DEP-090
5/95

New Jersey Department of Environmental Protection
COMMUNICATIONS CENTER NOTIFICATION REPORT

Received: 03/31/2001 TD Log#: 76295

Operator: JON Reviewed By: Case #: 01-03-31-2313-48

Notification Type: Facility

Reported By	Affiliation	Phone
DON POLZO	ITT	973-284-4036

Street Address	Municipality	State
100 KINGSLAND RD	CLIFTON 07014	NJ

Incident Location: Facility

Site: ITT Phone: 973-284-4036

Street Address	Municipality	County	State
100 KINGSLAND RD	CLIFTON 07014	PASSAIC	NJ

Location Type: Industrial Incident Date: 03/31/2001 Time: 1230

Substance Released: ETHYLENE GLYCOL

Amount Released (Estimate): 50.00 GALS. GALS.

ID: Known State: Liquid CAS#: 107211 Release Is: Terminated

Additional Substances:

Substance Contained? No Hazardous Material? Y TCPA? N A310 Letter? Y

COMU Code: 1602 Referral Code: 001 Is Hazardous Waste Involved? No

Incident Description: Spill

Injuries? No Public Evac? No Facility Evac? No Public Exposure? No

Police On Scene? No Firemen On Scene? No DEP Requested? No Road Closure? No

Wind Speed/Direction: Contamination Of: Water, Land Receiving Water: THIRD RIVER

Status at Scene: LINE BROKE ON AIR HANDLER CAUSING RELEASE. 20 GALS INTO STORM DRAIN. CLEAN UP IN PROGRESS. NON EMERGENT.

Responsible Party: Known

Party: ITT Phone: 973-284-4036

Contact: DON POLZO Title: ENVIRO SAFETY

Street Address	Municipality	County	State
100 KINGSLAND RD	CLIFTON 07014	PASSAIC	NJ

OFFICIALS NOTIFIED

	Name	Affiliation	Phone	Date	Time
NJSP		OEM Faxed		03/31/2001	
MUNIC	CLIFTON CITY	OPR 38 Office	973-470-5911	03/31/2001	2328
OTHER		DHSS/OEM Faxed		03/31/2001	

	Name	Affiliation	Method	Date	Time
1.	BRUCE DOYLE	ER1 DRPSR	Home	03/31/2001	2321
2.		HQ DFG	Faxed	03/31/2001	
3.		Metro/Nort HAZ-WST	Faxed	03/31/2001	

COMMENTS

SOP 9 CHART C

ADC000305

TIERRA-B-007571

ITT

Avionics Division
Defense-Space Group
ITT Corporation

100 Kingsland Road
Clifton, New Jersey 07014
Telephone (201) 284-0123

August 22, 1986

Mr. Stuart Palfreyman
Health Department, City of Clifton
900 Clifton Avenue
Clifton, NJ 07011

Dear Mr. Palfreyman:

In accordance with the provisions of N.J.A.C. 7:26-9.7 and 7:1-7.1, I am submitting the following hazardous substance discharge report. I am also forwarding copies of this report to the New Jersey Department of Environmental Protection.

I hope this information is sufficient. If you need more detailed information call Jim Pettis or Steve Buzzard at (201)284-4098.

Very truly yours,

A.J. Marino, Jr.
Manager, Materials & Evaluation Lab
Environmental Coordinator

cc: R.S. Ullman
J. Pettis
S. Buzzard
A. Leibowitz

Underground Tank Failure: Private Contractor called in to Remove. See Attached.

ADC000306

TIERRA-B-007572

HAZARDOUS SUBSTANCE DISCHARGE REPORT

Name: ITT Avionics

Individual Reporting Discharge: Anthony J. Marino, Jr.

Address: 100 Kingsland Road, Clifton, N.J. 07014

Telephone: (201)284-2170

Date and Time of Discharge: Sometime between 0:00 08-12-86 and 0800 08-13-86.

Location of Discharge: ITT Avionics
100 Kingsland Road
Clifton, NJ 07014 Block 83-1 Lot 1
Passaic County
EPA #NJD058112947

Type and Quantity of Discharge: 300-350 gallons 1,1,1 Trichloroethane

Actions Taken to Contain Discharge: None possible - Material is under concrete floor which is over rock.

Company selected and contracted for removal/clean-up:
OH Materials Corporation

Remedial Investigation

Samples Taken: Two borings through concrete. Visual confirmation in underlying soil only, no analysis.

Clean-up Date: Start Saturday, 23 August 1986

REMEDIAL INVESTIGATION REPORT

AND

REMEDIAL ACTION WORK PLAN

ITT Avionics Division

100 Kingsland Road
Clifton, Passaic County, New Jersey

ISRA Case No. E96303

JUNE 1996

[June 12, 1996]

H2M ASSOCIATES, INC.
999 Riverview Drive
Totowa, New Jersey 07512

H2M GROUP
Engineers, Scientists, Planners

ITT Industries
AUTOMOTIVE
DEFENSE & ELECTRONICS
FLUID TECHNOLOGY

Environmental Health & Safety

ITT Avionics
100 Kingsland Road
Clifton, NJ 07014-1993
Tel: (201)284-4852
Fax: (201)284-3345

November 19, 1996.

Certified Mail.

Mr. Albert Greco
Clifton City Health Officer
900 Clifton Avenue
Clifton, New Jersey 07015

Re: ITT Avionics ISRA Case No. E96303.
Remedial Action Work Plan (RAWP).

Dear Mr. Greco:

At the request of Mr. Gary Lipsius, NJDEP Case Manager for the referenced ISRA case site, I am forwarding the enclosed RAWP for your reference. Please feel free to call me directly at 201-284-4036 or Mr. Lipsius at 609-984- 0955 with any questions. Thank you.

Sincerely,

Donald T. Polzo
Manager, Environment
Health & Safety.

cc: G. Lipsius (NJDEP).

REMEDIAL INVESTIGATION REPORT

AND

REMEDIAL ACTION WORK PLAN

ITT Avionics Division

100 Kingsland Road
Clifton, Passaic County, New Jersey

ISRA Case No. E96303

JUNE 1996

[June 12, 1996]

H2M ASSOCIATES, INC.
999 Riverview Drive
Totowa, New Jersey 07512

H2MGROUP
Engineers, Scientists, Planners

ADC000419

TIERRA-B-007576

H2MGROUP

Holzmacher, McLendon & Murrell, P.C. • H2M Associates, Inc.
H2M Construction Management, Inc. • H2M Labs, Inc.

ACEC Member
Supporting Excellence
In Engineering

999 Riverview Drive, Totowa, NJ 07512
(201) 256-5454 • FAX: (201) 256-8289

Via Federal Express

August 8, 1996

Mr. Gary Lipsius
New Jersey Department of Environmental Protection
Division of Responsible Party Site Remediation
Bureau of State Case Management
401 East State Street
Trenton, New Jersey 08625

Re: Remedial Investigation Report and Remedial Action Work Plan
ITT Avionics Division, Clifton, New Jersey
ISRA Case No. E96303

Dear Mr. Lipsius:

On behalf of ITT Avionics Division and in accordance with your telephone conversation of this date, H2M is providing herewith one copy of the Remedial Investigation Report (RIR) and Remedial Action Work Plan (RAWP) pertaining to ITT's facility located at 100 Kingsland Road in Clifton, New Jersey. In addition, one copy is being provided to George Nicholas of the NJDEP under separate cover. Additional copies will be provided to you as requested.

The RIR and RAWP are being submitted under the requirements of ISRA for the triggering event that occurred on July 17, 1996 for which a General Information Notification (GIN) was submitted to the NJDEP. The RIR and RAWP was developed to satisfy the requirements of the *Technical Requirements for Site Remediation* (N.J.A.C. 7:26E). This report is also being submitted to satisfy the notification requirements of N.J.A.C. 7:1E-5.2. To facilitate your review of past activities, a time line has been developed with references to appropriate sections, tables and figures within the report.

At your earliest convenience, we would like to schedule a meeting at the ITT facility to view the site and review the RIR and RAWP for conditional approval. A contract of sale for the subject property has been executed and time is of the essence. If you should have any questions or comments, please feel free to contact this office.

Very truly yours,
H2M ASSOCIATES, INC.

Stanley G. Puszcz, P.E., CGWP

CC: Ronald J. Wienckoski, Jr., NJDEP, BFO
George Nicholas, NJDEP
Donald T. Polzo, ITT Avionics Division
Jack Russo, ITT Avionics Division
Alan Leibowitz, ITT Defense and Electronics
Andrew DiCicco, Esq., ITT Defense and Electronics

Enc.

CERTIFICATIONS : ISRA RAWP June 1996. ITT Avionics Case #E96303.

A. The following certification shall be signed by the highest ranking individual at the site with overall responsibility for that site or activity. Where there is no individual at the site with overall responsibility for that site or activity, this certification shall be signed by the individual having responsibility for the overall operation of the site or activity.

I certify under penalty of law that the information provided in this document is true, accurate and complete. I am aware that there are significant civil penalties for knowingly submitting false, inaccurate or incomplete information and that I am committing a crime of the fourth degree if I make a written false statement which I do not believe to be true. I am also aware that if I knowingly direct or authorize the violation of any statute, I am personally liable for the penalties.

Typed/Printed Name Henry J. Driesse Title President

Signature [signature] Date 8-6-96

Sworn to and Subscribed Before Me
on this 6th
Date of August 1996

Anna Marie ANNA MARIE SIMONETTI
Notary NOTARY PUBLIC OF NEW JERSEY
My Commission Expires June 8, 1997

B. The following certification shall be signed as follows:

1. For a corporation, by a principal executive officer of at least the level of vice president;
2. For a partnership or sole proprietorship, by a general partner or the proprietor, respectively; or
3. For a municipality, State, Federal or other public agency, by either a principal executive officer or ranking elected official; or
4. For persons other than 1-3 above, by the person with the legal responsibility for the site.

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate and complete. I am aware that there are significant civil penalties for knowingly submitting false, inaccurate or incomplete information and that I am committing a crime of the fourth degree if I make a written false statement which I do not believe to be true. I am also aware that if I knowingly direct or authorize the violation of any statute, I am personally liable for the penalties.

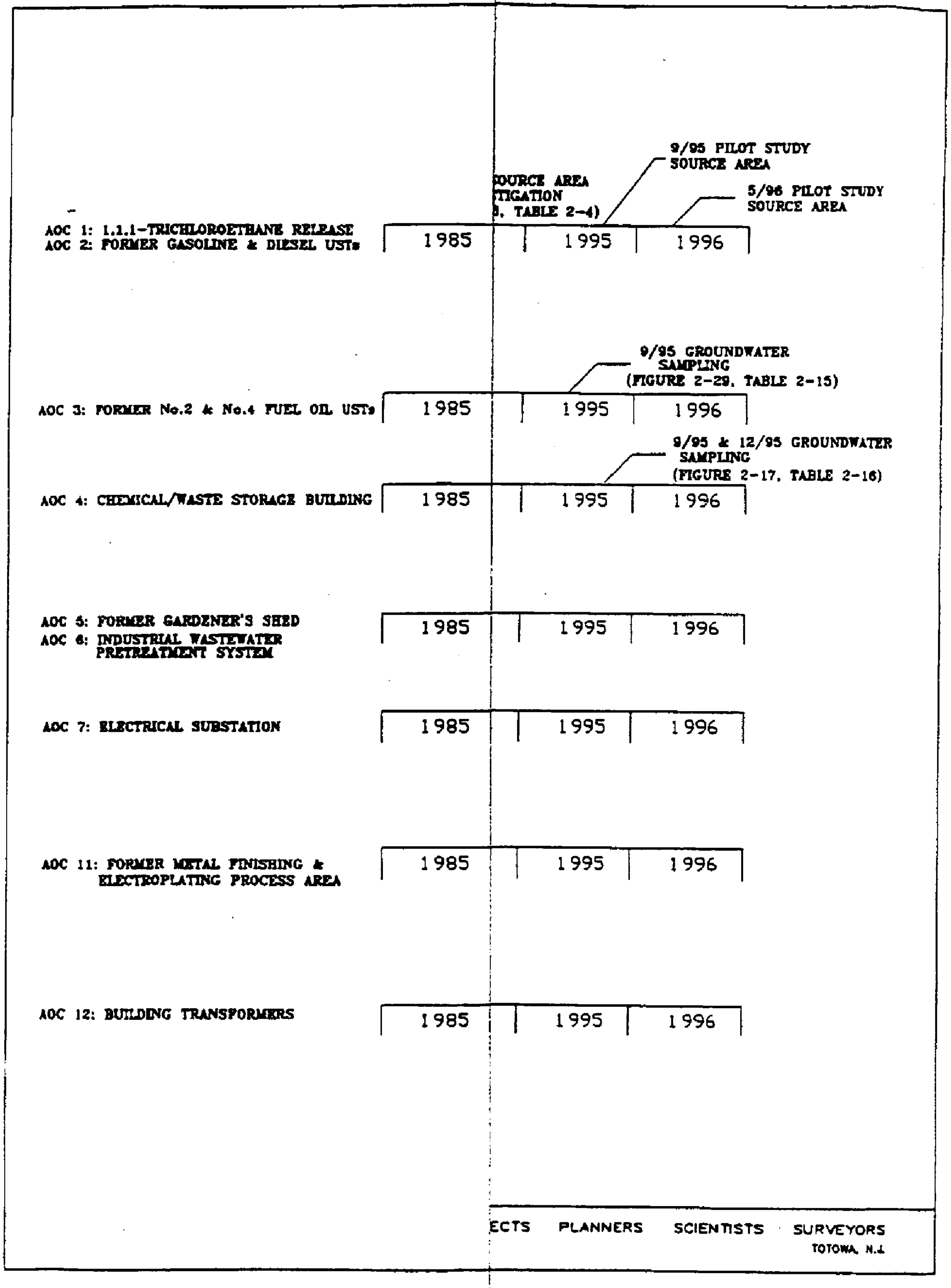
Typed/Printed Name Henry J. Driesse Title President

Signature [signature] Date 8-6-96

Sworn to and Subscribed Before Me
on this 6th
Date of August 1996

Anna Marie Simonetti
Notary

ANNA MARIE SIMONETTI
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires June 8, 1997


9/95 PILOT STUDY SOURCE AREA
OURCE AREA
TIGATION
, TABLE 2-4)
5/96 PILOT STUDY SOURCE AREA
AOC 1: 1,1,1-TRICHLOROETHANE RELEASE
AOC 2: FORMER GASOLINE & DIESEL USTs
1985
1995
1996
9/95 GROUNDWATER SAMPLING (FIGURE 2-29, TABLE 2-15)
AOC 3: FORMER No.2 & No.4 FUEL OIL USTs
1985
1995
1996
9/95 & 12/95 GROUNDWATER SAMPLING (FIGURE 2-17, TABLE 2-16)
AOC 4: CHEMICAL/WASTE STORAGE BUILDING
1985
1995
1996
AOC 5: FORMER GARDENER'S SHED
AOC 6: INDUSTRIAL WASTEWATER PRETREATMENT SYSTEM
1985
1995
1996
AOC 7: ELECTRICAL SUBSTATION
1985
1995
1996
AOC 11: FORMER METAL FINISHING & ELECTROPLATING PROCESS AREA
1985
1995
1996
AOC 12: BUILDING TRANSFORMERS
1985
1995
1996
ECTS PLANNERS SCIENTISTS SURVEYORS
TOTOWA, N.J.

H2M GROUP

REMEDIAL INVESTIGATION REPORT
AND
REMEDIAL ACTION WORK PLAN

ITT Avionics Division
100 Kingsland Road
Clifton, Passaic County, New Jersey
NJPDES Permit No. NJ0076023

June 1996

TABLE OF CONTENTS

H2M GROUP

TABLE OF CONTENTS

(Continued)

List of Appendices

List of Figures

H2M GROUP

List of Tables

H2M GROUP

REMEDIAL INVESTIGATION REPORT AND REMEDIAL ACTION WORK PLAN

ITT Avionics Division
100 Kingsland Road
Clifton, Passaic County, New Jersey

June 1996

1.0 Introduction

The objective of this Remedial Investigation Report and Remedial Action Work Plan is to establish a basis for and identify the appropriate remedial action for the ITT Avionics Division (ITT) facility located at 100 Kingsland Road, Clifton, New Jersey. This report summarizes previous remedial investigation activities performed at the site, including work performed as part of the New Jersey Department of Environmental Protection (NJDEP or Department) Bureau of Underground Storage Tanks (BUST) and New Jersey Pollutant Discharge Elimination System (NJPDES) programs, as well as voluntary investigation work performed under a corporate environmental survey program, and presents the proposed remedial action for remaining areas of concern. This report also serves as notification pursuant to N.J.A.C. 7:1E-5.2. This Remedial Action Work Plan has been prepared in accordance with the NJDEP Technical Requirements for Site Remediation (N.J.A.C. 7:26E) and the Industrial Site Recovery Act (ISRA).

2.0 Remedial Investigation Summary

2.1 Location and Description

The ITT facility is shown in Figure 2-1, Location Map, and Figure 2-2, Site Map. The site is located in an area of Clifton occupied by residential dwellings and industrial facilities. The nearly 50-acre site is bordered to the north by New Jersey State Highway Route 3, a Shell gasoline service station, and a Ramada Inn hotel. Yantacaw Pond is immediately north of Route 3. A vacant facility formerly operated by Automated Data Processing borders the northwestern portion of the site. The eastern site boundary is River Road, the southern boundary is Kingsland Road. The Third River, a tributary of the Passaic River, borders part of the site to the west, and flows around to the property to the west, north and east. This tributary discharges to the Passaic River approximately one-quarter mile east of the site. The site contains seven buildings, six of which house non-manufacturing operations, including maintenance, boiler, electrical, and storage areas. These six buildings range in size from 1,700 to 24,000 square feet. Site manufacturing operations are limited to the main building, which contains approximately 919,000 square feet of floor space. The site was occupied by a country club and golf course prior to its purchase by ITT in 1946.

ITT assembles electronic equipment used in the defense industry. Historical operations have included manufacturing of television and radio tubes, telephones, radios, washing machines, and printed circuit boards. Current site operations include welding, soldering, painting, printing, degreasing, drilling, machining, grinding, assembly, and testing of products.

2.2 Physical Setting

2.2.1 Topography, and Drainage

Overall site relief is approximately 40 feet, from a high of approximately 70 feet above mean sea level in the southwestern portion of the site to a low of approximately 30 feet above mean sea level in the northeastern portion of the site. The site slopes towards the Third River, which drains into the Passaic River approximately one quarter-mile east of the site. The subject property is within the Passaic River drainage basin, with local drainage to storm sewers.

2.2.2 Geology and Hydrogeology

The site lies within the Piedmont Province of northern New Jersey. The uppermost unconsolidated materials in this area generally consist of fill material, and glacial till of Pleistocene Age, composed of red-brown sand and gravel with some silts and clays. These glacial deposits are underlain by the weathered reddish-brown shales and sandstones of the Passaic, or Brunswick Formation. The Brunswick Formation was deposited within the Newark Basin, one of many Triassic rift basins formed during the separation of North America from Africa and the opening of the Atlantic Ocean, during the Late Triassic period.

Sediments, eroded from adjacent uplands, were deposited along rivers and in lakes within the basins during this time. These sediments became compacted and lithified to form conglomerate (at the basin margins), mudstone, sandstone, siltstone, and shale. In the course of rifting, the rock layers of the Piedmont became tilted northwestward. The strata generally strikes northeast to southwest and dips northwest at 5 to 25 degrees. A directional, anisotropic response to pumping is often documented in the Brunswick. In most cases, monitoring wells aligned along the strike of the formation react faster and show much greater drawdown than those located perpendicular to the strike. This is especially true when wells are drilled to greater depths, since wells installed to similar depths or elevations down-dip or up-dip of a pumping well may screen different water-bearing units. Major fracture orientations, measured by a previous consultant in an outcrop at the Third River located southwest of the site, were found to be approximately northeast (N59°E) and northwest (N52°W).

Twenty-seven (27) monitoring wells have been installed as part of site assessment and remedial investigation activities to evaluate sub-surface conditions and groundwater quality. The locations of these wells are also provided in Figure 2-2. A summary of monitoring well construction details is provided in Table 2-1. Borehole logs, NJDEP Forms-A and B, and monitoring well records have been previously submitted to the Department as they related to Bureau of Underground Storage Tank (BUST) or New Jersey Pollution Discharge Elimination System (NJPDES) requirements. The unconsolidated strata encountered consists primarily of fill material varying in thickness from 1 to 5 feet, typically composed of brown silt, occasional gray gravel (roadbase), and tan silt and clay. The fill overlies glacial till of Pleistocene Age, composed of red-brown sand and gravel with some silts and clays. Weathered shale and sandstone of the Brunswick Formation occurs beneath the fill. Rock cores, collected during the installation of MW-1A, indicated that bedrock becomes more competent at a depth of 34 to 59 feet below grade. The upper bedrock surface, from 20 feet below grade to 34 feet below grade, is heavily weathered and fractured. The rock was also less competent at a depth ranging from 69 to 79 feet below grade, and became competent again at 69 to 79 feet below grade. The elevation of the top of the weathered bedrock surface at each monitoring well location is provided in Table 2-2. A contour map of the bedrock elevation is provided in Figure 2-3. The contour map shows that bedrock slopes to the northwest in the southwestern portion of the site at an angle of about 4 degrees, or 0.054 feet per foot. Bedrock topography is more complex in the northeastern portion of the site, where the slope is predominantly to the northeast, except for a ridge in the vicinity of MW-4 and MW-5, and an apparent trough which reaches a low at MW-11.

Contour maps identifying the potentiometric surface of the shallow and deep aquifer zones have been developed from 23 shallow groundwater monitoring wells screening the first water encountered, and 4 deeper monitoring wells screened exclusively in more competent Brunswick (Figures 2-4 through 2-11). Shallow groundwater flow direction is primarily toward Yantacaw Pond to the north and the Third River to the northeast, and influenced by the bedrock slope. Groundwater in these shallow wells generally occurs below the bedrock/overburden interface, with the exception of MW-11, 13, 14, where groundwater is present in the overburden. Groundwater was also encountered in MW-10 above the bedrock surface in the overburden prior to pumping associated with the current groundwater remediation system. Groundwater extraction has created drawdown in MW-10 to an elevation currently within the bedrock. Contour maps presenting the May 1995, August 1995, November 1995 and February 1996 rounds of groundwater elevations from the shallow monitoring wells are presented as Figures 2-4 through 2-7. Ignoring the hydraulic effect of the groundwater extraction system at RW-1, RW-2 and RW-3 and the recharge system, groundwater flow is primarily northward in the southern portion of the site. In the northern portion of the site, groundwater flow becomes east-northeasterly, to the Third River. The hydraulic gradient in the central portion of the site is approximately 0.036 feet per foot. Average linear flow velocity, using this gradient and an average hydraulic conductivity (determined from slug tests performed in selected monitoring wells screened in the overburden and shallow weathered bedrock) of approximately 1.5 feet per day, and a porosity of 20%, is estimated at 0.3 feet per day.

Deeper groundwater flow beneath the site is to the northeast and southeast, as demonstrated by three and a half years of quarterly water level data. Contour maps for the May 1995, August 1995, November 1995 and February 1996 are provided in Figure 2-8 through Figure 2-11. The gradient in the deeper flow zone is slightly less than that of the shallower zone, at approximately 0.014 feet per foot, resulting in a lower groundwater flow velocity. Hydraulic conductivity and groundwater flow velocity in the deeper zone will be most affected by bedding planes, fracture frequency, and the interconnectivity of fractures. Downward flow exists between the shallow and deeper zones where monitoring well couplets are present to evaluate vertical flow conditions (MW-1/MW-1A, MW-13/MW-13A), with the exception of the MW-14/MW-14-A well couplet, where vertical flow is not apparent.

Groundwater elevation data associated with historic quarterly groundwater monitoring events (August 1990 through February 1996) are summarized in Table 2-3.

2.3 Summary of Environmental Concerns

Sixteen areas of Potential Environmental Concern (AOC) were identified throughout the investigation. Remedial actions have been taken at some of these AOCs. The location of each AOC is identified in Figure 2-12.

2.3.1 AOC 1: 1,1,1-Trichloroethane Release

On August 14, 1986, approximately 300 gallons of 1,1,1-trichloroethane (1,1,1-TCA) was released to the subsurface beneath the main manufacturing building. 1,1,1-TCA was released into a piping vault which discharged to the subsurface. Due to structural limitations of the building, excavation of contaminated soil under the floor slabs and pier footings was not feasible. In January 1987, one monitoring well (MW-1) was installed downgradient of the spill in agreement with the NJDEP and was found to contain 1,1,1-TCA. The presence of 1,1,1-TCA prompted a groundwater investigation and the groundwater remediation program presently being undertaken. The groundwater investigation and remediation is discussed in Section 2.4.

In October of 1993, a source area investigation was conducted to determine the extent of contamination remaining in soil in the vicinity of the original 1,1,1-TCA release. Mechanical and hand boring equipment were used to obtain soil samples in four boreholes beneath the building in the vicinity of the historic 1,1,1-TCA release. The locations of the four borings are presented in Figure 2-13. Boring B-2 was advanced through the floor adjacent to a small concrete vault which the 1,1,1-TCA collected in. At the time of the release, the vault had an earthen bottom. Borings B-1 and B-3 are located 20 to 25 feet adjacent to B-2 with boring B-4 located 25 feet northeast (downgradient) of B-2. A concrete utility trench, recessed in the floor, is located immediately adjacent to borings B-1 and B-3. Borings B-1, B-2, and B-3 were constructed utilizing a rotary hammer powered by an air compressor. Due to height restrictions in the room adjacent to the source area, boring No. B-4 was constructed utilizing a stainless steel hand-held bucket auger. Soil sampling was conducted at six-inch intervals utilizing a hand auger to accommodate field screening with a portable photoionization detector (PID). The uppermost (shallow) sample was collected upon encountering the first soil strata beneath the floor slab, approximately six inches thick. No gravel sub-base was encountered at any of the boring locations. The maximum depth of each boring was established when weathered bedrock or boulders were encountered, preventing further penetration by the sampling tools. Boring Nos. B-1, B-2, and B-3 were advanced to a depth of 8 to 8.5 feet below grade. Boring B-4 was advanced to a depth of 5.5 feet. Elevated PID responses were observed at one location, during advancement of boring No. B-2. The PID responses ranged from 70 ppm calibration gas equivalents (3 feet below grade) to 30 ppm calibration gas equivalents (8 feet below grade) within the borehole.

Soil samples submitted for laboratory analysis were collected in each borehole at the first encounter of native soils beneath the floor slab, at an intermediate depth of 5 to 5.5 feet below grade, and at a depth of 8 to 8.5 feet below grade (with the exception of B-4 due to refusal at 5.5 feet). Sample results are provided in Table 2-4. Acetone, a common laboratory contaminant, was quantified in many of the samples, but below the Department's most stringent soil cleanup criteria. 1,1,1-TCA was quantified at one location, B-2, at concentrations ranging from 0.036 ppm (0 to 6 inches below grade) to 0.120 ppm (5 to 5.5 feet below grade), below the NJDEP's Impact to Groundwater Soil Cleanup Criteria of 1 ppm as well as NJDEP's Residential Direct Contact Soil Cleanup Criteria of 210 ppm. Lower concentrations of some breakdown compounds were also found. All volatile organic compounds were well below the Department's most stringent soil cleanup criteria.

As part of the source area investigation, monitoring well MW-18 was installed in this vicinity of the source area. This part of the source area investigation is described in Section 2.4.

Soils in the vicinity of the historic 1,1,1-TCA release have been investigated to the extent practicable. No further action is warranted for soils in this area, based on the results of the source area investigation performed, which indicated that volatile organic compounds are not present in overburden soils at levels above NJDEP's most stringent soil cleanup criteria. The effect of the 1,1,1-TCA release on groundwater has been evaluated, and is addressed in Section 2.4.

2.3.2 AOC 2: Former Gasoline and Diesel USTs

On August 27, 1987, Fairfield Maintenance, Inc. (FMI) conducted petrotite tests of two (2) adjacent 4,000 gallon leaded gasoline USTs in the vicinity of the northeast corner of the main manufacturing building. Both USTs failed the petrotite test. These USTs (BUST Case No. 87-08-21-1419) and all appurtenances were subsequently removed on February 8, 1988. A total of eight post-excavation confirmatory soil samples were collected by Dan Raviv Associates, Inc. (DRAI) and analyzed for Volatile Organic Compounds(VOCs). Sample locations are presented in Figure 2-14. Table 2-5 presents the analytical soil data for the UST systems. All sample results were quantified at concentrations below current NJDEP Impact to Groundwater Cleanup Criteria as well as NJDEP's Residential Direct Contact Soil Cleanup Criteria. A summary of UST removal procedures and analytical data was submitted to the Department in the DRAI report entitled, "Investigation of the Impact From Past TCA Spillage and Former Gasoline Underground Storage Tanks on Surface and Hydrogeologic Conditions," on July 25, 1988. Groundwater data is summarized further in a supplemental hydrogeologic investigation documented in a DRAI report submitted to the NJDEP on May 18, 1989. No further action is required for these tank excavations.

On September 15, 1989, two (2) additional USTs were pressure tested by FMI. The results indicated that a 1,000 gallon diesel fuel UST (UST system E-10) failed the test and a 4,000 gallon leaded gasoline UST (UST system E-9) tested inconclusively. On December 19 and 20, 1989, the two USTs (BUST Case No. 89-09-15-1420) and all appurtenances were excavated and removed from the site under the field oversight of an H2M representative and a NJDEP Northern Bureau of Regional Enforcement representative. Product from within the tanks was transported to S&W Waste (EPA I.D. No. NJD991291105) under manifest No. NJA0633829. Four post-excavation confirmatory soil samples were collected from each excavation and analyzed for VOCs and total petroleum hydrocarbons (TPHC).

Sampling locations are identified on Figure 2-15. VOCs were not detected above NJDEP's Impact to Groundwater Cleanup Criteria at any of the eight locations nor did they exceed NJDEP's Residential Direct Contact Soil Cleanup Criteria. TPHC concentrations were below method detection limits in five of the eight sampling locations. The remaining samples had TPHC concentrations of 240 ppm, 10,000 ppm, and 12,000 ppm, respectively. Sample results are provided in Table 2-6.

All four USTs were located in an area where depth to the weathered bedrock surface is generally 5 to 10 feet. Removal of weathered bedrock under the tanks was performed until the backhoe bucket could no longer penetrate the strata. The groundwater treatment plant has since been constructed at this location. Approximately 13 cubic yards of soil and rock was removed.

A summary of UST removal procedures and analytical data is included in the H2M report submitted to the NJDEP entitled, "Discharge Investigation and Corrective Action Report," dated January 1990.

No further action is required with respect to soils at this location. Volatile organic compounds are not present above the Department's Impact to Groundwater and Residential Direct Contact Soil Cleanup criteria. The excavations were advanced in weathered bedrock to the extent practical. The effects of the UST releases on groundwater have been evaluated, and are currently being addressed by the groundwater remediation system, described in Section 2.4.

2.3.3 AOC 3: Former No. 2 and No. 4 Fuel Oil USTs

Six (6) USTs, identified as UST systems E1 through E6, were closed and removed from the northern side of the boiler house (Building 100 D) by Direct Environmental, Inc. between July 12, 1990 and October 25, 1990. UST systems Nos. E1 through E4 were 22,000 gallons in capacity and were used for the storage of No. 6 fuel oil. UST systems E5 and E6 were 2,000 and 6,000 gallons in capacity, respectively, and were used for the storage of No. 4 fuel oil.

The UST system E5 excavation was sampled on August 17, 1990. A total of five (5) post-excavation soil samples were collected and analyzed for VOCs and TPHC. VOCs were not present in any of the samples. TPHC concentrations ranged from 14.4 mg/kg to 202 mg/kg. Twelve (12) post-excavation soil samples were collected from the excavation of E1 through E4 and E6. Post-excavation soil sample locations are presented in Figure 2-16. Each sample was analyzed for TPHC and VOCs. Four of these samples (sample 1, 4, 7, and 12) were also analyzed for B/N + 15. VOCs were not detected above NJDEP's Impact to Groundwater Cleanup Criteria nor were they detected above NJDEP's Residential Direct Contact Soil Cleanup Criteria at any of the twelve locations. TPHC concentrations were below method detection limits in six of the twelve sampling locations. TPHC concentrations in the remaining samples ranged from 76 mg/kg to 5800 mg/kg. B/Ns were not detected above NJDEP's Impact to Groundwater Cleanup Criteria nor were they detected above NJDEP's Residential Direct Contact soil Cleanup Criteria at any of the four locations. Table 2-7 presents the analytical soil results. Excavated soils were stockpiled and characterized for disposal. Based on analytical results, approximately 900 cubic yards of soil was removed and disposed of off-site as a non-hazardous waste. Documentation of the management of excavated soils was included within the report submitted to NJDEP.

To assess the effect that the former UST systems may have had on the groundwater quality, three monitoring wells were installed on the northern side of the boiler house. Results of the groundwater investigation are presented in Section 2.4.

A summary of UST removal procedures and analytical data is included in the H2M report entitled, "Discharge Investigation and Corrective Action Report For 100 Kingsland Road," submitted to the NJDEP, dated February 1991. This area was closed by the Department's Bureau of Underground Storage Tanks with NJDEP correspondence dated September 9, 1991.

No further action is required for soils in this area, since all parameters were below NJDEP's Impact to Groundwater Soil Cleanup Criteria and NJDEP's Residential Direct Contact Soil Cleanup Criteria.

2.3.4 AOC 4: Chemical/Waste Storage Building

The chemical/waste storage building, located north of the main building, is identified as an AOC due to the current and historical handling of raw and hazardous materials in this area. This AOC was investigated under ITT's corporate environmental survey program. Chemicals which have been stored at the building, typically in 55-gallon drums, include methylene chloride, trichloroethene (TCE), and 1,1,1-TCA.

Two (2) soil borings were constructed and completed as monitoring wells. One monitoring well was installed on the north of the waste storage building as a downgradient well. The other monitoring well was installed on the south of the building as the upgradient well. Soil boring and monitoring well locations are presented in Figure 2-17. Three (3) soil samples were collected from each borehole at depths of 0.5 to 2.5, 6 to 8, and either 10 to 12 or 13 to 15 feet below grade. Samples were analyzed for metals, VOCs, semi-volatile organic compounds, and pH. Analytical results are presented in Table 2-8. Concentrations of all parameters throughout the soil column were below the NJDEP's Impact to Groundwater and Residential Direct Contact Soil Cleanup Criteria in all six samples. While this implies that no further action is required for soils in this area, two additional samples will be collected to ensure that operations conducted within the building have not impacted soil quality. One shallow soil sample will be collected from immediately outside the building adjacent to the loading dock on the south side of the building. The other shallow sample will be collected from just outside the access doors on the north side of the building. While there are no records of spills having occurred within the building, this sample will provide a greater level of assurance that a spill did not occur and become released through the doors. The shallow soil sample will be analyzed for VOCs. Groundwater quality is addressed in Section 2.4.

2.3.5 AOC 5: Former Gardener's Shed

The former gardener's shed, located southwest of the west parking area, was used for the storage of gardening materials and supplies for grounds maintenance. This storage shed burned down during a fire in the early 1970s. This AOC was investigated under ITT's corporate environmental survey program.

One soil boring was constructed and completed as a monitoring well at APC 2-A, the approximate location of the former gardener's shed as part of an ITT Corporate site assessment program conducted in 1992. The location of the soil boring is identified in Figure 2-18. Three (3) soil samples were collected from discrete six-inch intervals from split spoons obtained at depths of 0 to 2, 4 to 6, and 8 to 10 feet below grade. These samples were analyzed for pesticides and PCBs. Groundwater was sampled and analyzed for VOCs, pesticides, and PCBs.

No pesticides or PCBs were detected in either the soil or the groundwater from this location. In addition, no VOCs were detected above detection limits in the groundwater sample.

Since concentrations in soil were not detected above NJDEP's Impact to Groundwater and Residential direct Contact Soil Cleanup Criteria and since VOCs were not detected above their respective practical quantitation limit (PQL) in groundwater, no further action is required at this location.

2.3.6 AOC 6: Industrial Wastewater Pretreatment System

Industrial wastewater from facility process operations was conveyed to a pretreatment system located in the sub-basement of the main building for pretreatment prior to discharge to the municipal sanitary sewer operated by the Passaic County Sewerage Commissioners (PVSC). Pretreatment consisted of chrome reduction (i.e., hexavalent to trivalent), metal hydroxide precipitation and neutralization. The pretreatment system began operation in 1982 and discontinued operation in 1990 because of the termination of process operations generating industrial wastewater. The pretreatment system currently operates as a neutralization system in the event that the pH associated with other industrial wastewater generated throughout the facility is outside of discharge limits. Figure 2-19 identifies the location of the pretreatment system. This AOC was investigated under ITT's corporate environmental survey program.

The process operations contributing industrial wastewater utilized plating baths consisting of cadmium, chromium, copper, lead, molybdenum, nickel, silver, tin, and zinc. Further, degreasing operations utilized trichloroethene (TCE) and 1,1,1-trichloroethane (1,1,1-TCA).

Pretreated wastewater was ultimately accumulated in a wet-well located in the subbasement area. Sewer discharge monitoring was automatically performed at this location. When a sufficient quantity of pretreated wastewater accumulated in the wetwell, it was pumped through a force main to the sanitary sewer. All floor drains located in this area feed directly to a separate wetwell, to be transferred directly to the pretreatment process.

Because of logistical constraints, the soils underlying the concrete slab were not evaluated. However, monitoring well MW-10 was utilized to evaluate the potential impact to groundwater quality downgradient of the wastewater pretreatment system. MW-10 was sampled and analyzed for VOCs, semi-volatile organic compounds, cyanide, metals, and pH as part of an ITT Corporate site assessment program conducted in 1992.

Volatile organic compounds attributable to AOC-1, the (1,1,1-TCA release) are present in MW-10 above the NJDEP Groundwater Quality Criteria. There were no semi-volatile compounds quantified above their respective PQLs in MW-10. All of the metals were quantified at concentrations below their respective NJDEP Groundwater Quality Criteria.

Based on the absence of metals above NJDEP's Groundwater Quality Criteria, groundwater does not appear to have been impacted by the operation of the pretreatment system. The presence of VOCs in the groundwater is attributable to the 1,1,1-TCA release (AOC-1), which is currently being addressed. Therefore, no further action relating to groundwater is required with respect to AOC 6.

2.3.7 AOC 7: Electrical Substation

The area in the vicinity of the electrical substation located north of the main building (see Figure 2-20) was identified because of the presence of a transformer which historically contained oil that had leaked onto the concrete pad. Three transformers are located on the concrete pad, with each having been sampled and analyzed for PCBs by General Electric on April 17, 1989. Sampling results indicated that PCBs are not present in the transformer oil. This AOC was investigated under ITT's corporate environmental survey program.

To evaluate the oil which had caused a stain on the concrete pad, three (3) shallow soil borings were advanced around the electrical substation as part of an ITT Corporate site assessment program conducted in 1992. Soil samples were collected from each borehole at a depth of 0.5' to 1.0' below grade. These soil samples were composited and analyzed for TPHC and PCBs.

TPHC was detected at a concentration of 120 mg/kg, below the NJDEP action level of 1,000 mg/kg. No PCBs were detected.

Based on the absence of PCBs, no further action is required for this location.

2.3.8 AOC 8: Area without Vegetation

An area without vegetation, approximately twenty feet by twenty feet in size, identified by an NJDEP representative during a recent site visit, is present adjacent to (outside) the fence at the northeast corner of the property, near MW-9. Weathered bedrock can be observed at this location. There are no records or recollection of site operations having been conducted in this area. Since this area has not been analytically evaluated, it remains an AOC to be investigated.

2.3.9 AOC 9: 1,1,1-Trichloroethane Still

1,1,1-Trichloroethane was utilized to clean printed circuit boards and metal parts prior to electroplating and metal finishing. The still is located in the northeast corner of the industrial wastewater pretreatment system subbasement. Spent solvent was transferred in piping from the degreaser units to the still for reclamation with reclaimed solvent pumped back to the degreasers. The still is situated on a raised concrete platform. The platform is currently provided with protective coatings and a secondary containment berm, although the coatings and berms are relatively recent improvements. There is no recollection of the original condition of the flooring system, nor are there any recollections of spills associated with the still at this location. The nearest floor drain discharges directly to the industrial wastewater pretreatment system for pretreatment prior to sewer discharge.

Monitoring well MW-10 is located downgradient of the still. Many rounds of groundwater sampling have taken place at MW-10 which has had concentrations of VOCs in excess of the NJDEP groundwater quality criteria. However, the presence of VOCs in the groundwater is attributable to the 1,1,1-TCA release (AOC-1), which is currently undergoing remediation. Therefore, no further action relating to groundwater is required with respect to AOC 9. Soil quality below the elevated concrete platform and the adjacent concrete floor slab has not been evaluated.

2.3.10 AOC 10: Chemical Storage Room

Raw materials are stored within the chemical storage room located on the north side of the facility between the industrial wastewater pretreatment area and the former metal finishing and electroplating areas. Raw materials have been stored in drums, pails and in bags (for dry materials). Protective floor coatings have existed on the concrete slab since its use was first utilized.

On August 27, 28 and September 10, 1990, York Laboratories (York) performed sampling and analytical services to assess environmental conditions within the chemical storage room and former metal finishing and electroplating area. A description of the investigation and analytical results are presented in section 2.3.11. York's summary report is provided herewith as Appendix C.

An extensive network of monitoring wells are located immediately downgradient of the Chemical Storage Room. These monitoring wells have been sampled numerous times for VOCs and Semi volatile organic compounds. Several VOCs are in excess of the NJDEP groundwater quality criteria. However, the presence of VOCs in the groundwater is attributable to the 1,1,1-TCA release (AOC-1), which is currently undergoing remediation. Therefore, no further action is required with respect to AOC 10.

2.3.11 AOC 11: Former Metal Finishing and Electroplating Process Area

Metal finishing and electroplating operations were performed in an area of the facility directly east of the chemical storage room. These operations included solvent degreasing (i.e., trichloroethene and 1,1,1-trichloroethane), acid etching, pickling, aqueous alkaline cleaning, plating and electroplating (i.e., cadmium, chromium, copper, lead, molybdenum, nickel, silver, tin, and zinc). Process baths were located throughout the area on elevated gratings. Rinsewater was discharged to concrete troughs which drained to the industrial wastewater pretreatment system.

The area has since been closed with all process equipment having been removed. On August 27, 28 and September 10, 1990, York Laboratories (York) performed sampling and analytical services to assess environmental conditions within the former metal finishing and electroplating area. York's summary report is provided herewith as Appendix C.

The sampling program included the collection and analysis of samples to evaluate the quality of the floors, walls, and ceilings within this area. Sampling was conducted to evaluate the area consistent with RCRA characteristics (reactivity, corrosivity, and toxicity). RCRA toxicity metal analyses were performed for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. The samples were collected and compared to EP Toxicity Threshold Limits. The results of these samples are included within Tables 2-9, 2-10, and 2-11.

Concrete Floor Samples

According to ITT personnel, areas of the floor where deterioration was evident were subjected to concrete removal, scarification and washing prior to sampling. Sampling locations were biased based upon former operations and floor condition, which includes those areas having had deterioration. Twenty one concrete floor core samples were collected in accordance with ASTM Standards. The thickness of each concrete core varied between 3 to 8 inches. The core samples generally consisted of Terrazzo and paint for the top 1/8 inch, and the balance of the core was a blended coarse and fine aggregate.

The analytical results of concrete core testing indicates that the quality of the concrete was not impacted by process operations. All concrete samples exhibited concentrations less than their respective E.P. Toxicity limits. All samples were found to be non-reactive and non-corrosive. The pH readings ranged from 11.3 to 12.4 standard units.

Wall Wipe Samples

Fifteen wall wipe samples were collected from within the former process area. Sample locations were biased to those areas with a dust/soot accumulation. A 25 cm by 25 cm template was utilized to segregate the sample area which was then sampled by wiping with a 3 inch by 3 inch sterile gauze pad soaked with deionized water. Four adjacent areas were wiped using the template and the same gauze pad to cover the required area for the sample. According to the report, some of the walls sampled consisted of brick and the balance was drywall.

While there are no applicable standards to compare the RCRA toxicity metals results for wipe samples, the results were related to a "clean" background location. Based on this comparison, the walls were found to be unimpacted by the former process operations. All samples were found to be non-reactive and non-corrosive. The pH readings ranged from 4.0 to 6.4 standard units.

Ceiling Tile Samples

Six ceiling tile samples were collected from within the Printed Circuit Board Area. A 4 inch by 4 inch piece of ceiling tile was cut for analysis. The ceiling tiles were described as one-half inch thick textured (white on white) with holes and tan backing. A background sample (CT-7) was collected outside of the process area to compare results.

None of the ceiling samples exceeded E.P. Toxicity limits. Further, the ceiling samples were found to be non-reactive and non-corrosive. The pH readings ranged from 7.1 to 7.9 standard units.

Based on the foregoing, there is no indication that the former process operations have impacted the quality of the underlying soils. Therefore, no further action is required with respect to AOC 11.

2.3.12 AOC 12: Building Transformers

Oil filled electrical transformers and switches are located throughout the facility. Since 1985 ITT has undertaken an extensive assessment of all potential PCB containing electrical equipment. Analytical testing of transformer and switchgear oil was performed on all units. Those units found to contain PCBs were retrofilled and retested until the PCB concentrations were below 50 ppm. Most of the electrical systems were found to contain less than 10 ppm PCBs. This AOC was investigated under ITT's corporate environmental survey program.

A visual inspection of each transformer and switchgear was conducted on May 15, 1996. Each location was inspected to identify any visual indication of leaking or stains. During the inspection, three locations were identified as having stains adjacent to transformers. A description of each is provided as follows:

Area T-2 [ITT Inventory Map # 4, 5, 6 and 7]: One transformer and three switches are located on a concrete pad on the south side of the boiler house. The transformer oil was tested and found to contain 170 ppm PCBs (1985 Eastern High Voltage, Inc. Report). The oil within the switches were tested by General Electric on April 17, 1989 and found to be PCB free. Staining of the concrete pad was identified on the northwest side of the transformer. Records pertaining to the PCB assessment work performed by ITT indicate that minor leaking occurred at the gasket for the oil sight gauge on the transformer. The transformer was retrofilled in December 1989 and was reportedly subsequently replaced. A concrete chip sample will be collected for TPHC and PCB analyses.

Area T-3 [ITT Inventory Map # 8]: One transformer is located on a concrete pad on the north side of the main building immediately opposite the electrical substation. The oil within the transformer was tested by General Electric on April 15, 1989 and found to be PCB free. Staining of the concrete pad was identified during the May 15th inspection. A concrete chip sample will be collected for TPHC and PCB analyses.

