceptable to the Department and consistent with the qualitative and quantitative remedial objectives. Therefore, the previous requirement for the geotextile marker fabric contained in Alternative 2 has been waived and is no longer necessary. Please refer to EA Engineering, Science, and Technology, Inc.'s "Risk Assessment, Riverwalk Phase III & IV, Wilmington, DE February 2000" for a complete summary of the risk.

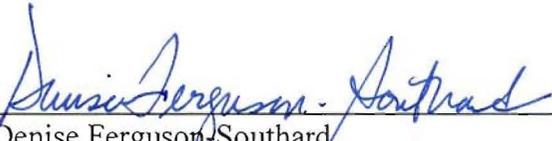
VII PUBLIC PARTICIPATION

The Department solicited public comments or suggestions on the Proposed Amended Final Plan of Remedial Action in a form of a twenty-day comment. No comments were received.

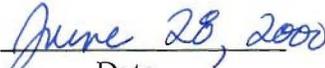
The comment period began May 8, 2000 and ended May 29, 2000.

VIII DECLARATION

This Amended Final Plan of Remedial Action for the Christina River Pedestrian Walkway site is protective of human health, welfare and the environment and is consistent with the requirements of the Delaware Hazardous Substance Cleanup Act.



Denise Ferguson-Southard
Director, Division of Air and Waste Management



Date

Table 1
Riverbank Sediment/Soil Re-Use Levels for Christina River Pedestrian Walkway Project
Phase III & IV
(Concentrations in mg/Kg)

Riverbank Sediment/Soil Category	A	B*	C	Z
Contaminant of Concern	Unlimited Contractor Re-Use	Construction Re-Use within Project Area	Re-Use Limited to Under Foundations of Building in Project Area	Off-Site Treatment of Disposal
Oily Soil or Free Product	none	none	none	Yes
Petroleum Hydrocarbons				**
C5 through C8 aliphatic hydrocarbons	100	500	500	
C9 through C12 Aliphatic hydrocarbons	1000	2500	2500	
C19 through C18 Aliphatic hydrocarbons	1000	2500	2500	
C19 through C36 Aliphatic hydrocarbons	2500	5000	5000	
C9 through C10 Aromatic hydrocarbons	100	500	500	
BTEX	<10	10 to 25	25 to 100	>100
C PAHs	<1	1 to 25	25 to 300	>300
PCBs	<0.5	0.5 to 3	3 to 8	>8
Arsenic	<3	60 to 100	100 to 500	>500
Lead	<400	400 to 1,500	1,500 to 5,500	>5,000

*Requires a Geotextile marker Fabric of a minimum quality of Amoco ACF 4508 or equivalent as determined by DNREC and a minimum on one foot fill over contaminated soil.

**Above 5,000 ppm for total TPH in soil.