Transformer 12-H [ITT Inventory Map # 40]: Six transformers and associated switch gears are located in the subbasement on the east side of the main building (currently utilized for records storage). The unit identified by label as P000168 is situated on a concrete floor. The oil within the transformers were tested by General Electric on April 15, 1989 and found to be PCB free. Staining was observed on the concrete floor adjacent to the electrical systems. Two concrete chip samples will be collected for TPHC and PCB analyses.

2.3.13 AOC 13: Machine Shop

Support for production operations included the operation of a machine shop where specialized tools and equipment were made from metal stock. Operations included machining (utilizing cutting oils) and degreasing (utilizing solvents and ultrasonic aqueous solutions).

The machine shop is located on the north side of the facility on the lower level. The floor is constructed of creosoted wood blocks resting on a concrete floor. Raw materials (cutting oils and solvent) were kept in a caged area for stores. Materials in use were limited to designated locations where equipment was operated and where degreasing operations took place.

Monitoring well MW-12 is located downgradient of the machine shop. Many rounds of groundwater sampling have taken place at MW-12 which has had minor concentrations of VOCs. However, the presence of VOCs in the groundwater is attributable to the 1,1,1-TCA release (AOC 1), which is currently undergoing remediation. Therefore, no further action is required with respect to AOC 13.

2.3.14 AOC 14: Shipping and Receiving Bays

Four shipping and receiving bays are located at the facility identified as AOC 14a through 14d. All raw materials received at the facility and goods shipped from the facility are transferred through one of the loading bays. There are no records of spills having occurred at any of the loading bays. Each loading bay consists of an elevated dock and recessed truck bays. The loading docks were formerly constructed out of wood block flooring sitting on a concrete floor. In the late 1970s, the wood block flooring was removed and replaced with concrete. A visual inspection was conducted in each loading bay on May 14, 1996.

AOC 14a (Lower Level Northwest Loading Bay)

The lower level northwest loading bay is the main receiving location for all materials utilized at the facility. A catch basin is located in the middle of three bays which is approximately upgradient of the chemical/waste storage building. A second catch basin is located in the western bay which reportedly receives condensate from an air conditioning unit. The loading bay is paved throughout with slope toward each catch basin. Water collected within the catch basins is conveyed to the stormwater collection system. While there are no records of any spills having occurred and there was no visual indication of historic releases observed during the inspection, soil sampling will be performed to assess its potential as a source of groundwater contamination downgradient of this location (i.e., AOC 4). If sediment is found to exist within the catch basin, a sample will be collected for analysis. Further, two shallow soil borings will be collected in the vicinity of the catch basin to assess whether the soil has been impacted by leaking collection piping. In addition, a shallow soil sample will be collected below the concrete floor of each elevated loading dock.

AOC 14b (Upper Level West Loading Bay)

The upper level west loading bay was utilized intermittently for shipping and receiving as well for temporary storage of finished materials. A catch basin appears to be located in the middle of the loading bay, however, it was obscured due to the presence of a tar-like substance on the paved surface. Water that is collected in the catch basin is understood to be conveyed to the stormwater collection system. The loading bay is paved throughout with the slope toward the catch basin. Similar to AOC 14a, soil sampling will be performed to assess its potential as a source of groundwater contamination downgradient of this location (i.e., AOC 4). If sediment is found to exist within the catch basin, a sample will be collected for analysis. Further, two shallow soil borings will be collected in the vicinity of the catch basin to assess whether the soil has been impacted by leaking collection piping. In addition, a shallow soil sample will be collected below the concrete floor of each elevated loading dock.

AOC 14c (Upper Level Southeast Loading Bay)

The upper level southeast loading bay was utilized to ship finished goods following their assembly and testing. Two catch basins are located in the middle of the loading bay with steel gratings. Water that is collected in the catch basins is understood to be conveyed to the stormwater collection system. The loading bay is paved throughout with the slope toward the catch basins. Based on the visual inspection, there were no indications of staining or past releases. Since there were no visual indications of past releases and since this loading was utilized exclusively for the shipping of finished goods, no further action is required for this area.

AOC 14d (Lower Level Northeast Loading Bay)

The lower level northeast loading bay was utilized to receive small items for the ITT A/CD operation and to ship finished goods from the ITT A/CD operation. Half of the loading bay has been converted for use in electronic testing with a raised computer floor. Based on the visual inspection, there were no indications of staining or past releases. Since there were no visual indications of past releases and since this loading was utilized exclusively for the receiving of small items and the shipping of finished goods, no further action is required for this area.

2.3.15 AOC 15: Laboratory/Testing Areas

Five Materials Evaluation Laboratories (MEL) are located on the upper level on the southwest side of the facility. Circuit board components are manufactured and tested in these areas. Limited quantities of chemicals are utilized in these labs. There are no records of any spills having occurred in the labs.

Therefore, no further action is required with respect to AOC 15. A visual inspection of each laboratory was conducted on May 15, 1996.

AOC 15a (Micro-Electronics Circuit Board Components)

Physical testing of manufactured components are tested by subjecting them to heat and various chemicals. All operations are considered small scale with chemicals typically stored in liter and gallon size containers. Any waste chemicals generated by the operation are transferred to the Chemical/Waste Storage Building (AOC 4) for management. Since there were no visual indications of releases having occurred within this laboratory, no further action is required for this area.

AOC 15b (Southwestern Material Evaluation Laboratory)

Physical testing of manufactured components are tested by simulating flight conditions. All operations are considered small scale with chemical use limited to Freon gas. Since there were no visual indications of releases having occurred within this laboratory, no further action is required for this area.

AOC 15c (Southeastern Material Evaluation Laboratory)

Physical testing of manufactured components are tested by subjecting them to various chemicals. All operations are considered small scale with chemicals typically stored in liter and gallon size containers. Any waste chemicals generated by the operation are transferred to the Chemical/Waste Storage Building (AOC 4) for management. Since there were no visual indications of releases having occurred within this laboratory, no further action is required for this area.

AOC 15d (Northwestern Material Evaluation Laboratory)

Physical testing of manufactured components are tested by subjecting equipment to vibration. All operations are considered small scale with chemicals limited to machine oil utilized in the vibration testing unit. Any waste oil generated by the operation are transferred to the Chemical/Waste Storage Building (AOC 4) for management. Since there were no visual indications of releases having occurred within this laboratory, no further action is required for this area.

AOC 15e (Northeastern Failure Analysis Laboratory)

Physical testing of manufactured components are tested in the RAM Testing Chamber. All operations are considered small scale with chemical use limited to Freon gas. Since there were no visual indications of releases having occurred within this laboratory, no further action is required for this area.

2.3.16 AOC 16: Detrex Process Area (Fishbowl)

A circuit board solvent wash process operates within the Clean Room of the printed circuit board assembly area on the southwest side of the lower level. The Detrex process discontinued operation in 1992. This area has housed various processes utilizing solvents. Over time, there had been anecdotal evidence of spills, the most significant of which is addressed as AOC 1. The groundwater remediation program addressed under AOC 1 will address groundwater contamination resultant from any of these spills at this location. This area is within twenty feet of the historic 1,1,1-trichloroethane spill location (AOC 1). The process is contained within a Detrex Model self contained unit. Circuit boards are fed through the unit on a conveyor system wherein the boards are sprayed with solvent and allowed to drain. Circuit boards are sealed elsewhere subsequent to the solvent washing process. The Detrex unit is situated on a raised floor system. The raised floor system is part of the Clean Room design.

Because the Detrex unit is located within a Clean Room, investigation of this area is logistically impossible. However, the area is located approximately twenty feet upgradient of AOC 1. Therefore, it will be managed as part of the investigation and source area remediation associated with AOC 1.

2.3.17 Summary of Soil Quality

Based on the laboratory analytical data for soil samples presented herein and in previous submissions to the Department as referenced herein, no further soil investigation or remedial action is required with respect to those areas of concern which have been characterized (i.e., AOC 1, AOC 2, AOC 3, AOC 5, AOC 7, AOC 10 and AOC 11). None of the parameters at each of these AOCs exceeded NJDEP's Impact to Groundwater Soil Cleanup Criteria nor did they exceed NJDEP's Residential Direct Contact Soil Cleanup Criteria. Additional characterization at AOC 4 is proposed. Further, characterization at AOC 6, AOC-8, AOC 12 and AOC 14 will be proposed. Since there is no indication of a release having occurred in AOC 9, AOC 13, and AOC 15 and since AOC 16 will be managed with AOC 1, no further action is proposed with respect to these two areas. The effects of these AOCs on groundwater have been evaluated. The groundwater investigation is summarized in the next section.

2.4 Groundwater Investigation

2.4.1 AOCs 1 and 2

In August 1986, a 1,1,1-trichloroethane (1,1,1-TCA) release occurred in ITT Building K. The spill was reported to NJDEP and one monitoring well (MW-1) was installed downgradient of the spill in January 1987. Sampling and analysis of groundwater from MW-1 indicated the presence of dissolved 1,1,1-TCA in the groundwater.

Two 4,000 gallon capacity underground storage tanks used to store gasoline were removed from the site in February of 1988 after having failed a petrotite test in 1987. Following the UST removal, additional monitoring wells were installed to monitor the effects of the 1,1,1-TCA release and potential UST release on groundwater. In April 1988, the monitoring wells were sampled and analyzed for volatile organic compounds, alcohols, and ethers. Laboratory results indicated the presence of both 1,1,1-TCA and petroleum related compounds, specifically, benzene, toluene, ethylbenzene, and xylene (BTEX) dissolved in the groundwater. The groundwater sampling events confirmed the presence of 1,1,1-TCA and BTEX as separate groundwater plumes traveling adjacent to each other in the northeast portion of the ITT facility. Light non-aqueous phase liquid (LNAPL) was also discovered in MW-3. Subsequently, in December 1989, one 4,000-gallon gasoline UST and one 1,000-gallon diesel UST were removed after the diesel tank failed a petrotite test.

NJPDES-DGW permit No. NJ0076023 was issued on May 1, 1990. The permit required delineation of the groundwater plumes to a concentration of 1 ppm, the installation of seven additional shallow and deep monitoring wells, and hydraulic control of the plume where concentrations exceeded 5 ppm. The wells were installed in July 1990. A quarterly groundwater monitoring program, inclusive of the existing seventeen wells installed to date, was initiated as required by the permit. These wells included shallow on-site wells (MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-8, MW-9, MW-10, MW-11, MW-12), an on-site deep well (MW-1A), and two shallow and deep off-site well couplets (MW-13/13A, MW-14/14A). A tabulation of the laboratory data is provided as Tables 2-12 and 2-13. As demonstrated by the data, the NJPDES permit conditions with respect to delineation were satisfied. Further, the extent of the LNAPL plume was determined to be limited to the vicinity of monitoring wells MW-3 and MW-15. Monitoring conducted in August 1990, November 1990 and February 1991 (after the installation of one additional shallow well MW-16 and deep well MW-17A requested by the Department) demonstrated that LNAPL was located within a 100 foot radius of MW-3 and MW-15. No other on-site or off-site monitoring wells contained LNAPL. The LNAPL, composed of petroleum products, was determined at that time to be less than 6 inches in thickness in monitoring well MW-15 and less than 0.4 inches in thickness in monitoring well MW-3.

Formal design of a groundwater pump and treat system to address the LNAPL and dissolved halogenated and non-halogenated plumes was initiated in early 1990. Two groundwater extraction wells were installed in the vicinity of MW-1 and MW-10 to a depth of 40 feet below grade. Leaching pools were installed upgradient of MW-2, but within the zone of capture of the recovery wells, for the purpose of recharging treated groundwater. MW-3 and MW-15 were constructed with stainless steel screens when installed in anticipation of including them in the groundwater treatment system to recover LNAPL and dissolved BTEX compounds.

Following submission of H2M's March 1991 Engineering Report for the Groundwater Treatment Facilities, treatment works approval was granted by NJDEP in June 1991 for a groundwater pump and treat system which utilized a counter-current packed bed air stripping tower and vapor-phase granular activated carbon (GAC) for contaminant removal. LNAPL removal was accomplished via depression pumps and skimmer pumps placed in MW-3 and MW-15, which extracted water from the bottom of the monitoring wells to a gravity differential separator prior to the air stripper, and extracted LNAPL directly to a storage tank. Construction of the system was completed in the summer of 1992 with the system becoming fully operational in September of 1992.

NJDEP set a performance based standard for the treatment system with monitoring well MW-2, which is immediately downgradient of the groundwater recharge area, as the compliance point. The performance based standard established that the average total volatile organic compound concentration in MW-2 be less than or equal to 100 ppb for any consecutive four quarters with no one quarter greater than 250 ppb. ITT's NJPDES-Discharge to Groundwater (DGW) permit No. NJ0076023 was modified and re-issued on April 23, 1992 to reflect changes in the monitoring program and to outline the performance-based standards for operation of the treatment system. During 1995, discussions and correspondence with the NJDEP resulted in a major modification to the NJPDES-DGW Permit. The final major modification was issued on August 1, 1995 with an expiration date of August 1, 1998. The major modification transferred all groundwater monitoring requirements to the Memorandum of Agreement (MOA) dated March 30, 1993 and outlined the compliance monitoring requirements presented in NJDEP's correspondence to ITT dated November 29, 1994. The NJPDES-DGW Permit addresses the required quality of treated groundwater discharged to the onsite leaching pools pursuant to NJDEP's Anti-degradation Policy. ITT has been well within the compliance limitations of the original and current NJPDES permit.

Performance monitoring of the treatment system has been conducted on a routine basis, as required by the air permit. Influent and effluent samples have been collected on a quarterly basis from sampling ports on the groundwater treatment system since it became operational in September 1992. Based on these influent samples, the average VOC concentration to the tower has been calculated to be approximately 2.5 ppm. VOC concentrations in all but two rounds of discharged water have been below the laboratory method detection limit of 5 ppb. For two rounds of effluent monitoring, the effluent was quantified with a 1,1,1-TCA concentration of 5 ppb. The calculated removal efficiency for the treatment system has averaged greater than 99.8%. Groundwater monitoring and performance monitoring data have been submitted to the Department on a regular basis in accordance with the schedule defined in the NJPDES permit and the MOA.

Prior to commencement of system operation in September 1992, four monitoring wells (MW-1, MW-4, MW-10, and MW-11) contained average concentrations of total volatile organic compounds (VOCs) in excess of 1,000 ppb. Since system start-up, a dramatic decrease in VOC concentrations has been observed in nearly all monitoring wells, with exception of monitoring well MW-11. A summary of the total volatile organic compound concentrations in all monitoring wells since the groundwater investigation began (April 1988 through November 1995) is presented in Table 2-14. Contour maps of the most recent two years of total VOC concentrations in the shallow and deep aquifers are presented in Figures 2-21 through 2-28. ITT has remained in compliance with all performance monitoring, compliance monitoring, hydraulic control, and contaminant delineation requirements of the MOA and the NJPDES permit.

In an effort to expedite and optimize capture of the 1,1,1-TCA, additional investigation in the immediate vicinity of the 1,1,1-TCA release area was conducted. One groundwater monitoring well (MW-18) was installed in September 1993 inside of the building approximately 55 feet downgradient from the suspected source area, and upgradient of the groundwater extraction wells. This location is within the zone of capture of the extraction wells. Due to restricted access within the building, the well was installed via air rotary drilling methods utilizing a customized mobile rig. MW-18 was sampled for analysis of volatile organic compounds approximately three weeks following installation. Results from this initial round of monitoring indicated that the total concentration of VOCs in MW-18 was 101,152 ppb, higher than at the locations further downgradient of the source area, as expected. The primary compounds detected were 1,1,1-TCA (72,000 ppb), 1,1-dichloroethene (20,000 ppb), and 1,2-dichloroethane (8,100 ppb). Two subsequent rounds of groundwater sampling conducted in November 1993 and March 1994 indicated a significant reduction in concentration at MW-18. Total VOCs were quantified at concentrations of approximately 33,000 ppb in November 1993 (a 67% reduction), and approximately 10,000 ppb in March 1994 (a 70% reduction since November). The drilling and removal of silt within existing fractures via installation and development of this well, coupled with purging associated with the three sampling events, is most likely facilitating the rapid decrease in concentration observed at this location.

The vast majority of the groundwater plume has been reduced to a narrow concentrated area in the vicinity of recovery wells RW-1 & RW-2, MW-11, and MW-18. This remaining area is targeted for more aggressive remediation.

A pilot study for source area remediation was conducted in October 1995 in accordance with the Permit-by-Rule issued by the NJDEP on September 6, 1995. In-situ chemical oxidation was selected for source area remediation based on the well defined location at which the original release occurred, the success of the reaction based on bench scale treatability testing and the logistical constraints imposed by the building and ongoing site operations. The in-situ process involved the injection of process chemistry into the aquifer through MW-18. A total of 2,825 pounds of process chemistry consisting of potable water, acetic acid, ferrous sulfate heptahydrate and hydrogen peroxide was injected into the well. Baseline groundwater quality was established prior to injection in MW-1, MW-2, MW-4, MW-5, MW-6, MW-10, MW-11, MW-12, MW-18, RW-1 and RW-2. Groundwater was subsequently monitored seven days, fifteen days and twenty two days following completion of the injection. At MW-18, the location of injection, groundwater concentrations were found to decrease from a pre-injection concentration of 93,082 ppb total VOC to 1,744 ppb, 3,193 ppb and 2,171 ppb total VOC. A fourth sample was collected from MW-18 on February 6, 1996 (85 days following completion of injection) with total VOC concentrations quantified at 3,412 ppb. A reduction in concentration was also observed in the downgradient well MW-11 with a pre-injection total VOC concentration of 34,615 ppb and a post-injection total VOC concentration of 4,848 ppb. The results of the pilot study were submitted to NJDEP on February 15, 1996 in a report entitled "Summary Report, Pilot Treatability Study - In-Situ Chemical Oxidation, ITT Avionics Division, Clifton, New Jersey".

2.4.2 AOC 3

To assess the effect that the six former UST systems (AOC-3) may have had on groundwater quality, three monitoring wells (MW-203, MW-204 and MW-205) were installed on the northern side of the boiler house. Figure 2-29 identifies the location of these monitoring wells. Based on water levels measured within these monitoring wells, groundwater in this area flows generally north, as demonstrated in Figure 2-30. Two rounds of monitoring were performed at these wells in May of 1991 with a third round performed in September 1995. Semi-volatile organic compounds were analyzed for but not detected in both initial rounds. Volatile organic compounds not associated with petroleum storage were detected in the groundwater samples at each of the three wells. These results are provided in Table 2-15. Chloroform was found in all three rounds, at concentrations ranging from 4 ppb to 20 ppb, with several results above the NJDEP specific groundwater criteria of 6 ppb. Trichloroethene, not found in MW-204 (the upgradient well), was found in MW-203 and MW-205 at concentrations ranging from 5 ppb to 18 ppb, above the NJDEP specific groundwater criteria of 1 ppb. Based on the September 1995 round of groundwater sampling as compared to the May 1991 rounds of groundwater sampling, a decreasing trend in dissolved contaminant concentrations have been observed. Chloroform concentrations have decreased 50% in MW-203 and 70% in MW-205. Chloroform is below the Specific Groundwater Quality Criteria in MW-205. Trichloroethene concentrations have decreased 58% in MW-203 and 72% in MW-205. If a linear relationship of concentration over time is utilized, chloroform can be projected to naturally reach its Specific Groundwater Quality Criteria of 6 ppb in MW-203 by early 1997. Similarly, trichloroethene can be projected to naturally reach its specific Groundwater Quality Criteria of 1 ppb in MW-203 by mid-1998 and in MW-205 by early 1997.

Since a dissolved concentration of chloroform was quantified at 10 ppb, above its Specific Groundwater Quality Criteria of 6 ppb, in MW-203 and, since dissolved concentrations of trichloroethene were quantified at 6 ppb in MW-203 and at 5 ppb in MW-205, above its Specific Groundwater Quality Criteria of 1 ppb, groundwater in this area remains a concern.

2.4.3 AOC 4

Two (2) soil borings were constructed and completed as monitoring wells (MW-APC1-A and MW-APC1-B) in the vicinity of the chemical/waste storage building (AOC-4). One monitoring well was installed to the north of the waste storage building as a downgradient well (MW-APC1-A). The other monitoring well was installed to the south of the building as the upgradient well (MW-APC1-B). Figure 2-17 identifies the location of these wells. One round of samples were collected on December 4, 1992 and analyzed for VOCs, semi-volatile organic compounds, dissolved priority pollutant metals, and pH. One VOC was quantified above the NJDEP Groundwater Quality Criteria in the downgradient well (1,1,1-TCA, at a concentration of 31 ppb). VOCs were also quantified in the upgradient well above their respective Groundwater Quality Criteria (chloroform at 77 ppb, trichloroethene at 36 ppb, total 1,2-dichloroethene at 11 ppb, and carbon tetrachloride at 78 ppb). There were no semi-volatile organic compounds or dissolved metals present at concentrations above their respective PQL in either well. Two subsequent rounds of groundwater monitoring were conducted in September and December of 1995. This data is summarized in Table 2-16. In both rounds, concentrations in the upgradient well were either not quantified above their respective PQL or were quantified below their respective Specific Groundwater Quality Criteria. An increase in concentration was observed in the downgradient well during the September 1995 round with a significant decrease observed in the December 1995 round for most contaminants. Based on the December 1995 round of monitoring, chloroform, carbon tetrachloride and trichloroethene remain above their respective Specific Groundwater Quality Criteria.

Since dissolved concentration of chloroform, carbon tetrachloride and trichloroethene were quantified at 94 ppb, 27 ppb, and 55 ppb, above their Specific Groundwater Quality Criteria of 6 ppb, 2 ppb and 1 ppb, groundwater in this area remains a concern.

2.5 Remedial Investigation Conclusions

2.5.1 Soil

No further soil investigation is necessary in the areas of concern where previous studies have concluded that soil quality is in compliance with NJDEP's Residential Direct Contact Soil Cleanup Criteria as well as NJDEP's Impact to Groundwater Criteria. The remaining areas to be investigated are AOC 4 (chemical/waste storage building), AOC 6 (industrial wastewater pretreatment system area), AOC 8 (the area without vegetation), AOC 12 (building transformers), and AOC 14 (shipping and receiving bays).

Sampling will be performed where no previous study has been conducted. The sampling will follow the protocols described in N.J.A.C. 7:26E.

2.5.2 Groundwater

Groundwater affected by the former UST and 1,1,1-TCA releases in the northeastern portion of the facility (AOCs 1 and 2) is currently undergoing remediation. Active remediation, which commenced in September 1992, is being conducted in accordance with an MOA and a NJPDES DGW permit. ITT has remained in compliance with all performance monitoring, compliance monitoring, hydraulic control, and delineation requirements of the MOA and NJPDES permit. While the groundwater extraction, treatment and recharge system has been effective in concentrating the plume and removing contaminants from groundwater, and although not required, a more aggressive source area remediation program has been undertaken by ITT. The pilot treatability study for source area remediation utilizing in-situ chemical oxidation yielded the following conclusions:

1. Utilizing the quantity estimated by the remedial contractor to represent the volume of water contacted by the process chemistry (219,875 gallons), the reduction in concentration of 1,1,1-TCA and 1,1-DCE observed is equivalent to the oxidation of approximately 167 pounds of pure solvent. The reduction in MW-11, using an equivalent volume of groundwater is approximately 53 pounds of pure solvent.

2. The pilot treatability study demonstrated that the chemistry is successful in reducing the concentrations of dissolved 1,1,1-TCA and 1,1-DCE. Positive effects were observed in MW-18 and the downgradient well MW-11.

Based on the results of the pilot treatability test conducted at MW-18, a continued longer term treatability study for source area remediation is proposed utilizing newly installed injection wells. This program is described in Section 3.3.2. This approach will focus on reducing dissolved concentrations in the vicinity of RW-1, RW-2, RW-3, MW-11 and MW-18 with the ultimate objective of terminating the operation of the existing groundwater extraction, treatment and recharge system. Natural remediation will be pursued for that portion of the dissolved plume outside of the hydraulic control of the groundwater extraction system.

Groundwater in the vicinity of the boiler house (AOC 3), when sampled twice in 1991, contained chloroform and trichloroethene at concentrations slightly above groundwater quality criteria. When sampled again in 1995, a significant reduction in dissolved concentrations were observed. A linear relationship of concentration versus time projects compliance with Specific Groundwater Quality Criteria by mid-1998. Natural remediation will be pursued for this area.

Groundwater in the vicinity of the chemical/waste storage area (AOC 4), when sampled once in 1992, contained chloroform, 1,1-dichloroethene, 1,1-dichloroethane, total 1,2-dichloroethene, carbon tetrachloride, and trichloroethene at concentrations above groundwater quality criteria. Subsequent rounds of sampling conducted in September and December of 1995 indicated a significant reduction in concentration within the upgradient monitoring well such that all contaminants were below their Specific Groundwater Quality Criteria. However, the downgradient monitoring well experienced an increase followed by a decrease in concentrations. Chloroform, carbon tetrachloride and trichloroethene remain above their Specific Groundwater Quality Criteria. Soil sampling will be performed at locations adjacent to the building access doors together with an assessment of AOC 14a (Main Building Lower Level Northwest Loading Bay). In addition, two additional rounds of sampling will be conducted at this location for evaluating water quality to assess the necessity of further action in this area.

3.0 Remedial Alternatives Evaluation

3.1 Proposed Additional Sampling

3.1.1 Soil

No soil sampling is warranted at AOC 1 (1,1,1-trichloroethane release), AOC 2 (former gasoline and diesel USTs), AOC 3 (former No. 2 and No. 4 fuel oil USTs), AOC 4 (chemical/waste storage building), AOC 5 (former gardener's shed), and AOC 7 (electrical substation) since concentrations of the parameters for which samples were analyzed were below their respective NJDEP Residential Direct Contact Soil Cleanup Criteria and NJDEP Impact to Groundwater Soil Cleanup Criteria. Additional sampling is, however, proposed for AOC 4 (chemical/waste storage building) to preclude the possibility that a source of groundwater contamination exists.

An assessment of the quality of concrete floors, walls and ceiling tiles was performed in AOC 10 (chemical storage room) and AOC 11 (former metal finishing and electroplating process area). The results of that assessment indicated that the floors, walls and ceiling were not impacted by former process operations. Therefore, no further action is required for these areas.

An evaluation of the quality of concrete floors and/or underlying soils has not been undertaken at AOC 6 (industrial wastewater pretreatment system), AOC 8 (area without vegetation), AOC 9 (1,1,1-trichloroethane still), AOC 12 (building transformers), AOC 13 (machine shop), AOC 14 (shipping and receiving bays), AOC 15 (laboratory/testing areas), and AOC 16 (Detrex process area). However, some of these AOCs do not warrant additional investigation based on a visual inspection of each area and an evaluation of the operations conducted within each area. The remaining AOCs (i.e., AOC 4, AOC 6, AOC 8, AOC 12 and AOC 14) will undergo soil sampling and analysis to evaluate the quality of the soil relative to the NJDEP Residential Direct Contact Soil Cleanup Criteria and NJDEP Impact to Groundwater Soil Cleanup Criteria. A brief summary of the status of each AOC with respect to the need for sampling and analysis is presented as follows:

AOC 1: 1,1,1-Trichloroethane Release

Soils in the vicinity of the historic 1,1,1-TCA release have been investigated to the extent practicable. No further action is warranted for soils in this area, based on the results of the source area investigation performed, which indicated that volatile organic compounds are not present in overburden soils at levels above NJDEP's Residential Direct Contact Soil Cleanup Criteria and NJDEP's Impact to Groundwater Criteria.

AOC 2: Former Gasoline and Diesel USTs

Soils in the vicinity of the former gasoline and diesel USTs have been thoroughly investigated and remediated to the extent practicable. No further action is warranted for soils in this area, based on the results of post-remediation sampling, which indicated that volatile organic compounds are not present in the unsaturated soils at levels above NJDEP's Residential Direct Contact Soil Cleanup Criteria and NJDEP's Impact to Groundwater Criteria.

AOC 3: Former No. 2 and No. 4 Fuel Oil USTs

Soils in the vicinity of the former No. 2 and No. 4 fuel oil USTs have been thoroughly investigated and remediated to the extent practicable. No further action is warranted for soils in this area, based on the results of post-remediation sampling, which indicated that volatile organic compounds are not present in the unsaturated soils at levels above NJDEP's Residential Direct Contact Soil Cleanup Criteria and NJDEP's Impact to Groundwater Criteria.

AOC 4: Chemical/Waste Storage Building

Two (2) soil borings were constructed and completed as monitoring wells with three (3) soil samples collected from each borehole. Samples were analyzed for metals, VOCs, semi-volatile organic compounds, and pH. Concentrations of all parameters throughout the soil column were below the NJDEP's Impact to Groundwater and Residential Direct Contact Soil Cleanup Criteria in all six samples. While this implies that no further action is required for soils in this area, based on the groundwater quality results, two additional samples will be collected to ensure that operations conducted within the building have not impacted soil and groundwater quality. One shallow soil sample will be collected from immediately outside the building adjacent to the loading dock on the south side of the building. The other sample will be collected from outside the access door on the north side of the building. While there are no records of spills having occurred within the building, these samples will provide a greater level of assurance that a spill did not occur and become released through the doors. The shallow soil samples will be analyzed for VOCs. Groundwater quality is addressed in Section 2.4.

AOC 5: Former Gardener's Shed

Since concentrations in soil were not detected above NJDEP's Impact to Groundwater and Residential Direct Contact Soil Cleanup Criteria and since VOCs were not detected above their respective practical quantitation limit (PQL) in groundwater, no further action is required with respect to this area.

AOC 6: Industrial Wastewater Pretreatment System

Surface sampling will be conducted of the asphaltic concrete floor in accordance with the Technical Requirements for Site Remediation (N.J.A.C. 7:26E). Asphaltic concrete core samples will be collected for laboratory analysis. One sample per nine hundred square feet of floor space will be collected from the sub-basement. The asphaltic concrete core will be analyzed for heavy metals.

AOC 7: Electrical Substation

Three (3) shallow soil borings were advanced around the electrical substation with soil samples collected at a depth of 0.5' to 1.0' below grade. These soil samples were composited and analyzed for TPHC and PCBs. Although TPHC was detected at a concentration of 120 mg/kg, it is below the NJDEP action level of 1,000 mg/kg. PCB concentrations were not detected. Based on the absence of PCBs and the low concentration of TPHC, no further action is required with respect to this area.

AOC 8: Area Without Vegetation

An area without vegetation, approximately 20 feet by 20 feet in size, identified by an NJDEP representative during a recent site visit, is present adjacent to (outside) the fence at the northeast corner of the property, near MW-9. Surface soil sampling was recommended by the NJDEP representative to characterize this area. Two shallow soil samples (0"-6") will be collected and analyzed for TPHC and priority pollutant metals in accordance with N.J.A.C. 7:26E.

AOC 9: 1,1,1-Trichloroethane Still

Since there is no record of any releases having occurred at the still and since the floor is underlain by concrete with protective coatings and a berm, no further action is required with respect to AOC 9.

AOC 10: Chemical Storage Room

Since there is no indication that any chemical release occurred within the chemical storage room and since the quality of the concrete floor has been assessed through extensive sampling and analysis, no further action is required with respect to AOC 10.

AOC 11: Former Metal Finishing and Electroplating Process Area

Following closure of the former metal finishing and electroplating process area, concrete floors exhibiting deterioration were scarified and cleaned. Subsequent sampling indicated that concentrations of metals, cyanide and sulfide were below their respective RCRA standards with most concentrations below their detection limit. The former troughs have since been filled with concrete. Since there is no indication that any chemical penetrated the concrete floors and since the quality of the concrete floor has been assessed through extensive sampling and analysis, no further action is required with respect to AOC 11.

AOC 12: Building Transformers

Oil filled electrical transformers and switches are located throughout the facility. Since 1985, ITT has undertaken an extensive assessment of all potential PCB containing electrical equipment including the sampling and analysis of oil within the units. A visual inspection of each transformer and switchgear was conducted on May 15, 1996. Each location was inspected to identify any visual indication of leaking or stains. During the inspection, three locations were identified as having stains adjacent to transformers, namely: Area T-2 [ITT Inventory Map # 4, 5, 6 and 7]; Area T-3 [ITT Inventory Map # 8]; and, Transformer 12-H [ITT Inventory Map # 40]. One concrete chip sample will be collected from Area T-2 and Area T-3. Two concrete chip samples will be collected from the vicinity of Transformer 12-H. The concrete samples will be analyzed for TPHC and PCBs.

AOC 13: Machine Shop

Since their is no record of any releases having occurred within the machine shop and since the floor is underlain by concrete without floor drains, no further action is required with respect to AOC 13.

AOC 14: Shipping/Receiving Bays

AOC 14a: Lower Level Northwest Loading Bay

The lower level northwest loading bay is the main receiving location for all materials utilized at the facility. Two catch basins are located in the loading bay. While there are no records of any spills having occurred and there was no visual indication of historic releases observed during the inspection, soil sampling will be performed to assess its potential as a source of groundwater contamination downgradient of this location (i.e., AOC 4). If sediment is found to exist within the catch basins, samples will be collected for analysis. Further, two shallow soil borings will be collected in the vicinity of the catch basin to assess whether soil has been impacted by leaking collection piping. Each sample will be analyzed for VOCs.

AOC 14b: Upper Level West Loading Bay

The upper level west loading bay was utilized intermittently for shipping and receiving as well for temporary storage of finished materials. A catch basin appears to be located in the middle of the loading bay, however, it was obscured due to the presence of a tar-like substance on the paved surface. Similar to AOC 14a, soil sampling will be performed to assess its potential as a source of groundwater contamination downgradient of this location (i.e., AOC 4). If sediment is found to exist within the catch basin, a sample will be collected for analysis. Further, two shallow soil borings will be collected in the vicinity of the catch basin to assess whether soil has been impacted by leaking collection piping. Each sample will be analyzed for VOCs.

AOC 14c: Upper Level Southeast Loading Bay

The upper level southeast loading bay was utilized to ship finished goods flowing their assembly and testing. Two catch basins are located in the middle of the loading bay with steel gratings. Based on the visual inspection, there were no indications of staining or past releases. Since there were no visual indications of past releases and since this loading was utilized exclusively for the shipping of finished goods, no further action is required for this area.

AOC 14d: Lower Level Northeast Loading Bay

The lower level northeast loading bay was utilized to receive small items for the ITT A/CD operation and to ship finished goods from the ITT A/CD operation. Half of the loading bay has been converted for use in electronic testing with a raised computer floor. Based on the visual inspection, there were no indications of staining or past releases. Since there were no visual indications of past releases and since this loading was utilized exclusively for the receiving of small items and the shipping of finished goods, no further action is required for this area.

AOC 15: Laboratory/Testing Areas

Five Materials Evaluation Laboratories (MEL) are located on the upper level on the southwest side of the facility. Circuit board components are manufactured and tested in these areas. There are no records of any spills having occurred in the labs, nor was there any evidence of releases having occurred during the May 15, 1996 inspection of each laboratory. All operations are considered small scale with limited chemical usage. Since there were no visual indications of releases having occurred within this laboratory, no further action is required for this area.

AOC 16: Detrex Process Area (Fishbowl)

Because the Detrex Process Area is located within a Clean Room, investigation of this area is logistically impossible. However, the area is located approximately twenty feet upgradient of AOC 1. This area has housed various processes utilizing solvents. Over time, there had been anecdotal evidence of spills, the most significant of which is addressed as AOC 1. Any other spill would be remedied under the management of AOC 1. Therefore, it will be managed as part of the investigation and source area remediation associated with AOC 1.

3.1.2 Groundwater

Groundwater quality relative to the 1,1,1-TCA and UST releases (AOC 1 and AOC 2) has been well defined and characterized in accordance with the MOA and NJPDES permit since the investigation began in 1987. Groundwater quality is currently being monitored on a quarterly basis under the facility's MOA and NJPDES permit. No additional groundwater monitoring is proposed beyond what is currently being conducted in compliance with the MOA and NJPDES. A successful pilot treatability study was performed in October 1995 which resulted in reduction of VOC concentrations in MW-18 and MW-11.

Groundwater in the vicinity of the boiler house (AOC-3) contained chloroform and trichloroethene at concentrations slightly above groundwater quality criteria. Natural remediation is proposed for the remaining concentrations. Two rounds of groundwater monitoring will be conducted in to support the natural remediation proposal. Analysis will be for volatile organic compounds (USEPA Method 624 additionally calibrated for xylenes) since all other parameters analyzed for in the initial sampling rounds were below NJDEP groundwater quality criteria.

Groundwater in the vicinity of the chemical/waste storage area (AOC 4) contained chloroform, 1,1-dichloroethene, 1,1-dichloroethane, total 1,2-dichloroethene, carbon tetrachloride, and trichloroethene at concentrations slightly above groundwater quality criteria. Reductions in concentration were evident during the 1995 sampling rounds as compared to the 1992 round. Based on these reductions, natural remediation may be proposed for the remaining concentrations. Soil sampling will be performed at the location of the access doors to the building as well as AOC 14a which is upgradient of the chemical/waste storage building. Further, two rounds of groundwater monitoring will be conducted to assess the trend of natural reductions in concentrations. Analysis will be for volatile organic compounds (USEPA Method 624 additionally calibrated for xylenes) since all other parameters analyzed for in the initial sampling rounds were below NJDEP groundwater quality criteria.

3.2 Identification of Applicable Remediation Standards

The NJDEP has statewide groundwater quality standards that are based on the NJDEP's Specific Groundwater Quality Criteria (N.J.A.C. 7:9-6) for volatile organic compounds.

3.3 Classification Exception Area

If classification exemption area (CEA) is required to be established as part of an approved remedy (i.e. active treatment, passive treatment, or no further action), an application will be developed in accordance with N.J.A.C. 7:9 and N.J.A.C. 7:26E.

The CEA essentially serves as a public notification document that groundwater quality standards for a certain aquifer will not be met and certain groundwater uses within this area are restricted or require special installation and construction requirements.

As a prerequisite to applying for a CEA, contaminant delineation and fate of the contaminant plume must be established in accordance with N.J.A.C. 7:26E, Technical Requirements for Site Remediation. This may be accomplished by:

1. collection of sample data indicating contamination is below remediation standards,

2. a demonstration that contaminant levels will not exceed New Jersey Groundwater Quality Criteria beyond the proposed boundaries of the CEA, and

3. a demonstration that contaminant levels will achieve New Jersey Groundwater Quality Criteria within the timeframe proposed by the CEA.

After delineating the contaminant plume and determining the area for which the CEA will apply, notifications will be made to the local municipal authorities, health agencies, and if required, individual property owners, that groundwater standards have been contravened within the CEA. The present and future groundwater use for that area will dictate the level of notification required.

3.4 Remedial Alternative Evaluation

3.4.1 Groundwater Extraction, Treatment and Recharge

The existing treatment facility's function is to process the extracted groundwater, provide for the removal of settleable and suspended solids, remove volatile organic compounds from the contaminated groundwater to specified levels, and recharge the treated water. The design of the groundwater treatment facility is based on data developed and presented within the report entitled, "Engineering Report, Groundwater Treatment Facilities, ITT Avionics Division, Clifton, New Jersey, NJPDES-DGW Permit No. NJ0076023", dated March 1991 and submitted to the NJDEP for Treatment Works Approval. The treatment system began operation on September 24, 1992. Since then, the treatment system has operated continuously at a total groundwater extraction rate of approximately ten (10) gpm. This extraction rate is based on the ability of the system to provide hydraulic control of the delineated plume of dissolved volatile organic compounds. To date, the treatment plant has treated and recharged approximately sixteen million gallons of groundwater. ITT has remained in compliance with all performance monitoring, compliance monitoring, hydraulic control, and delineation requirements of the MOA and NJPDES permit.

3.4.2 Source Area Remediation

A more aggressive remediation of the area of concentrated groundwater impact in the vicinity of RW-1, RW-2, MW-11 and MW-18 is proposed. The source area remedial technology is considered innovative and involves in-situ chemical oxidation.

3.4.2.1 Technology

The innovative technology, referred to in the patent as the CleanOX process, essentially entails the injection of a hydrogen peroxide based solution into one or more monitoring wells. The basic transformation reaction is known as the Fenton reaction which results in the generation of hydroxyl radicals. These radicals are strong oxidizers which react with organic compounds. A simplified representation of the reaction can be described as the addition of hydrogen peroxide (H_2O_2) in a groundwater medium (H_2O) making contact with dissolved hydrocarbons (HC) to produce steam and carbon dioxide (CO_2). The reaction can be simply expressed as:

$$H_2O_2 + 2HC + H_2O \xrightarrow{\text{inhibitor/initiator/enhancer/catalyst}} 3H_2O + CO_2$$

This chemical equation represents the CleanOX process in the simplest of forms. In practice, substituted hydrocarbons will also undergo oxidation, with the halide being released as a free radical. In addition, organic compounds adsorbed onto or occluded in the saturated soils are also subject to oxidation. To facilitate an increased reaction yield, additional chemistry is applied on a case by case basis. The additional chemistry is intended to more fully initiate the reaction, increase the rate of reaction, and bring the reaction closer to completion. The additional chemistry is also used to address conditions where the groundwater chemistry contributes scavenger compounds that compete with the desired reaction.

To increase the rate of reaction, hydrogen peroxide is transformed into hydroxyl radicals utilizing chemical additives (e.g., ferrous sulfate heptahydrate) according to Fenton's Reaction:

$$Fe^{+2} + H_2O_2 \longrightarrow Fe^{+3} + OH^- + \bullet OH$$

The hydroxyl radical (i.e., denoted as $\bullet OH$) reacts typically a million to a billion times faster than other simple oxidants, resulting in greatly reduced treatment costs.

During application, the process undergoes an exothermic reaction within the aquifer resulting in a volume expansion and the generation of energy and carbon dioxide within the aquifer. Across the site where the reaction takes place, the energy that is generated is absorbed by the groundwater resulting in a slight increase in the groundwater temperature. The exothermic nature of the reaction and the high heat capacity of water necessitates that the process solution be injected below the groundwater table. The volume expansion and exothermic nature of the reaction results in a pressure front surrounding the injection points. This induced pressure assists in the migration of the process chemistry to the site(s) of dissolved contaminants. On contact with the process chemistry, the chlorinated organic contaminants are oxidized, resulting in carbon dioxide, water and free chloride radicals.

3.4.2.2 Remedial Approach

Bench Scale Treatability Testing

Based on the delineation and assessment of the types and nature of dissolved contaminants identified onsite, laboratory bench scale treatability testing was performed. The results of bench scale treatability testing demonstrated that the process is effective in reducing dissolved concentrations of VOCs. Further, the technology vendor has had successful experiences in applying the process chemistry on sites that were contaminated with similar dissolved compounds.

Pilot Scale Treatability Phase

Phase I Pilot Study

A pilot treatability study was performed by CleanOX Environmental Services, Inc.. The pilot study was conducted in accordance with a Permit by Rule Authorization granted by NJDEP on September 6, 1995. The pilot study was conducted at monitoring well MW-18. During the pilot treatability study, the groundwater extraction, treatment and recharge system remained operating to maintain hydraulic control of the dissolved contaminant plume.

The pilot treatability study commenced on October 27, 1995 and was completed on November 13, 1995. The in-situ chemical oxidation process involved the injection of process chemistry into the aquifer through MW-18. Injection into MW-18 was much slower than anticipated during the pilot design phase. The hydraulic conductivity of the screened zone was estimated by the remedial contractor to be 100 times lower than the hydraulic conductivity of the formation estimated by H2M during previous aquifer tests at other monitoring well locations. A total of 2,825 pounds of process chemistry, consisting of potable water, acetic acid, ferrous sulfate heptahydrate, and hydrogen peroxide, was injected into the well. The injected quantity of hydrogen peroxide was 145 pounds less than that of the original pilot treatability design, due to the low injection rate.

At the injection location, MW-18, the concentration of 1,1-DCE decreased from a pre-injection concentration of 14,000 ppb to an average of 710 ppb, a reduction of 95 percent following the in-situ chemical oxidation reaction. The concentration of 1,1,1-TCA in MW-18 decreased from 79,000 ppb to an average of 1,300 ppb, a reduction of 98 percent. Low concentrations of 1,2-dichloroethane, 1,1-dichloroethane, and trichloroethane quantified before injection also exhibited reductions after injection.

The NJPDES-required quarterly monitoring data demonstrated that a reduction in contaminant concentration also occurred in MW-11. When compared to the pre-injection water quality data obtained on October 27, 1995, the concentrations of 1,1,1-TCA and 1,1-DCE were reduced by 85 percent and 98 percent, respectively, to the lowest concentrations quantified at this location since August 1990.

The initial pilot treatability study demonstrated that the chemistry is successful in reducing the concentrations of dissolved 1,1,1-TCA and 1,1-DCE at the ITT facility. Positive effects were observed in MW-18 and nearby MW-11.

Phase II Pilot Study

Based on the results of the initial pilot study, a continued long term treatability study will be performed in accordance with the permit-by-rule agreed to by the NJDEP. The Permit-by-Rule will go into effect on commencement of injection.

The goal of the phase II pilot study is to aggressively affect the source of groundwater contamination so that over time, the concentrations in the plume will decrease naturally. Because the source area is located within fractured bedrock, a definitive evaluation of the radial effects of the in-situ chemical oxidation process within the aquifer is not possible. However, it is appropriate that additional injection points are necessary to distribute the process chemistry within the fracture network where source material may be present. Based on technology vendor's modeling efforts and our evaluation of the source area, eight (8) injection points will be installed to supplement the MW-18 injection point. These additional injection points will be located throughout the general vicinity of the historic release location. The injection process will consist of several cycles of injection over approximately eight weeks to maximize contact between process chemistry and the source of contaminants. This phase has not been designed to fully remediate the plume of groundwater contamination. Rather, it is intended to aggressively reduce the source area.

The groundwater extraction, treatment and recharge system will again remain operating during the pilot study. Pre-injection and post-injection monitoring will be performed for the purpose of evaluating the degree of oxidation. The monitoring program will be similar to the one conducted during the initial pilot work, but will be expanded to reflect the greater area of intended impact and a longer duration of effect. Based on the permit-by-rule authorization, pre-injection and post-injection monitoring will include monitoring wells MW-3, MW-5, MW-6, MW-9, MW-11, MW-18 and the eight (8) new injection points. In addition, Recovery Wells RW-1, RW-2 and RW-3 may also be monitored periodically for field parameters. This will result in a maximum of seventeen (17) monitoring locations.

One week following commencement of injection, the first round of monitoring will be conducted. Seven weeks and sixteen weeks after injection is initiated, the second and third rounds of monitoring will be conducted. This phase of the pilot has been designed to satisfy the requirements of the Permit-by-Rule as well as establish data with which to evaluate the performance of the remedial activities. Each sample will be analyzed for volatile organic compounds by USEPA method 624 plus identification of the fifteen highest non-targeted peaks. Additional parameters will also be monitored in the field (e.g., pH, conductivity, dissolved oxygen, temperature).

4.0 Remedial Action Requirements Summary

The data presented within this report addressed: the local hydrogeologic conditions and characteristics, soil conditions, the extent of groundwater contamination, and the basis for the design of groundwater remediation systems

An application to establish a Classification Exception Area (CEA) will be developed to address those areas where groundwater concentrations of dissolved contaminants exceed NJDEP's groundwater quality criteria. This will form the basis of establishing the natural remediation program for selected groundwater associated with selected AOCs.

Five monitoring wells in the northwestern part of the facility will be resampled for comparison with previous results obtained in 1991 and 1992, where concentrations of halogenated volatile organic compounds above the groundwater quality criteria were previously detected. A Phase II Pilot Treatability Study will be conducted in the vicinity of the past 1,1,1-trichloroethane spill. This will involve the installation of eight injection wells, the performance of a baseline groundwater monitoring event and three post-injection groundwater monitoring events.

The existing groundwater remediation program is effective in providing short term and long term protection to the public and the environment. The groundwater extraction wells are preventing further migration of the contaminant plume from the site, and are capturing contaminated groundwater for treatment. The treatment technology is effective in removing low levels of halogenated and non-halogenated volatile organic compounds from groundwater at this site. A decrease has been observed in average volatile organic compound concentrations since start-up of the treatment system. However, ITT will commence additional source area remediation in order to optimize and expedite the remedial program.

Additional characterization of site soils and floors will be conducted for comparison to NJDEP's Residential Direct Contact Cleanup Criteria and NJDEP's Impact to Groundwater Criteria. A summary of additional sampling associated with each AOC is summarized below:

AOC	Description	Groundwater	Soil
1	1,1,1-Trichloroethane Spill	Active Remediation	NFA
2	Former Gasoline and Diesel USTs	Natural Remediation	NFA
3	Former No. 2 and No. 4 Fuel Oil USTs	Natural Remediation	NFA
4	Chemical/Waste Storage Building	Natural Remediation	2 Samples

AOC	Description	Groundwater	Soil
5	Former Gardener's Shed	NFA	NFA
6	Industrial Wastewater Pretreatment System Area	NFA	1 Concrete Sample/900 sf
7	Electrical Substation	NFA	NFA
8	Area Without Vegetation	NFA	2 Soil Samples
9	1,1,1-Trichloroethane Still	NFA	NFA
10	Chemical Storage Room	NFA	NFA
11	Former Metal Finishing and Electroplating Process Area	NFA	NFA
12	Building Transformers	NFA	3 Concrete Chip Samples
13	Machine Shop	NFA	NFA
14	Shipping/Receiving Bays	NFA	3 Sediment Sample 4 Soil Samples
15	Laboratory/Testing Areas	NFA	NFA
16	Detrex Process Area	NFA	NFA

The Quality Assurance Project Plan provides additional detail relating to the number and types of samples to be collected together with quality assurance/quality control requirements. A report summarizing the sampling results and providing recommendations for further action, as required, will be provided to the NJDEP.

5.0 Permitting and Approvals

All permits and approvals required for the existing groundwater remediation system have been obtained. These permits include a permit to construct/install/alter air quality control apparatus/equipment (No. 01902268), New Jersey Pollution Discharge Elimination System (NJPDES) Discharge to Groundwater (DGW) Permit (No. NJ0076023), Permit-by-rule authorization to conduct the source area remediation pilot test, and well installation permits.

6.0 Quality Assurance Project Plan

The site-specific Quality Assurance Project Plan ("QAPP") is provided in Appendix D.

7.0 Health and Safety Plan

A Health and Safety Plan has been developed by H2M for utilization during site activities. A copy of the Health and Safety Plan is attached as Appendix E.

8.0 Site Restoration

Site restoration, to be performed following full and permanent termination of the active remediation system, will encompass the abandonment of the entire groundwater treatment system. All process equipment (i.e., air stripping tower, filters, above ground piping, pumps, electrical controls, etc.) will be disassembled for salvage or disposal, as appropriate. The carbon adsorption units will be disposed of off-site at a permitted facility. Above ground piping associated with the treatment system will be disconnected and removed. Connections to below grade piping will be cut and capped.

All mechanical equipment will be removed from the extraction wells, and the wells will be sealed. With the concurrence of NJDEP that groundwater monitoring for this site will no longer be required, the on-site monitoring wells will also be sealed. Procedures for well abandonment will be in accordance with NJDEP requirements (N.J.A.C. 7:9-9). In addition, the recharge system associated with the discharge of treated groundwater will be backfilled with clean soil.

9.0 Costs

The cost to sample, analyze, and report results for the groundwater, soil and concrete media is estimated to be approximately $50,500. as outlined below.

AOC	Additional Investigation	Remedial Action and Reporting
3	$0.	$8,900.
4	$0.	$12,300.
6	$9,100.	$10,600.
8	$1,500.	$1,200.
12	$1,400.	1,100.
14	$2,600.	$1,800.
Total	$14,600.	$35,900.

The source area remediation phase II pilot study, currently under way has been estimated to cost $239,935. inclusive of contractor fees, monitoring and reporting. The objective of source area remediation will be to sufficiently reduce concentrations of dissolved volatile organic compounds such that the operation of the groundwater treatment facility can be discontinued. At least two years of continued operation is anticipated with two years of groundwater monitoring. Current annual operating costs for the operation of the groundwater treatment system are approximately $90,000. The annual cost for quarterly compliance monitoring required under the NJPDES permit and the MOA are approximately $80,000.

Based on the foregoing, the implementation of this Remedial Action Workplan is estimated to cost $630,435.

10.0 Project Schedule

Proposed soil sampling and groundwater sampling will be initiated within thirty days of NJDEP approval. A report will be provided to the Department within six weeks of receipt of laboratory results. Groundwater monitoring being conducted in accordance with the MOA and NJPDES Permit will continue to be performed.

The Phase II Pilot Treatability Study was begun in May 1996 in accordance with NJDEP's permit-by-rule authorization.

11.0 References

Dan Raviv Associates, Inc., 1988. *Investigation of the Impact From Past TCA Spillage and Former Underground Storage Tanks on Surface and Hydrogeologic Conditions, ITT Avionics Division*. Millburn, New Jersey.

Dan Raviv Associates, Inc., 1989. *Supplementary Hydrogeologic Investigation, ITT Avionics Division*. Millburn, New Jersey.

H2M Group, 1990. *Discharge Investigation and Corrective Action Report, ITT Avionics Division, Clifton and Nutley, New Jersey*. Totowa, New Jersey.

H2M Group, 1991. *Discharge Investigation and Corrective Action Report for 100 Kingsland Road, ITT Avionics Division, Clifton and Nutley, New Jersey*. Totowa, New Jersey.

H2M Group, 1991. *Addendum to Discharge Investigation and Corrective Action Report for 100 Kingsland Road, ITT Avionics Division, Clifton and Nutley, New Jersey*. Totowa, New Jersey.

H2M Group, 1991. *Engineering Report, Groundwater Treatment Facilities, ITT Avionics Division*. Totowa, New Jersey.

H2M Group, 1993. *Quantitative Environmental Survey at ITT Avionics Division, 100 Kingsland Road, Clifton, New Jersey*. Totowa, New Jersey.

H2M Group, February 15, 1996. *Summary Report, Pilot Treatability Study - In-Situ Chemical Oxidation, ITT Avionics Division, Clifton, New Jersey*. Totowa, New Jersey.

APPENDIX A
FIGURES

H2M GROUP

List of Figures

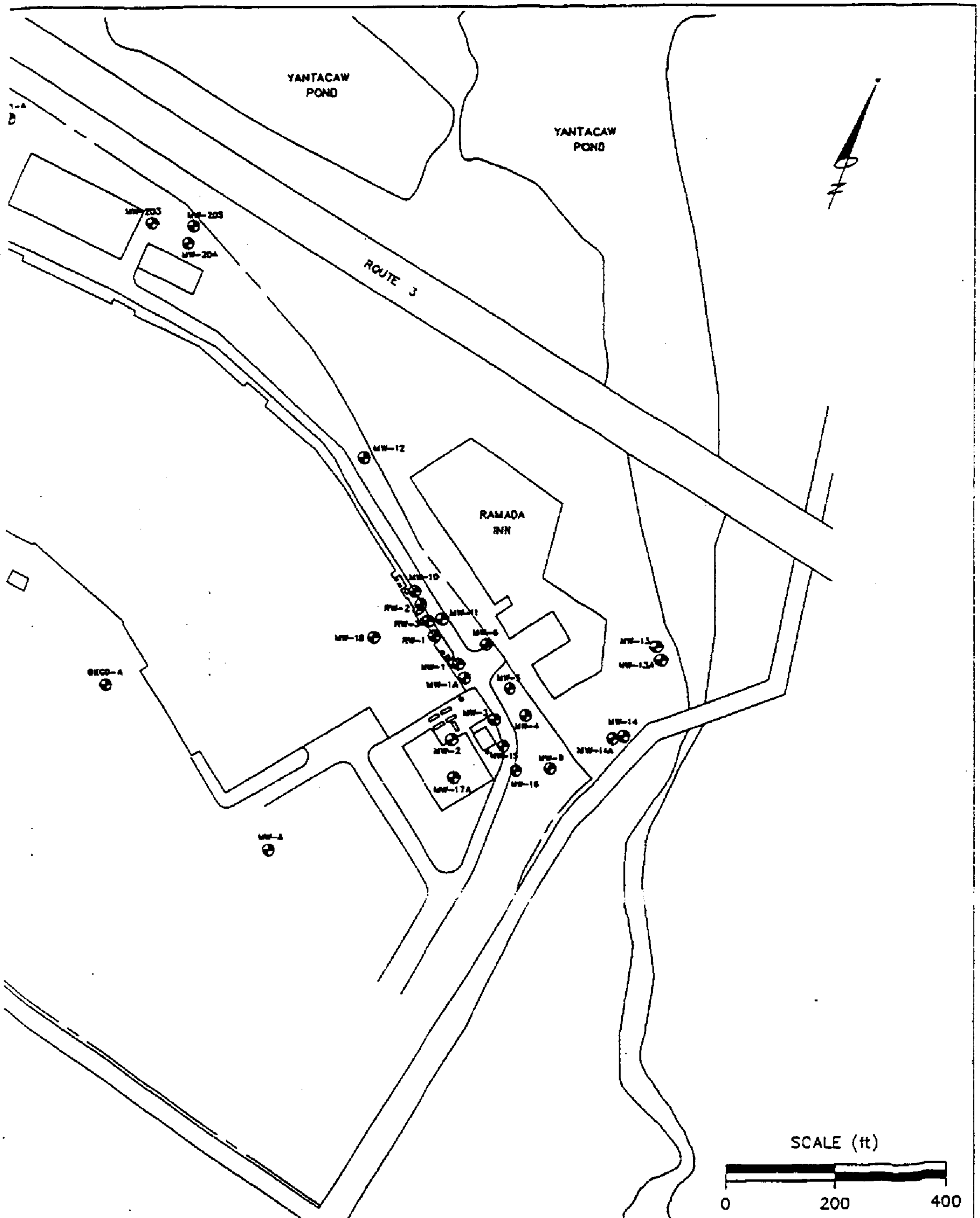
LOCATION MAP
ITT AVIONICS DIVISION
CLIFTON, NEW JERSEY

REFERENCE:
USGS QUADRANGLE 7.5 MINUTE
ORANGE,NJ (1955 REV. 1970)
APPROX. SCALE = 1:24000

ZITA9401\RAW\LOCMAP.DWG

H2MGROUP ENGINEERS · ARCHITECTS · PLANNERS · SCIENTISTS · SURVEYORS
MELVILLE, N.Y. TOTOWA,NJ

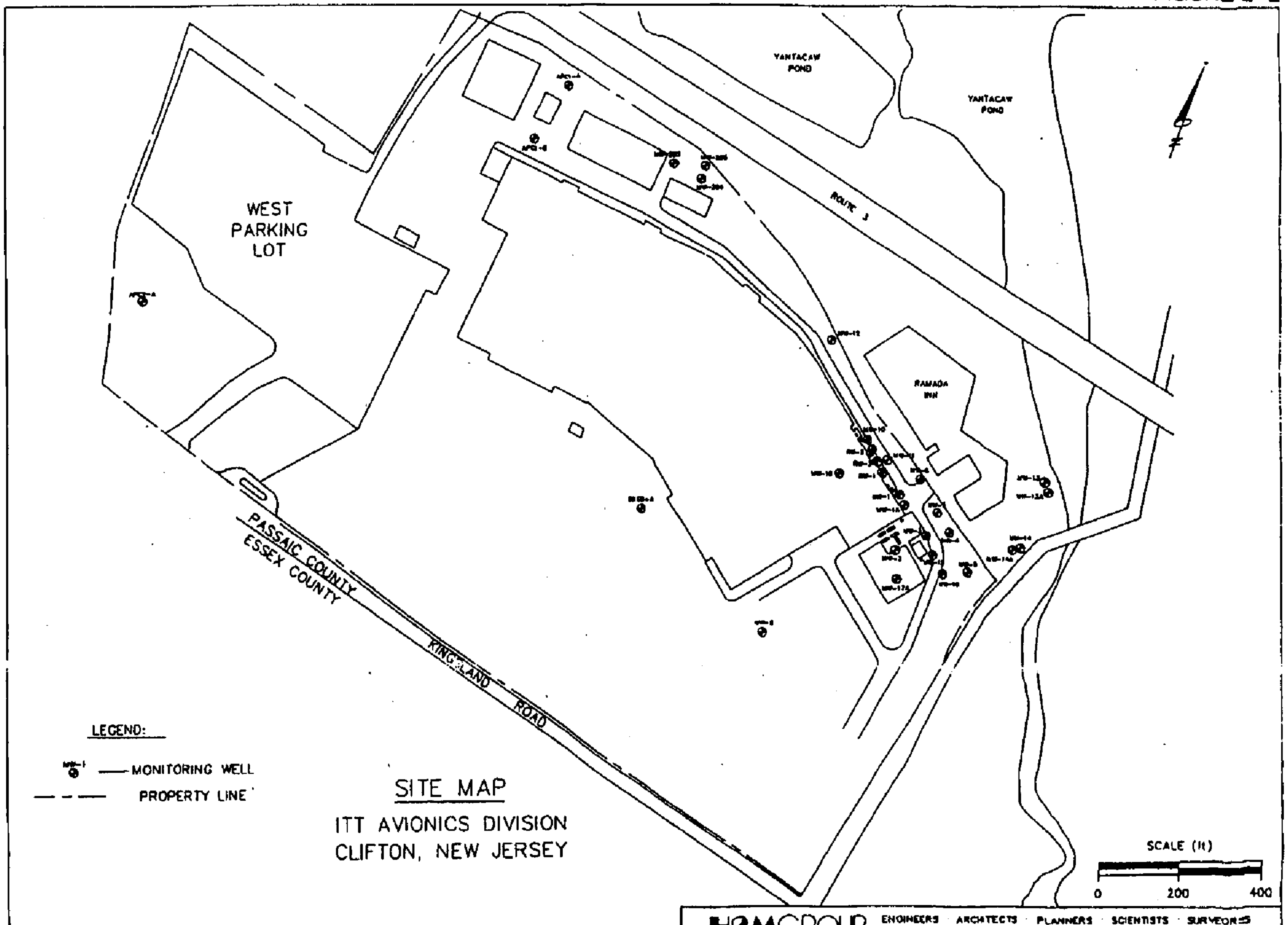
FIGURE 2-2



H2MGROUP ENGINEERS · ARCHITECTS · PLANNERS · SCIENTISTS · SURVEYORS
MELVILLE, N.Y. TOTOWA, N.J.

ADC000476

FIGURE 2-2



SITE MAP

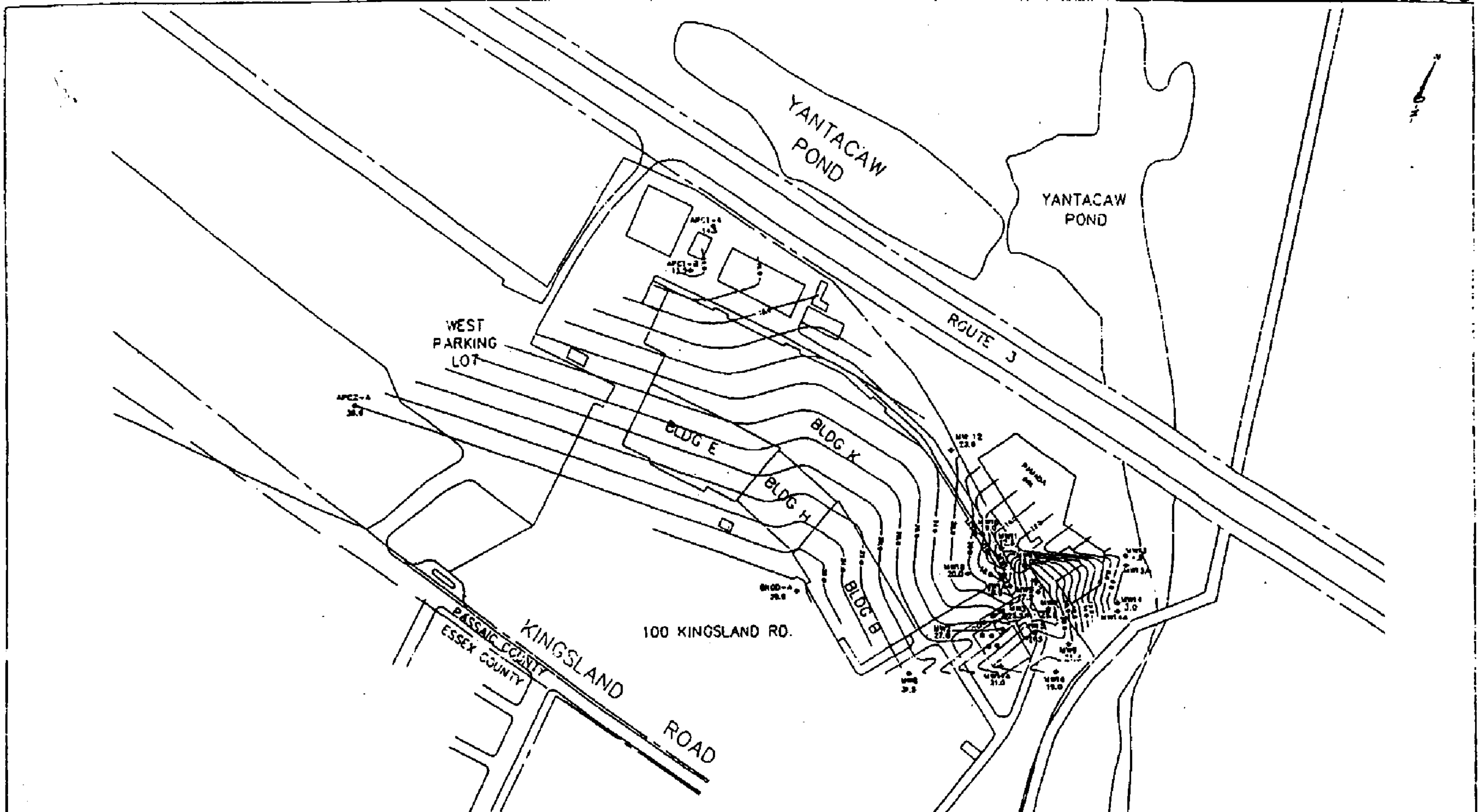
ITT AVIONICS DIVISION
CLIFTON, NEW JERSEY

H2M GROUP ENGINEERS · ARCHITECTS · PLANNERS · SCIENTISTS · SURVEYORS

ADC000477

TIERRA-B-007634

FIGURE 2-3



BEDROCK ELEVATION CONTOUR MAP

ITT AVIONICS DIVISION
CLIFTON, NEW JERSEY

LEGEND

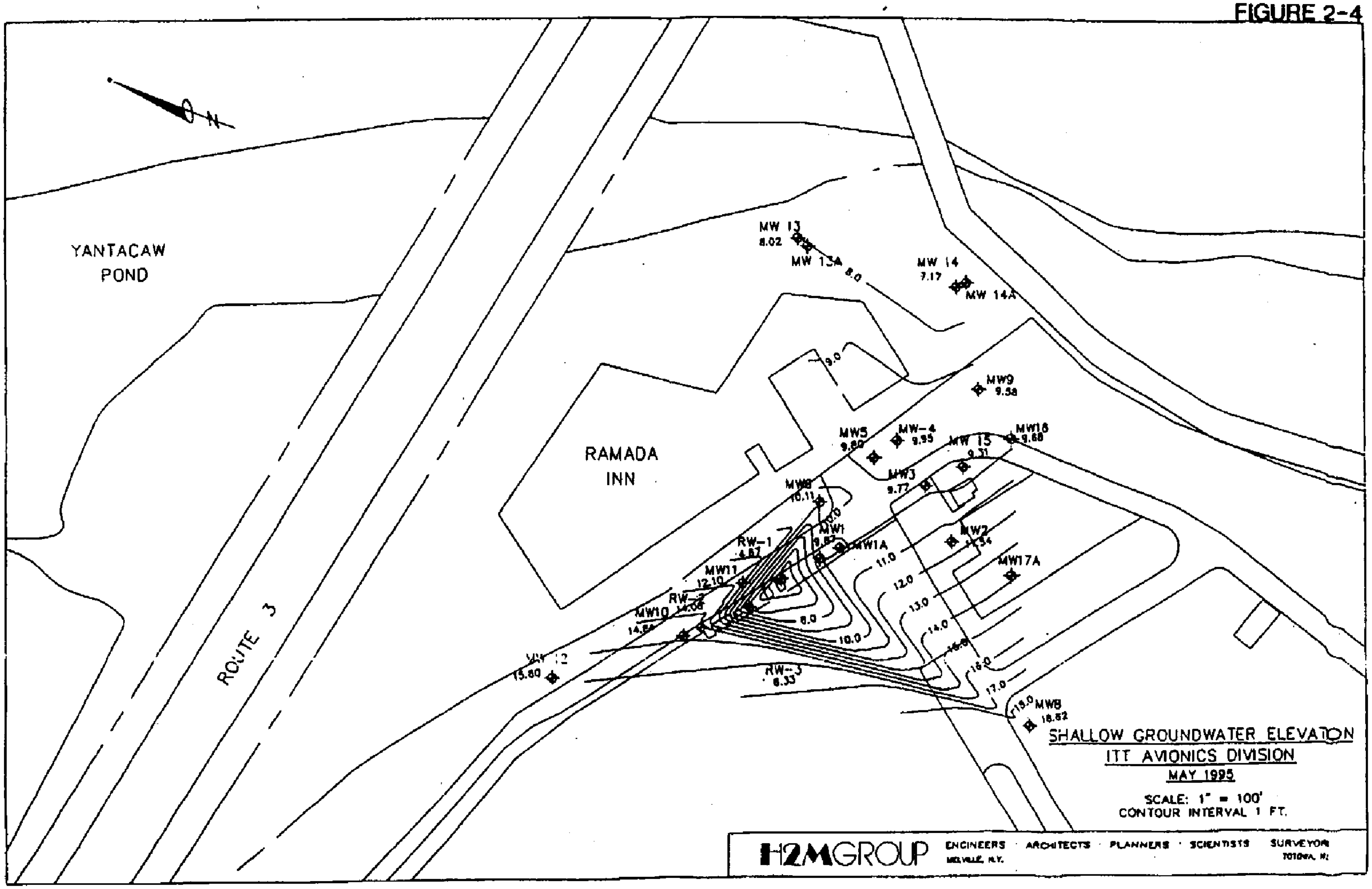
MW4 ⊕ MONITORING WELL LOCATION

H2M GROUP ENGINEERS ARCHITECTS PLANNERS SCIENTISTS SURVEYORS
MELVILLE, N.Y.

ADC000478

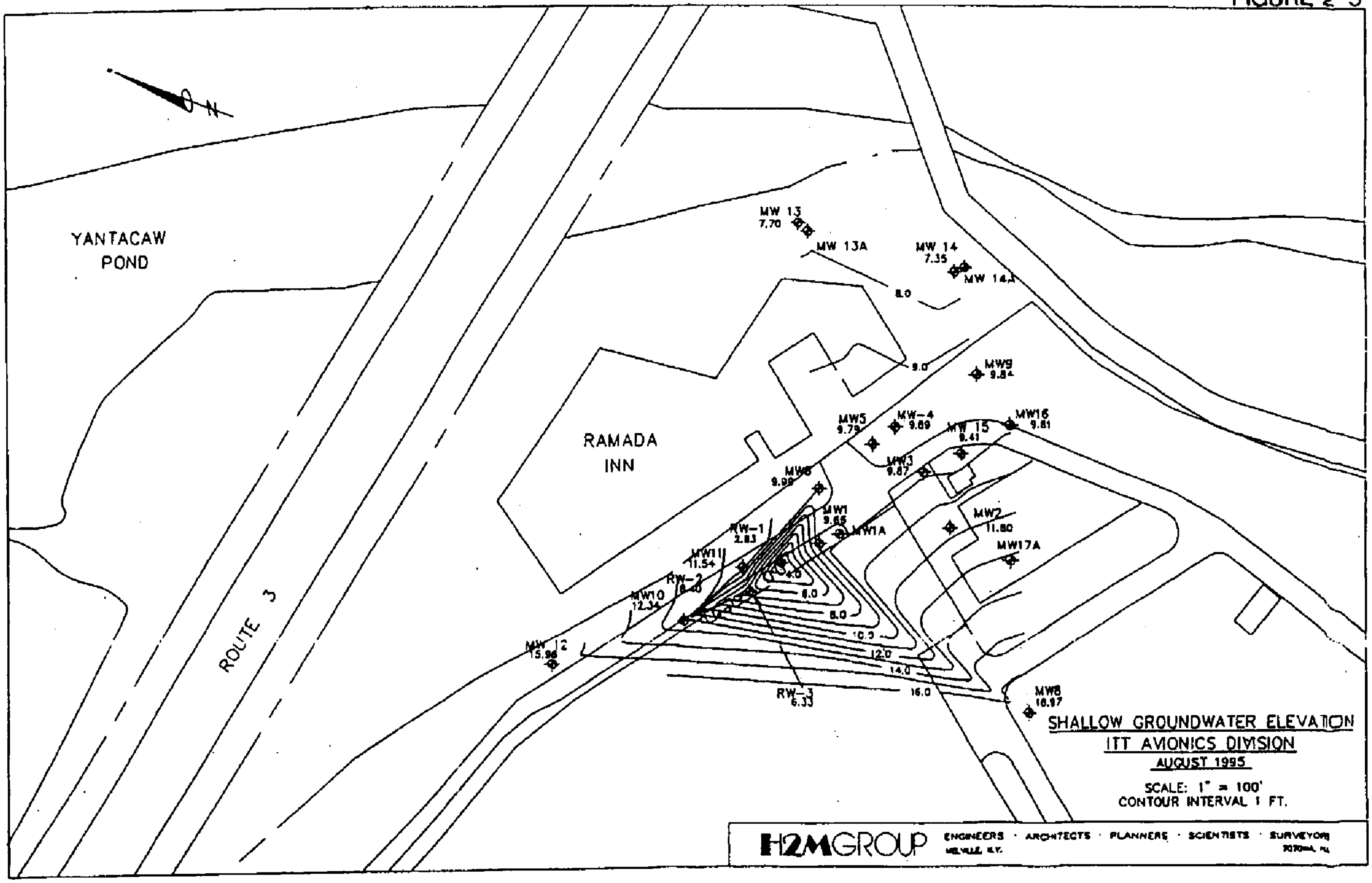
TIERRA-B-007635

FIGURE 2-4



ADC000479

FIGURE 2-5



SHALLOW GROUNDWATER ELEVATION
ITT AVIONICS DIVISION
AUGUST 1995

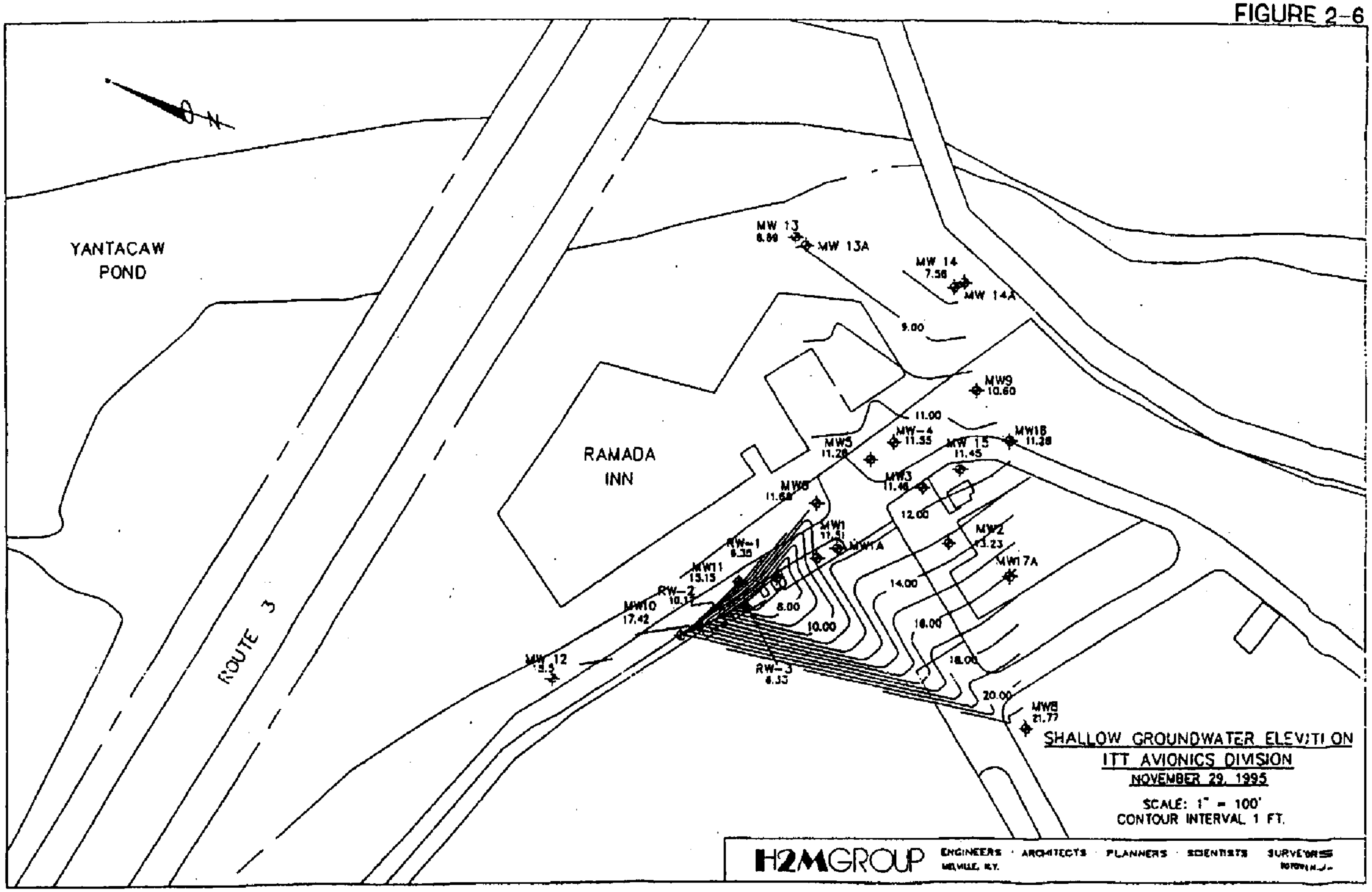
SCALE: 1" = 100'
CONTOUR INTERVAL 1 FT.

H2M GROUP ENGINEERS · ARCHITECTS · PLANNERS · SCIENTISTS · SURVEYORS
MELVILLE, N.Y. TOTOWA, NJ

ADC000480

TIERRA-B-007637

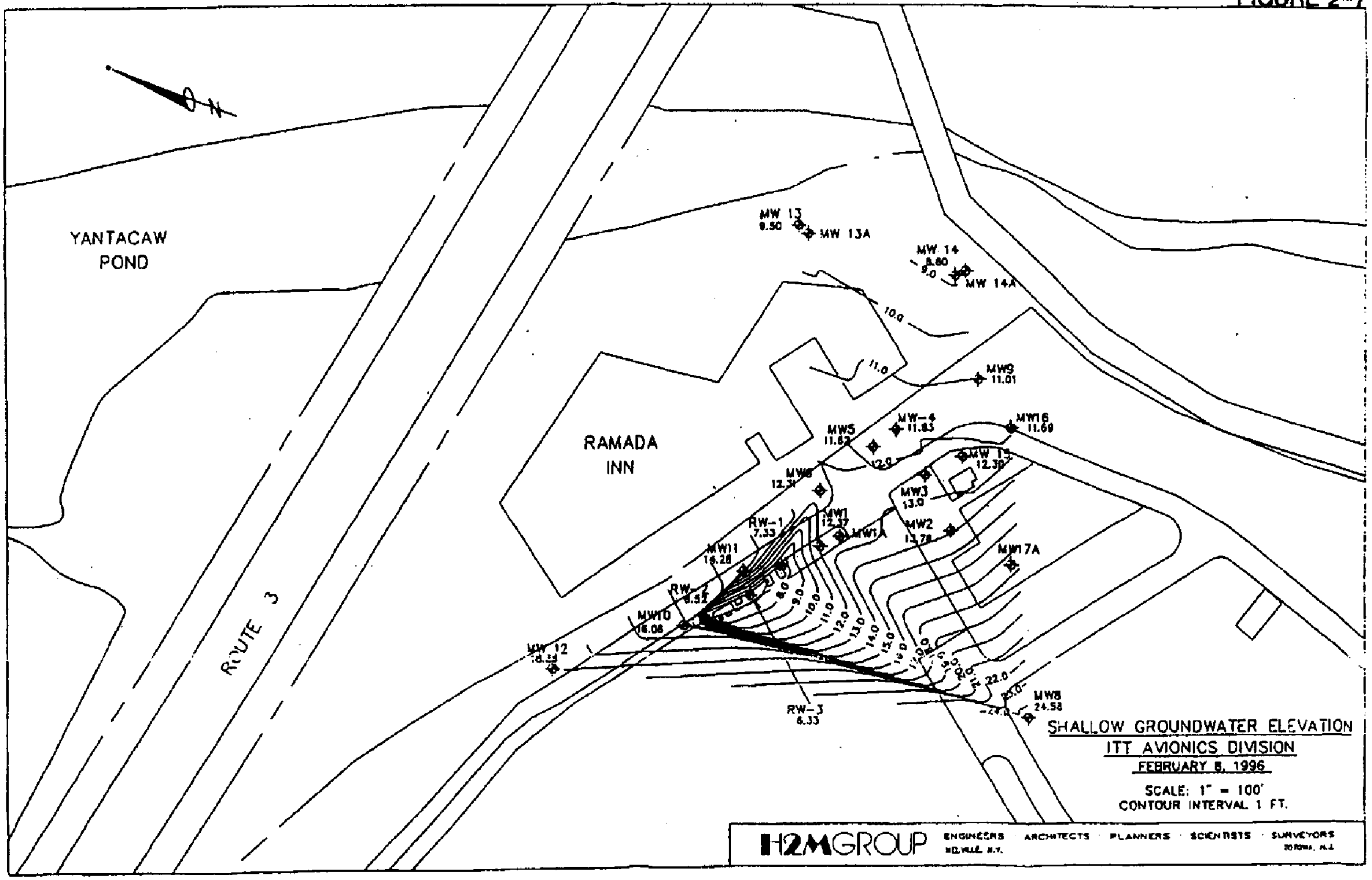
FIGURE 2-6



ADC000481

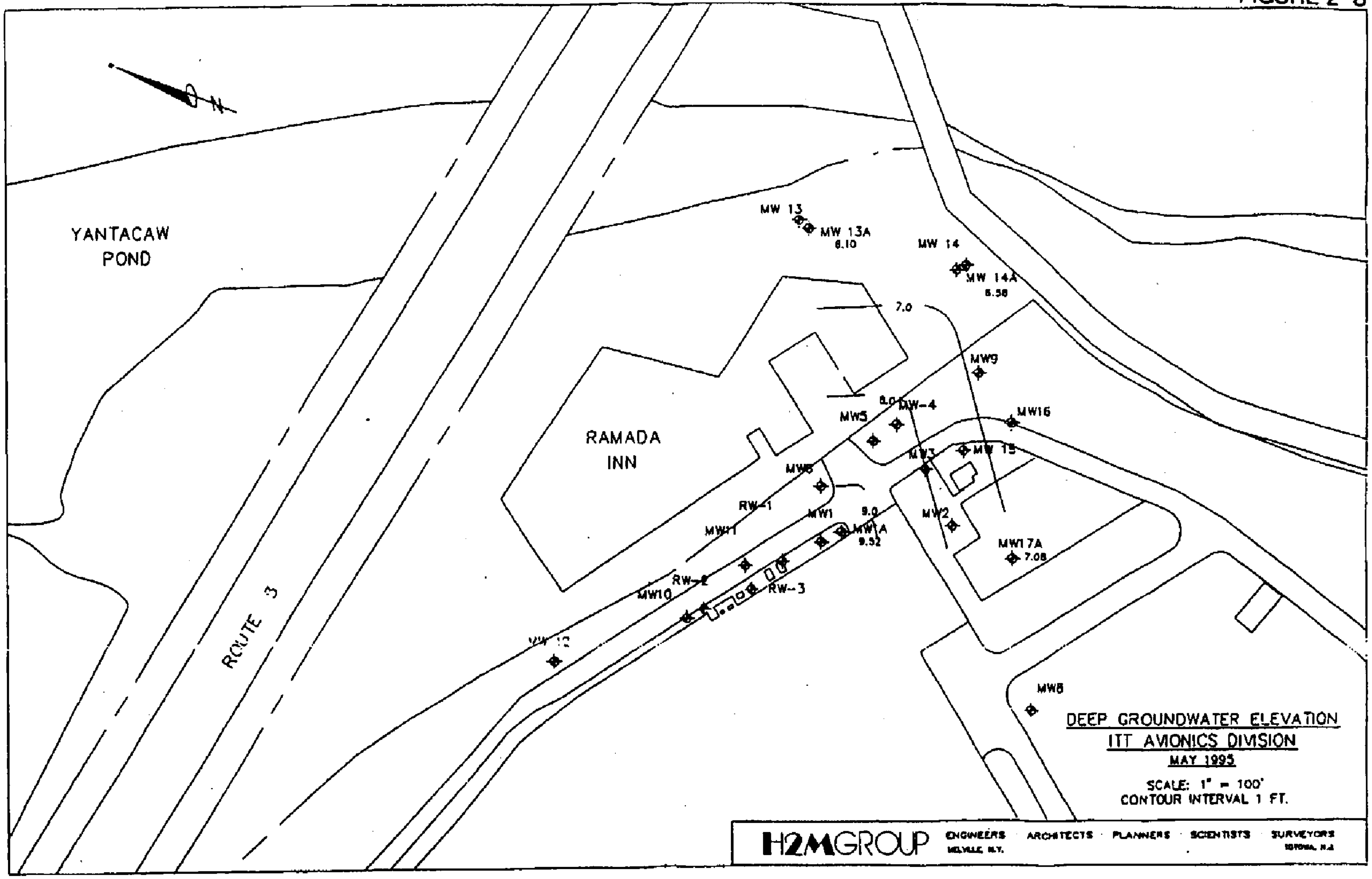
TIERRA-B-007638

FIGURE 2-7



ADC000482

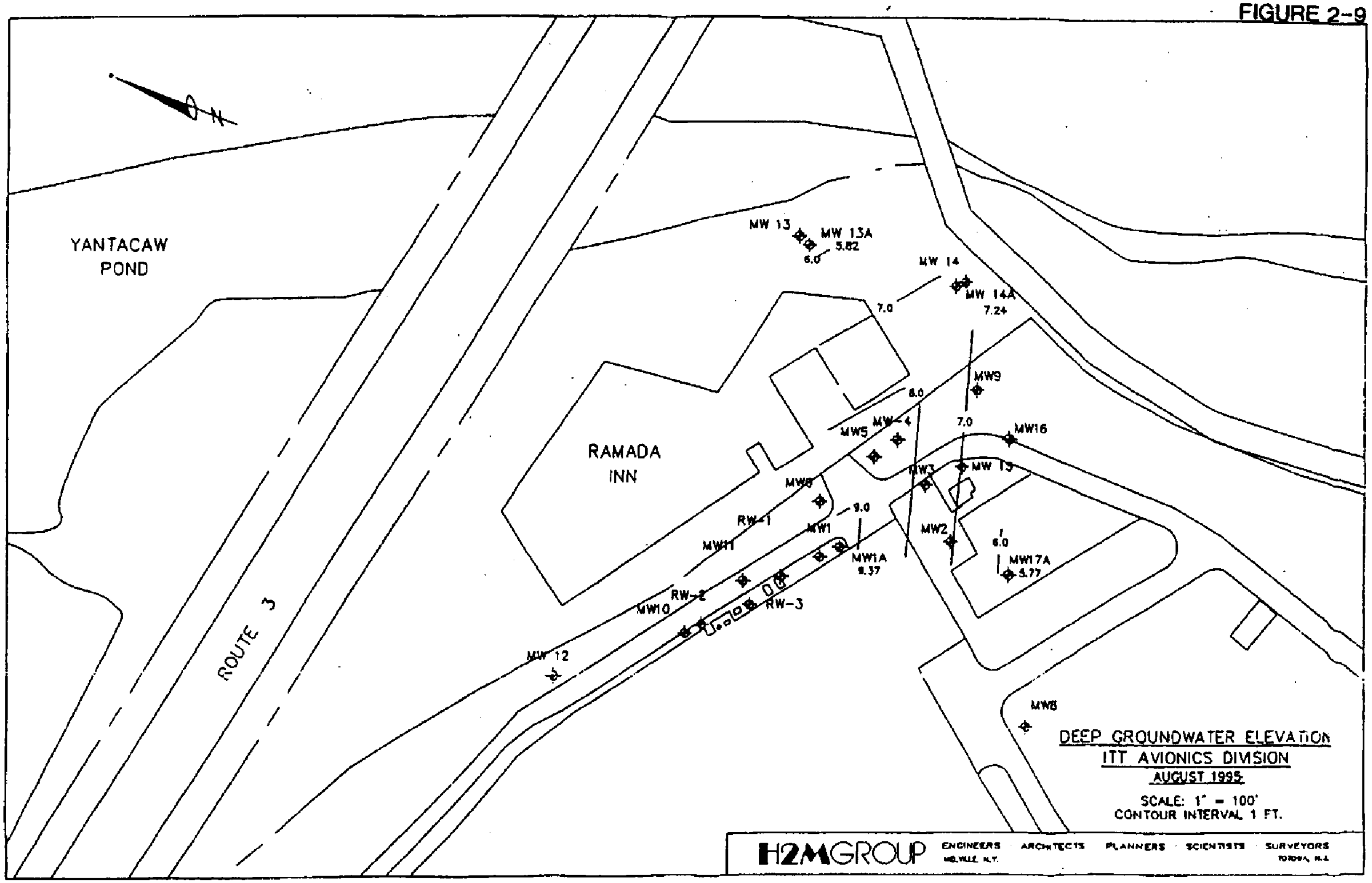
FIGURE 2-8



ADC0000483

TIERRA-B-007640

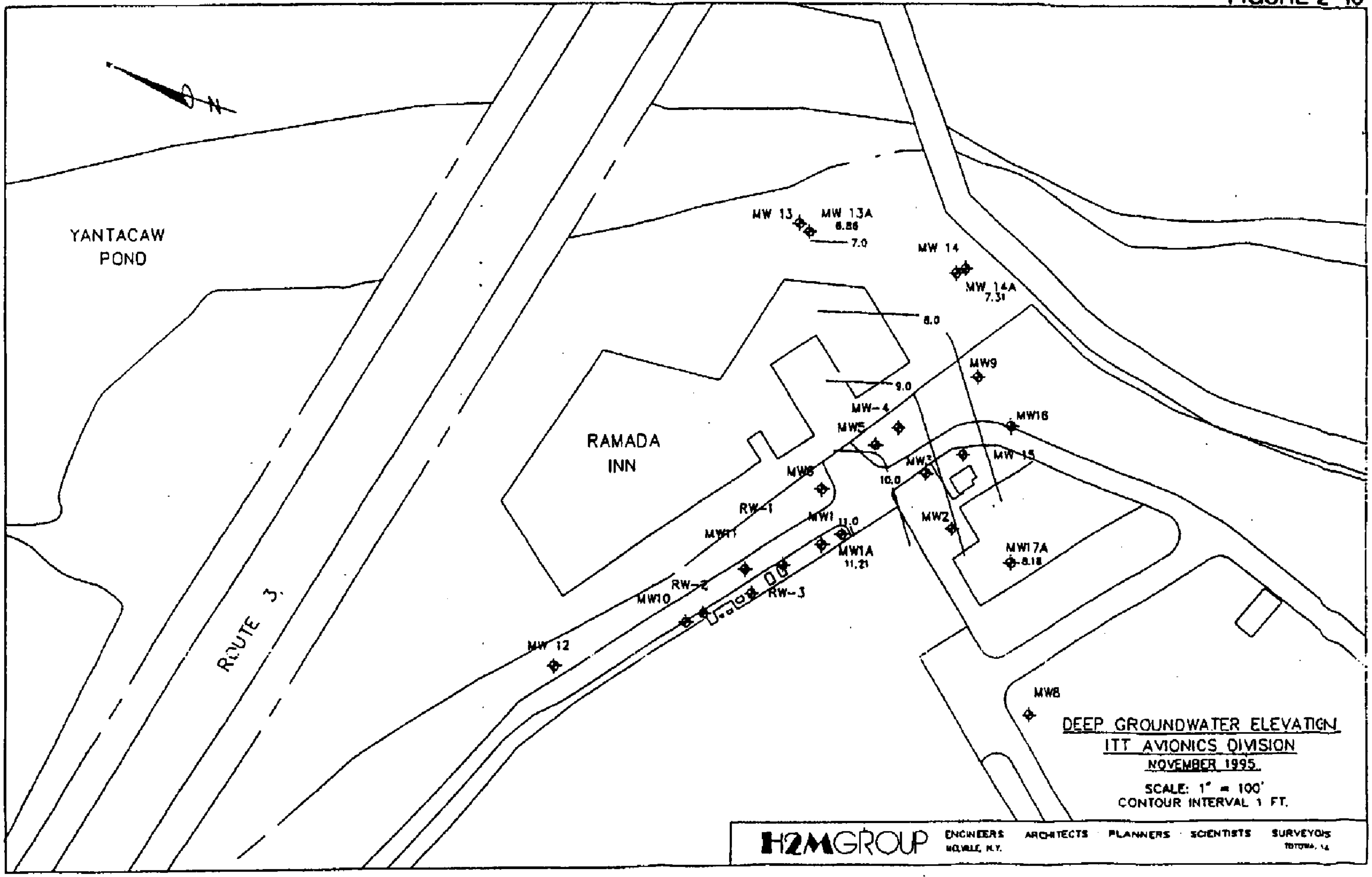
FIGURE 2-9



ADC000484

TIERRA-B-007641

FIGURE 2-10



DEEP GROUNDWATER ELEVATION
ITT AVIONICS DIVISION
NOVEMBER 1995
SCALE: 1" = 100'
CONTOUR INTERVAL 1 FT.

H2M GROUP ENGINEERS ARCHITECTS PLANNERS SCIENTISTS SURVEYORS

ADC000485

TIERRA-B-007642

FIGURE 2-11

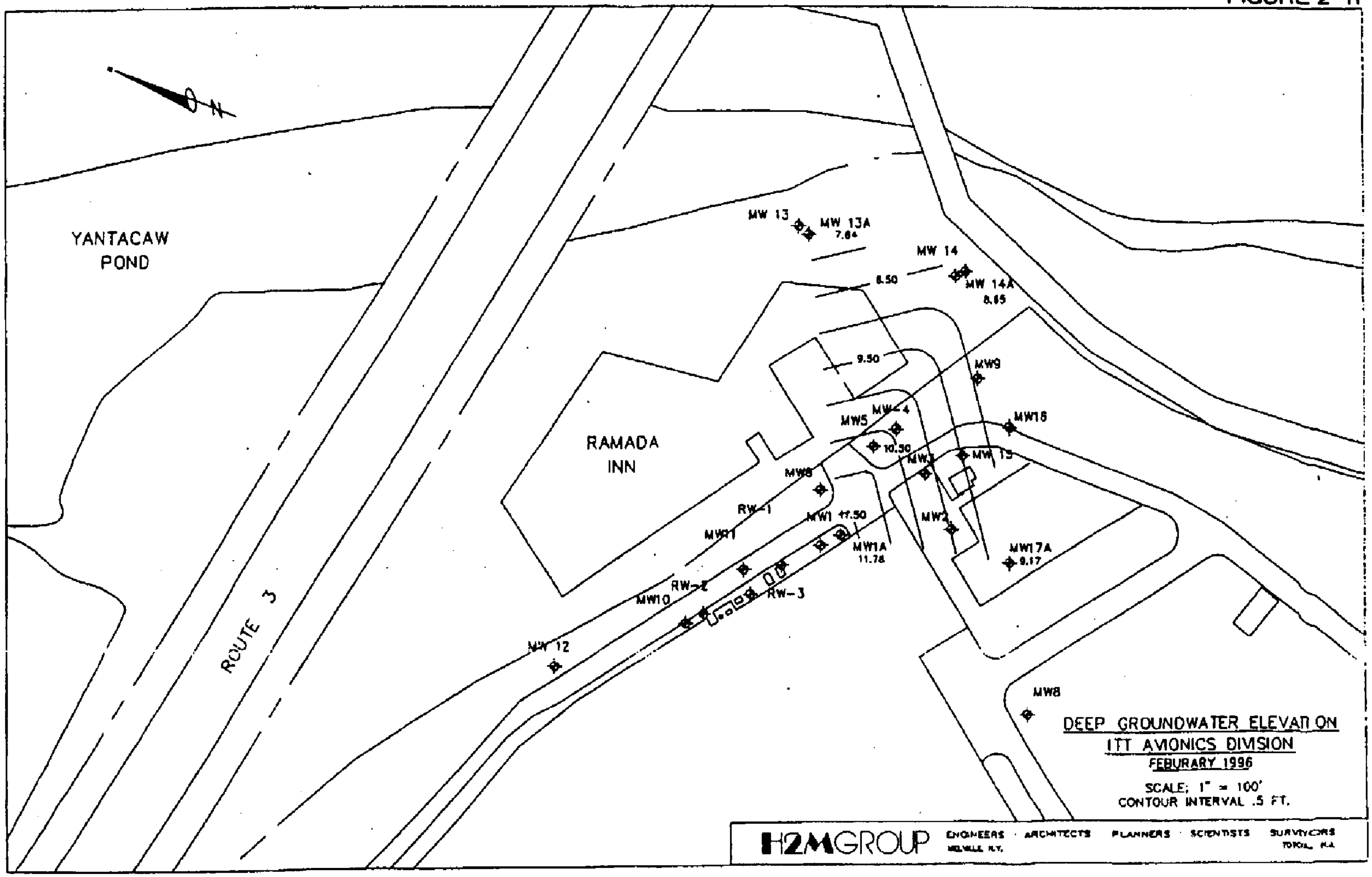
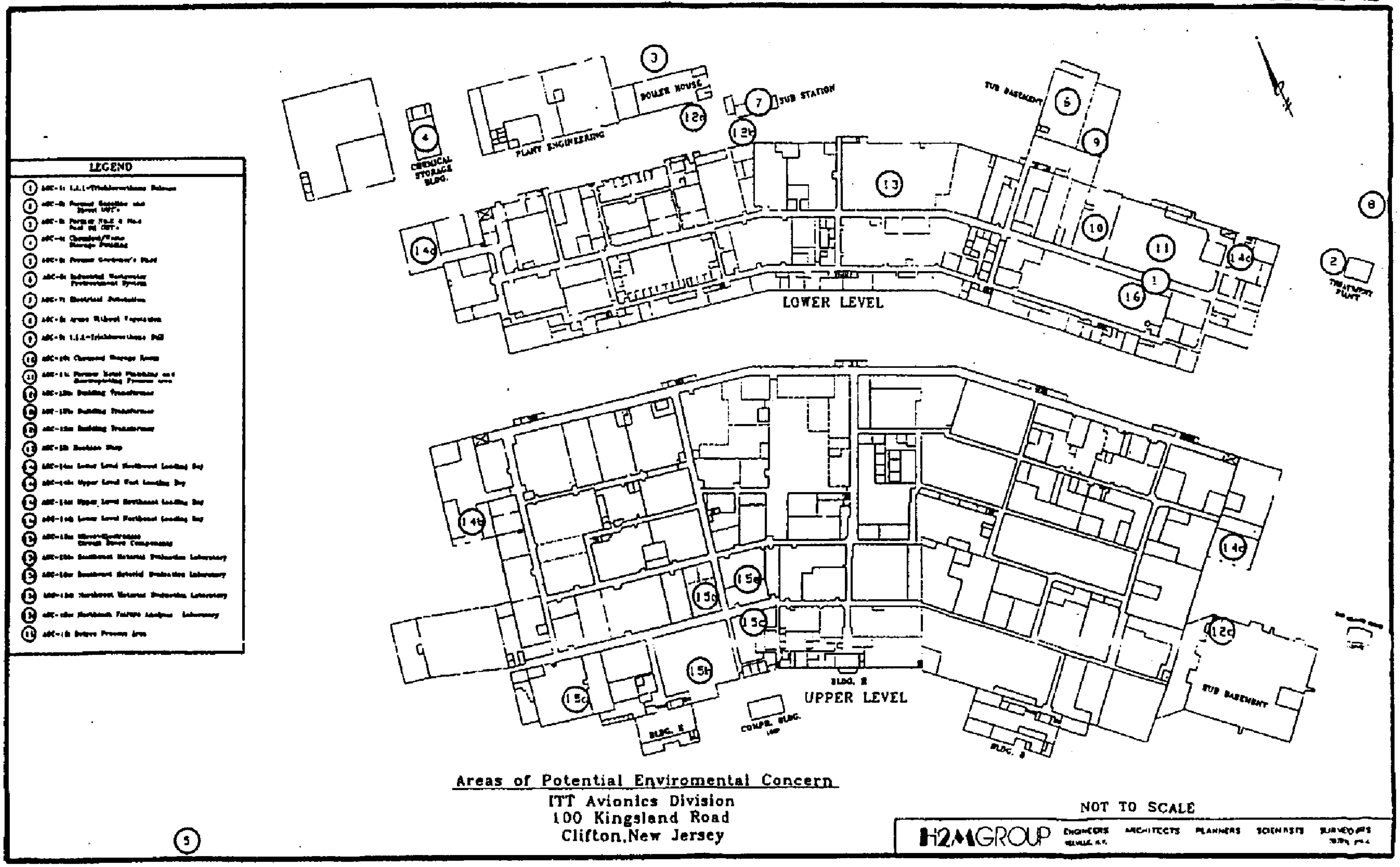
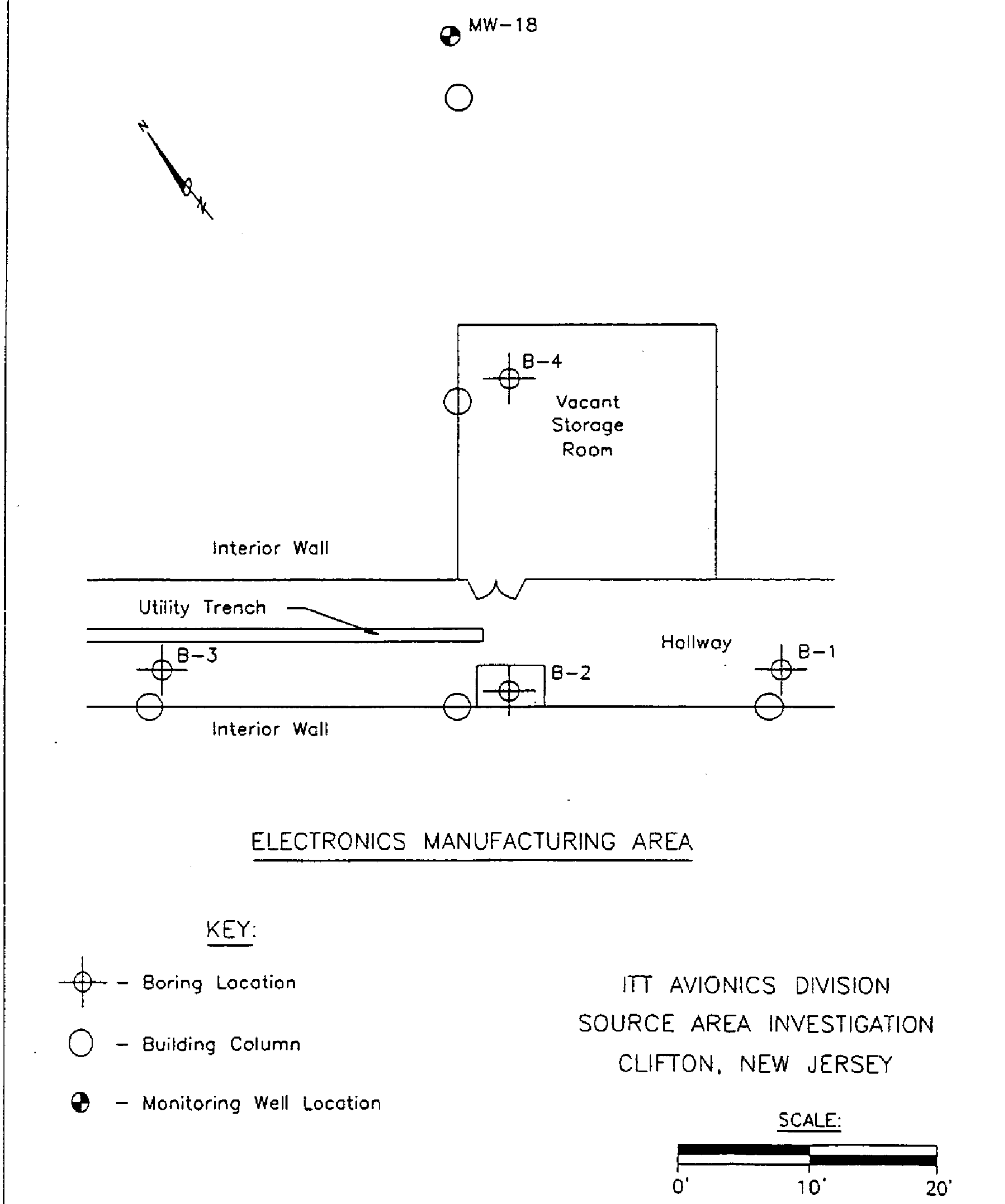

N
YANTACAW
POND
ROUTE 3
RAMADA
INN
MW 13
MW 13A
7.64
MW 14
8.50
MW 14A
8.65
9.50
MW9
MW5
MW-4
10.50
MW16
MW3
MW 15
MW6
RW-1
MW1 11.50
MW11
MW2
MW1A
11.76
MW17A
9.17
RW-2
MW10
RW-3
MW 12
MW8
DEEP GROUNDWATER ELEVATI ON
ITT AVIONICS DIVISION
FEBURARY 1996
SCALE; 1" = 100'
CONTOUR INTERVAL .5 FT.
H2MGROUP
ENGINEERS · ARCHITECTS · PLANNERS · SCIENTISTS · SURVEYORS
MELVILLE, N.Y.
TOTOWA, N.J.

FIGURE 2-12



ADC000487

FIGURE 2-13



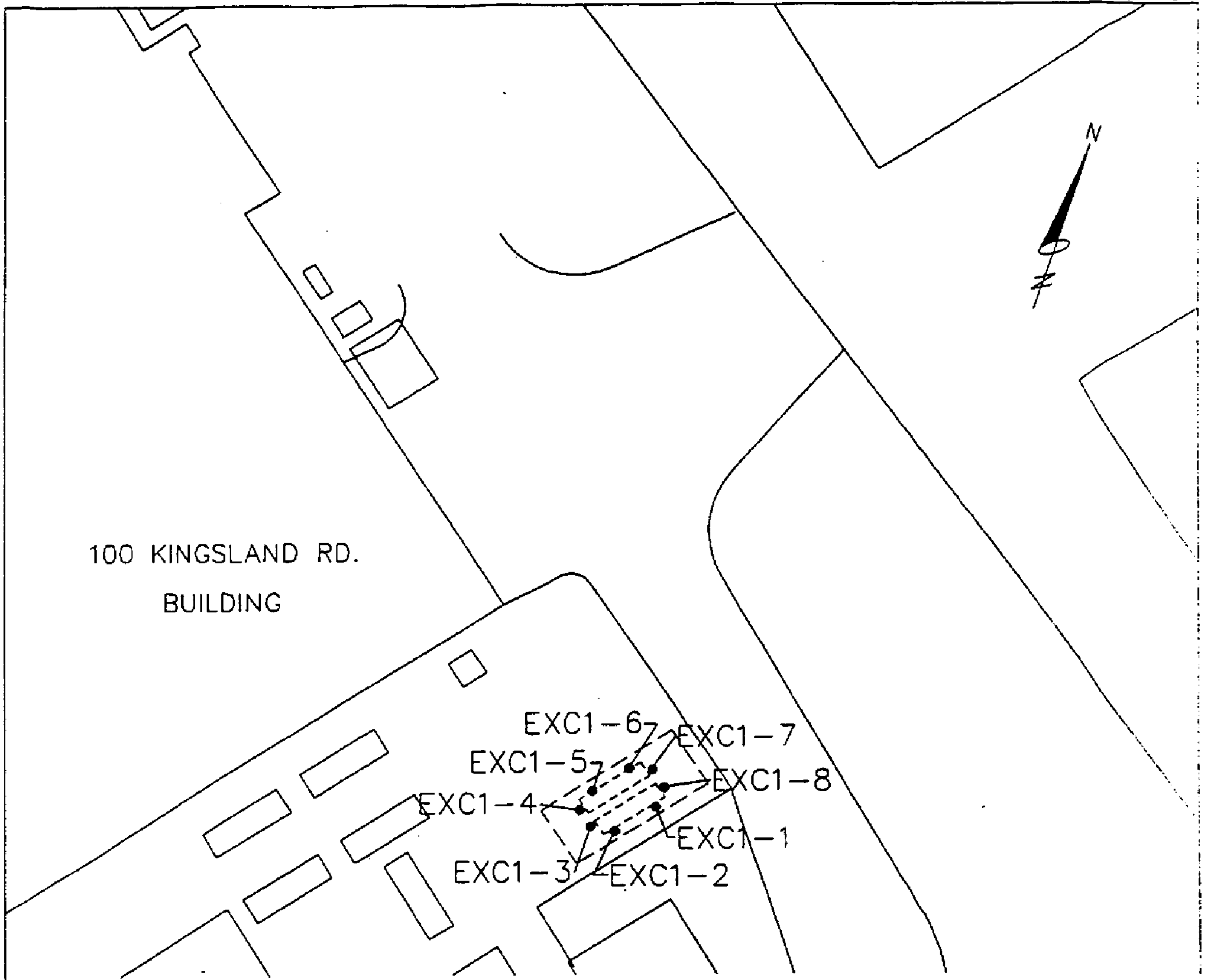
ITT AVIONICS DIVISION
SOURCE AREA INVESTIGATION
CLIFTON, NEW JERSEY

H2M GROUP ENGINEERS ARCHITECTS PLANNERS SCIENTISTS SURVEYORS
MELVILLE, N.Y. TOTOWA, N.J.

ADC000488

TIERRA-B-007645

FIGURE 2-14



POST-EXCAVATION CONFIRMATORY
SOIL SAMPLE LOCATIONS
FORMER GASOLINE UST's

ITT AVIONICS DIVISION
CLIFTON, NEW JERSEY

SCALE (ft)

0 25 50

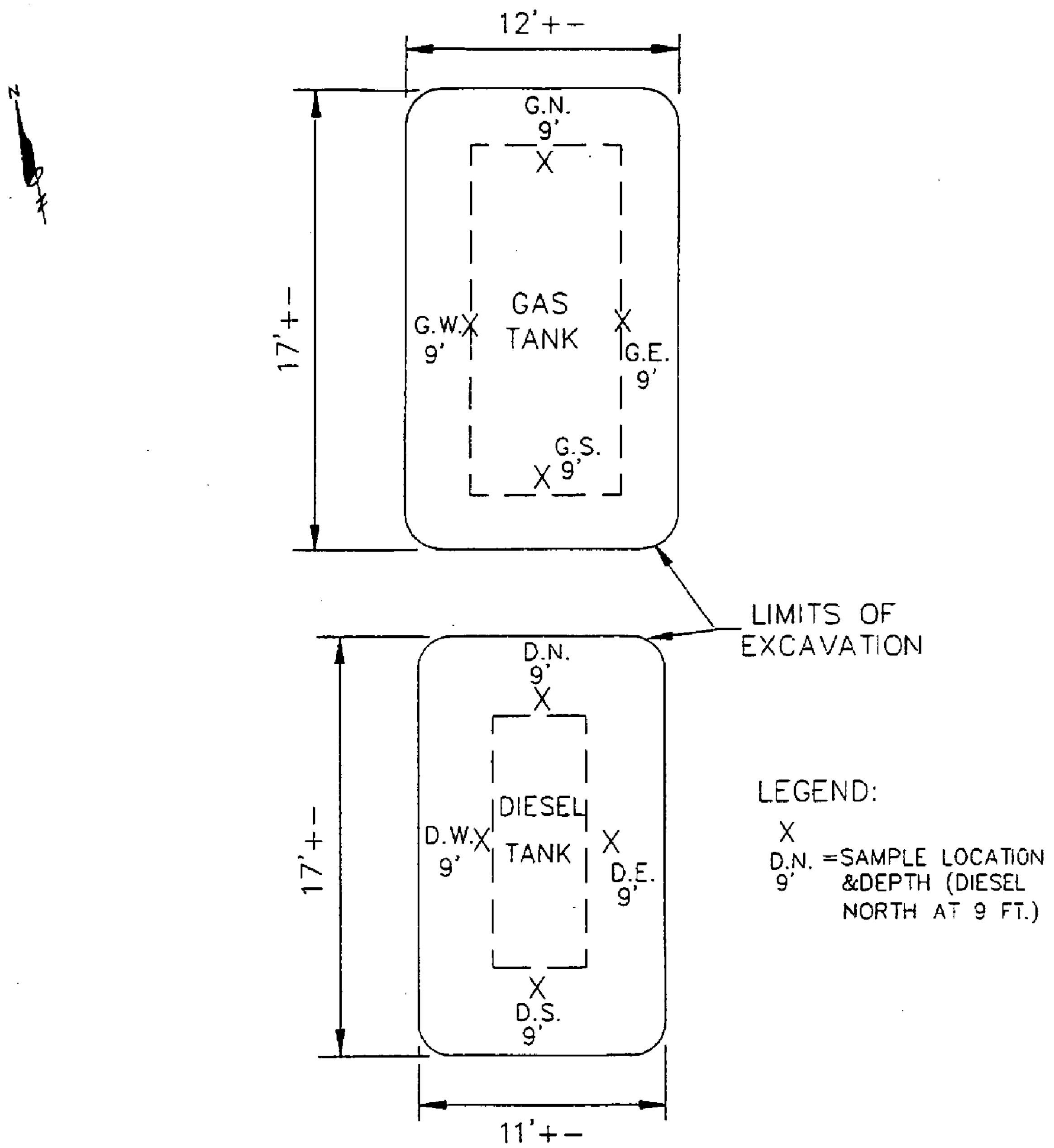
ZITA9401\RAW\EXCAV.DWG

H2MGROUP ENGINEERS · ARCHITECTS · PLANNERS · SCIENTISTS · SURVEYORS
MELVILLE, N.Y. FAIRFIELD, N.J.

ADC000489

TIERRA-B-007646

FIGURE 2-15



POST-EXCAVATION CONIFMATORY SOIL SAMPLE LOCATIONS
FORMER GASOLINE AND DIESEL FUEL UST's
ITT AVIONICS DIVISION
CLIFTON, NEW JERSEY

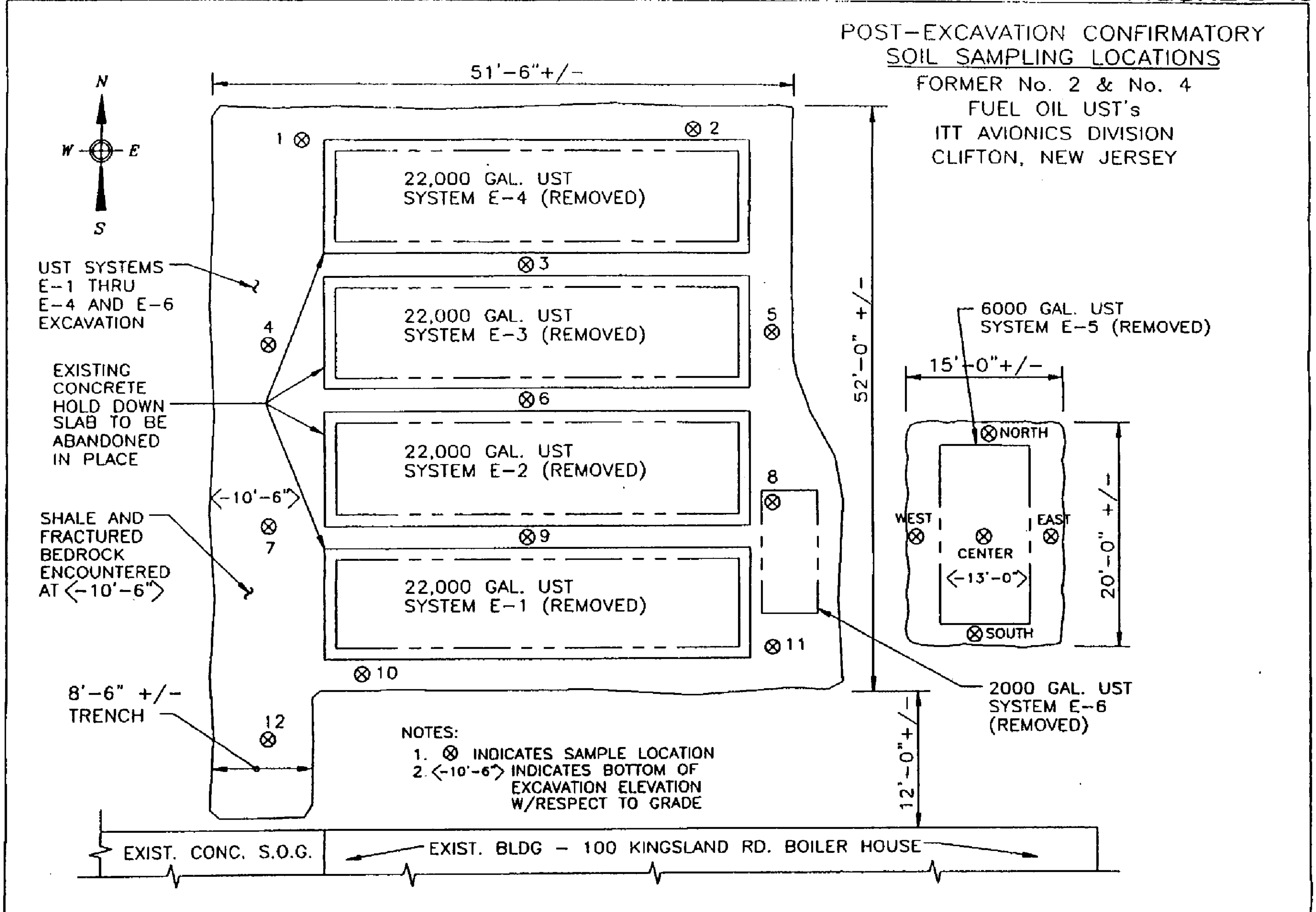
NOT TO SCALE

ZITA9401\RAW\D&GAS.DWG

H2MGROUP ENGINEERS ARCHITECTS PLANNERS SCIENTISTS SURVEYORS
MELVILLE, N.Y. TOTOWA,NJ

ADC000490

FIGURE 2-16

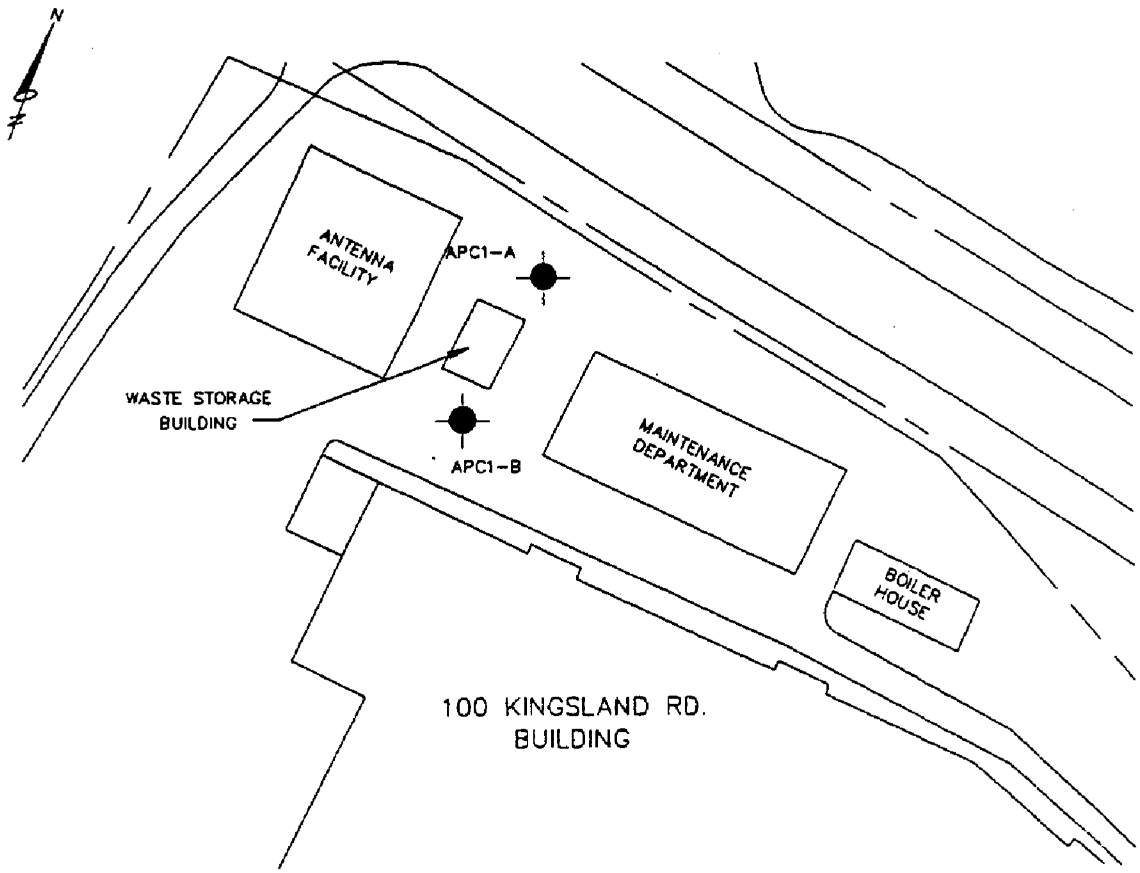


H2M GROUP ENGINEERS · ARCHITECTS · PLANNERS · SCIENTISTS · SURVEYORS
MELVILLE, N.Y. TOTOWA, N.J.

ADC000491

TIERRA-B-007648

FIGURE 2-17



SOIL BORING/MONITORING WELL LOCATIONS
CHEMICAL/WASTE STORAGE BUILDING

ITT AVIONICS DIVISION
CLIFTON, NEW JERSEY

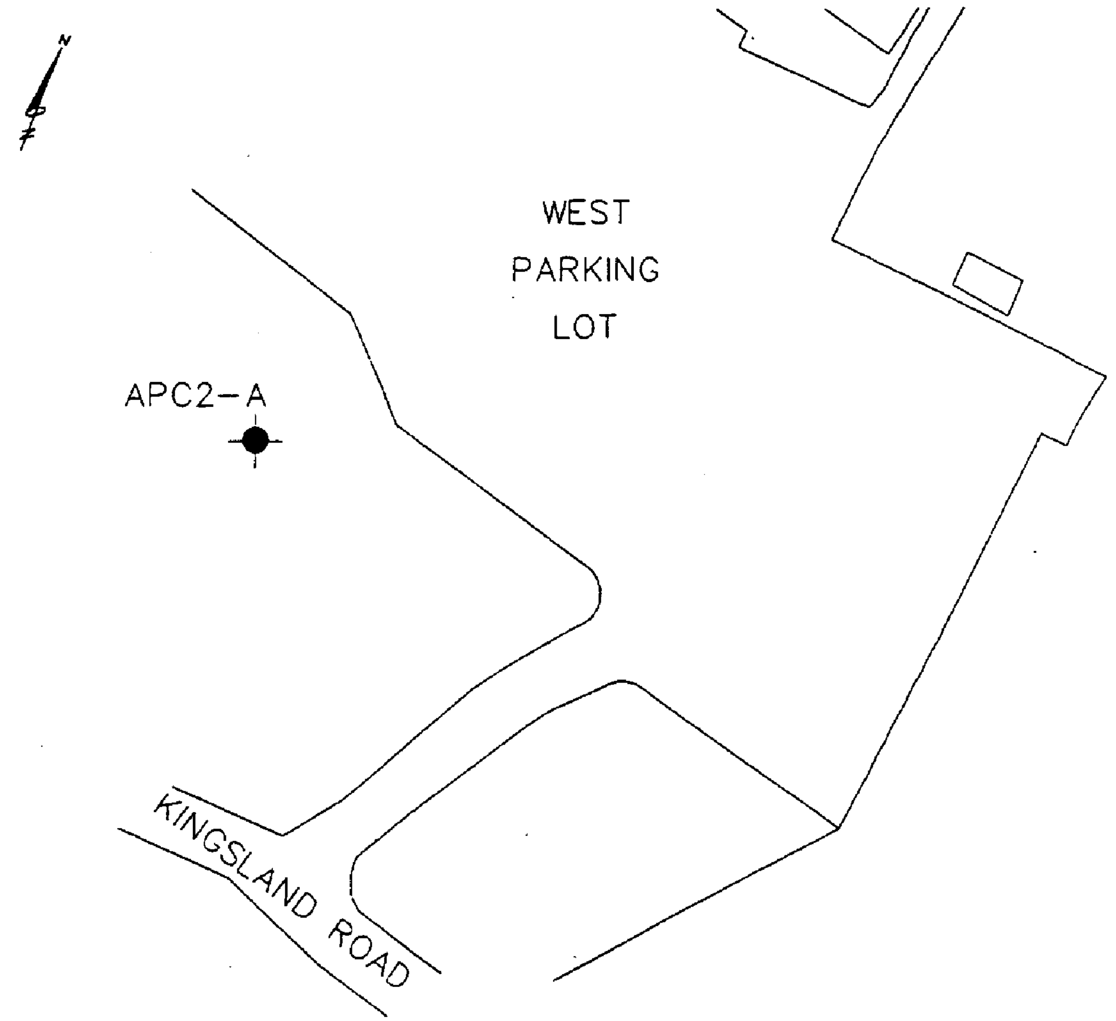
SCALE (ft)
0 100 200

LEGEND
SOIL BORING COMPLETED AS A MONITORING WELL

ZITA9401\RAW\SBMWLOC.DWG

H2MGROUP ENGINEERS ARCHITECTS PLANNERS SCIENTISTS SURVEYORS
MELVILLE, N.Y. FAIRFIELD, N.J.

FIGURE 2-18



SOIL BORING/MONITORING WELL LOCATION

FORMER GARDENER'S SHED

ITT AVIONICS DIVISION
CLIFTON, NEW JERSEY

SCALE (ft)

0 100 200

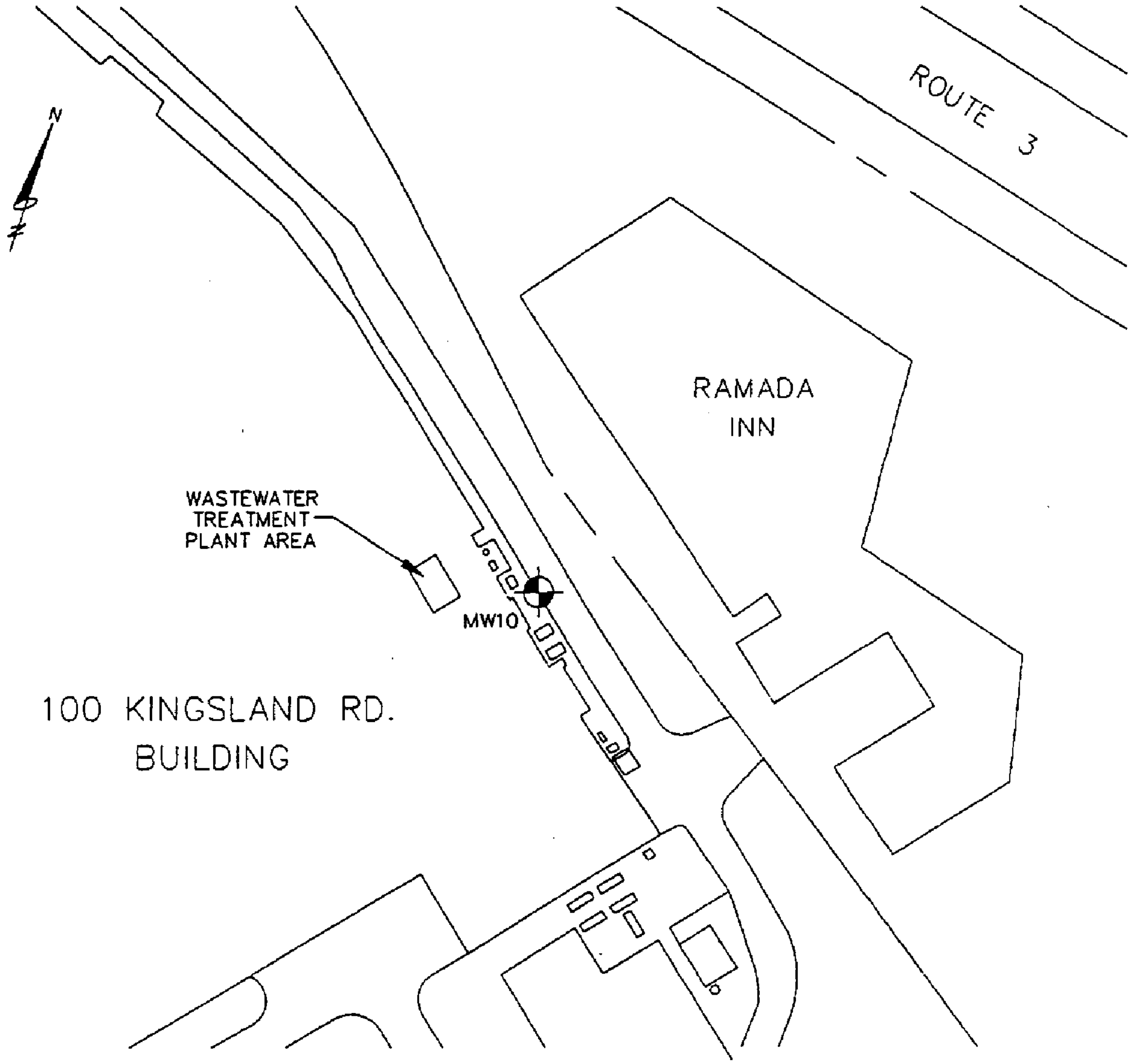
LEGEND

SOIL BORING COMPLETED AS A MONITORING WELL

ZITA9401\RAW\GARDSHED.DWG

H2MGROUP ENGINEERS MELVILLE, N.Y. ARCHITECTS PLANNERS SCIENTISTS SURVEYORS FAIRFIELD, N.J.

FIGURE 2-19



WASTEWATER TREATMENT
PLANT AREA

ITT AVIONICS DIVISION
CLIFTON, NEW JERSEY

SCALE (ft)

0 100 200

LEGEND

EXISTING MONITORING WELL

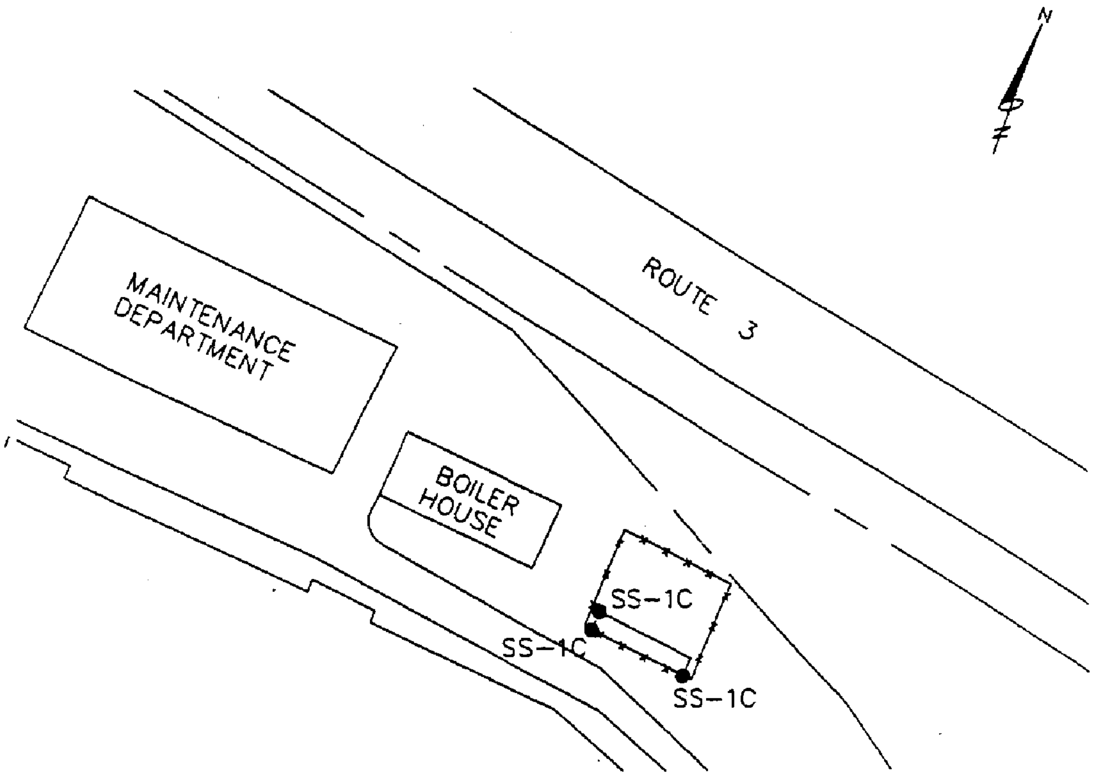
ZITA9401\RAW\WWTPA.DWG

H2M GROUP ENGINEERS ARCHITECTS PLANNERS SCIENTISTS SURVEYORS
MELVILLE, N.Y. FAIRFIELD, N.J.

ADC000494

TIERRA-B-007651

FIGURE 2-20



SOIL BORING LOCATIONS
ELECTRICAL SUBSTATION

ITT AVIONICS DIVISION
CLIFTON, NEW JERSEY

SCALE (ft)

0 100 200

LEGEND
● SOIL BORING

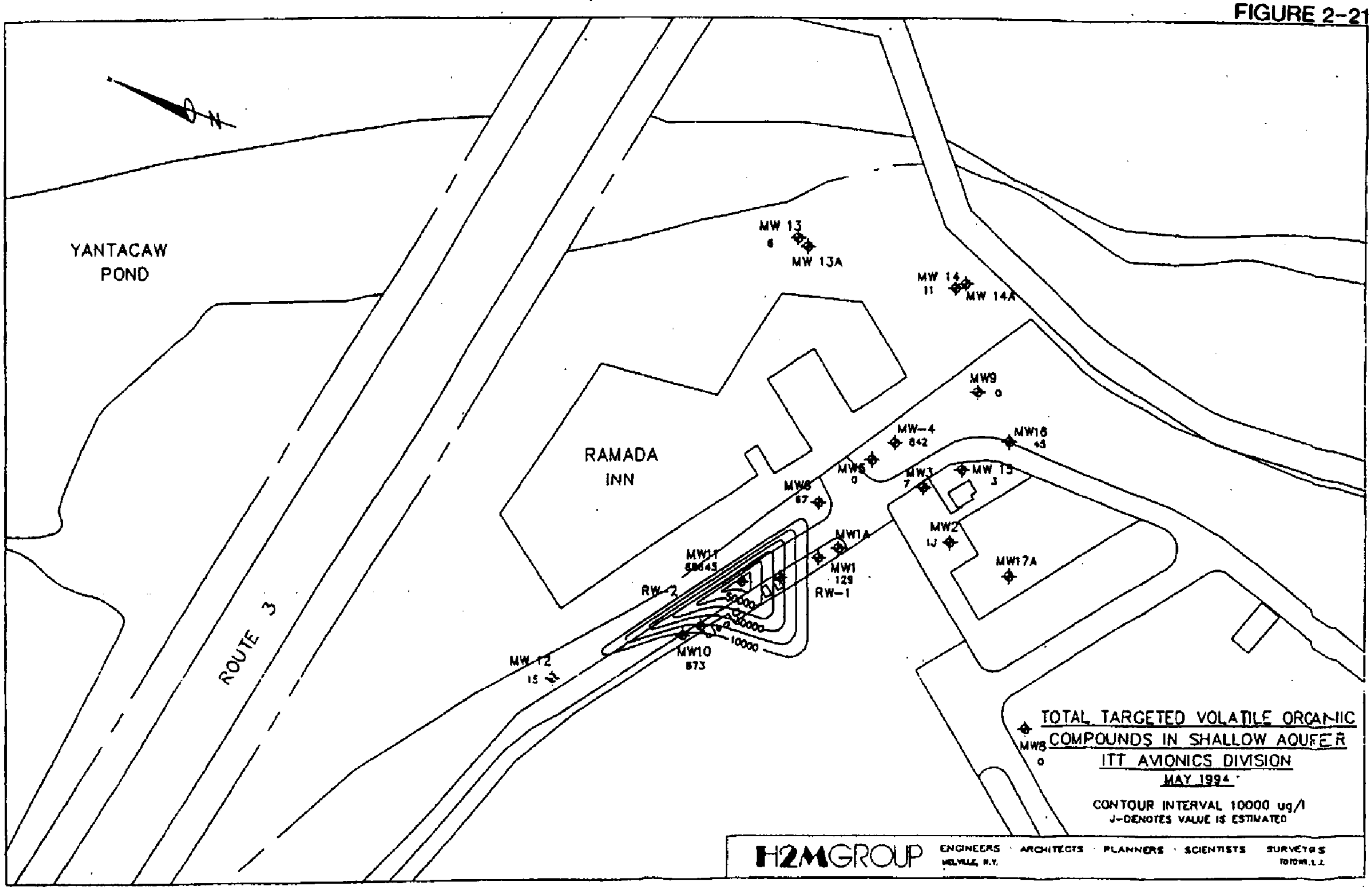
ZITA9401\RAW\SBLOC.DWG

H2M GROUP ENGINEERS MELVILLE, N.Y. ARCHITECTS PLANNERS SCIENTISTS SURVEYORS FAIRFIELD, N.J.

ADC000495

TIERRA-B-007652

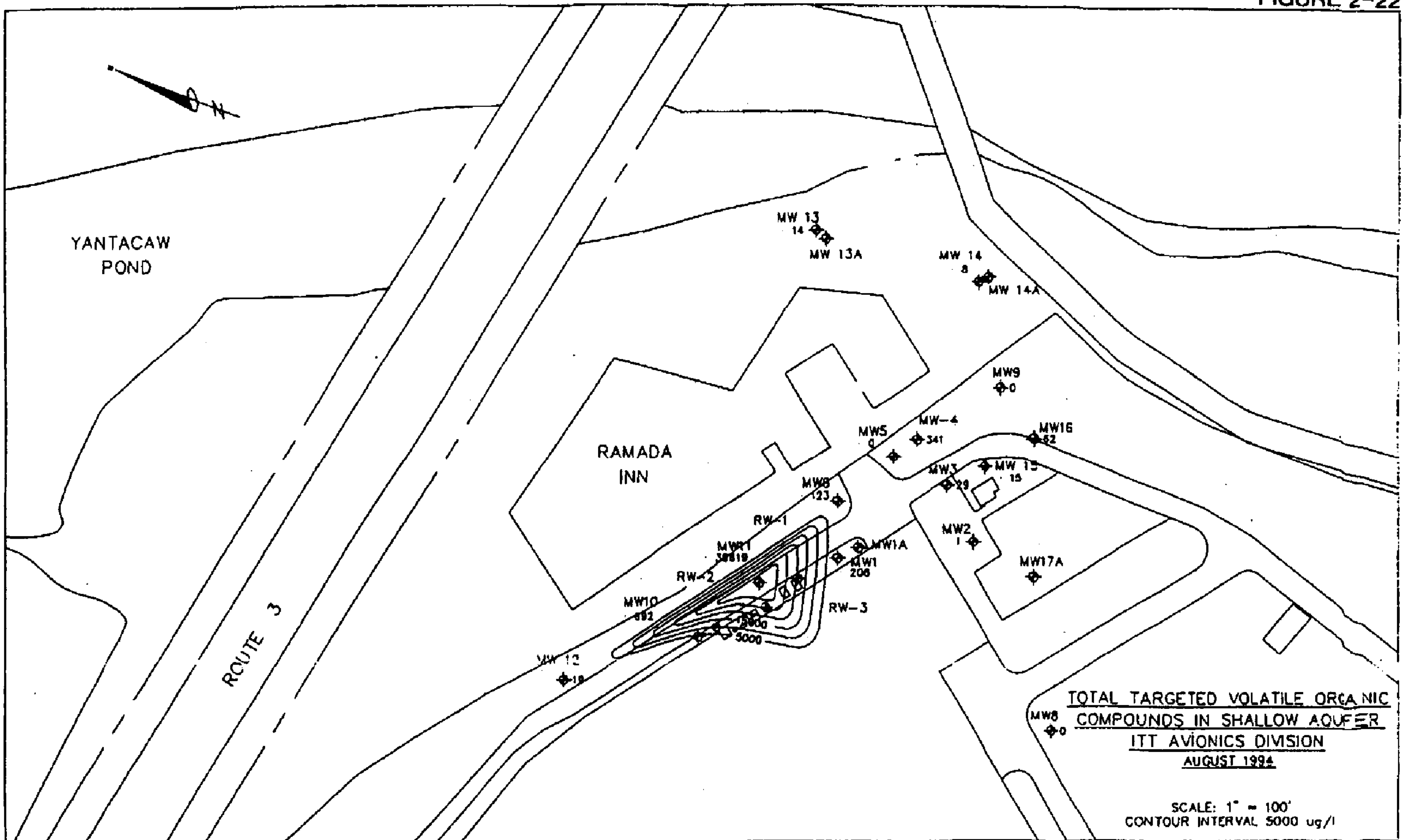
FIGURE 2-21



ADC000496

TIERRA-B-007653

FIGURE 2-22



TOTAL TARGETED VOLATILE ORGANIC COMPOUNDS IN SHALLOW AQUIFER
ITT AVIONICS DIVISION
AUGUST 1994

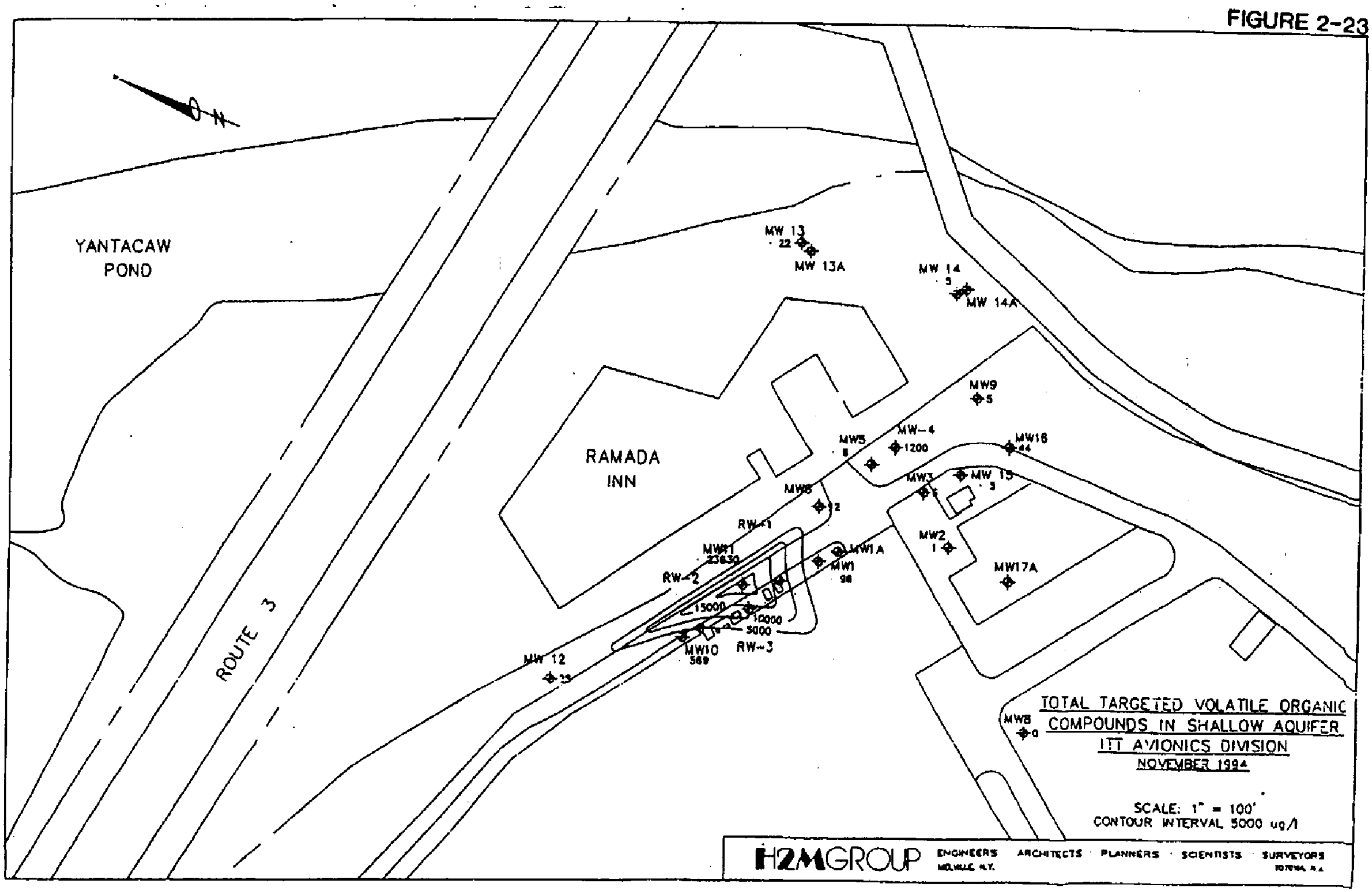
SCALE: 1" = 100'
CONTOUR INTERVAL 5000 ug/l

H2MGROUP ENGINEERS · ARCHITECTS · PLANNERS · SCIENTISTS · SURVEYORS
MELVILLE N.Y.

ADC000497

TIERRA-B-007654

FIGURE 2-23



TOTAL TARGETED VOLATILE ORGANIC COMPOUNDS IN SHALLOW AQUIFER
ITT AVIONICS DIVISION
NOVEMBER 1994

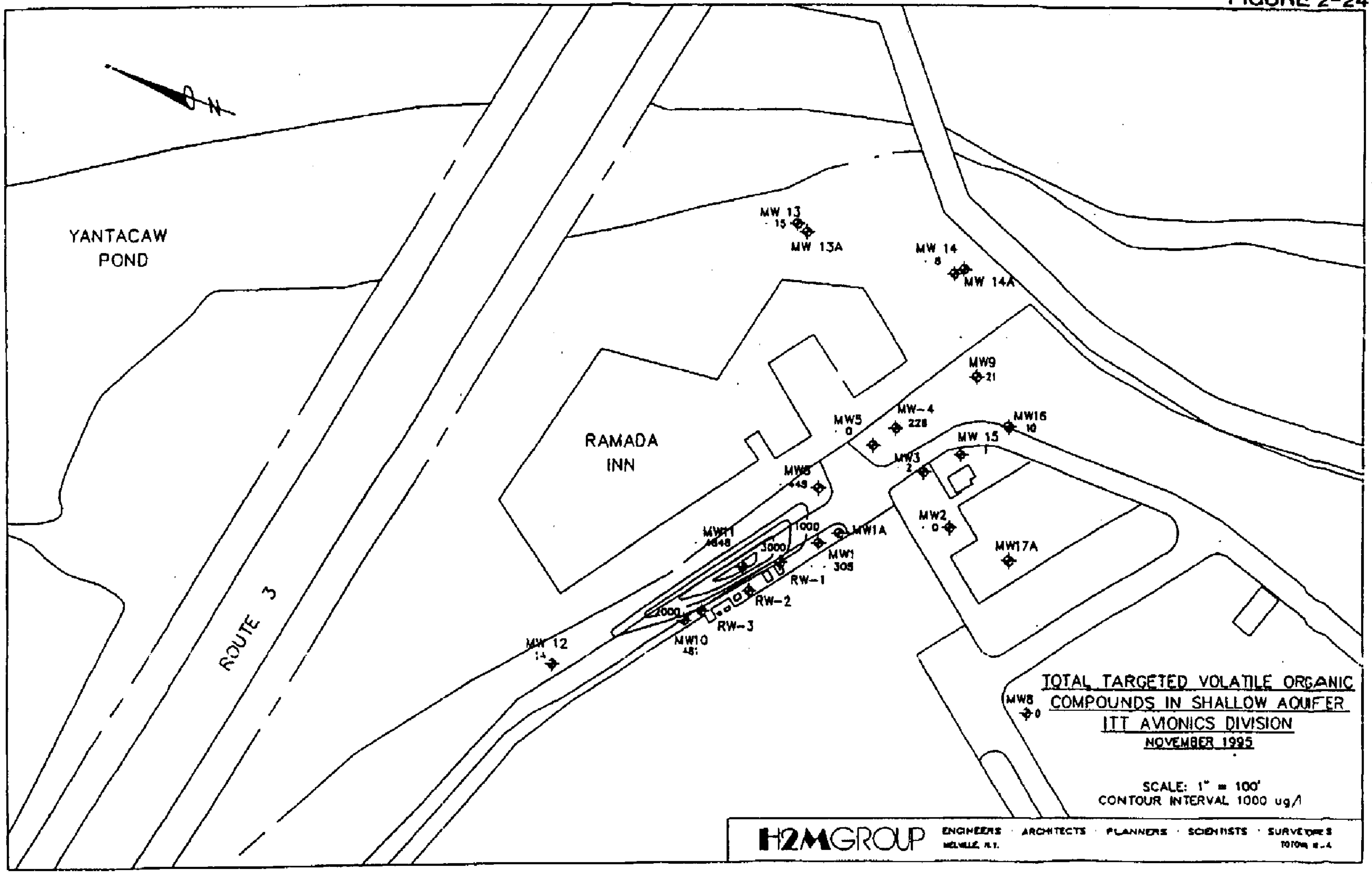
SCALE: 1" = 100'
CONTOUR INTERVAL 5000 ug/l

H2M GROUP ENGINEERS · ARCHITECTS · PLANNERS · SCIENTISTS · SURVEYORS

ADC0000498

TIERRA-B-007655

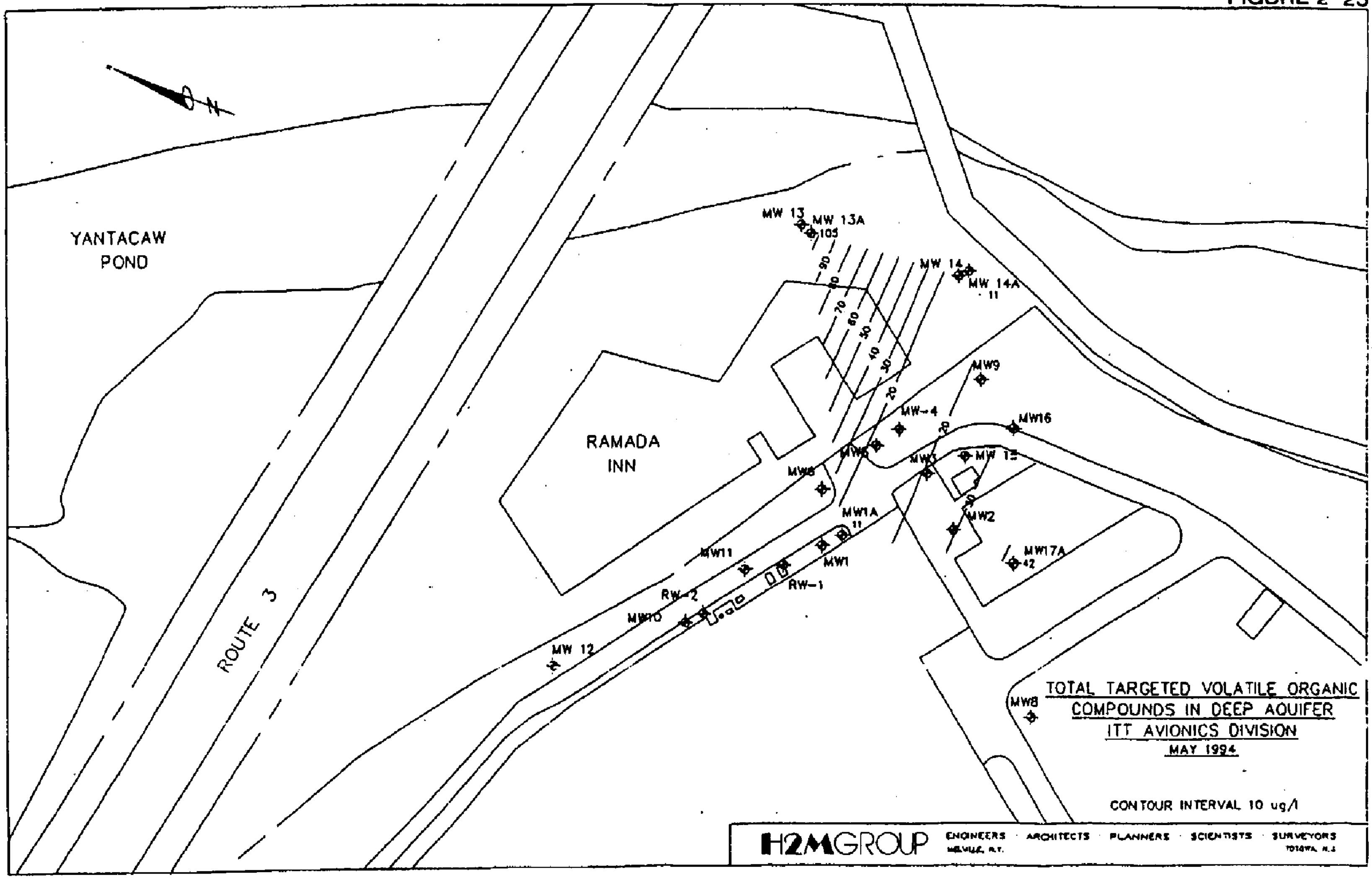
FIGURE 2-24



ADC000499

TIERRA-B-007656

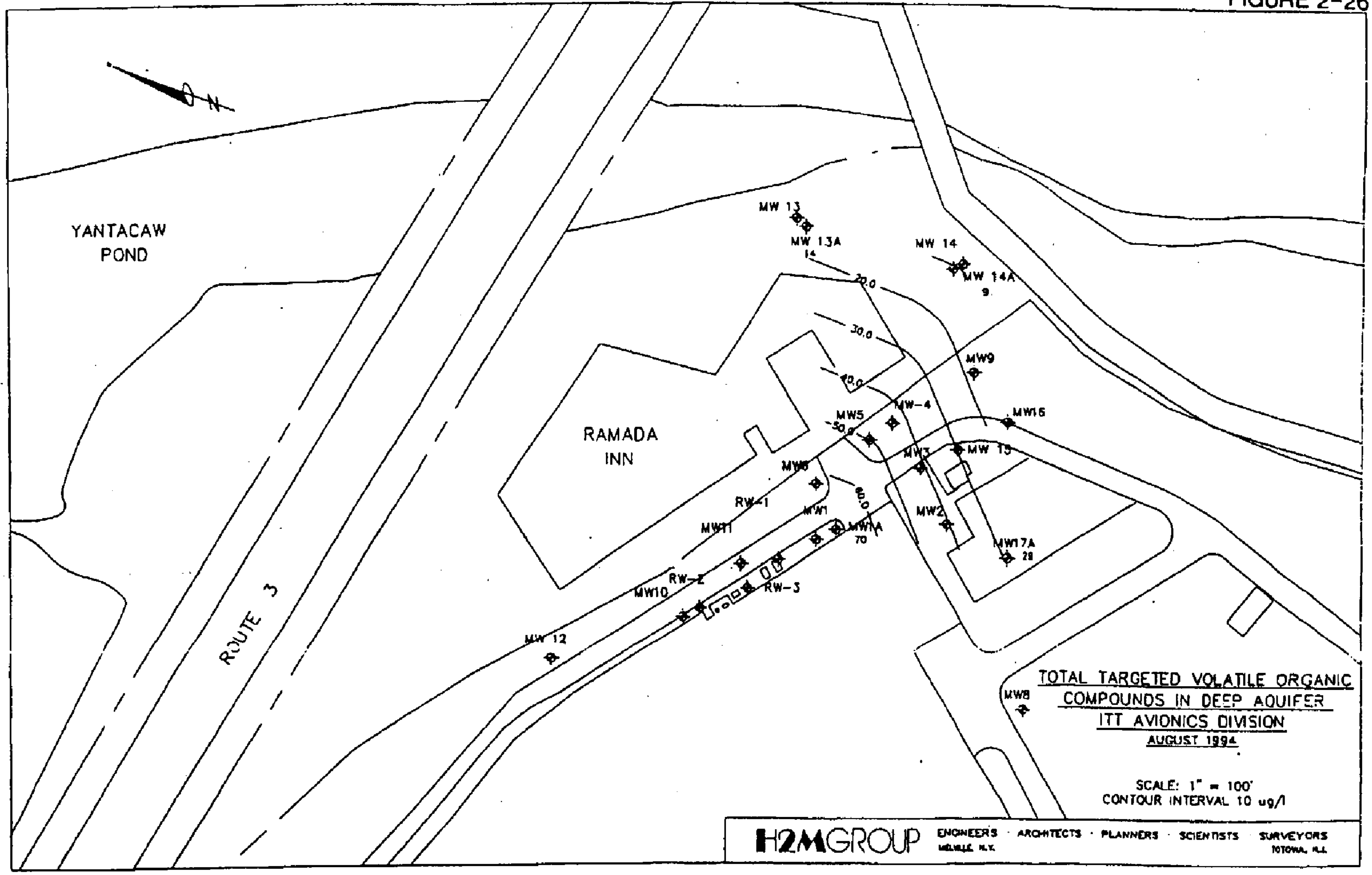
FIGURE 2-25



ADC000500

TIERRA-B-007657

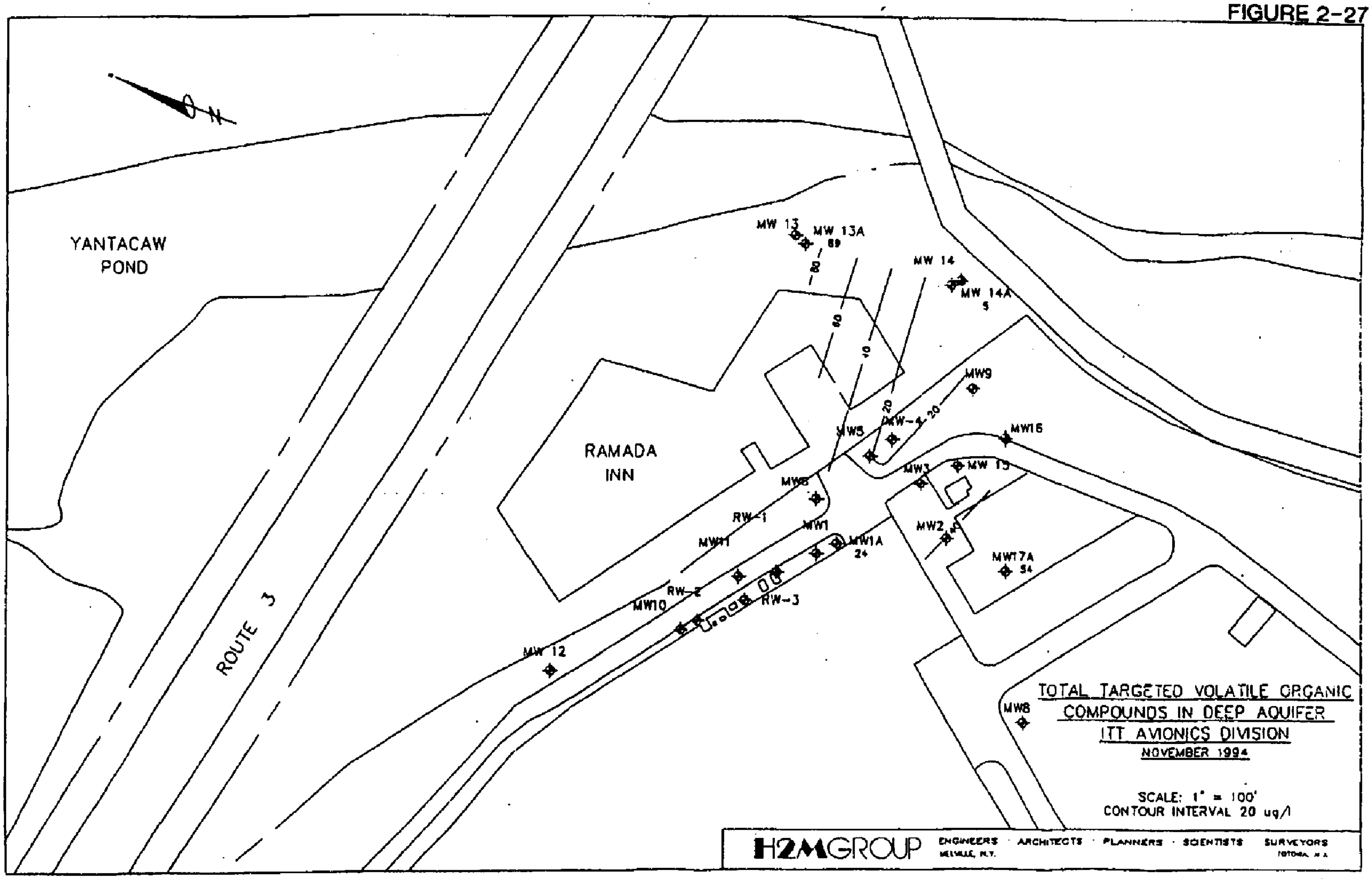
FIGURE 2-26



ADC0000501

TIERRA-B-007658

FIGURE 2-27



TOTAL TARGETED VOLATILE ORGANIC COMPOUNDS IN DEEP AQUIFER
ITT AVIONICS DIVISION
NOVEMBER 1994

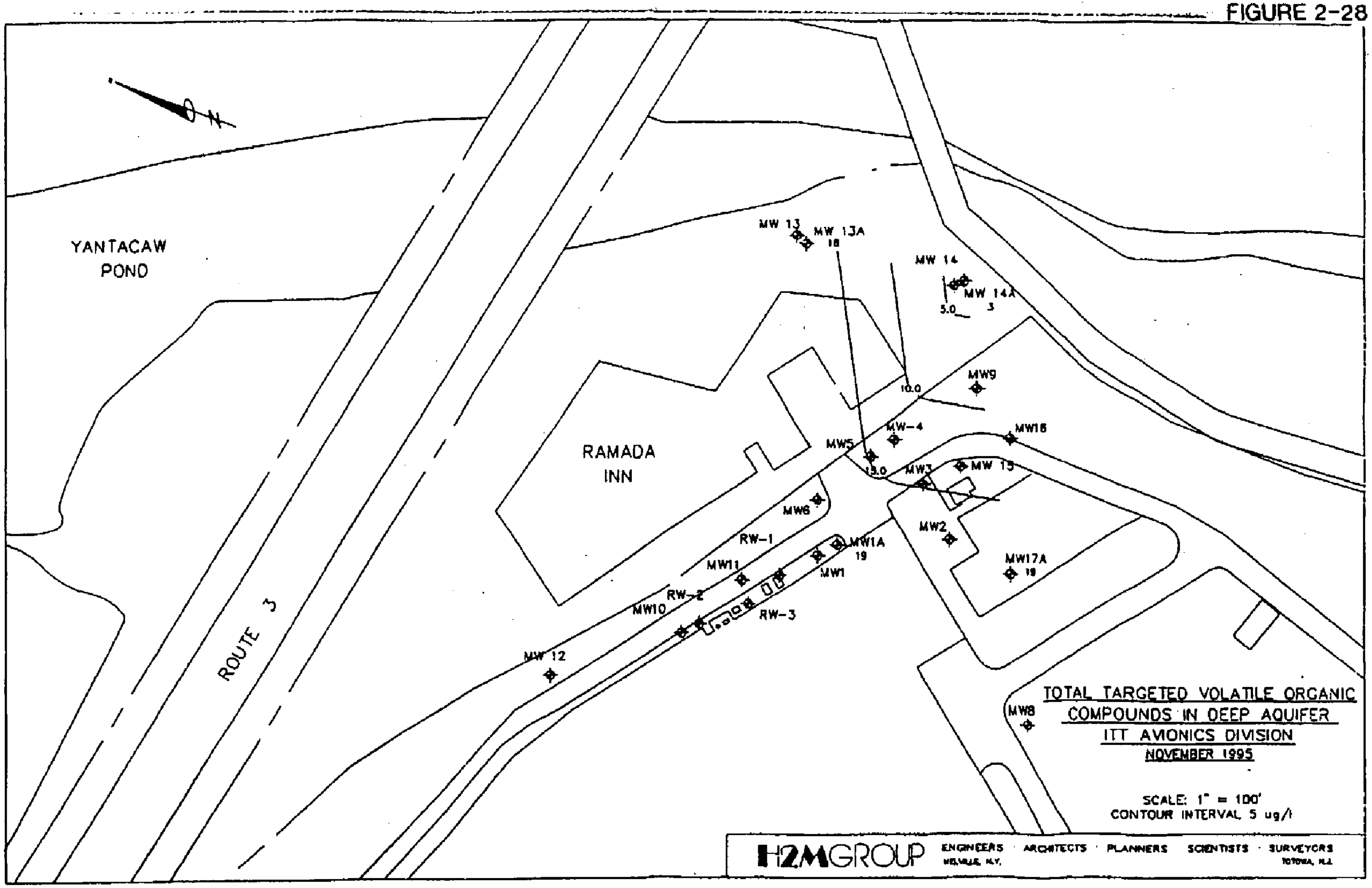
SCALE: 1" = 100'
CONTOUR INTERVAL 20 ug/l

H2M GROUP ENGINEERS · ARCHITECTS · PLANNERS · SCIENTISTS · SURVEYORS

ADC000502

TIERRA-B-007659

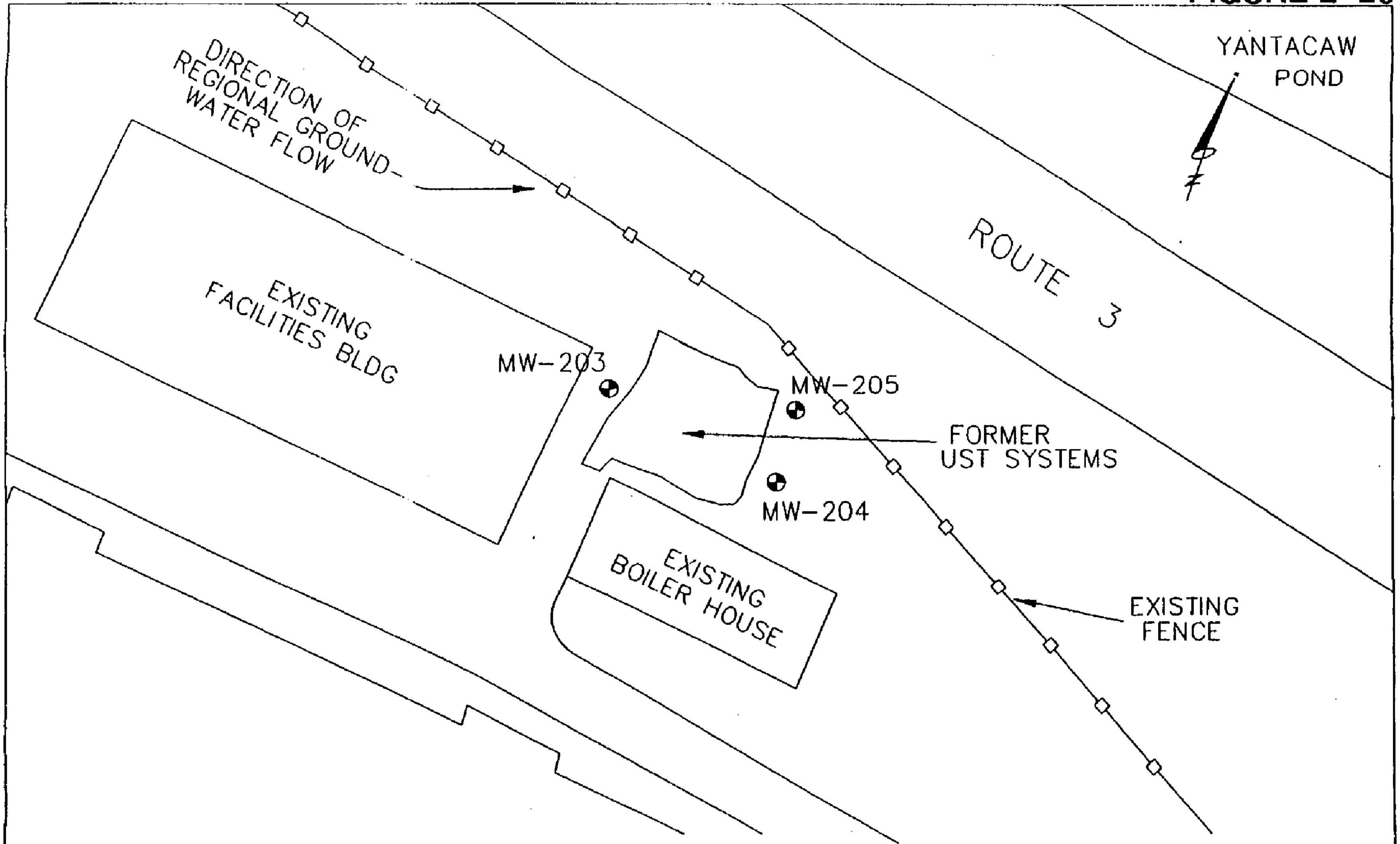
FIGURE 2-28



ADC000503

TIERRA-B-007660

FIGURE 2-29



MONITORING WELL LOCATIONS
FORMER No.2 AND No. 4 FUEL OIL UST's
ITT AVIONICS DIVISION
CLIFTON, NEW JERSEY

LEGEND:

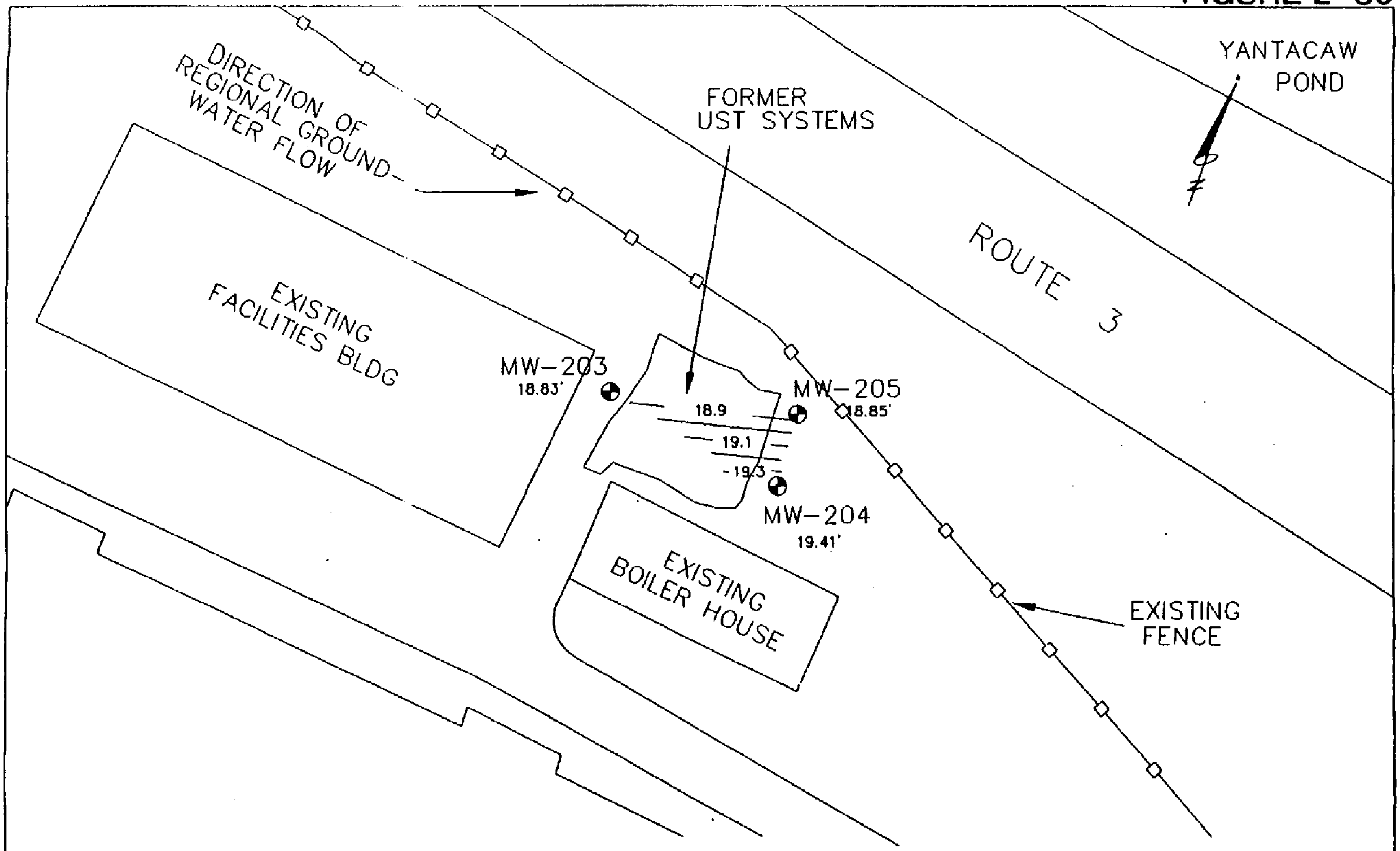
MW-1 — MONITORING WELL

SCALE (ft)
0 50 100

H2MGROUP ENGINEERS · ARCHITECTS · PLANNERS · SCIENTISTS · SURVEYORS
MELVILLE, N.Y. TOTOWA, N.J.

ADC000504

FIGURE 2-30



GROUNDWATER ELEVATION CONTOUR MAP
FORMER No.2 AND No. 4 FUEL OIL UST's
ITT AVIONICS DIVISION
CLIFTON, NEW JERSEY
CONTOUR INTER. .10 FT.

LEGEND:

MW-1 — MONITORING WELL

SCALE (ft)
0 50 100

H2M GROUP ENGINEERS · ARCHITECTS · PLANNERS · SCIENTISTS · SURVEYORS
MELVILLE, N.Y. TOTOWA, N.J.

ADC000505

APPENDIX B

ADC000506

TIERRA-B-007663

H2M GROUP

List of Tables

H2M GROUP

Table 2-1
Summary Matrix of Monitoring Well Construction Details
ITT Avionics Division
100 Kingsland Road
Clifton, New Jersey

Owner's Well No.	NJDEPE Permit No.	Total Well Depth (ft.)	Well Diam.(in.)	Riser Length (ft.)	Screen Length (ft.)	Screen Slot Size (in.)	Well Elev. (a)	Top of Screen Elevation (a)	Bottom of Screen Elevation (a)
MW-1	26-10121-1	27.8	4	17.8	10.0	0.02	32.14	14.34	4.34
MW-1A	26-18467-2	79.2	4 / O.H. 3	49.2	30.0	O.H.	29.40	-19.80	-49.80
MW-2	26-11914-5	26.2	4	11.2	15.0	0.02	35.41	24.19	9.19
MW-3	26-17121-0	29.6	4	4.6	25.0	0.03	25.91	21.34	-3.66
MW-4	26-11912-9	31.0	4	16.0	15.0	0.02	30.64	14.64	-0.36
MW-5	26-11911-1	29.2	4	14.2	15.0	0.02	30.67	16.48	1.48
MW-6	26-11910-2	24.4	4	14.4	10.0	0.02	30.62	16.22	6.22
MW-8	26-13205-2	38.8	4	23.8	15.0	0.02	45.98	22.18	7.18
MW-9	26-13204-4	27.8	4	12.8	15.0	0.02	29.36	16.56	1.56
MW-10	26-14799-8	29.0	4	14.0	15.0	0.02	35.22	21.22	6.22
MW-11	26-14800-5	25.7	4	10.7	15.0	0.02	31.02	20.32	5.32
MW-12	26-18468-1	24.9	4	9.9	15.0	0.02	31.09	21.19	6.19
MW-13	26-17118-0	20.1	4	5.1	15.0	0.02	17.81	12.71	-2.29
MW-13A	26-18465-6	68.1	4 / O.H. 3	41.9	26.2	O.H.	18.02	-23.88	-50.08
MW-14	26-17119-8	21.5	4	6.5	15.0	0.02	17.85	11.35	-3.65
MW-14A	26-18466-4	68.6	4 / O.H. 3	39.9	28.7	O.H.	17.89	-22.01	-50.71
MW-15	26-18469-9	31.7	4	6.7	25.0	0.03 / SS	26.39	19.69	-5.31
MW-16	26-23065-8	31.3	4	16.3	15.0	0.02	31.75	15.45	0.45
MW-17A	26-23066-6	81.7	4 / O.H. 3	56.7	25.0	O.H.	35.68	-21.02	-46.02
MW-18	26-34493	29.5	2	14.5	15.0	0.01	32.90	18.40	3.40
MW-203	26-24504-3	23.5	4	8.5	15.0	0.02	31.96	23.46	8.46
MW-204	26-24505-1	27.5	4	12.5	15.0	0.02	34.80	22.30	7.30
MW-205	26-24506-0	28.0	4	13.0	15.0	0.02	34.30	21.30	6.30
MW-APC1-A	26-31648	20.5	4	10.5	10.0	0.02	30.25	19.75	9.75
MW-APC1-B	26-31649	22.5	4	12.5	10.0	0.02	27.94	15.44	5.44
MW-APC2-A	26-31650	24.0	4	14.0	10.0	0.02	48.51	34.51	24.51
MW-BCKGD-A	26-31647	32.0	4	17.0	15.0	0.02	54.95	37.95	22.95

Notes:
a: Reference mark at top of PVC mon. well casing; all elevations in feet above mean sea level, USGS NGVD, 1929.
O.H.: Open Hole in competent bedrock.
All well casings and screen constructed with schedule 40 PVC, except where designated "SS", for stainless steel.

[June 12, 1996]

H2M GROUP

Table 2-2
Elevation of Top of Bedrock Surface*
ITT Avionics Division
100 Kingsland Road
Clifton, New Jersey

Well Location	Grade Elevation	Depth to Bedrock	Bedrock Elevation
MW-1A	29.8	12.0	17.8
MW-2	32.8	5.6	27.2
MW-3	29.3	4.0	25.3
MW-4	28.9	2.5	26.4
MW-5	28.7	1.0	27.7
MW-6	28.8	3.6	25.2
MW-8	43.9	12.3	31.6
MW-9	27.1	5.5	21.6
MW-10	32.2	13.0	19.2
MW-11	31.2	18.5	12.7
MW-12	32.0	9.0	23.0
MW-13	18.3	14.0	4.3
MW-14	18.0	15.0	3.0
MW-15	30.3	9.0	21.3
MW-16	32.1	13.0	19.1
MW-17A	36.0	15.0	21.0
MW-18	33.0	13.0	20.0
MW-203	32.1	14.0	18.1
MW-204	32.6	14.0	18.6
MW-205	32.0	14.0	18.0
MW-APC1-A	30.7	16.0	14.7
MW-APC1-B	28.3	15.0	13.3
MW-APC2-A	46.0	10.0	36.0
MW-BCKGD-A	52.6	13.5	39.1

Notes:
All elevations in feet above mean sea level, USGS NGVD, 1929.
* Top of weathered bedrock surface (Brunswick Formation).

[June 12, 1996]

Table 2-3
Groundwater Elevations
ITT Avionics Division
Clifton, New Jersey
August 1990 to February 1996

DATE	MW-1	MW-1A	MW-2	MW-3	MW-4	MW-5	MW-6	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	MW-13A	MW-14	MW-14A	MW-15	MW-16	MW-17A
Aug-90	12.3	9.98	11.78	11.15	11.6	12	12.4	21.7	11.1	17.72	14.35	18.05	9.26	7.57	7.38	7.37	10.03	NI	NI
Nov-90	12.7	10.3	12.21	11.53	12	12.3	12.7	21.8	11.8	17.34	14.89	17.44	9.54	7.34	7.67	7.65	10.39	NI	NI
Feb-91	13.4	10.9	12.66	10.94	12.3	12.6	13	23.4	12.4	18.04	15.84	17.47	9.88	7.32	7.87	7.86	12.19	12.31	8.87
May-91	13.6	12	13.33	11.65	12.9	13.2	13.7	24.1	12.9	17.51	16.43	18.78	10.25	7.62	8.74	8.67	12.87	12.92	8.93
Aug-91	9.23	6.68	NA	7.79	9.03	9.52	10	19	8.85	15.36	13.1	15.28	7.8	3.97	6.25	6.41	8.68	7.62	3.55
Nov-91	11.2	9.57	10.75	10.08	10.4	10.5	11.1	19.2	10.2	16.02	13.71	16.45	9.52	6.8	7.88	8.08	9.99	9.07	7.64
Feb-92	10.8	9.34	10.56	9.67	10.3	10.3	10.8	19.6	10.1	15.96	13.39	16.57	8.84	6.44	7.53	7.51	9.56	9.95	7.38
May-92	11.9	10.15	11.27	NA	11.1	11.3	11.6	20.1	10.4	16.69	14.52	17.11	8.94	6.44	7.45	7.49	NA	10.87	8.03
Aug-93	9.25	9.51	12.69	NA	9.73	9.95	10.2	17.1	9.92	13.32	11.52	15.82	7.8	6.13	6.23	6.18	NA	9.94	7.15
Nov-93	10.7	10.35	12.61	NA	10.6	10.8	11.1	21.3	9.88	14.65	12.65	17.47	8.27	6.54	6.65	6.68	NA	10.24	7.38
Feb-94	11.1	11.06	13.31	NA	11.2	11.3	11.7	21.3	11	14.7	13.48	NA	9.04	6.79	7.67	7.35	NA	11.06	8.07
May-94	12.2	11.69	13.43	NA	11.8	11.8	12.3	22.8	11.4	16.57	14.38	18.86	9.22	7.34	8.2	8.14	NA	11.58	8.65
Aug-94	11	10.92	13.02	NA	12	11.8	11.6	21.7	11.2	15.74	13.01	18.03	7.00	9.07	7.68	7.67	NA	11.72	8.14
Nov-94	8.67	8.83	12.00	NA	9.43	9.06	9.30	16.22	9.32	14.00	11.40	15.73	7.41	5.74	5.66	5.66	NA	9.19	6.52
Feb-95	10.11	9.72	12.33	10.45	10.51	10.40	10.75	20.30	9.81	15.77	12.74	17.20	8.41	6.29	5.87	5.79	10.47	10.28	7.62
May-95	9.87	9.52	11.54	9.77	9.95	9.80	10.11	18.82	9.58	14.84	12.10	15.80	8.02	6.10	7.17	6.58	9.31	9.68	7.08
Aug-95	9.66	9.37	11.8	9.87	9.89	9.79	9.99	17	9.84	12.34	11.54	15.69	7.7	5.82	7.35	7.24	9.41	9.81	5.77
Nov-95	11.5	11.21	13.23	11.46	11.6	11.3	11.7	21.8	10.6	17.42	15.15	18.5	8.89	6.86	7.56	7.31	11.45	11.28	8.18
Feb-96	12.4	11.78	13.76	15.37	11.8	11.6	12.3	24.6	11	16.06	14.28	18.86	9.50	7.64	8.80	8.65	12.30	11.69	9.17

Notes:
NA - Water Level Not Available during Monitoring Event.
NI - Monitoring Well Not Installed.

H2M GROUP

ADC000510

(June 12, 1996)

H2M GROUP

Table 2-4
Volatile Organic Compounds
Quantified in Borehole Soils (mg/kg)
AOC 1: 1,1,1-Trichloroethane Release
ITT Avionics Division
Clifton, New Jersey
June 1993

Compound	B-1 (0' - 0.5')	B-1 (5' - 5.5')	B-1 (8' - 8.5')	B-2 (0' - 0.5')	B-2 (5' - 5.5')	B-2 (8' - 8.5')	B-3 (0' - 0.5')	B-3 (5' - 5.5')	B-3 (8' - 8.5')	B-4 (0' - 0.5')	B-4 (5' - 5.5')	NJDEP Impact to GW Criteria (a)	NJDEP Residential Criteria(b)
1,1,1-Trichloroethane	<0.011	<0.010	<0.011	0.036	0.120	0.083	<0.011	<0.011	<0.011	<0.010	<0.010	50	210
1,2-Dichloroethane	<0.011	<0.010	<0.011	<0.010	0.035	0.034	<0.011	<0.011	<0.011	<0.010	<0.010	1	6
1,1-Dichloroethene	<0.011	<0.010	<0.011	<0.010	0.030	0.039	<0.011	<0.011	<0.011	<0.010	<0.010	10	8
Acetone	0.037	<0.010	<0.011	0.020	0.022	<0.010	0.023	0.017	<0.011	0.015	<0.010	50	1000

Notes:
<0.011 - Not found at or above the practical quantification limit shown.
(a) - NJDEP impact to Groundwater Criteria
(b) - NJDEP Residential Direct Contact Soil Cleanup Criteria

ADC000511

Table 2-5
Volatile Organic Compounds Quantified in Post-Excavation Confirmatory Soil Samples (mg/kg)
Two Former 4,000 Gallon Gasoline Underground Storage Tank Systems (BUST Case No. 87-08-21-1419)
AOC 2: Former Gasoline and Diesel USTs
ITT Avionics
Clifton, New Jersey
February 1988

Volatile Organic Compound	EXC1-1	EXC1-2	EXC1-3	EXC1-4A	EXC1-4B	EXC1-5	EXC1-6	EXC1-7	EXC1-8	NJDEP Impact to GW Criteria (a)	NJDEP Residential Criteria (b)
Methylene Chloride	0.031B	0.026B	0.007B	0.031B	0.015B	0.013B	0.029B	0.02B	0.018B	10	49
Toluene	0.004B	0.003B	0.002B	0.003B	0.003B	0.002B	0.006B	0.004B	0.003B	500	1000
2-Propanone	0.024B	0.026B	0.02B	<0.0055	<0.0055	0.055B	0.021B	ND	0.013	--	--
1,2-Trichloro-1,2,2-Trifluoroethane	0.084	0.07	0.073	0.075	0.07	0.085	0.22	0.039	0.03	--	--
TIC's	0.009B	0.006B	0.007B	0.006B	0.007B	0	0.018B	0.01B	0.011B	--	--

Notes:
<0.0055 - Not found at or above the practical quantification limit shown.
TIC's - Tentatively Identified Compounds
B - Compound Detected in Quality Assurance/Quality Control Blanks
(- -) - No Standard Available
(a) - NJDEP Impact to to Groundwater Criteria
(b) - NJDEP Residential Direct Contact Soil Cleanup Criteria

ADC000512

H2M GROUP

Table 2-6

Volatile Organic Compounds and Total Petroleum Hydrocarbons Quantified in Post-Excavation Confirmatory Soil Samples (mg/kg)
Former 1,000 Gallon Diesel Fuel and 4,000 Gasoline Underground Storage Tank Systems (BUST Case No. 89-09-15-1420)
AOC 2: Former Diesel and Gasoline USTs
ITT Avionics
Clifton, New Jersey
December 1989

Parameter	Diesel North	Diesel South	Diesel West	Diesel East	Gasoline North	Gasoline South	Gasoline West	Gasoline East	NJDEP Impact to GW Criteria (a)	NJDEP Residential Criteria (b)
Volatile Organic Compound:										
1,2-Dichloropropane	<0.005	0.01	<0.006	0.008	<0.005	<0.006	<0.006	<0.006	1	10
Benzene	0.008	0.37	<0.006	0.40	<0.005	<0.006	<0.006	<0.006	1	3
Toluene	0.20	4.2	0.026	4.0	<0.005	<0.006	<0.006	<0.006	500	1000
Ethylbenzene	0.11	1.4	<0.006	1.5	<0.005	<0.006	<0.006	<0.006	100	1000
TIC's	0.588	0.85	0.091	0.719	0.009	0.132	0	0.464	- -	- -
Total Petroleum Hydrocarbons	240.0	10,000.0	<16	12,000.0	<16	<16	<16	<16	10,000.0*	10,000.0*

Notes:

TIC's - Tentatively Identified Compounds

<0.005 - Not found at or above the practical quantification limit shown.

(- -) - No Standard Available

* - Action Level Based on Total Organic Contaminants

NJDEP Cleanup Standards for Contaminated Sites Proposed New Rule: N.J.A.C. 7:26D, New Jersey Register, Monday, February 3, 1992.

(a) - NJDEP Impact to Groundwater Criteria.

(b) - NJDEP Residential Direct Contact Soil Cleanup Criteria.

ADC000513

Table 2-7
Post-Excavation Confirmatory Soil Sample Results (mg/kg)
AOC 3: Former No. 2 and No. 4 Fuel Oil USTs
ITT Avionics Division
Clifton, New Jersey

Parameter	Sample No. 1	Sample No. 2	Sample No. 3	Sample No. 4	Sample No. 5	Sample No. 6	Sample No. 7	Sample No. 8	Sample No. 9	Sample No. 10	Sample No. 11	Sample No. 12	Center	East	North	West	South	NJDEP Impact to GW Criteria (a)	NJDEP Residential Criteria (b)
Volatile Organic Compounds:																			
Trichloroethene	<0.006	<0.006	<0.007	0.008	<0.007	<0.007	0.008	<0.005	<0.006	<0.005	<0.006	<0.005	<0.005	<0.006	<0.006	<0.007	<0.006	1	23
Methylene Chloride	<0.006	<0.006	<0.007	<0.006	<0.007	<0.007	<0.006	<0.005	<0.006	<0.005	0.044B	<0.005	<0.005	<0.006	<0.006	<0.007	<0.006	10	49
Trichlorofluoromethane	<0.006	<0.006	<0.007	<0.006	<0.007	<0.007	<0.006	<0.005	<0.006	<0.005	<0.006	0.008	<0.005	<0.006	<0.006	<0.007	<0.006	--	--
Semi-Volatile Organic Compounds:																			
Fluoranthene	<0.71	NA	NA	0.29	NA	<0.78	0.35	NA	NA	NA	NA	0.11	NA	NA	NA	NA	NA	500	2300
Pyrene	<0.71	NA	NA	0.76	NA	<0.78	0.72	NA	NA	NA	NA	0.24	NA	NA	NA	NA	NA	500	1700
Bis (2-Ethylhexyl) phthalate	<0.71	NA	NA	0.39	NA	<0.78	5.60	NA	NA	NA	NA	1.40	NA	NA	NA	NA	NA	100	49
Chrysene	<0.71	NA	NA	3.90	NA	<0.78	0.40	NA	NA	NA	NA	0.12	NA	NA	NA	NA	NA	500	9
Benzo (A) anthracene	<0.71	NA	NA	0.37	NA	<0.78	0.38	NA	NA	NA	NA	0.11	NA	NA	NA	NA	NA	500	0.9
Benzo (B) fluoranthene	<0.71	NA	NA	0.31	NA	<0.78	0.36	NA	NA	NA	NA	<0.72	NA	NA	NA	NA	NA	500	0.9
Benzo (K) fluoranthene	<0.71	NA	NA	0.11	NA	<0.78	0.087	NA	NA	NA	NA	<0.72	NA	NA	NA	NA	NA	500	0.9
Benzo (A) pyrene	<0.71	NA	NA	0.20	NA	<0.78	0.25	NA	NA	NA	NA	0.13	NA	NA	NA	NA	NA	500	0.9
Indeno (1,2,3-C,D) pyrene	<0.71	NA	NA	0.14	NA	<0.78	0.15	NA	NA	NA	NA	<0.72	NA	NA	NA	NA	NA	100	0.66
Benzo (G,H,I) perylene	<0.71	NA	NA	0.11	NA	<0.78	0.18	NA	NA	NA	NA	0.20	NA	NA	NA	NA	NA	500	0.9
Phenanthrene	<0.71	NA	NA	<0.74	NA	<0.78	0.25	NA	NA	NA	NA	1.50	NA	NA	NA	NA	NA	–	–
Acenaphthene	<0.71	NA	NA	<0.74	NA	<0.78	<0.74	NA	NA	NA	NA	0.37	NA	NA	NA	NA	NA	--	--
Fluorene	<0.71	NA	NA	<0.74	NA	<0.78	<0.74	NA	NA	NA	NA	0.66	NA	NA	NA	NA	NA	100	3400
																		100	2300
Total Petroleum Hydrocarbons	76	<47	<50	188	<48	100	1580	<50	273	<60	<55	5800	31.1	19.1	14.4	202	24.2	10,000.0	10,000.0

Notes:

Other compounds not shown in table were analyzed but not detected.

<0.006 - Not found at or above the practical quantification limit shown.

B - Found in blank as well as sample; sample contamination may be attributable to blank contamination.

(- -) - No standard available.

* - Action Level Based on Total Organic Contaminants, NJDEP Cleanup Standards for Contaminated Sites Proposed New Rule: N.J.A.C. 7:26D, New Jersey Register, February 3, 1992.

NA - Not Analyzed.

(a) - NJDEP Impact to Groundwater Criteria.

(b) - NJDEP Residential Direct Contact Soil Cleanup Criteria.

[June 12, 1996]

H2M GROUP

ADC000514

H2M GROUP

Table 2-8
Analytical Soil Sample Results (mg/kg)
AOC 4: Chemical/Waste Storage Building
ITT Avionics
Clifton, New Jersey

Parameter	A-SS1 (0.5'-2.5')	A-SS2 (6'-8')	A-SS3 (13'-15')	B-SS1 (0.5'-2.5')	B-SS2 (6'-8')	B-SS3 (10'-12')	NJDEP Impact to GW Criteria (a)	NJDEP Residential Criteria (b)
Volatile Organic Compounds:								
Methylene Chloride	0.320BJ	<0.0054	0.004J	0.001J	<0.0056	<0.0055	10	49
Chloroform	<0.750	<0.0054	0.016J	0.002J	<0.0056	<0.0055	1	19
1,2-Dichloroethane	0.680J	<0.0054	<0.0056	<0.0054	<0.0056	<0.0055	1	6
Chlorobenzene	<0.750	0.001J	<0.0056	<0.0054	<0.0056	<0.0055	1	37
2-Hexanone	<0.750	<0.0054	0.004J	<0.0054	0.007J	<0.0055	--	--
1,1,1-Trichloroethane	<0.750	<0.0054	<0.0056	0.004J	<0.0056	<0.0055	50	210
Carbon Tetrachloride	<0.750	<0.0054	<0.0056	<0.0054	0.002J	<0.0055	1	2
2-Butanone (MEK)	<0.750	0.015J	0.009J	0.002J	0.005J	0.005J	50	1000
Dibromochloromethane	<0.750	<0.0054	<0.0056	<0.0054	<0.0056	0.002J	1	110
Acetone	<0.750	0.042J	0.024J	0.024J	0.040J	0.026J	50	1000
Toluene	1.1	0.003J	0.003J	0.036	0.009	0.001J	500	1000
Ethylbenzene	1.0	<0.0054	<0.0056	0.002J	<0.0056	<0.0055	100	1000
Xylenes	7.4	<0.0054	<0.0056	0.008	<0.0056	<0.0055	10	410
Semi-Volatile Organic Compounds:								
Phenanthrene	0.460J	<0.360	<0.370	<0.360	<0.370	<0.370	--	--
Fluoranthene	<4.0	0.007J	<0.370	0.0048J	<0.370	<0.370	500	2300
Bis (2-Ethylhexyl) phthalate	<4.0	0.450	0.970	0.120J	0.340J	0.930	100	49
1,4-Dichlorobenzene	0.740J	<0.360	<0.370	<0.360	<0.370	<0.370	100	570
1,2-Dichlorobenzene	9.4	0.012J	<0.370	<0.360	<0.370	<0.370	50	5100
Naphthalene	<4.0	0.0069J	<0.370	<0.360	<0.370	<0.370	100	230
2-Methylnapthalene	0.190J	<0.360	<0.370	<0.360	<0.370	<0.370	--	--
Inorganics:								
Arsenic	3.8	1.1	<1.1	2.0	<1.1	<1.1	--	2
Beryllium	0.65	<0.54	<0.56	<0.54	<0.55	<0.55	--	1
Chromium	15.0	9.0	5.2	8.7	7.1	11.0	--	--
Copper	20.0	4.0	3.6	11.0	4.6	4.5	--	600
Lead	13.0	3.4	2.5	6.7	4.9	3.6	--	100
Mercury	0.2	<0.010	<0.011	<0.011	<0.010	<0.010	--	14
Nickel	21.0	7.3	6.0	8.4	7.2	7.3	--	250
Zinc	120.0	24.0	12.0	16.0	14.0	16.0	--	1500

Notes:
Other compounds not shown in table were analyzed but not detected.
<0.750 - Not found at or above the practical quantification limit shown.
(- -) - No Standard Available.
J - Parameter found below the practical quantification limit; concentration not quantifiable.
B - Found in blank as well as sample; sample contamination may be attributable to blank contamination.
(a) - NJDEP Impact to Groundwater Criteria.
(b) - NJDEP Residential Direct Contact Soil Cleanup Criteria.

[June 12, 1996]

ADC000515

TIERRA-B-007672

H2M GROUP

Table 2-8
Analytical Soil Sample Results (mg/kg)
AOC 4: Chemical/Waste Storage Building
ITT Avionics
Clifton, New Jersey

Parameter	A-SS1 (0.5'-2.5')	A-SS2 (6'-8')	A-SS3 (13'-15')	B-SS1 (0.5'-2.5')	B-SS2 (6'-8')	B-SS3 (10'-12')	NJDEP Impact to GW Criteria (a)	NJDEP Residential Criteria (b)
Volatile Organic Compounds:								
Methylene Chloride	0.320BJ	<0.0054	0.004J	0.001J	<0.0056	<0.0055	10	49
Chloroform	<0.750	<0.0054	0.016J	0.002J	<0.0056	<0.0055	1	19
1,2-Dichloroethane	0.680J	<0.0054	<0.0056	<0.0054	<0.0056	<0.0055	1	6
Chlorobenzene	<0.750	0.001J	<0.0056	<0.0054	<0.0056	<0.0055	1	37
2-Hexanone	<0.750	<0.0054	0.004J	<0.0054	0.007J	<0.0055	--	--
1,1,1-Trichloroethane	<0.750	<0.0054	<0.0056	0.004J	<0.0056	<0.0055	50	210
Carbon Tetrachloride	<0.750	<0.0054	<0.0056	<0.0054	0.002J	<0.0055	1	2
2-Butanone (MEK)	<0.750	0.015J	0.009J	0.002J	0.005J	0.005J	50	1000
Dibromochloromethane	<0.750	<0.0054	<0.0056	<0.0054	<0.0056	0.002J	1	110
Acetone	<0.750	0.042J	0.024J	0.024J	0.040J	0.026J	50	1000
Toluene	1.1	0.003J	0.003J	0.036	0.009	0.001J	500	1000
Ethylbenzene	1.0	<0.0054	<0.0056	0.002J	<0.0056	<0.0055	100	1000
Xylenes	7.4	<0.0054	<0.0056	0.008	<0.0056	<0.0055	10	410
Semi-Volatile Organic Compounds:								
Phenanthrene	0.460J	<0.360	<0.370	<0.360	<0.370	<0.370	--	--
Fluoranthene	<4.0	0.007J	<0.370	0.0048J	<0.370	<0.370	500	2300
Bis (2-Ethylhexyl) phthalate	<4.0	0.450	0.970	0.120J	0.340J	0.930	100	49
1,4-Dichlorobenzene	0.740J	<0.360	<0.370	<0.360	<0.370	<0.370	100	570
1,2-Dichlorobenzene	9.4	0.012J	<0.370	<0.360	<0.370	<0.370	50	5100
Naphthalene	<4.0	0.0069J	<0.370	<0.360	<0.370	<0.370	100	230
2-Methylnapthalene	0.190J	<0.360	<0.370	<0.360	<0.370	<0.370	--	--
Inorganics:								
Arsenic	3.8	1.1	<1.1	2.0	<1.1	<1.1	--	2
Beryllium	0.65	<0.54	<0.56	<0.54	<0.55	<0.55	--	1
Chromium	15.0	9.0	5.2	8.7	7.1	11.0	--	--
Copper	20.0	4.0	3.6	11.0	4.6	4.5	--	600
Lead	13.0	3.4	2.6	6.7	4.9	3.6	--	100
Mercury	0.2	<0.010	<0.011	<0.011	<0.010	<0.010	--	14
Nickel	21.0	7.3	6.0	8.4	7.2	7.3	--	250
Zinc	120.0	24.0	12.0	16.0	14.0	16.0	--	1500

Notes:
Other compounds not shown in table were analyzed but not detected.
<0.750 - Not found at or above the practical quantification limit shown.
(- -) - No Standard Available.
J - Parameter found below the practical quantification limit; concentration not quantifiable.
B - Found in blank as well as sample; sample contamination may be attributable to blank contamination.
(a) - NJDEP Impact to Groundwater Criteria.
(b) - NJDEP Residential Direct Contact Soil Cleanup Criteria.

[June 12, 1996]

H2M GROUP

Table 2-9
Summary of Concrete Floor Sampling - Printed Circuit Board Area
ITT Avionics Division
Clifton, New Jersey
August 27 - 28, 1990

Parameter	C-1	C-2	C-3	C-4	C-5	C-6	C-7	C-8	C-9	C-10	C-11
Corrosivity	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
pH	11.8	11.9	11.3	11.8	12.3	12.3	12.4	12.3	11.8	12.1	11.8
Reactivity	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Cyanide (mg/kg)	<0.10	0.33	0.33	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sulfide (mg/kg)	<10.0	40.6	40.2	20.0	10.0	<10.0	40.0	<10.0	<10.0	38.3	<10.0
Arsenic (mg/l)	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
Barium (mg/l)	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Cadmium (mg/l)	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Chromium (mg/l)	<0.100	<0.100	<0.100	<0.100	<0.100	0.102	0.370	0.478	<0.100	<0.100	<0.100
Lead (mg/l)	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
Mercury (mg/l)	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Selenium (mg/l)	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
Silver (mg/l)	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025

Parameter	C-12	C-13	C-14	C-15	C-16	C-17	C-18	C-18 D	C-19*	C-20	C-21
Corrosivity	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
pH	11.8	11.7	12.2	12.2	12.1	12.2	11.7	11.9	11.7	12.1	11.6
Reactivity	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Cyanide (mg/kg)	<10.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sulfide (mg/kg)	21.2	12.4	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Arsenic (mg/l)	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
Barium (mg/l)	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Cadmium (mg/l)	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.059	0.032	<0.025	<0.025
Chromium (mg/l)	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	0.45	<0.100
Lead (mg/l)	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
Mercury (mg/l)	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Selenium (mg/l)	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
Silver (mg/l)	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025

Notes:
NC - Non Corrosive
NR - Non Reactive
< 0.025 - Parameter not detected above detection limit.
C-18D - Duplicate Sample
* - Control Sample

H2M GROUP

Table 2-10
Summary of Wall Wipe Sampling - Printed Circuit Board Area
ITT Avionics Division
Clifton, New Jersey
August 28, 1996

Parameter	WW-1	WW-2	WW-3	WW-4	WW-5	WW-6	WW-7	WW-8	WW-9
Corrosivity	NC	NC	NC	NC	NC	NC	NC	NC	NC
pH	5.2	5.6	5.5	5.4	5.5	6.1	5.5	5.6	5.7
Reactivity	NR	NR	NR	NR	NR	NR	NR	NR	NR
Cyanide (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Sulfide (mg/kg)	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	57.6
Arsenic (ug/m^2)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium (ug/m^2)	55.6	52.8	15.28	39.72	16.4	2.86	11.52	2.048	2.868
Cadmium (ug/m^2)	4.88	9.92	2.788	1.488	<0.50	<0.50	1.26	<0.50	<0.50
Chromium (ug/m^2)	159.2	119.6	33.68	76.8	35.44	6.84	23.48	3.512	15.04
Lead (ug/m^2)	448.0	768.0	82.0	279.2	44.0	5.08	28.8	112.4	25.6
Mercury (ug/m^2)	2.504	1.968	1.920	0.72	0.412	<0.40	1.756	2.808	1.852
Selenium (ug/m^2)	<0.50	<0.50	<0.50	0.920	<0.50	<0.50	<0.50	<0.50	<0.50
Silver (ug/m^2)	<1.0	3.168	2.308	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Parameter	WW-10	WW-11	WW-12	WW-13	WW-14	WW-15	WW-16*	FB1
Corrosivity	NC	NC	NC	NC	NC	NC	NC	NC
pH	5.4	4.0	6.4	6.4	4.8	6.3	6.3	6.3
Reactivity	NR	NR	NR	NR	NR	NR	NR	NR
Cyanide (mg/kg)	<0.20	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20
Sulfide (mg/kg)	<20.0	158.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0
Arsenic (ug/m^2)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium (ug/m^2)	11.4	2.688	<1.0	2.848	11.64	1.36	1.592	<1.0
Cadmium (ug/m^2)	<0.50	<0.50	<0.50	<0.50	102.4	<0.50	<0.50	<0.50
Chromium (ug/m^2)	49.2	6.48	1.28	6.64	12.96	1.2	<1.0	<1.0
Lead (ug/m^2)	616.0	96.0	4.24	23.6	86.4	2.768	0.9	<0.50
Mercury (ug/m^2)	1.396	1.30	<0.40	1.836	1.92	0.792	0.876	<0.40
Selenium (ug/m^2)	<0.50	<0.50	<0.50	<0.50	0.840	<0.50	<0.50	<0.50
Silver (ug/m^2)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Notes:
NC - Non Corrosive
NR - Non Reactive
< 0.025 - Parameter not detected above detection limit.
* - Control Sample

H2M GROUP

Table 2-11
Summary of Ceiling Tile Sampling - Printed Circuit Board Area
ITT Avionics Division
Clifton, New Jersey
August 28 & September 10, 1996

Parameter	CT-1	CT-2	CT-3	CT-4	CT-5	CT-6	CT-6D	CT-7
Corrosivity	NC	NC	NC	NC	NC	NC	NC	NC
pH	7.7	7.1	7.9	7.9	7.2	7.6	7.7	7.7
Reactivity	NR	NR	NR	NR	NR	NR	NR	NR
Cyanide (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sulfide (mg/kg)	196.0	148.0	310.0	323.0	147.0	142.0	135.0	256.0
Arsenic (mg/l)	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
Barium (mg/l)	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Cadmium (mg/l)	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Chromium (mg/l)	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Lead (mg/l)	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
Mercury (mg/l)	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.000250	0.000500	0.00275
Selenium (mg/l)	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200
Silver (mg/l)	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025

Notes:
NC - Non Corrosive
NR - Non Reactive
< 0.025 - Parameter not detected above detection limit.
CT-6D - Duplicate Sample

[June 12, 1996]

Table 2-12
Volatile Organic Compounds Quantified in Groundwater (ug/l)
ITT Avionics Division
Clifton, New Jersey
August 1990

Compound	MW-1	MW-1A	MW-2	MW-3	MW-4	MW-5	MW-6	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	MW-13A	MW-14	MW-14A	MW-15	NJDEP Specific GW Quality Criteria
1,1-Dichloroethene	1500	55	<5	<5	5	<5	10	<5	<5	1800	190	<5	<5	<5	<5	<5	<5	2
1,1-Dichloroethane	<5	5	5	18	<5	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	70
Chloroform	<5	7	<5	<5	<5	5	7	<5	16	<5	<5	33	32	5	12	14	<5	6
1,1,1-Trichloroethane	3700	200	<5	14	9	8	34	<5	<5	5600	590	24	<5	14	<5	<5	100	30
Carbon Tetrachloride	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	5	<5	<5	<5	<5	<5	2
Tetrachloroethene	<5	<5	<5	<5	9	<5	<5	<5	<5	130	<5	<5	<5	<5	<5	<5	<5	1
Trichloroethene	<5	44	<5	5	17	26	38	<5	7	180	<5	<5	6	6	<5	<5	<5	1
Benzene	<5	<5	18	230	100	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	250	1
Toluene	<5	<5	<5	170	160	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	390	1000
Ethylbenzene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	760	700
Methylene Chloride	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	5	<5	2

Notes:
< 5 - Analyte not detected at or above the given quantification limit.
180 - Denotes concentration above NJDEP Specific Groundwater Quality Criteria
<5 - Denotes detection limit is above the NJDEP Specific Groundwater Quality Criteria.

[June 12, 1996]

ADC000519

TIERRA-B-007677

H2M GROUP

Table 2-13
Volatile Organic Compounds Quantified in Groundwater (ug/L)
ITT Avionics Division
Clifton, New Jersey
November 1990

Compound	MW-1	MW-1A	MW-2	MW-3	MW-4	MW-5	MW-6	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	MW-13A	MW-14	MW-14A	MW-15	NJDEPE Specific GW Quality Criteria
Benzene	<5	<5	<5	*110*	*140*	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	*240*	1
Carbon Tetrachloride	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	*22*	<5	<5	<5	<5	<5	2
Chlorobenzene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	*6*	<5	<5	<5	<5	<5	<5	4
Chloroform	3J	*9*	<5	<5	<5	5	<5	<5	5	<5	*14*	*10*	*39*	<5	*7*	*10*	<5	6
1,1-Dichloroethane	10	11	<5	<5	7	6	2J	<5	<5	<5	*160*	23	3J	8	<5	<5	7	70
1,2-Dichloroethane	*24*	<5	<5	<5	<5	<5	<5	<5	<5	*7*	*65*	<5	<5	<5	<5	<5	<5	2
1,1-Dichloroethene	*1,000*	*140*	<5	<5	<5	<5	*19*	<5	<5	*1,000*	*2,700*	*51*	*51*	*12*	<5	<5	<5	2
Ethylbenzene	<5	8	<5	270	380	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	600	700
Tetrachloroethene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	*15*	<5	<5	<5	<5	<5	<5	1
Toluene	1J	6	<5	120	830	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	390	1000
1,1,1-Trichloroethane	*4,400*	*400*	<5	<5	<5	13	*87*	<5	8	*4,400*	*7,400*	*191*	<5	*45*	5	<5	<5	30
Trichloroethene	*23*	*61*	<5	<5	<5	*32*	*32*	<5	*23*	*130*	*130J*	*130*	*6*	*13*	*12*	<5	<5	1
Vinyl Chloride	*<10*	*<10*	*<10*	*<10*	*<10*	1J	*<10*	*<10*	*<10*	*<10*	*<10*	*<10*	*<10*	*<10*	*<10*	*<10*	*<10*	5
1,2-trans-Dichloroethene	<5	5	<5	<5	28	10	2J	<5	<5	<5	8	<5	<5	<5	<5	<5	8	100

Notes:

180 - Denotes concentration above NJDEPE Specific Groundwater Quality Criteria.

<5 - Denotes detection limit is above the NJDEPE Specific Groundwater Quality Criteria.

Table 2-14
Total Volatile Organic Compounds
Quantified in Groundwater (ppb)
ITT Avionics Division
Clifton, New Jersey

H2M GROUP

Monitoring Period	MW 1	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8	MW 9	MW 10	MW 11	MW 12	MW 13	MW 14	MW 15	MW 16	MW 1A	MW 13A	MW 14A	MW 7A
April 88	11,068	75	14,400	21,280	9,300	595	30,099	100	35	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
January 89	32,300	168	84,000	43,000	81,000	758	-	12	98	20,678	1,571	NI	NI	NI	NI	NI	NI	NI	NI	NI
August 90	5,245	23	437	300	45	89	-	0	23	8,210	805	62	43	12	1,500	NI	311	30	19	NI
November 90	5,457	0	500	1,385	72	142	-	0	36	5,537	10,368	381	53	24	1,245	NI	640	78	10	NI
February 91	3,836	0	340	45	39	226	-	14	43	104	13,600	413	29	32	40	NI	81	47	60	NI
May 91	3,615	13	3,061	3,166	61	349	-	0	48	6,042	14,345	330	41	19	1,286	204	1,269	54	39	184
August 91	948	-	2,090	639	127	128	-	4	35	5,829	16,450	89	94	32	887	389	515	49	46	303
November 91	610	12	1,129	2,780	536	172	-	0	25	2,306	5,309	47	66	18	1,062	140	603	24	24	137
February 92	1,080	6	710	2,774	27	231	-	0	15	6,610	11,780	47	38	37	1,100	206	598	30	25	248
May 92	481	0	239	2,860	20	186	-	0	12	3,990	9,800	26	29	17	130	110	293	29	24	237
August 92	480	0	62	1,979	29	46	-	0	16	2,880	10,300	25	44	25	366	45	353	0	28	105
September 92										Treatment system operation begins *										
November 92	207	0	47	1,869	10	71	-	0	13	3,181	6,414	18	34	22	1,905	7	136	154	21	150
February 93	140	7	14	1,767	25	42	-	0	0	1,708	14,909	11	18	7	460	165	120	18	9	86
May 93	92	0	0	6	6	1,693	-	0	31	1,708	22,835	12	0	0	0	46	6	63	45	92
August 93	79	0	0	646	9	45	-	0	9	1,219	15,173	12	23	7	0	135	8	7	0	45
November 93	123	0	6	1,156	23	70	-	0	0	862	16,208	16	28	0	7	74	38	73	0	118
February 94	47	0	0	1,164	0	22	-	0	0	746	31,681	0	0	0	0	85	0	42	5	74
May 94	129	1	7	842	0	67	-	0	0	673	68,645	15	6	11	3	45	11	44	11	42
										Extraction Well RW-3 Installed and Operational *										
August 94	206	1	29	341	0	123	-	0	0	692	39,619	19	14	8	15	62	70	14	9	29
November 94	96	1	6	1200	8	92	-	0	5	569	23,630	28	22	5	5	44	24	89	5	54
May 95	313	-	-	1096	-	127	-	-	-	809	34,519	-	-	-	-	-	-	-	-	-
Nov-95	305	0	2	228	0	445	-	0	21	481	4848	14	15	8	1	10	19	18	3	19

ADC000521

Note:
NI - Not yet installed.

(June 12, 1996)

H2M GROUP

Table 2-15
Volatile Organic Compounds Quantified in Groundwater (ug/L)
Former No. 2 and No. 4 Fuel Oil USTs
ITT Avionics Division
Clifton, New Jersey

Compound	MW-203 May 8, 1991	MW-203 May 22, 1991	MW-203 Sept 27, 1995	MW-204 May 8, 1991	MW-204 May 22, 1991	MW-204 Sept 27, 1995	MW-205 May 8, 1991	MW-205 May 22, 1991	MW-205 Sept 27, 1995	NJDEPE Specific GW Quality Criteria
Chloroform	18	20	10	14	14	6	15	13	4	6
1,1,1-Trichloroethane	11	9	<1	9	7	<1	9	6	<1	30
Trichloroethene	11	14	6	<5	<5	<1	7	18	5	1
1,4-Dichlorobenzene	<5	<5	<1	<5	<5	22	<5	19	6	75
c/t-1,2-Dichloroethene	<5	<5	<1	<5	<5	<1	5	10	<1	10/100*
1,3-Dichlorobenzene	<5	<5	<1	<5	<5	4	<5	<5	2	600
Chlorobenzene	<5	<5	<1	<5	<5	15	<5	<5	1	4

Notes:
[shaded] - Denotes concentration above NJDEP Specific Groundwater Quality Criteria.
<5 - Denotes detection limit is above the NJDEPE Specific Groundwater Quality Criteria.
<5 - Not found at or above the practical quantification limit shown.
* - Specific Groundwater Quality Criteria for cis-1,2-dichloroethene and trans-1,2-dichloroethene, respectively.

[June 12, 1996]

Table 2-16
Volatile Organic Compounds Quantified in Groundwater (ug/L)
AOC 4 - Chemical / Waste Storage Building
ITT Avionics Division
Clifton, New Jersey

Compound	Upgradient MW-APC1-B Dec. 4, 1992	Upgradient MW-APC1-B Sept 27, 1995	Upgradient MW-APC1-B Dec 13, 1995	Downgradient MW-APC1-A Dec. 4, 1992	Downgradient MW-APC1-A Sept 27, 1995	Downgradient MW-APC1-A Dec 13, 1995	NJDEP Specific GW Quality Criteria
Methylene Chloride	3BJ	<1	< 5	2BJ	<1	<5	2
Chloroform	77	<1	< 5	<5	430D	94	6
1,1-Dichloroethene	3J	2	< 5	5J	<1	<5	2
1,1-Dichloroethane	4J	<1	< 5	<5	2	<5	70
1,2-Dichloroethene	11	<1	<5	<5	<1	<5	10/100*
1,1,1-Trichloroethane	18	2	14	31	9	22	30
Carbon Tetrachloride	7.8	<1	< 5	<5	58	27	2
Trichloroethene	3.6	<1	< 5	<5	20	55	1
Tetrachloroethene	<5	<1	< 5	<5	1	<5	1

Notes:
[shaded] - Denotes concentration above NJDEP Specific Groundwater Quality Criteria.
<5 - Denotes detection limit is above the NJDEP Specific Groundwater Quality Criteria.
<5 - Not found at or above the practical quantification limit shown.
D - Diluted sample; initial run above calibration range of laboratory analytical instrument.
* - Specific Groundwater Quality Criteria for cis-1,2-dichloroethene and trans-1,2-dichloroethene, respectively.
J - Parameter found below the practical quantification limit; concentration not quantifiable.
B - Found in blank as well as sample; sample contamination may be attributable to blank contamination.

H2M GROUP

ADC000523

[June 12, 1996]

APPENDIX D

YORK LABORATORIES
A DIVISION OF YWC

RECEIVED
OCT 26 1990
"RONMENTAL PROTECTIO"

SAMPLING PLAN RESULTS
OF
CONCRETE BORINGS, WALL WIPES, AND CEILING TILE
AT THE
ITT CORPORATION
CLIFTON, NEW JERSEY

PREPARED BY:
YORK LABORATORIES OF NEW JERSEY
628 ROUTE 10
WHIPPANY, NEW JERSEY 07981

OCTOBER, 1990

628 ROUTE 10 • WHIPPANY, NEW JERSEY 07981 • (201) 428 8181
200 MONROE TURNPIKE • MONROE, CONNECTICUT 06468 • (203) 452 8200
125 WEST CENTER COURT • SCHAUMBURG, ILLINOIS 60195 • (708) 705 0740

TABLE OF CONTENTS

YORK LABORATORIES
A DIVISION OF YWC

October 10, 1990

Advanced Environmental Technology Corporation
1 Eden Lane
Flanders, New Jersey 07836

Attention: Kevin Anderson

Re: Sampling Plan Results
ITT Printed Circuit Board Area
Project # 02279004

Dear Mr. Anderson:

As requested, we have completed the environmental sampling and testing of the Printed Circuit Board area, at the ITT Corporation, of Clifton, New Jersey. In this report, we present the sampling procedures, field quality control, and sampling plan results.

SITE LOCATION AND DESCRIPTION

The ITT Corporation is located at 100 Kingsland Road, Clifton, Passaic County, New Jersey. The Printed Circuit Board Area consists of ten rooms and is located on the east side of the facility.

SAMPLING PLAN

In order to conduct an environmental assessment of the Printed Circuit Board Area, ITT and York Laboratories designed a sampling plan which included the collection and laboratory analysis of concrete floor samples, ceiling tile samples, and wall wipe samples. The sampling plan was executed on August 27, 28 and September 10, when a total of twenty one (21) concrete boring samples, six (6) ceiling tile samples, and fifteen (15) wall wipe samples were collected in the Printed Circuit Board Area. The sample locations are shown on the Sample Location Diagrams on pages 9-11. The following sections of this report describe the work performed in each task. All sampling procedures were performed in accordance with the Sampling and Analysis Plan prepared by Gail Mazzarell Quotation No.: 080790-E29-GM/TM.

TASK I CONCRETE CORE SAMPLES

Twenty (20) concrete core samples were collected within ten (10) rooms of the Printed Circuit Board area and one (1) control sample (Sample I.D. C-19) was collected at the location outside the Printed Circuit Board Area. The sample locations were marked by Mr. Donald Porzo, the ITT Corporation's Supervisor of Environmental Protection.

The core drilling procedures were conducted in accordance with ASTM C42-87. All core specimens were drilled with a portable Black and Decker drill equipped with a two (2) inch diameter core barrel. At each sample location, the floor surface area was first cleaned with a wire brush and distilled water to remove loose particles and dirt. The sample location was then cored to the specified depth between five (5) and seven (7) inches below the surface. The diamond bit was cooled with a constant flow of distilled water to prevent over heating and destruction of the core barrel. Distilled water was used to prevent the possibility of contamination from tap water. The waste water was disposed of at the floor drain sites within the PCB Area.

Upon retrieval of each core sample, the sample was placed on plastic sheeting where the sample was measured and the physical characteristics were described in the field sampling log book. The sample was placed into a clean sample container and labeled with the sample I.D., client, date and time collected, and parameters to be tested for. A field quality control sample was taken at sample location C-18 DUP . It was performed by drilling a core sample adjacent to the location specified by the representative for ITT Corporation. The duplicate was handled and analyzed the same as the other samples.

The drilling equipment was decontaminated between sample locations using the following procedure:

1. Wash with tap water and non phosphate soap.
2. Rinse with tap water.
3. Rinse with deionized water.
4. Rinse with a 10% Nitric Acid solution.
5. Rinse with deionized water.
6. Air dried.

TASK II WALL WIPE SAMPLES

Fifteen (15) wall wipe samples were collected within five rooms of the printed circuit board area and one (1) sample was collected in the environmental conference room for background data (Sample I.D. WW-15). The sample locations were marked by Mr. Donald Polzo.

The wipe samples were collected by taping a template measuring 25 cm x 25 cm square on the wall to be sampled. The template was used to measure out the sample area to minimize error and markings on the wall. A 3 inch X 3 inch sterile gauze pad was then used to wipe four 25 cm X 25 cm square areas. The gauze pad was removed from the sterile wrapping and was soaked with 15-20 mls of deionized water prior to the sampling. The sample area was then stroked with the saturated gauze pad once in the horizontal direction and once in the vertical direction. The gauze pad was then placed into a clean sample container and labeled to show sample I.D., client, date and time collected, and parameters to be tested for. This information along with a sample description was recorded in the field log book. Field quality control samples included one (1) field blank. The field blank was performed by saturating a sterile gauze pad with deionized water and placing it into a clean sample container. The blank samples were tested for the same parameters as the other wipe samples collected in Task II.

TASK III CEILING TILE SAMPLES

Six (6) ceiling tile samples were collected within four rooms of the printed circuit board area and one (1) sample (Sample I.D. CT-6) was collected in the store room of the Environmental office for background data. The sample locations were identified by Mr. Donald Polzo.

The ceiling tile samples were collected by measuring four (4) inches X four (4) inches and marking the tile with a decontaminated utility knife. The ceiling tile was then cut with the same decontaminated utility knife. The sample was then placed into a clean sample container and labeled to show sample I.D., client, date and time collected and parameters to be tested for this information was also recorded in the field log book. After each sample was taken a new decontaminated blade was placed into the utility knife. A second sampling episode was required due to the insufficient amount of sample collected during the first sampling episode. During the second sampling episode three (3) more pieces of ceiling tile measuring four (4) inches X four (4) inches were collected from the same areas as the first sampling episode. The quality control sample for Task III was a field duplicate and was collected from a location specified by ITT Corporation.

FIELD QUALITY CONTROL SAMPLES

Field QA/QC samples were collected during this project to provide data necessary information for subsequent review, interpretation, and validation of generated analytical data.

The Field QA/QC samples collected during the sampling programs included one (1) field duplicate for the TASK I (C-18DUP) and TASK III (CT-6DUP) sampling events and one (1) field blank for the wall wipe sampling (FB-1). All QA/QC samples were handled in an identical manner as the other samples and tested for EP Toxicity Metals or Total RCRA Metals, Reactivity and Corrosivity.

FIELD LOGS

All field sampling information was recorded in a bound field log book and transcribed onto the Field Sampling Report Forms enclosed in this report.

Field logs were completed after each sample was collected to record the following information:

- date and time sample was collected
- sampler
- sample point I.D.
- sample description
- sampling equipment used
- field measures (where appropriate)
- general comments (e.g. odor, staining, etc.)
- parameters to be tested for

SAMPLE SHUTTLE AND CHAIN OF CUSTODY

All samples were placed into a cooler chilled with blue ice for transportation to York Laboratories. All samples were accompanied by a chain of custody and test request form.

The Chain of Custody Form was signed with the date and time for the following activities:

- whenever the shuttle was opened (the seal was broken) the form was signed.
- each time the shuttle was transferred to the responsibility of another person.

In addition, the following was included on the Chain of Custody Form for every sample:

a. Sample identification number
b. Analyses requested
c. Sample matrix
d. Date and time
e. Signature of sampler
f. Signature of those involved in the Chain of Custody progression

The samples were delivered to York Laboratories located at 628 Route 10, Whippany, New Jersey (NJ Certification No. 14530) where the samples were relinquished to the sample custodian and logged in.

SAMPLE PREPARATION AND LABORATORY ANALYSIS

The concrete samples from Task I were pulverized prior to testing and the ceiling tile samples were cut into smaller pieces prior to analysis. The concrete samples and the ceiling tile samples were tested for EP TOX Metals, Reactivity, and Corrosivity. The wall wipe samples were tested for RCRA Metals, Reactivity, and Corrosivity.

628 ROUTE 10 • WHIPPANY, NEW JERSEY 07981 • (201) 428 8181

FINDINGS

PHYSICAL CHARACTERISTICS

TASK I-CONCRETE CORE SAMPLE

The most detailed description of the core samples can be found on the "TASK I Concrete Core Sampling-Field Sampling Report Forms" found on pages 11 to 18. The report forms illustrate the total length of the core obtained which is then divided into sections based on color differences, staining or descriptions. For convenience purposes, the sample descriptions are summarized below.

In general, all core samples consisted of a 1/8" top layer of Tarazzo and Paint. The remainder of the core was typically coarse aggregate (round gravel) embedded in a mixture of fine aggregate (sand) and cement. Below the top layer, the common color of the concrete cores was found to be a dark gray/black or tan which distinctly changed to a white or light gray with depth. Staining was observed samples C-19 and C-21 at a point where the core was found fractured upon retrieval. Wire mesh was detected in cores C-5, C-6, and C-7.

It is important to note that the sampling plan specified a core thickness of five (5) inches or seven (7) inches depending on the sample location point. The drilling crew attempted to achieve these depths, however, due to the thickness of the concrete slab in some areas and the fracturing of the concrete core during drilling at shallower depths, the specified length of some samples was not obtainable.

TASK II-WALL WIPE SAMPLES

The most detailed description of the wall wipe samples can be found on the "TASK II Wall Wipe Sampling-Field Sampling Report Forms" found on pages 19 to 20. The report forms give a detailed description of the surface of the area sampled and of the gauze pad after sampling.

In general, all wipe samples consisted of light brown/black in color with dust or soot accumulation. The surface sampled included painted brick and painted drywall.

TASK III-CEILING TILE SAMPLES

The "TASK III Ceiling Tile Sampling-Field Sampling Report Form" found on page 21 give descriptions of the ceiling tiles sampled. The samples were consistently textured (white on white) with holes and tan backing.

628 ROUTE 10 • WHIPPANY, NEW JERSEY 07981 • (201) 428 8181

CHEMICAL CHARACTERISTICS

The results of the laboratory analysis and Tier II Quality Control/Quality Assurance data package is presented in Attachment I, report numbers 20900-1743, 1753, 1757, and 1858.

For the review of the detailed analytical data package in Tier II Deliverables format, refer to the table below for the list of samples and their corresponding report packages.

* Report Number 20900-1743	Concrete Core Samples C-1 through C-10 and C-12 through C-14.
* Report Number 20900-1753	Wall Wipe Samples WW-1 through WW-16, Ceiling Tile Samples CT-1 through CT-7
* Report Number 20900-1757	Concrete Core Samples C-11, C-15 through C-21.
* Report Number 20900-1858	Ceiling Tile Samples CT-1 through CT-7.

For interpretation purposes, data summary tables have been prepared for the sampling events to evaluate the analytical data which characterizes each sampling location. Tables I through X on pages 24-44 summarize the test results.

DISCUSSION OF TEST RESULTS

TASK I-E.P. TOXICITY METALS, REACTIVITY, CORROSIVITY

The E.P. Toxicity Metals analysis included testing for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver on the sample leachate. The test results of the twenty one (21) concrete core samples, and one (1) duplicate sample showed that all concentrations were below the RCRA guidelines (See Table III).

The Reactivity test results shown on Table II indicated that the samples were non reactive.

The Corrosivity test results shown on Table I indicated that the samples were non corrosive. The pH readings ranged from 11.3 to 12.4 standard units.

The results of these analyses are shown in the data summary tables one through three on pages 24-30.

TASK II-RCRA METALS, REACTIVITY, CORROSIVITY

The RCRA Metals analysis included testing for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. The test results of the sixteen (15) wall wipe samples and one (1) field blank are shown on Tables VI and VII. The results were compared to the control sample WW-16 which was collected in the environmental office conference room to provide data necessary for subsequent review and interpretation.

Separate tables have been compiled, showing the test results in both ug/wipe, as they are represented in the analytical data package 20900-1753 and ug/square meter (M^2) after conversion. Because each sample wipe area was less than a square meter, the analytical data was converted to ug/M^2 using a multiple conversion factor of 4. This factor was arrived by using the following formula:

A X 4 =B

then: 1 SQUARE METER/B = 4

where:

A = Area of each wipe = 0.0625 square meter
4 = Number of wipes per composite
B = Total area of composite wipe = 0.25 square meter

In comparison to the control sample utilizing the results presented in Table VII, the following parameters were elevated above background levels:

Barium was detected at sample locations WW-1 through WW-11, WW-13 and WW-14. The concentrations of these samples ranged from 1.36 to 55.6 ug/M^2. The highest levels were found at sample locations WW-1 and WW-2. The test results of the control sample indicated that Barium was detected at 1.592 ug/M^2.

Cadmium was detected at sample locations WW-1 through WW-4, WW-7 and WW-14. The concentration of these samples ranged from 1.26 to 102.4 ug/M^2. The highest level was found at sample location WW-14. The test results of the control sample indicated that Cadmium was not detected at <0.50 ug/M^2.

Chromium was found at concentrations which ranged from 1.2 to 159.2 ug/M^2 in all samples tested. The highest levels were detected at sample locations WW-1 and WW-2. Chromium was not detected in the control sample at <1.0 ug/M_2.

Lead was detected in all samples tested. The concentrations ranged from 2.768 to 768.0 ug/M^2.The highest levels were found in samples

W-1, WW-2, WW-4 and WW-10. Lead was detected in the control sample at a concentration of 0.90 ug/M^2.

Mercury was found at sample locations WW-1, WW-2, WW-3, WW-7 through WW-11, WW-13, and WW-14. The concentrations of these samples ranged from 0.72 to 2.808 ug/M^2. The highest levels were detected in samples WW-1 and WW-8. Mercury was detected in the control sample at a concentration of 0.876 ug/M^2.

Selenium was detected in samples WW-4 and WW-14. Their concentrations were 0.920 and 0.840 ug/M^2, respectively. Selenium was not detected in the control sample at <0.50 ug/M^2.

Silver was detected in samples WW-2 and WW-3. The concentrations were 3.168 and 2.308 ug/M^2, respectively. Silver was not detected in the control sample at <1.0 ug/M^2.

Arsenic was not detected in any of the samples tested above <1.0 ug/M^2.

In general, the highest metal concentrations were detected in the samples collected from the hazardous waste storage area and the adjacent room.

The Reactivity test results shown on Table V indicated that the samples were non reactive.

The Corrosivity test results shown on Table IV indicated that the samples were non corrosive. The pH ranged from 4.0 to 6.4 standard units.

The results of these analyses are shown in the data summary tables four through seven on pages 31-39.

TASK III-E.P. TOXICITY METALS, REACTIVITY, CORROSIVITY

The E.P. Toxicity Metals analysis included testing for arsenic, barium, chromium, lead, mercury, selenium, and silver on the sample leachate. The test results of the seven (7) ceiling tile samples and, one (1) duplicate sample shown on Table X indicated that all concentrations were below the RCRA guidelines.

The Reactivity test results shown on Table IX indicated that the samples were non reactive.

The Corrosivity test results shown on Table VIII indicated that the samples were non corrosive. The pH readings ranged from 7.1 to 7.9 standard units.

The results of these analyses are shown in the data summary tables eight through ten on pages 40-44.

The remaining portions of this report include the site diagrams, the field sampling report forms, the analytical data summary tables and the data packages.

If you have any questions regarding this report, please do not hesitate to contact me at (201) 428-8181.

Sincerely,

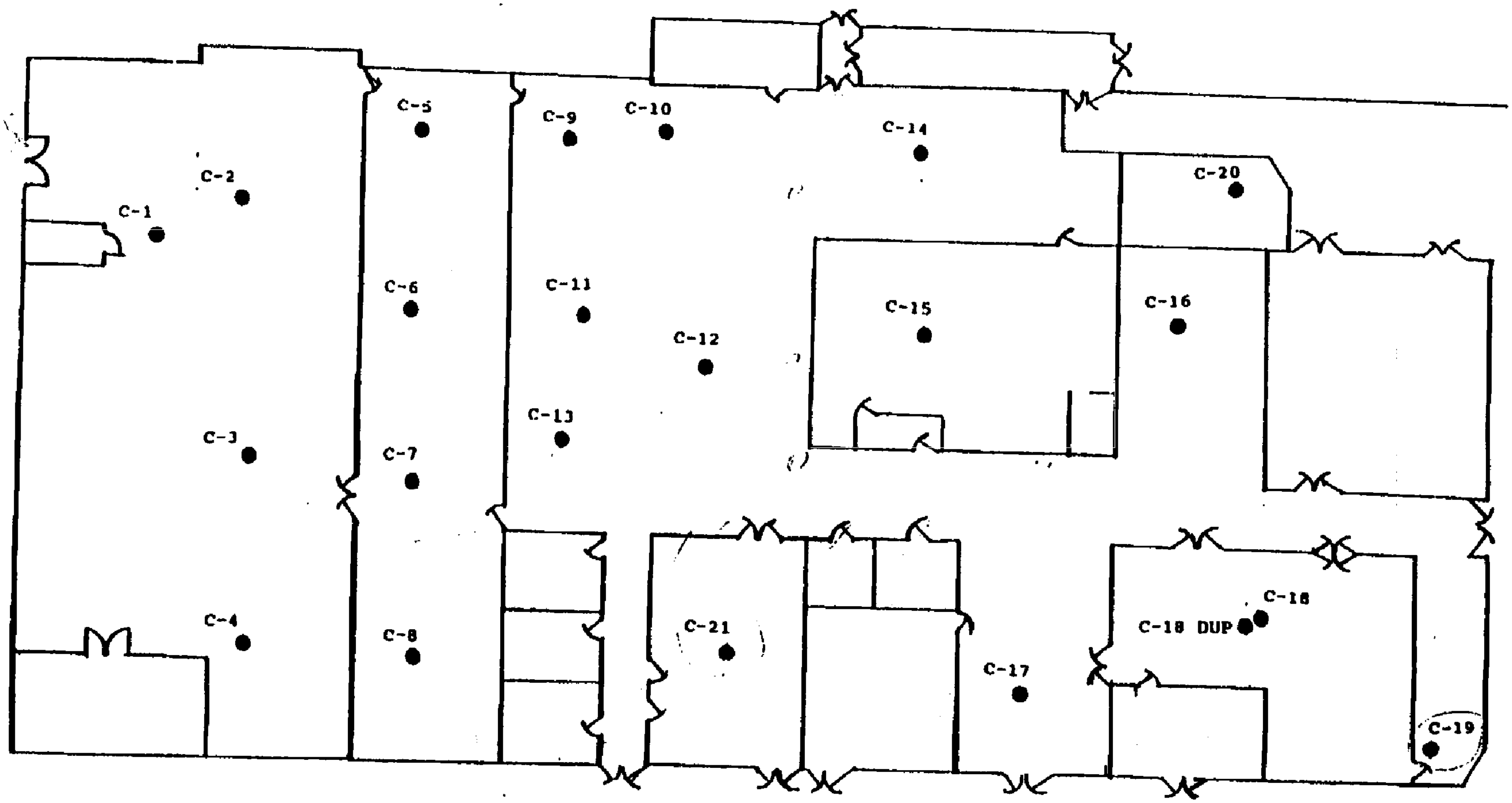
York Laboratories of New Jersey

Gail Mazzarell
Project Manager

CC: Donald Polzo, ITT
Kyle Dolbow, York

628 ROUTE 10 • WHIPPANY, NEW JERSEY 07981 • (201) 428 8181

TASK I SAMPLE LOCATION DIAGRAM
ITT CORPORATION



10A

KEY

SCALE 1/8" = 3 FEET

● CONCRETE CORE SAMPLE LOCATION

CLIENT: ITT CORPORATION
LOCATION: 100 Kingsland Rd.
Clifton, N.J.

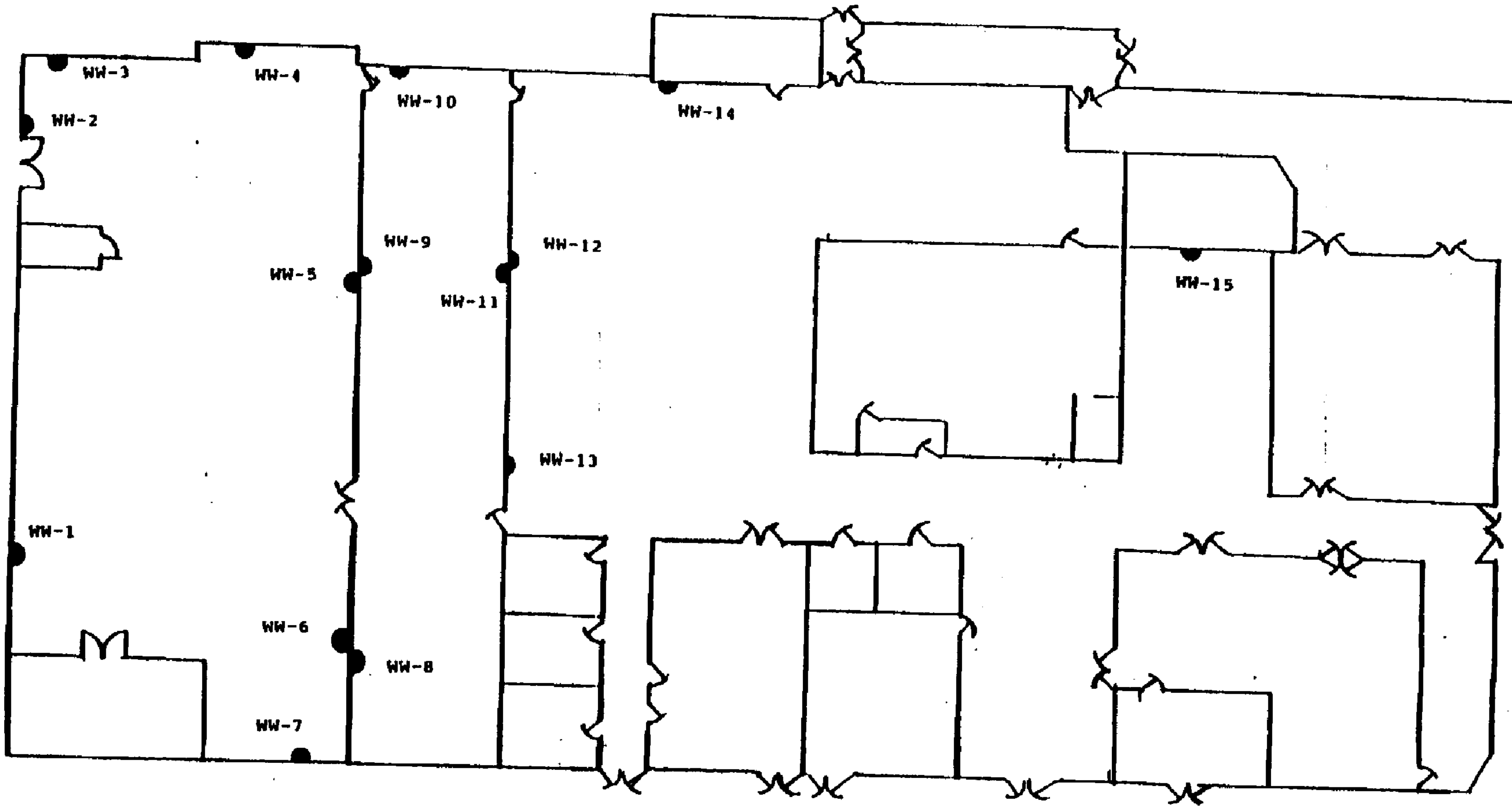
YORK LABORATORIES
628 ROUTE 10
WHIPPANY N.J. 07981

M.J.Q.

ADC000537

TIERRA-B-007694

TASK II SAMPLE LOCATION DIAGRAM
ITT CORPORATION



KEY

SCALE 1/8" = 3 FEET

● WALL WIPE SAMPLE LOCATION

CLIENT: ITT CORPORATION
LOCATION: 100 Kingsland Rd.
Clifton, N.J.

YORK LABORATORIES
628 ROUTE 10
WHIPPANY N.J. 07981

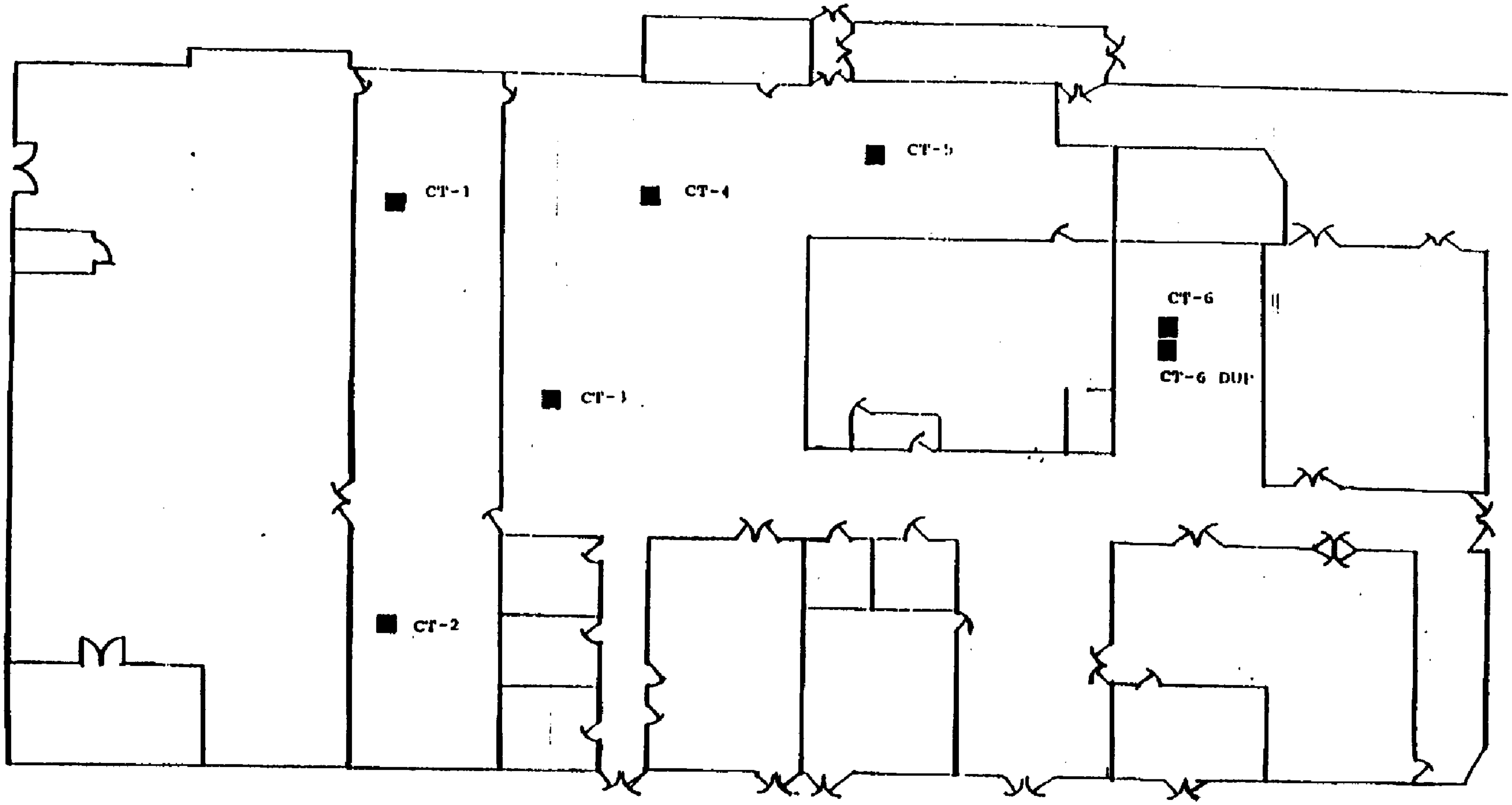
M.J.Q.

10B

ADC000538

TASK III SAMPLE LOCATION DIAGRAM
ITT CORPORATION

10C



KEY

SCALE 1/8" = 3 FEET

■ CEILING TILE SAMPLE LOCATION

CLIENT: ITT CORPORATION
LOCATION: 100 Kingsland Rd.
Clifton, N.J.

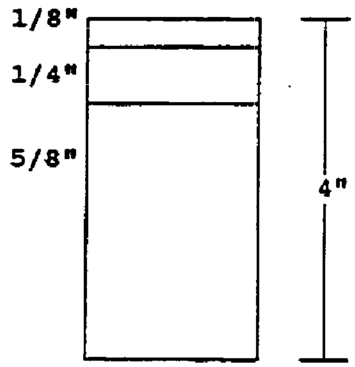
YORK LABORATORIES
628 ROUTE 10
WHIPPANY N.J. 07981

H.J.Q.

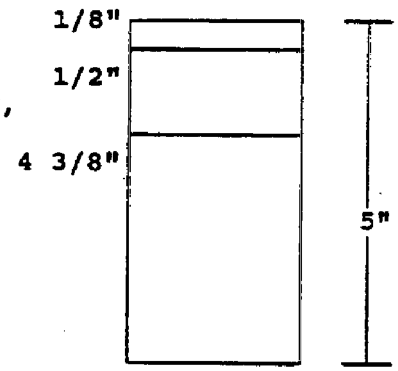
ADC000539

TASK I
CONCRETE CORE SAMPLING
FIELD SAMPLING REPORT FORM

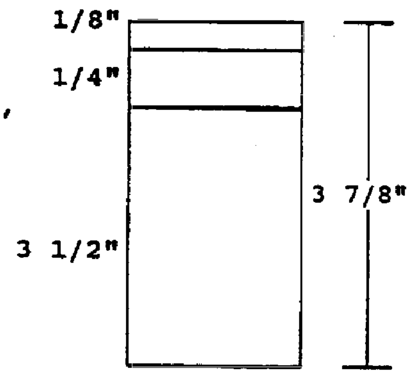
Sample ID: C-1
Date: 8/27/90
Time: 1000
Parameters: EP TOX Metals, Reactivity, Corrosivity
Description: 1/8" Tarazzo & Paint
1/4" Dark Gray
3 5/8" White, Gray, MF Gravel



Sample ID: C-2
Date: 8/27/90
Time: 1015
Parameters: EP TOX Metals, Reactivity, Corrosivity
Description: 1/8" Tarazzo & Paint
1/2" Dark Gray, Black
4 3/8" White, Gray, MF Gravel

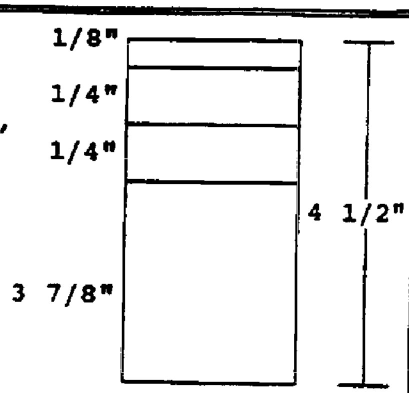


Sample ID: C-3
Date: 8/27/90
Time: 1030
Parameters: EP TOX Metals, Reactivity, Corrosivity
Description: 1/8" Tarazzo & Paint
1/4" Dark Gray, Black
3 1/2" White, Lt Gray, MF Gravel

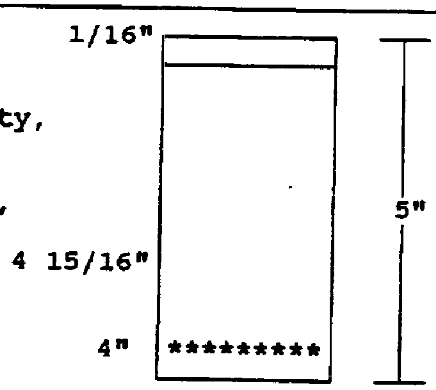


TASK I
CONCRETE CORE SAMPLING
FIELD SAMPLING REPORT FORM

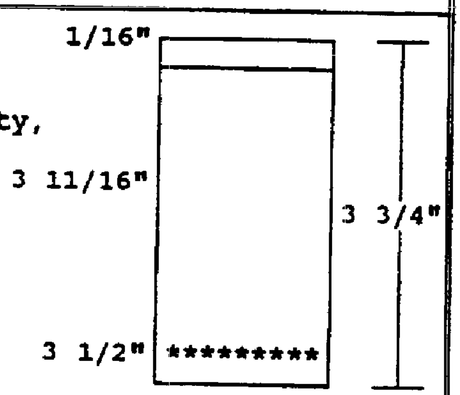
Sample ID: C-4
Date: 8/27/90
Time: 1043
Parameters: EP TOX Metals, Reactivity, Corrosivity
Description: 1/8" Tarazzo, Paint
1/4" Dark Gray, Black
1/4" Tan, Brown
3 7/8" White, Lt Gray, MF Gravel



Sample ID: C-5
Date: 8/27/90
Time: 1105
Parameters: EP TOX Metals, Reactivity, Corrosivity
Description: 1/16" Tarazzo, Paint
4 15/16" White, Lt Gray, MF Gravel
Wire Mesh at 4"

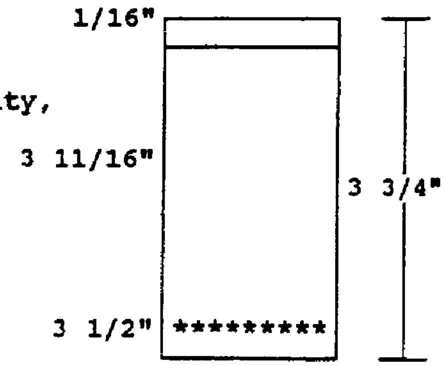


Sample ID: C-6
Date: 8/27/90
Time: 1115
Parameters: EP TOX Metals, Reactivity, Corrosivity
Description: 1/16" Tarazzo, Paint
3 11/16" Gray White MF Gravel
Wire Mesh at 3 1/2"

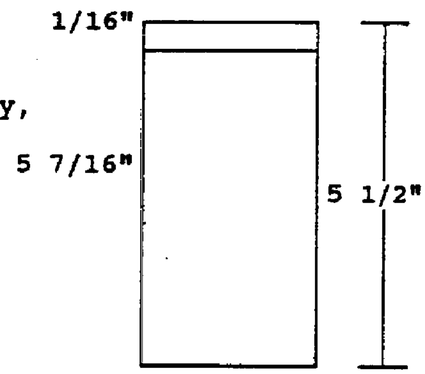


TASK I
CONCRETE CORE SAMPLING
FIELD SAMPLING REPORT FORM

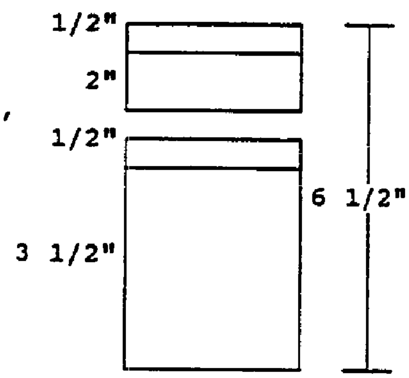
Sample ID: C-7
Date: 8/27/90
Time: 1130
Parameters: EP TOX Metals, Reactivity, Corrosivity
Description: 1/16" Tarazzo, Paint
3 11/16" Gray White
MF Gravel
3 1/2" Wire Mesh



Sample ID: C-8
Date: 8/27/90
Time: 1145
Parameters: EP TOX Metals, Reactivity, Corrosivity
Description: 1/16" Tarazzo, Paint
5 7/16" Lt Gray, White
MF Gravel



Sample ID: C-9
Date: 8/27/90
Time: 1307
Parameters: EP TOX Metals, Reactivity, Corrosivity
Description: 1/2" Tarazzo, Paint
2" Lt Tan MF Gravel
1/2" Dark Gray, Black
3 1/2" Lt Gray, White
MF Gravel

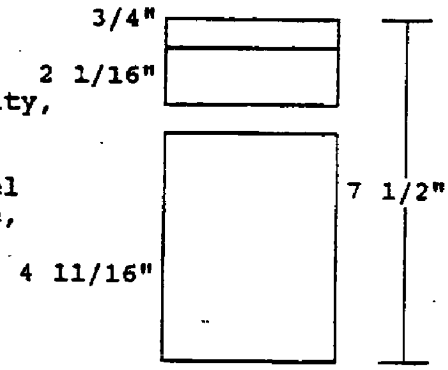


ADC000542

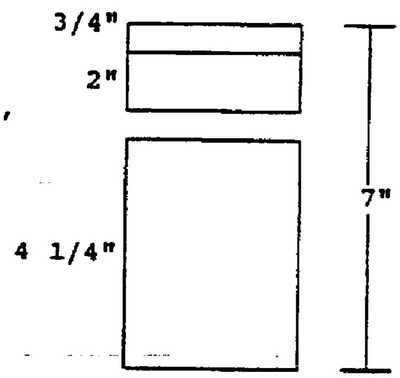
TIERRA-B-007699

TASK I
CONCRETE CORE SAMPLING
FIELD SAMPLING REPORT FORM

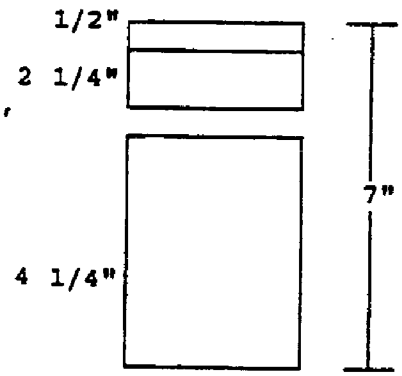
Sample ID: C-10
Date: 8/27/90
Time: 1315
Parameters: EP TOX Metals, Reactivity, Corrosivity
Description: 3/4" Tarazzo, Paint
2 1/16" Lt Tan MF Gravel
4 11/16" Lt Gray, White, MF Gravel



Sample ID: C-11
Date: 8/27/90
Time: 1330
Parameters: EP TOX Metals, Reactivity, Corrosivity
Description: 3/4" Tarazzo, Paint
2" Lt Tan, MF Gravel
4 1/4" Lt Gray MF Gravel



Sample ID: C-12
Date: 8/27/90
Time: 1345
Parameters: EP TOX Metals, Reactivity, Corrosivity
Description: 1/2" Tarazzo, Paint
2 1/4" Lt Tan, MF Gravel
4 1/4" Lt Gray,MF Gravel

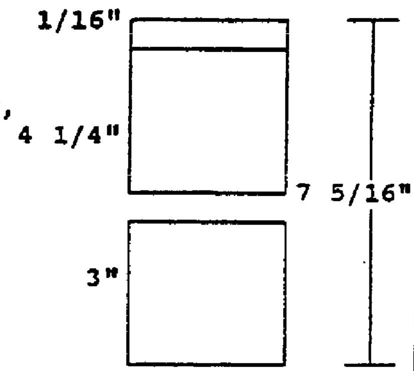


ADC000543

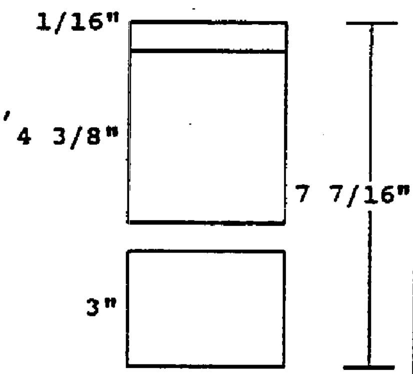
TIERRA-B-007700

TASK I
CONCRETE CORE SAMPLING
FIELD SAMPLING REPORT FORM

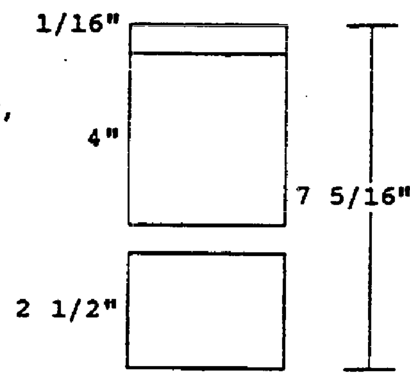
Sample ID:	C-16
Date:	8/28/90
Time:	0935
Parameters:	EP TOX Metals, Reactivity, Corrosivity
Description:	1/16" Tarazzo, Paint 4 1/4" Lt Tan, MF Gravel 3" Gray, MF Gravel



Sample ID:	C-17
Date:	8/28/90
Time:	0925
Parameters:	EP TOX Metals, Reactivity, Corrosivity
Description:	1/16" Tarazzo, Paint 4 3/8" Lt Tan, MF Gravel 3" White, Gray, MF Gravel



Sample ID:	C-18
Date:	8/28/90
Time:	0945
Parameters:	EP TOX Metals, Reactivity, Corrosivity
Description:	1/16" Tarazzo, Paint 4" Lt Tan, MF Gravel 2 1/2" Gray, White, MF Gravel

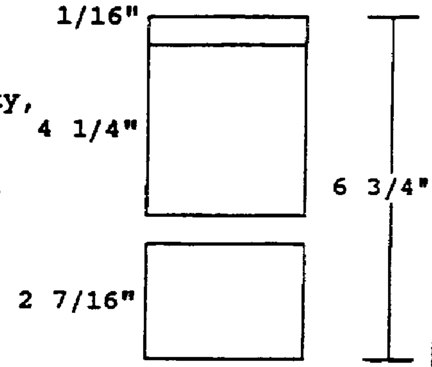


ADC000544

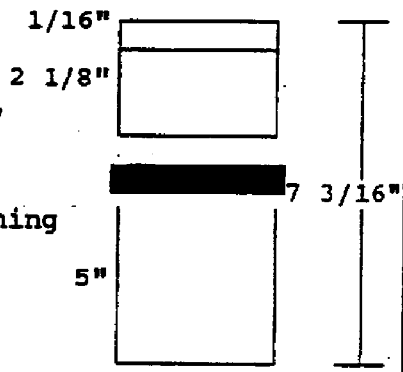
TIERRA-B-007701

TASK I
CONCRETE CORE SAMPLING
FIELD SAMPLING REPORT FORM

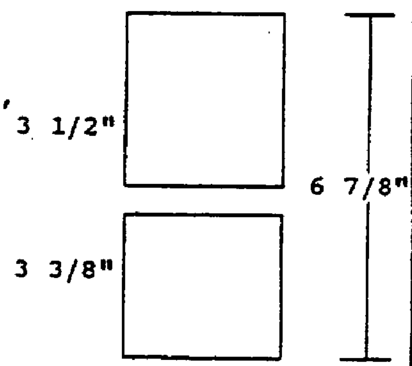
Sample ID:	C-18 DUP
Date:	8/28/90
Time:	0950
Parameters:	EP TOX Metals, Reactivity, Corrosivity
Description:	1/16" Tarazzo, Paint 4 1/4" Lt Tan, MF Gravel 2 7/16" White, Gray, MF Gravel



Sample ID:	C-19
Date:	8/28/90
Time:	1025
Parameters:	EP TOX Metals, Reactivity, Corrosivity
Description:	1/16" Tarazzo, Paint 2 1/8" Lt Tan, MF Gravel 5" White, Gray, Some Staining Top 1" Of This Section



Sample ID:	C-20
Date:	8/28/90
Time:	1045
Parameters:	EP TOX Metals, Reactivity, Corrosivity
Description:	3 1/2" Gray, White, MF Gravel 3 3/8" Gray, Pink, MF Gravel

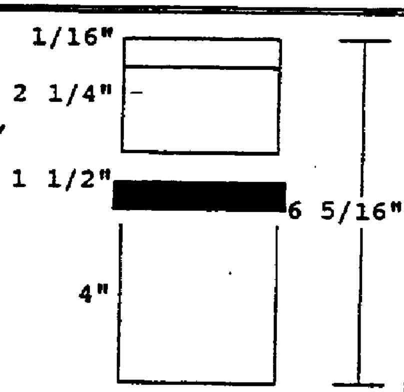


ADC000545

TIERRA-B-007702

TASK I
CONCRETE CORE SAMPLING
FIELD SAMPLING REPORT FORM

Sample ID: C-21
Date: 8/28/90
Time: 1035
Parameters: EP TOX Metals, Reactivity, Corrosivity
Description: 1/16" Tarazzo, Paint
2 1/4" Lt Tan, MF Gravel
4" White, Gray,
MF Gravel, Discoloration
Top 1 1/2"



ADC000546

TIERRA-B-007703

TASK II WALL WIPE SAMPLING FIELD SAMPLING REPORT FORM		
SAMPLE I.D.	DATE-TIME	DESCRIPTION
WW-1	8/28/90-1500	Area=0.25 square meters. Wipe Desc.- dark brown, black, rough. Surface Desc.- brick. (4 areas)
WW-2	8/28/90-1530	Area-0.25 square meters. Wipe Desc.- dark brown, black, soot. Surface Desc.- rough, painted brick. (4 areas)
WW-3	8/28/90-1540	Area-0.25 square meters. Wipe Desc.- dark brown, black, soot, paint chips. Surface Desc.- (in waste storage area) rough, painted brick.
WW-4	8/28/90-1510	Area-0.25 square meters. Wipe Desc.- dark brown, black. Surface Desc.- rough, brick. (4 areas)
WW-5	8/28/90-1525	Area-0.25 square meters. Wipe Desc.- dark brown, black. Surface Desc.- painted drywall (4 areas)
WW-6	8/28/90-1545	Area-0.25 square meters. Wipe Desc.- medium dust accumulation. Surface Desc.- (near solvent storage area) smooth painted surface.
WW-7	8/28/90-1605	Area-0.25 square meters. Wipe Desc.- light brown, dark brown, soot. Surface Desc.- painted brick.
WW-8	8/28/90-1555	Area-0.25 square meters. Wipe Desc.- medium dust accumulation. Surface Desc.- smooth. (4 areas)

TASK II WALL WIPE SAMPLING FIELD SAMPLING REPORT FORM		
SAMPLE I.D.	DATE-TIME	DESCRIPTION
WW-9	8/28/90-1610	Area-0.25 square meters. Wipe Desc.- medium dust accumulation. Surface Desc.- smooth painted. (4 areas)
WW-10	8/28/90-1620	Area-0.25 square meters. Wipe Desc.- dark brown, some dust. Surface Desc.- painted drywall. (4 areas)
WW-11	8/28/90-1615	Area-0.25 square meters. Wipe Desc.- medium dust accumulation. Surface Desc.- rough, painted brick. (4 areas)
WW-12	8/28/90-1625	Area-0.25 square meters. Wipe Desc.- lightly soiled. Surface Desc.-(yellow sticky material stuck on wall) smooth painted wall surface. (4 areas)
WW-13	8/28/90-1635	Area-0.25 square meters. Wipe Desc.- lightly soiled. Surface Desc.- painted wall with holes. (4 areas)
WW-14	8/28/90-1635	Area-0.25 square meters. Wipe Desc.- light brown, dark brown. Surface Desc.- painted dry wall. (4 areas)
WW-15	8/28/90-1640	Area-0.25 square meters. Wipe Desc.- lightly soiled. Surface Desc.- painted dry wall. (4 areas)
WW-16	8/28/90-1650	Area-0.25 square meters. Wipe Desc.- Surface Desc.- Painted dry wall conference room. (4 areas)

TASK III CEILING TILE SAMPLING EPISODE I FIELD SAMPLING REPORT FORM		
SAMPLE I.D.	DATE-TIME	DESCRIPTION
CT-1	8/28/90-1420	4"X4"X0.5" Textured (white on white) tan backing, ivory top.
CT-2	8/28/90-1427	4"X4"X0.5" Textured (white on white) with holes, tan backing.
CT-3	8/28/90-1435	4"X4"X0.5" Textured (white on white) with holes, tan backing.
CT-4	8/28/90-1437	4"X4"X0.5" Textured (white on white) with holes, tan backing.
CT-5	8/28/90-1440	4"X4"X0.5" Textured (white on white) with holes, tan backing.
CT-6	8/28/90-1445	4"X4"X0.5" Textured (white on white) with holes, tan backing.
CT-6 DUP	8/28/90-1447	4"X4"X0.5" Textured (white on white) with holes, tan backing.
CT-7	8/28/90-1645	4"X4"X0.5" Textured (white on white) with holes, tan backing. Sample taken in storage area of the Environmental Office.

TASK III CEILING TILE SAMPLING EPISODE II FIELD SAMPLING REPORT FORM		
SAMPLE I.D.	DATE-TIME	DESCRIPTION
CT-1	9/10/90-0927	3 4"X4"X0.5" Textured (white on white) tan backing, ivory top.
CT-2	9/10/90-0925	3 4"X4"X0.5" Textured (white on white) with holes, tan backing.
CT-3	9/10/90-0912	3 4"X4"X0.5" Textured (white on white) with holes, tan backing.
CT-4	9/10/90-0915	3 4"X4"X0.5" Textured (white on white) with holes, tan backing.
CT-5	9/10/90-0920	3 4"X4"X0.5" Textured (white on white) with holes, tan backing.
CT-6	9/10/90-0905	3 4"X4"X0.5" Textured (white on white) with holes, tan backing.
CT-6 DUP	9/10/90-0908	3 4"X4"X0.5" Textured (white on white) with holes, tan backing.
CT-7	9/10/90-0955	3 4"X4"X0.5" Textured (white on white) with holes, tan backing. Sample taken in storage area of the Environmental Office.

TABLE I CONCRETE CORE SAMPLING DATA SUMMARY TABLE		
SAMPLE I.D.	CORROSIVITY	pH
C-1	NON CORROSIVE	11.8
C-2	NON CORROSIVE	11.9
C-3	NON CORROSIVE	11.3
C-4	NON CORROSIVE	11.8
C-5	NON CORROSIVE	12.3
C-6	NON CORROSIVE	12.3
C-7	NON CORROSIVE	12.4
C-8	NON CORROSIVE	12.3
C-9	NON CORROSIVE	11.8
C-10	NON CORROSIVE	12.1
C-11	NON CORROSIVE	11.8
C-12	NON CORROSIVE	11.8
C-13	NON CORROSIVE	11.7
C-14	NON CORROSIVE	12.2
C-15	NON CORROSIVE	12.2
C-16	NON CORROSIVE	12.1
C-17	NON CORROSIVE	12.2
C-18	NON CORROSIVE	11.7
C-18 DUP	NON CORROSIVE	11.9
C-19	NON CORROSIVE	11.7
C-20	NON CORROSIVE	12.1
C-21	NON CORROSIVE	11.6

TABLE II CONCRETE CORE SAMPLING DATA SUMMARY TABLE			
SAMPLE I.D.	REACTIVITY	REACTIVE CYANIDE mg/kg	REACTIVE SULFIDE mg/kg
C-1	NON REACTIVE	<0.10	<10.0
C-2	NON REACTIVE	0.33	40.6
C-3	NON REACTIVE	0.33	40.2
C-4	NON REACTIVE	<0.10	20.0
C-5	NON REACTIVE	<0.10	10.0
C-6	NON REACTIVE	<0.10	<10.0
C-7	NON REACTIVE	<0.10	40.0
C-8	NON REACTIVE	<0.10	<10.0
C-9	NON REACTIVE	<0.10	<10.0
C-10	NON REACTIVE	<0.10	38.3
C-11	NON REACTIVE	<0.10	<10.0
C-12	NON REACTIVE	<0.10	21.2
C-13	NON REACTIVE	<0.10	12.4
C-14	NON REACTIVE	<0.10	<10.0
C-15	NON REACTIVE	<0.10	<10.0
C-16	NON REACTIVE	<0.10	<10.0
C-17	NON REACTIVE	<0.10	<10.0
C-18	NON REACTIVE	<0.10	<10.0
C-18 DUP	NON REACTIVE	<0.10	<10.0
C-19	NON REACTIVE	<0.10	<10.0
C-20	NON REACTIVE	<0.10	<10.0
C-21	NON REACTIVE	<0.10	<10.0

TABLE III CONCRETE CORE SAMPLING DATA SUMMARY TABLE mg/l						
ANALYSIS	SAMPLE IDENTIFICATION					
	C-1	C-2	C-3	C-4	C-5	EP TOXICITY THRESHOLD LIMITS
ARSENIC	<0.200	<0.200	<0.200	<0.200	<0.200	5.00
BARIUM	<1.00	<1.00	<1.00	<1.00	<1.00	100.0
CADMIUM	<0.025	<0.025	<0.025	<0.025	<0.025	1.00
CHROMIUM	<0.100	<0.100	<0.100	<0.100	<0.100	5.00
LEAD	<0.200	<0.200	<0.200	<0.200	<0.200	5.00
MERCURY	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.200
SELENIUM	<0.200	<0.200	<0.200	<0.200	<0.200	1.00
SILVER	<0.025	<0.025	<0.025	<0.025	<0.025	5.00

TABLE III CONCRETE CORE SAMPLING DATA SUMMARY TABLE mg/l						
ANALYSIS	SAMPLE IDENTIFICATION					
	C-6	C-7	C-8	C-9	C-10	EP TOXICITY THRESHOLD LIMITS
ARSENIC	<0.200	<0.200	<0.200	<0.200	<0.200	5.00
BARIUM	<1.00	<1.00	<1.00	<1.00	<1.00	100.0
CADMIUM	<0.025	<0.025	<0.025	<0.025	0.027	1.00
CHROMIUM	0.102	0.370	0.478	<0.100	<0.100	5.00
LEAD	<0.200	<0.200	<0.200	<0.200	<0.200	5.00
MERCURY	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.200
SELENIUM	<0.200	<0.200	<0.200	<0.200	<0.200	1.00
SILVER	<0.025	<0.025	<0.025	<0.025	<0.025	5.00

TABLE III
CONCRETE CORE SAMPLING
DATA SUMMARY TABLE
mg/l

ANALYSIS	SAMPLE IDENTIFICATION					
	C-11	C-12	C-13	C-14	C-15	EP TOXICITY THRESHOLD LIMITS
ARSENIC	<0.200	<0.200	<0.200	<0.200	<0.200	5.00
BARIUM	<1.00	<1.00	<1.00	<1.00	<1.00	100.0
CADMIUM	<0.025	<0.025	<0.025	<0.025	<0.025	1.00
CHROMIUM	<0.100	<0.100	<0.100	<0.100	<0.100	5.00
LEAD	<0.200	<0.200	<0.200	<0.200	<0.200	5.00
MERCURY	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.200
SELENIUM	<0.200	<0.200	<0.200	<0.200	<0.200	1.00
SILVER	<0.025	<0.025	<0.025	<0.025	<0.025	5.00

TABLE III CONCRETE CORE SAMPLING DATA SUMMARY TABLE mg/l						
ANALYSIS	SAMPLE IDENTIFICATION					
	C-16	C-17	C-18	C-18 DUP	C-19	EP TOXICITY THRESHOLD LIMITS
ARSENIC	<0.200	<0.200	<0.200	<0.200	<0.200	5.00
BARIUM	<1.00	<1.00	<1.00	<1.00	<1.00	100.0
CADMIUM	<0.025	<0.025	<0.025	0.059	0.032	1.00
CHROMIUM	<0.100	<0.100	<0.100	<0.100	<0.100	5.00
LEAD	<0.200	<0.200	<0.200	<0.200	<0.200	5.00
MERCURY	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.200
SELENIUM	<0.200	<0.200	<0.200	<0.200	<0.200	1.00
SILVER	<0.025	<0.025	<0.025	<0.025	<0.025	5.00

TABLE III CONCRETE CORE SAMPLING DATA SUMMARY TABLE mg/l				
ANALYSIS	SAMPLE IDENTIFICATION			
	C-20	C-21		EP TOXICITY THRESHOLD LIMITS
ARSENIC	<0.200	<0.200		5.00
BARIUM	<1.00	<1.00		100.0
CADMIUM	<0.025	<0.025		1.00
CHROMIUM	0.450	<0.100		5.00
LEAD	<0.200	<0.200		5.00
MERCURY	<0.0002	<0.0002		0.200
SELENIUM	<0.200	<0.200		1.00
SILVER	<0.025	<0.025		5.00

TABLE IV WALL WIPE SAMPLING DATA SUMMARY TABLE		
SAMPLE I.D.	CORROSIVITY	pH
WW-1	NON CORROSIVE	5.2
WW-2	NON CORROSIVE	5.6
WW-3	NON CORROSIVE	5.5
WW-4	NON CORROSIVE	5.4
WW-5	NON CORROSIVE	5.5
WW-6	NON CORROSIVE	6.1
WW-7	NON CORROSIVE	5.5
WW-8	NON CORROSIVE	5.6
WW-9	NON CORROSIVE	5.7
WW-10	NON CORROSIVE	5.4
WW-11	NON CORROSIVE	4.0
WW-12	NON CORROSIVE	6.4
WW-13	NON CORROSIVE	6.4
WW-14	NON CORROSIVE	4.8
WW-15	NON CORROSIVE	6.3
WW-16	NON CORROSIVE	6.3
FB1	NON CORROSIVE	6.3

TABLE V WALL WIPE SAMPLING DATA SUMMARY TABLE			
SAMPLE I.D.	REACTIVITY	REACTIVE CYANIDE mg/kg	REACTIVE SULFIDE mg/kg
WW-1	NON REACTIVE	<0.20	<20.0
WW-2	NON REACTIVE	<0.20	<20.0
WW-3	NON REACTIVE	<0.20	<20.0
WW-4	NON REACTIVE	<0.20	<20.0
WW-5	NON REACTIVE	<0.20	<20.0
WW-6	NON REACTIVE	<0.20	<20.0
WW-7	NON REACTIVE	<0.20	<20.0
WW-8	NON REACTIVE	<0.20	<20.0
WW-9	NON REACTIVE	<0.20	57.6
WW-10	NON REACTIVE	<0.20	<20.0
WW-11	NON REACTIVE	<0.10	158.0
WW-12	NON REACTIVE	<0.10	<20.0
WW-13	NON REACTIVE	<0.20	<20.0
WW-14	NON REACTIVE	<0.20	<20.0
WW-15	NON REACTIVE	<0.20	<20.0
WW-16	NON REACTIVE	<0.20	<20.0
FB1	NON REACTIVE	<0.20	<20.0

TABLE VI
WALL WIPE SAMPLING
DATA SUMMARY TABLE
ug/wipe

ANALYSIS	SAMPLE IDENTIFICATION					
	WW-1	WW-2	WW-3	WW-4	WW-5	CONTROL SAMPLE WW-16
ARSENIC	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250
BARIUM	13.9	13.2	3.82	9.93	4.10	0.398
CADMIUM	1.22	2.48	0.697	0.372	<0.125	<0.125
CHROMIUM	39.8	29.9	8.42	19.2	8.86	<0.250
LEAD	112.0	192.0	20.5	69.8	11.0	0.225
MERCURY	0.626	0.492	0.480	0.18	0.103	0.219
SELENIUM	<0.125	<0.125	<0.125	0.230	<0.125	<0.125
SILVER	<0.250	0.792	0.577	<0.250	<0.250	<0.250

TABLE VI
WALL WIPE SAMPLING
DATA SUMMARY TABLE
ug/wipe

ANALYSIS	SAMPLE IDENTIFICATION					
	WW-6	WW-7	WW-8	WW-9	WW-10	CONTROL SAMPLE WW-16
ARSENIC	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250
BARIUM	0.715	2.88	0.512	0.717	2.85	0.398
CADMIUM	<0.125	0.315	<0.125	<0.125	<0.125	<0.125
CHROMIUM	1.71	5.87	0.878	3.76	12.3	<0.250
LEAD	1.27	7.20	28.1	6.40	154	0.225
MERCURY	<0.10	0.439	0.702	0.463	0.349	0.219
SELENIUM	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
SILVER	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250

TABLE VI WALL WIPE SAMPLING DATA SUMMARY TABLE ug/wipe						
ANALYSIS	SAMPLE IDENTIFICATION					
	WW-11	WW-12	WW-13	WW-14	WW-15	CONTROL SAMPLE WW-16
ARSENIC	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250
BARIUM	0.672	<0.250	0.712	2.91	0.340	0.398
CADMIUM	<0.125	<0.125	<0.125	25.6	<0.125	<0.125
CHROMIUM	1.62	0.320	1.66	3.24	0.300	<0.250
LEAD	24.0	1.06	5.90	21.6	0.692	0.225
MERCURY	0.325	<0.10	0.459	0.480	0.198	0.219
SELENIUM	<0.125	<0.125	<0.125	0.210	<0.125	<0.125
SILVER	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250

TABLE VI WALL WIPE SAMPLING DATA SUMMARY TABLE ug/wipe						
ANALYSIS	SAMPLE IDENTIFICATION					
	FB1					CONTROL SAMPLE WW-16
ARSENIC	<0.250					<0.250
BARIUM	<0.250					0.398
CADMIUM	<0.125					<0.125
CHROMIUM	<0.250					<0.250
LEAD	<0.125					0.225
MERCURY	<0.10					0.219
SELENIUM	<0.125					<0.125
SILVER	<0.250					<0.250

TABLE VII WALL WIPE SAMPLING DATA SUMMARY TABLE ug/square meter						
ANALYSIS	SAMPLE IDENTIFICATION					
	WW-1	WW-2	WW-3	WW-4	WW-5	CONTROL SAMPLE WW-16
ARSENIC	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
BARIUM	55.6	52.8	15.28	39.72	16.4	1.592
CADMIUM	4.88	9.92	2.788	1.488	<0.50	<0.50
CHROMIUM	159.2	119.6	33.68	76.8	35.44	<1.0
LEAD	448.0	768.0	82.0	279.2	44.0	0.90
MERCURY	2.504	1.968	1.920	0.72	0.412	0.876
SELENIUM	<0.50	<0.50	<0.50	0.920	<0.50	<0.50
SILVER	<1.0	3.168	2.308	<1.0	<1.0	<1.0

TABLE VII WALL WIPE SAMPLING DATA SUMMARY TABLE ug/square meter						
ANALYSIS	SAMPLE IDENTIFICATION					
	WW-6	WW-7	WW-8	WW-9	WW-10	CONTROL SAMPLE WW-16
ARSENIC	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
BARIUM	2.86	11.52	2.048	2.868	11.4	1.592
CADMIUM	<0.50	1.26	<0.50	<0.50	<0.50	<0.50
CHROMIUM	6.84	23.48	3.512	15.04	49.2	<1.0
LEAD	5.08	28.8	112.4	25.6	616.0	0.90
MERCURY	<0.40	1.756	2.808	1.852	1.396	0.876
SELENIUM	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
SILVER	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

TABLE VII
WALL WIPE SAMPLING
DATA SUMMARY TABLE
ug/square meter

ANALYSIS	SAMPLE IDENTIFICATION					
	WW-11	WW-12	WW-13	WW-14	WW-15	CONTROL SAMPLE WW-16
ARSENIC	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
BARIUM	2.688	<1.0	2.848	11.64	1.36	1.592
CADMIUM	<0.50	<0.50	<0.50	102.4	<0.50	<0.50
CHROMIUM	6.48	1.28	6.64	12.96	1.2	<1.0
LEAD	96.0	4.24	23.6	86.4	2.768	0.90
MERCURY	1.30	<0.40	1.836	1.92	0.792	0.876
SELENIUM	<0.50	<0.50	<0.50	0.840	<0.50	<0.50
SILVER	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

TABLE VII WALL WIPE SAMPLING DATA SUMMARY TABLE ug/square meter						
ANALYSIS	SAMPLE IDENTIFICATION					
	FB1					CONTROL SAMPLE WW-16
ARSENIC	<1.0					<1.0
BARIUM	<1.0					1.592
CADMIUM	<0.50					<0.50
CHROMIUM	<1.0					<1.0
LEAD	<0.50					0.90
MERCURY	<0.40					0.876
SELENIUM	<0.50					<0.50
SILVER	<1.0					<1.0

TABLE VIII CEILING TILE SAMPLING DATA SUMMARY TABLE		
SAMPLE I.D.	CORROSIVITY	pH
CT-1	NON CORROSIVE	7.7
CT-2	NON CORROSIVE	7.1
CT-3	NON CORROSIVE	7.9
CT-4	NON CORROSIVE	7.9
CT-5	NON CORROSIVE	7.2
CT-6	NON CORROSIVE	7.6
CT-6 DUP	NON CORROSIVE	7.7
CT-7	NON CORROSIVE	7.7

TABLE IX
CEILING TILE SAMPLING
DATA SUMMARY TABLE

SAMPLE I.D.	REACTIVITY	REACTIVE CYANIDE mg/kg	REACTIVE SULFIDE mg/kg
CT-1	NON REACTIVE	<0.10	196.0
CT-2	NON REACTIVE	<0.10	148.0
CT-3	NON REACTIVE	<0.10	310.0
CT-4	NON REACTIVE	<0.10	323.0
CT-5	NON REACTIVE	<0.10	147.0
CT-6	NON REACTIVE	<0.10	142.0
CT-6 DUP	NON REACTIVE	<0.10	135.0
CT-7	NON REACTIVE	<0.10	256.0

TABLE X
CEILING TILE SAMPLING
DATA SUMMARY TABLE
mg/l

ANALYSIS	SAMPLE IDENTIFICATION					
	CT-1	CT-2	CT-3	CT-4	CT-5	EP TOXICITY THRESHOLD LIMITS
ARSENIC	<0.200	<0.200	<0.200	<0.200	<0.200	5.00
BARIUM	<1.00	<1.00	<1.00	<1.00	<1.00	100.0
CADMIUM	<0.025	<0.025	<0.025	<0.025	<0.025	1.00
CHROMIUM	<0.100	<0.100	<0.100	<0.100	<0.100	5.00
LEAD	<0.200	<0.200	<0.200	<0.200	<0.200	5.00
MERCURY	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.200
SELENIUM	<0.200	<0.200	<0.200	<0.200	<0.200	1.00
SILVER	<0.025	<0.025	<0.025	<0.025	<0.025	5.00

TABLE X CEILING TILE SAMPLING DATA SUMMARY TABLE mg/l					
ANALYSIS	SAMPLE IDENTIFICATION				
	CT-6	CT-6 DUP	CT-7		EP TOXICITY THRESHOLD LIMITS
ARSENIC	<0.200	<0.200	<0.200		5.00
BARIUM	<1.00	<1.00	<1.00		100.0
CADMIUM	<0.025	<0.025	<0.025		1.00
CHROMIUM	<0.100	<0.100	<0.100		5.00
LEAD	<0.200	<0.200	<0.200		5.00
MERCURY	0.000250	0.000500	0.00275		0.200
SELENIUM	<0.200	<0.200	<0.200		1.00
SILVER	<0.025	<0.025	<0.025		5.00

ADC000571

TIERRA-B-007728

H2M GROUP

Quality Assurance Project Plan

ITT Avionics Division
100 Kingsland Road
Clifton, Passaic County, New Jersey
NJPDES Permit No. NJ0076023

June 1996

1.0 Introduction

This Quality Assurance Project Plan ("QAPP") describes the project scope and specific measures that will be employed to achieve the data quality objectives appropriate for the proposed additional sampling at the ITT Avionics Division facility located at 100 Kingsland Road, Clifton, New Jersey. This QAPP was prepared in accordance with the specific requirements set forth in N.J.A.C. 7-26E-2.2. The proposed additional sampling is being undertaken in order to comply with N.J.A.C. 7:26E.

2.0 Project Scope

This QAPP provides a detailed description of the requirements necessary to implement the proposed additional sampling for the site. This sampling includes the following:

AOC	Description	Groundwater	Soil
3	Former No. 2 and No. 4 Fuel Oil USTs	3 wells; 2 rounds	
4	Chemical/Waste Storage Building	2 wells; 2 rounds	
6	Industrial Wastewater Pretreatment System Area		1 concrete sample/900 sf
8	Area Without Vegetation		2 soil samples
12	Building Transformers		1 concrete chip sample
14	Shipping/Receiving Bays		2 sediment samples 4 soil samples

3.0 Data Quality Objectives

Soil samples will be analyzed for volatile organic compounds (Method 8240), semi-volatile organic compounds (Method 8250), priority pollutant metals, (EPA 7000 series), and total petroleum hydrocarbons (Method 418.1). These analytical methods are sufficient to meet the detection limits required to determine if concentrations of these parameters are present above the Department's most stringent soil cleanup criteria.

Groundwater samples will be analyzed for volatile organic compounds using EPA Method 624. This analytical method is sufficient to meet the detection limits required to determine if concentrations of volatile organic compounds are above the Department's specific groundwater quality criteria. The concentration of volatile organics being analyzed can be estimated by the laboratory at concentrations below 5 ppb using this method. Estimating concentrations below 5 ppb will allow for comparison of concentrations with groundwater quality criteria which are less than 5 ppb (i.e., for benzene, 1,1-dichloroethene, 1,2-dichloroethane, tetrachloroethene, and trichloroethene).

4.0 Project Organization and Responsibilities

4.1 Laboratory

All matrix samples will be analyzed at H2M Labs, Inc. in Melville, New York (516- 694-3040). H2M Labs, Inc. is an NJDEP certified laboratory, Number 73158.

4.2 Project Coordination

General direction will be provided by H2M's Principal-in-Charge, Michael V. Tumulty, P.E. (201-256-5454). Mr. Tumulty has the corporate authority within the firm to commit corporate resources to ensure the quality and performance of the project.

4.3 Coordination of Field Sampling Activities and Quality Assurance/Quality Control

Coordination of all field activities will be provided by Charles A. Martello (201- 256-5454). Mr. Martello will be responsible for the management of all field activities associated with the additional sampling, coordination with the laboratory, as well as liaison with the NJDEP.

4.4 Coordination of Laboratory Activities

The Laboratory Director, John J. Molloy, P.E. (516-756-8000), has overall responsibility of all operational activities of H2M Labs, Inc. The Laboratory Quality Assurance Manager, Joann M. Slavin, will review all data and be responsible for laboratory reporting and quality control.

5.0 Summary of Laboratory Analytical Methods and Quality Assurance/Quality Control

This summary, prepared in accordance with N.J.A.C. 7:26E-2.2(a)1v., is provided in Table 1.

6.0 Site-Specific Sampling Procedures

Soil samples will be obtained with a hand auger. A shallow sample for total petroleum hydrocarbon and metals analysis will be obtained from 0.5 to 1.0 feet below grade. Volatile organic analysis will be performed on the 0.5 foot interval from 0.5 to 2.0 feet below grade which exhibits the

H2M GROUP

Table 1
Analytical Methods / Quality Assurance Summary Table
Quality Assurance Project Plan
ITT Avionics Division
Clifton, New Jersey

Sampling Event	Area [sq. feet]	Matrix	Quantity of Samples: Matrix Samples	F. B. (Aq.)	T. B.rip (Aq.)	MS/ MSD	Analytical Parameters	Analytical Methods	Sample Preservation	Sample Container Volume / Type	Holding Time
AOC 6	9,950	Concrete	11	1	0	1	Halogenated/Non-Halogenated Volatile Organic Compounds	EPA Method 8240/Aq. EPA 624	Cool, 4 deg C., Dark	120 ml glass with polypropylene screw cap with Teflon-lined septum/Aqueous described below	Soil / Aqueous - 10 Days
AOC 6	9,950	Concrete	11	1	0	1	Priority Pollutant Metals	EPA 7000 series of Methods	Cool, 4 deg C.	Soil: 4 - 32 oz. glass, black phenolic cap, polyethylene liner; Aq: 1000 ml plastic w/HNO3 to pH <2	Soil / Aqueous - 180 Days
AOC 8	N/A	Soil	2	1	0	1	Priority Pollutant Metals	EPA 7000 series of Methods	Cool, 4 deg C.	Soil: 4 - 32 oz. glass, black phenolic cap, polyethylene liner; Aq: 1000 ml plastic w/HNO3 to pH <2	Soil / Aqueous - 180 Days
AOC 8	N/A	Soil	1	1	0	1	Total Petroleum Hydrocarbons	EPA 418.1	Cool, 4 deg C.	Soil - 4 oz. glass Aqueous - 1 Liter Glass	Soil - 28 Days Aq. - 7 Days
AOC 12	N/A	Concrete	3	1	0	1	PCBs	EPA Method 8080	Cool, 4 deg C., Dark	120 ml glass with polypropylene screw cap with Teflon-lined septum/Aqueous described below	Soil / Aqueous - 10 Days
AOC 12	N/A	Concrete	3	1	0	1	Total Petroleum Hydrocarbons	EPA 418.1	Cool, 4 deg C.	Soil - 4 oz. glass Aqueous - 1 Liter Glass	Soil - 28 Days Aq. - 7 Days
AOC 14	N/A	Soil	10	1	0	1	Halogenated/Non-Halogenated Volatile Organic Compounds	EPA Method 8240/Aq. EPA 624	Cool, 4 deg C., Dark	120 ml glass with polypropylene screw cap with Teflon-lined septum/Aqueous described below	Soil / Aqueous - 10 Days
Ground Water	N/A	Aqueous	5	1	1	1	Halogenated/Non-Halogenated Volatile Organic Compounds	EPA Method 624	Cool, 4 deg C., Dark	40 ml amber glass vial with black phenolic plastic screw cap with Teflon-lined septum	10 Days

ADC000574

(June 12, 1996)

highest response on a PID, or at a depth of 1.5 to 2.0 feet below grade if there is no PID response, in accordance with N.J.A.C. 7:26E-3.6(a)4.

Concrete chip samples will be obtained utilizing a decontaminated chisel to break off a surficial piece of concrete. The location of the sample will be biased based on surface staining or signs of deterioration.

Groundwater sampling, including required field measurements and minimum purge volumes, will be conducted in accordance with applicable sections of Chapter 7, Section H of the NJDEP *Field Sampling Procedures Manual* (1992). Dedicated, disposable polyethylene bailers will be used to purge the monitoring wells. No decontamination will be required of this equipment, since bailers will be dedicated to each well and not reused. This significantly reduces the risk of cross-contamination of samples.

Each sample container will be provided with a label for sample identification purposes. The amount of information on the label should include a sample identification number, time, date and initials of the sample collector. Each sample collected in the field will be labeled using waterproof ink. All sample containers will be accompanied by a full chain-of-custody, provided by the laboratory. It is laboratory practice to pre-clean and pre-preserve sample containers in order to minimize potential contaminants in the field, and to reduce unnecessary sample handling in the field. Upon completion of sampling, the sample containers will be sealed and placed on ice in a cooler. Samples will be stored and shipped to H2M Labs via overnight courier or delivered by field personnel at the end of each day of sampling. It is estimated that the soil and groundwater sampling event will be completed in one day.

Information required by the Department in accordance with the NJDEP *Field Sampling Procedures Manual* (1992), as well as any other information pertinent to groundwater sampling activities, will be recorded in bound, waterproof field books and/or an H2M field sampling sheet. Proper documentation will consist of field personnel maintaining detailed records of all work accomplished potentially including but not limited to: (1) date and time of sampling events; (2) purpose of work; (3) names of people relevant to the project; (4) description of all sampling methods; (5) description of all samples; (6) quantity of samples; (7) description of sampling points; (8) date and time of sample collection; (9) sample collector's name; (10) weather; (11) field observations; and (12) any field measurements with portable instruments.

7.0 Field Instrumentation Calibration/Preventative Maintenance

All field instruments, including but not limited to photoionization detectors, water level probes, pH probes, conductivity probes, and dissolved oxygen probes, will be calibrated and maintained according to the manufacturers specifications and requirements. Calibration records will be maintained in the field log. Copies of the operations manuals, including calibration procedures for these specific field instruments currently being used by H2M field personnel, are maintained in the field and the office.

8.0 Chain of Custody Procedures

8.1 Field Custody

The field sampler initiates the chain-of-custody procedure in the field and is the first to sign the form upon collection of samples. A sample is under custody if:

1. it is in your actual possession; or
2. it is in your view, after being in your physical possession; or
3. it was in your physical possession and then you locked it up or sealed it to prevent tampering; or
4. it is in a designated secure place restricted to authorized personnel.

The field sampler is personally responsible for the care and custody of the samples until they are transferred and properly dispatched. Sample bottle labels shall be completed for each soil and aqueous sample, using waterproof ink subjected to proper preservation, and packaged to preclude breakage during shipment. Every sample shall be assigned a unique identification number that is entered on the chain-of-custody form. Samples can be grouped for shipment using a single form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date and note the time of transfer. This record documents transfer of custody of samples from the sampler to another person, to a courier, or to the laboratory. If samples are shipped directly to the laboratory, the chain-of-custody forms will be kept in possession of the person delivering the samples. For samples shipped by commercial carrier, the chain-of-custody form will be sealed in a watertight envelope, placed in the shipping container, and the shipping container sealed prior to being given to the carrier. The waybill will serve as an extension of the chain-of-custody record between the final field sampler and receipt in the laboratory. Whenever samples are split with a facility or regulatory agency, the chain-of-custody will be marked to indicate which samples and with whom the samples were split.

8.2 Laboratory Sample Custody/Sample Storage

H2M Labs, Inc. has a standard operating procedure for documenting the receipt, tracking and compilation of sample data. Sample custody related to sampling procedures and sample transfer are described below.

(1) Shipping or Pickup of Cooler by Field Team
   a. Cooler packed at H2M Labs after contact with field team or Project Manager.
   b. Cooler wrapped with custody seal.
   c. Chain-of-custody form filled out by H2M Labs personnel.
   d. Field team supplied with custody seal to secure cooler prior to shipment back to the laboratory.

(2) Delivery of Cooler to Field Team
   a. Samplers check for any external damages (such as leaking).
   b. Samplers or facility representative sign for cooler from shipper.

(3) Cooler Delivery to H2M Labs
   a. Check condition of external seal.
   b. Open cooler.
   c. Remove chain-of-custody forms, fill out and sign.
   d. Check to see if any samples are broken or damaged.

(4) Sample Storage at H2M Labs
   a. Samples are locked in a refrigerator until analyzed.
   b. Chain-of-custody maintained by laboratory receiving personnel and analysts.

9.0 Laboratory Data Deliverables Format

Pursuant to N.J.A.C. 7:26E-2.1(a)11, Non-CLP reduced laboratory deliverables will be provided, in accordance with N.J.A.C. 7:26E, Appendix A.

10.0 Report Format

A report will be submitted to the Department within six weeks of the sampling event. The report will include a brief summary of the sampling event, including field measurements; a summary table presenting the data, including a comparison to applicable NJDEP criteria, and, for groundwater, a discussion of the current data with respect to historic data. Recommendations for subsequent actions, if warranted, will be provided.

APPENDIX E
HEALTH & SAFETY PLAN

ADC000578

TIERRA-B-007735

H2MGROUP

Health and Safety Plan
ITT Avionics Division
Clifton, New Jersey

June 1996

1.0 Purpose

The purpose of this Health and Safety Plan is to establish a protocol for protecting field personnel from incidents that may arise during field activities at the ITT Avionics Division facility located at 100 Kingsland Road, Clifton, New Jersey. This plan has been prepared in accordance with the National Institute for Occupational Safety and Health (NIOSH), the Occupational Safety and Health Administration (OSHA) "Standards and Regulations, 29 CFR 1910 and 29 CFR 1926," the United States Coast Guard (USCG), and the United States Environmental Protection Agency (USEPA) publication, "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," dated October 1985.

This Health and Safety Plan is for H2M Group personnel. The plan establishes personnel protection standards and mandatory operating procedures, and provides a contingency plan for situations that may arise while field work is being conducted at the site. Personnel at the site may encounter hazards which include chemical exposure, explosion and fire, biological, safety, heat stress and noise.

2.0 Site Hazards

It is important that personnel protective equipment and safety requirements be appropriate to protect against potential or known hazards. Protective equipment will be selected based on the types, concentrations, possibilities and routes of personnel exposure to substances at a site. In situations where the type of material and possibilities of contact are unknown, or where the hazards are not clearly identifiable, a more subjective determination will be made of the personnel protective equipment required for initial safety.

The hazards that may be encountered include chemical exposure, explosion and fire, biological, safety, heat stress and noise.

- Chemical Exposure: Low levels of volatile organic compounds, predominantly 1,1,1-TCA and degradation compounds are present in the groundwater beneath the site.

- Explosion and Fire: The use of power equipment requires a source of fuel, usually gasoline; extreme care must be taken to avoid contact between fuel and hot surfaces (i.e., engine exhaust, etc.).

- Biological Hazards: The hazards that may be encountered include poison ivy, thorned brush, dogs, ticks and rodents.

- Safety Hazards: The hazards may include uneven terrain, sharp objects, heavy equipment, holes, ditches, and glass and debris.

- Heat/Cold Stress: Due to ambient conditions, personnel should be monitored for heat/cold stress.

- Noise: Work around heavy equipment often creates excessive noise. The effects of noise can include: workers being startled, annoyed or distracted; physical damage to the ear; and communication interference's.

3.0 Education and Training

All personnel involved in field work will be trained to carry out their designated field operations. Training will be provided in the use of all equipment, including: respiratory protective apparatus and protective clothing; safety practices and procedures; general safety requirements; first aid; and hazard recognition and evaluation. Each individual involved in field work must provide documentation of training, as per 29 CFR 1910.120 (e)(2). In addition, each individual must sign for, and be provided with, a copy of this Health and Safety Plan.

4.0 Personnel

4.1 Off-Site Personnel

4.1.1 Senior Level Management

Responsible for defining project objectives, allocating resources, determining the chain of command, and evaluating program outcome. Specific responsibilities include:

- Provide the necessary facilities and equipment.
- Provide adequate personnel and time resources to conduct activities safely.
- Support the efforts of on-site management.
- Provide appropriate disciplinary action when unsafe acts or practices occur.

4.1.2 Health and Safety Officer

Responsibilities include:

- Becoming familiar with the types of materials on-site, the potential for work exposures, and recommending the medical program for the site.
- Provide emergency treatment and decontamination procedures for the specific type of exposure that may occur at the site, and obtain special equipment or supplies necessary to treat such exposures.
- Provide emergency treatment procedures appropriate to the hazards on-site.

4.1.3 Project Manager

Reports to upper level management. The Project Manager has the authority to direct response operations and to assume total control over site activities. Specific responsibilities include:

- Prepare and organize the background review of the situation, the Work Plan, the Health and Safety Plan, and the field team.
- Obtain permission for site access and coordinate activities with appropriate officials.
- Ensures the Work Plan is complete and on schedule.
- Briefs the field team(s) on their specific assignments.
- Uses the site health and safety officer to ensure that health and safety requirements are met.
- Prepares the report and support files on the response activities.
- Serves as a liaison with client and/or public officials.

4.2 On-Site Personnel

4.2.1 Site Health and Safety Officer

Advises the field team leader on all aspects of health and safety on-site. Recommends stopping work, if any operation threatens workers or public health and safety. Specific responsibilities include:

- Selection of protective clothing and equipment.
- Periodic inspection of protective clothing and equipment.
- Ensuring that protective clothing and equipment are properly stored and maintained.
- Confirming each team member's suitability for work based on physician's recommendations.
- Monitoring the work parties for signs of stress, such as cold exposure, heat stress or fatigue.

- Monitoring on-site hazards and conditions.
- Conducting periodic inspections to determine if the Health and Safety Plan is being observed.
- Enforcement of the "buddy" system.
- Knowing emergency procedures, evacuation routes, telephone numbers of ambulance, local hospital, poison control center, fire and police departments.
- Notification, when necessary, to local public officials.
- Coordination of emergency medical care.

4.2.2 Field Team Supervisor

Responsible for field team operations and safety. Specific responsibilities include:

- Management of field team operations.
- Execution of the Work Plan and schedule.
- Enforcement of safety procedures.
- Coordination with the Site Health and Safety Officer in determining protection level requirements.
- Enforcement of site control.
- Documentation of field activities and sample collection.
- Notifying emergency response personnel by telephone or radio in the event of an emergency.
- Assisting the Site Health and Safety Officer in a rescue, if necessary.
- Maintaining a log of communication and site activities.
- Assisting other field team members in the clean areas, as needed.
- Maintaining line of sight and communication contact with the work parties via radio, signal horns or other means.

5.0 Personnel Protective Equipment

Anyone entering a zone in which hazards may be encountered must be protected against exposure to such hazards. The purpose of personnel protective clothing and equipment is to minimize exposure to hazards while working on-site.

Careful selection and use of adequate personnel protective equipment should protect the respiratory system, skin, eyes, face, hands, feet, head, body and hearing.

The level of protection is determined prior to the initial entry on-site based on available information and preliminary monitoring. Subsequent information may suggest changes in the original level chosen.

5.1 Level A Protection

The highest available level of respiratory, skin and eye protection.

5.1.1 Personal Protective Equipment

Recommended: Pressure demand, full face piece SCBA or pressure demand supplied-air respirator with escape SCBA, approved by OSHA and NIOSH.
Fully encapsulating, chemical resistant suit.
Inner chemical resistant gloves.
Chemical resistant safety boots/shoes.
Two-way radio communications.

Optional: Cooling unit; coveralls; long cotton underwear; hard hat; disposable gloves and boot covers.

5.1.2 Criteria for Selection

Meeting any of the criteria below warrants the use of Level A protection.

- The chemical substance has been identified and requires the highest level of protection for skin, eyes and the respiratory system based on either: measured (or potential for) high concentration of atmospheric vapors, gases or particulates; or site operations and work functions involve a high potential for splash, immersion or exposure to unexpected vapors, gases or particulates of materials that are harmful to skin or capable of being absorbed through the intact skin.

- Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible.

- Total atmospheric readings on a flame ionization detector (FID), photoionization detector (PID), or similar instruments indicate greater than 500 ppm above ambient background concentrations of unidentified substances in the breathing zone.

- Operations must be conducted in confined, poorly ventilated areas until the absence of these conditions, requiring Level A protection, is determined.

5.1.3 Limiting Criteria

Fully encapsulating suit material must be compatible with the substances involved.

5.1.4 Minimum Decontamination Procedure

Station 1:	Segregated equipment drop
Station 2:	Outer garment/boot/glove wash and rinse
Station 3:	Outer boot and glove removal
Station 4:	Tank change
Station 5:	Boot/glove/outer garment removal
Station 6:	SCBA removal
Station 7:	Field wash

5.2 Level B Protection

The same level of respiratory protection, but less skin protection than Level A. It is the minimum level recommended for initial site entries until the hazards have been identified.

5.2.1 Personal Protective Equipment

Recommended: Pressure demand, full face piece SCBA or pressure demand supplied-air respirator with escape SCBA.
Chemical resistant clothing (overalls and long sleeved jacket; hooded, one or two-piece chemical splash suit; disposable chemical resistant one-piece suit).
Inner and outer chemical resistant gloves.
Chemical resistant safety boots/shoes.
Hard hat.
Two-way radio communications.

Optional: Coveralls; disposable boot covers; face shield; long cotton underwear.

5.2.2 Criteria for Selection

Meeting any of the criteria below warrants use of Level B protection:

- The type of atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection. This involves atmospheres:

with IDLH concentrations of specific substances that do not represent a severe skin hazard; or that do not meet the criteria for use of air-purifying respirators.

- Atmosphere contains less than 19.5 percent oxygen.

- Presence of incompletely identified vapors or gases is indicated by direct reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the intact skin.

- Total atmospheric readings on an FID, PID or similar instrument indicates 10 to 500 ppm above ambient background concentrations of unidentified substances in the breathing zone.

5.2.3 Limiting Criteria

- Use only when the vapor or gases present are not suspected of containing high concentrations of chemicals that are harmful to skin or capable of being absorbed through the intact skin.

- Use only when it is highly unlikely that the work being done will generate high concentrations of vapors, gases, or particulates or splashes of material that will affect exposed skin.

5.2.4 Minimum Decontamination Procedure

Station 1:	Equipment drop
Station 2:	Outer garment/boot/glove wash and rinse
Station 3:	Outer boot and glove removal
Station 4:	Tank change
Station 5:	Boot/glove/outer glove removal
Station 6:	SCBA removal
Station 7:	Field wash

5.3 Level C Protection

The same level of skin protection as Level B, but a lower level of respiratory protection.

5.3.1 Personal Protective Equipment

Recommended: Full face piece, air purifying, canister equipped respirator.

Chemical resistant clothing (overalls and long sleeved jacket; hooded, one or two-piece chemical splash suit; disposable chemical resistant one-piece suit).

Inner and outer chemical resistant gloves.

Chemical resistant safety boots/shoes.

Hard hat.

Two-way radio communication.

Optional: Coveralls; disposable boot covers; face shield; escape mask; long cotton underwear.

5.3.2 Criteria for Selection

Meeting any of the criteria below warrants use of Level C protection:

- The atmospheric contaminants, liquid splashes or other direct contact will not adversely affect any exposed skin.
- All criteria for the use of air purifying respirators are met.
- Total atmospheric readings on a PID, FID or similar instrument indicates background to 10 ppm above background of unidentified substances in the breathing zone.

5.3.3 Limiting Criteria

Atmospheric concentration of chemicals must not exceed IDLH levels. The atmosphere must contain at least 19.5 percent oxygen.

5.3.4 Minimum Decontamination Procedure

Station 1:	Equipment drop
Station 2:	Outer boot and glove removal
Station 3:	Canister or mask change
Station 4:	Boot/glove/outer garment removal
Station 5:	Face piece removal
Station 6:	Face wash

5.4 Level D Protection

No respiratory protection. Minimal skin protection.

5.4.1 Personal Protective Equipment

Recommended: Coveralls.
Safety boots/shoes.
Safety glasses or chemical splash goggles.
Hard hat.

Optional: Gloves; escape mask; face shield.

5.4.2 Criteria for Selection

The atmosphere contains no known hazards. Work functions preclude splashes, immersion or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

5.4.3 Limiting Criteria

The atmosphere must contain at least 19.5 percent oxygen.

5.4.4 Minimum Decontamination Procedure

Station 1: Equipment drop
Station 2: Hand and face wash

5.5 Duration of Work Period

The anticipated duration of the work period will be established prior to daily activities. Work will only be performed during daylight hours. Other factors that limit work period length include:

- Rain.
- Ambient temperature.

6.0 Determination of the Site Specific Level of Hazard

Categories of required personal protection depend on the degree of hazard and probability of exposure by a route of entry into the body. Typically, the probable route of exposure is via inhalation of gases and of airborne particulates released from surface soil, standing liquids and lagoons.

Based on this, it has been determined that the appropriate level of protection for the majority of activities at the site is Level D, with frequent ambient air monitoring with a photoionization detector (PID), flame ionization detector (FID), and/or explosimeter.

If subsequent measurements using these instruments suggest significant changes in atmospheric conditions above background concentrations, the work zone will be evacuated and consideration will be given to upgrading the level of protection.

7.0 Work Zones

The work zones are defined as the areas encompassing the exclusion zone, decontamination zone and support zone.

7.1 Exclusion Zone

The exclusion zone is the active work area where exposure to contamination does or could occur. The outer boundary of the exclusion zone shall encompass the physical area necessary for the specific work operations. Only qualified field personnel with proper protective equipment involved in field activities will be permitted in the exclusion zone. The level of personnel protection in the exclusion zone will be Level D, unless subsequent changes warrant an upgrading in the level of protection (see Section 5).

7.2 Decontamination Zone

The decontamination zone is a transition area between the exclusion zone and the support zone. Personnel and field equipment will undergo decontamination within this zone only. All waste materials generated in this zone (contamination and wash/rinse waters) will be containerized before being removed from this zone. The decontamination zone is also referred to as the contamination-reduction zone. The level of protection in the decontamination zone is Level D, unless subsequent changes, as determined by the use of air monitoring equipment (i.e., PID, FID), warrant an upgrading of personal protection equipment.

7.3 Support Zone

The support zone will be a defined location where first aid equipment, eyewash fountains and fire extinguishers will be readily accessible. The support zone will be located adjacent to the decontamination zone.

8.0 Site Access Control

It is understood that vehicular access to the site and work area locations is readily attainable. Field equipment will be removed from the site on a daily basis.

Parking areas should be regulated to ensure free entry and egress to and from the site.

9.0 Personal Hygiene

The following personal hygiene rules must be followed while performing work at the site:

- Eating, drinking, chewing gum or tobacco, smoking or any other practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited on-site.

- Hands and face must be thoroughly washed upon leaving the work area and before eating, drinking or any other activity.

- Prior to entering any "clean" areas, rubber boots will be thoroughly cleaned. Safety boots will be cleaned of all excessive dirt and/or other contamination. "Clean" areas include eating and smoking areas, locker or change rooms, laboratory or office areas, personal vehicles and public buildings.

- Prior to leaving the site, workers must remove all contaminated clothing and place it in the appropriate storage or laundry area.

- Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.

- Under no circumstances are employees to use the site or any other operational area as a toilet facility. Only the toilet facilities provided are to be used for this purpose.

- No excessive facial hair, which interferes with a satisfactory fit of the mask-to-face seal, is allowed on personnel required to wear respiratory protection equipment.

- Contact with contaminated surfaces or with surfaces suspected of being contaminated should be avoided. Whenever possible, one should not walk through puddles, mud and other discolored surfaces, kneel on the ground, lean, sit or place equipment on drums, containers, vehicles or the ground.

- Medicine and alcohol can potentiate the effects from exposure to toxic chemicals. Prescribed drugs should not be taken by personnel on response operations if there is a likelihood of such potentiation.

10.0 Contingency Plan

This Contingency Plan is developed to identify precautionary measures, possible emergency conditions and emergency procedures.

10.1 Emergency Medical Care and Treatment

The Health and Safety Plan addresses emergency medical care and treatment of field personnel, including possible exposures to toxic substances and injuries due to accidents or physical problems. The following items are included in emergency care provisions:

- Name, address and telephone number of the nearest medical treatment facility will be readily available. Directions for locating the facility, plus the travel time, will also be readily available.

- Names and telephone numbers of ambulance service, police and fire departments, and procedures for obtaining these services, will be readily available.

- Procedure for prompt notification of H2M Health and Safety Officer/H2M Project Manager.

- Emergency eyewash fountains and first aid equipment will be readily available on-site and located in an area known to all personnel.

- Readily available fire extinguisher (ABC), non-toxic, dry chemical.

10.2 Off-Site Emergency Medical Care

The Site Health and Safety Officer shall develop plans for emergency medical care services at a convenient medical facility and establish emergency routes.

10.3 Personnel Accidents

Bodily injuries which occur as a result of an accident during the operations at the site will be handled in the following manner:

- First aid equipment will be available on-site for minor injuries. If the injuries are not considered minor, proceed to the next step.

- The local first aid squad rescue unit, a paramedic unit, the local hospital and the Site Health and Safety Officer shall be notified of the nature of the emergency.

- The injured employee shall be transported by the local emergency vehicle to the local hospital.

- A written report by the Site Health and Safety Officer shall be submitted to the H2M Health and Safety Officer/H2M Project Manager, detailing the events and actions taken during the emergency, within 24 hours of the accident.

- A for a list of emergency contacts in the area is attached.

10.3.1 Personnel Exposure

In the event that any personnel are splashed or otherwise excessively contaminated by chemicals, the following procedure will be undertaken:

- Disposable clothing contaminated with observable amounts of chemical residue is to be removed and replaced immediately.

- In the event of direct skin contact in Level D, the affected area is to be washed immediately with soap and water. For Level B, the person will also be taken to the hospital.

- The Site and Health and Safety Officer, or other individuals who hold a current first aid certificate, will determine the immediate course of action to be undertaken. This may involve using the first aid kit and/or eyewash.

10.3.2 Weather

Adverse weather conditions are important considerations in planning and conducting site operations. Hot or cold weather can cause physical discomfort, loss of efficiency and personal injury. Of particular importance is heat stress resulting when protective clothing decreases natural body ventilation. One or more of the following will help reduce heat stress:

- Provide plenty of liquids. To replace body fluids (water and electrolytes) lost because of sweating, use a 0.1 percent salt water solution and more heavily salted foods or commercial mixes. The commercial mixes may be preferable for those employee on a low sodium diet.

- Provide cooling devices to aid natural body ventilation. These devices, however, add weight, and their use should be balanced against worker efficiency. Long cotton underwear acts as a wick to help absorb moisture and protect the skin from direct contact with heat absorbing protective clothing. It should be the minimum undergarment worn.

- Install mobile showers and/or hose down facilities to reduce body temperature and cool protective clothing.

- In extremely hot weather, conduct non-emergency response operations in the early morning or evening.

- Ensure that adequate shelter is available to protect personnel against heat, cold, rain, snow, etc.

- In hot weather, rotate shifts of workers wearing impervious clothing.

10.3.3 Heat Stress Monitoring

For monitoring the body's recuperative ability to excess heat, one or more of the following techniques should be used as a screening mechanism. Monitoring of personnel wearing impervious clothing should commence when the ambient temperature is 70°F or above. Frequency of monitoring should increase as the ambient temperature increases, or as slow recovery rates are indicated. When temperatures exceed 85°F, workers should be monitored for heat stress after every work period. The following are important considerations.

- Heart rate (HR) should be measured by the radial pulse for 30 seconds as early as possible in the resting period. If the heart rate exceeds 110 beasts per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same. If the heart rate still exceeds 110 beast per minute at the next rest period, shorten the following work cycle by one third.

- Heat stroke is the most severe form of heat stress. The body must be cooled immediately to prevent severe injury and/or death. Signs and symptoms are: red, hot dry skin; no perspiration; nausea; dizziness and confusion; strong rapid pulse; and coma.

10.3.4 Effects of Cold Exposure

Persons working outdoors in temperatures at or below freezing may be frost-bitten. Extreme cold for a short time may cause severe injury to the surface of the body or result in profound generalized cooling, causing death. Areas of the body that have a high surface area-to-volume ratio, such as fingers, toes and ears, are the most susceptible.

Hypothermia can occur even at temperatures well above freezing, especially in windy, wet conditions. Signs of hypothermia include shivering and disorientation. Persons exhibiting these symptoms should remove damp clothing and go indoors or in a warm vehicle.

10.4 Fire

In the event of an uncontrolled fire occurring on-site, the following actions will be undertaken:

- Evacuate all unnecessary personnel from the site, if necessary.
- Contact the local fire and police departments (see Appendix A).
- Contact the local hospital concerning the possibility of fire victims.
- Contact the H2M Project Manager and H2M Health and Safety Officer.
- All personnel in the area of the fire shall be at Level B personnel protective equipment.

10.5 Personnel Protective Equipment Failure

If any site worker experiences a failure or alteration of protective equipment that affects the protection factor, that person and his/her buddy shall immediately leave the exclusion zone. Re-entry shall not be permitted until the equipment has been repaired or replaced.

11.0 Summary

This Health and Safety Plan establishes polices and procedures to protect workers from potential or known hazards that exist at a site. Personnel protective equipment will be based upon the type(s), concentration(s), possibility and routes of personal exposure to substances at a site. All site operation planning incorporates an analysis of the hazards involved and procedures for preventing or minimizing the risk to personnel. The following summarizes the rules which must be observed:

1. The Health and Safety Plan shall be made available to all personnel conducting field work on-site. All personnel must sign for this plan acknowledging that they are fully familiar with its contents.

2. All personnel will be familiar with standard operating procedures and additional instruction contained in the Health and Safety Plan.

3. All on-site personnel will be adequately trained and thoroughly briefed on anticipated hazards, equipment to be worn, safety practices to be followed, emergency procedures and communications.

4. Any required respiratory protective equipment and clothing will be worn by all personnel going on-site.

Pg 1-24

REPORT UPON

OVERFLOW ANALYSIS

TO

PASSAIC VALLEY SEWERAGE COMMISSIONERS
PASSAIC RIVER OVERFLOWS

1976

1

ELSON T. KILLAM ASSOCIATES, INC.
Environmental and Hydraulic Engineers 48 ESSEX STREET, MILLBURN, NEW JERSEY 07041

TIERRA-B-007752

ABSTRACT

ABSTRACT

OVERFLOW

A detailed study was conducted of the seventy-three combined sewer overflow systems within the jurisdiction of the Passaic Valley Sewerage Commissioners. The work included the identification and investigation of these systems in order to determine their location, physical characteristics, and extent of service area. The methodology of investigation included the physical examination of each overflow chamber to verify dimensions, elevations, pipe sizes, chamber condition, and other physical characteristics affecting overflow to the river.

Overflow measurements were made at each of the active overflow stations to relate the overflow to rainfall, where possible, and to study time-duration pollution loading to the river.

Sampling of such overflows was undertaken to determine the quality of the combined overflow. Alternative plans for corrective action were considered and are reported, together with estimates of cost. It is recommended that the solution to problems of overflows experienced in the system be developed through the use of underground storage as the most feasible alternative, considering all factors.

This report is submitted in fulfillment of the agreement between the Passaic Valley Sewerage Commissioners and Elson T. Killam Associates, Incorporated, dated August 19, 1974. The original scope of work was set forth in the "Overview Report Upon Infiltration/Inflow Study of the Passaic Valley Sewerage Commissioners' District" dated May, 1974, under Construction Grant No. C340430-01-0.

PREFACE

PREFACE

In accordance with the agreement between The Passaic Valley Sewerage Commissioners and Elson T. Killam Associates, Inc., Einvironmental and Hydraulic Engineers, dated August 19, 1974, and approved by the United States Environmental Protection Agency, a Final Report upon Overflow Analysis is hereby submitted, setting forth the findings, conclusions and recommendations, in accordance with the requirements of the agreement.

The Table of Contents indicates the report topics, the initial sections begin introductory information such as "Purpose of Report", "Scope", and "Methodology". The first section of the detailed body of the report discusses the general approach followed to develop the data required for a project of this magnitude and complexity. The other four sections in the body arrange the overflows in geographical groupings, from the northerly terminus of the PVSC interceptor in the Paterson Area to the southerly portions of the PVSC District in the Newark and Kearny-Harrison Areas.

The final conclusions and recommendations concerning the Overflow Study and Analysis are included ahead of the "Summary Report Upon Overflows into the Passaic River" to be found following the Table of Contents.

Appreciation and thanks are extended to all those who assisted in this task and helped to bring this phase of the work to completion. Special thanks are extended to the laboratory staff of PVSC, who did the sampling analysis, to the field personnel, whose cooperation was invaluable, and

particularly to Mr. S. Lubetkin, Chief Engineer, Mr. E. Moller, Mr. J. Lawrence, and their staff, without whose cooperation and assistance the work could not have been completed.

ELSON T. KILLAM ASSOCIATES, INC.

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLES

TABLES

PLATES

PLATES

CONCLUSIONS & RECOMMENDATIONS

CONCLUSIONS AND RECOMMENDATIONS

OVERFLOW

This study and report upon the Passaic Valley Sewerage Commissioners' Interceptor and tributary collection systems, serving an area of approximately one hundred square miles, covers both Infiltration/Inflow Analysis as well as an investigation of combined sewer overflows. Combined sewers are located in about twenty-four percent of the area served. Seventy-three overflows are located within the PVSC District, and these provide an outlet for about sixteen square miles of combined sewer area located within the District. About three square miles of combined sewers are located within the PVSC District but do not have PVSC overflows. Some of these overflows provide an outlet for sanitary sewer systems while the bulk serve combined systems. Sixty-five overflows are classified active, while eight are classified as inactive.

During the course of the study, it was found that approximately twenty-three additional overflows or bypasses owned by the City of Paterson are located within the City's collection system and discharge combined sewage directly into storm sewers which empty into the Passaic River. These are additional to the twenty-eight overflows classified active and located in the Paterson area which are part of the PVSC system.

It was also found that at least fourteen overflows owned by the City of Newark are located within the City's collection system and discharge combined sewage into storm sewers which empty into the Passaic River or Newark Bay. These are additional to the fifteen PVSC overflows classified active which are located within the City of Newark.

Three major overflows included in the foregoing, namely, Peddie, Queen, and Waverly, are located in the South Side of the City of Newark which is served by combined sewers. The overflows from the South Side of Newark discharge into Newark Bay.

Measurements were made at all of the active PVSC overflow chambers to determine the rate and volume of overflow, as well as the degree of pollution resulting from these overflows during storm periods. A comparison was made of the quality of the combined storm water overflow with the dry weather sewage flow which was measured at both the sixty-five active and the eight inactive overflow stations within the PVSC system.

Measurements of overflow were conducted over a period of a year. It was found that rainfall occurred on one hundred and four days during the one-year period of study. Furtheremore, overflows occurred from seventy to eighty times per year during the period of study. Overflows generally occurred within fifteen to twenty minutes after rainfall intensity exceeded 0.04 inches per hour. The duration of the overflow period generally coincided with the time of rainfall and overflow has been found to occur for only short periods following reduction of rainfall intensities. The peak overflow rates were found to be extremely high, ranging from twenty to thirty times the dry weather flow in the collection system tributary to the overflow chamber. The volume of overflow was found to be a function of rainfall intensity, duration of the storm, and the total rainfall. It was generally found that the initial overflows contained a higher degree of pollution than found in waste characteristics of the dry weather flow. Investigation of samples at the start of overflow indicated that the suspended solids were generally high, reflecting a flushing action through the sewers. The Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) in the overflow were often a function of the non-storm waste characteristics of the tributary area. However, after some initial modest reactions no general evidence was found in storm water characteristics which would indicate a major and continued decrease in pollutional strength when storm water overflows extended over a long time period.

The suspended solids indicated a wide variation in concentration and appeared to have no correlation with the storm overflow rates and duration. The strength of BOD and COD were generally found to be somewhat lower following an initial period of overflow. Investigation of the combined sewer system overflows reveals that approximately 7,600 Million Gallons (MG) of combined storm water and sewage were discharged into the Passaic River during the study period (1974-1975). This volume is equivalent to about eight percent of the total annual sewage flow treated at the plant during the same period. The result of this overflow and other local overflows (not owned by PVSC) located within the collection system is a measurable pollution load upon the receiving stream. It should be noted that the overflow observed, represents flow from combined sewers serving 16 square miles of the PVSC Area and furthermore represents the excess flow which initially is conveyed by the PVSC interceptor.

The remaining storm flow from the balance of the PVSC Area (about 84 square miles) discharged in excess of 40,000 MG during the same study period, via storm drains, also with a measurable pollutional load on the River.

It has been estimated that the total annual pollutional loading from the combined sewer overflows in the PVSC District aggregates about 4,800 tons of BOD per year, for the study period. It should be noted that the study year (1975) was found to be the second highest rainfall year of record. Subsequently, it is presumed that a proportionate condition of runoff to the Passaic River prevailed during the same period, that is, extremely high river volumes of flow.

The annual loading to the river from PVSC overflows occurs usually during storm periods and its effect on the river is complicated by: increased river flow - higher velocities; storm water, and overland discharges along the river; tidal effects; and other factors which require a study far beyond the scope of this investigation. It was intended to study the effect of loadings on the River, utilizing the available River model prepared under separate contract for the State of New Jersey. The mathematical model could not be used because of its limitations under actual dynamic conditions. In other words, the formulation of a dynamic model by Killam Associates is well beyond the intent of the contract with PVSC. The data compiled during this study and reported upon certainly could be used and would be helpful in the formulation of a dynamic model. It is recommended that such study by undertaken to determine the true effect on the River.

Regardless of the effect on the River, Public Law 92-500 requires the objective of "zero" discharge by year 1985. The practicality of the timing of this objective notwithstanding, four alternative solutions have been considered, as follows:

1. Relief interceptor to accommodate storm water flows.
2. Reconstruct portions of sanitary and combined sewer system (separation and replacement).
3. Separation of combined sewer systems and construction of PVSC relief interceptor.
4. Alternative storage plans.

It has been determined that the most effective method of eliminating overflows is to provide storage (Alternative 4). This storage might best be provided by the construction of deep rock tunnels with adequate capacity to store combined overflows. It has been estimated that the storage required would be in excess of 700 Million Gallons (MG). This capacity should be adequate to accommodate the runoff from a four-inch rainfall over the nineteen square miles of the combined sewer It would then be possible to pump the stored combined flow into the treatment plant, which would be able to handle a flow in excess of the existing PVSC interceptor capacity. The cost of constructing a storage tunnel, and required pumping facilities, has been estimated to be approximately $700 million to $800 million.

The total collection system possible infiltration was found to range from about 70 MGD to 100 MGD. It has been determined that approximately 73 percent of this possible infiltration was located in the combined sewer system districts. It has been estimated that approximately fifty percent of the possible infiltration can be reduced in both the sanitary sewer collection systems and the combined sewer systems in the District. Prior to undertaking a program of possible infiltration reduction, it would be advisable to determine whether or not overflows will be completely eliminated by the construction of deep storage tunnels or whether a combined sewer separation program will be undertaken. If a storage plan or separation program is authorized to be studied, it is recommended that the further investigation of possible infiltration under Phase II in the combined sewer system be limited to major and identifiable sources of possible infiltration that can readily be eliminated at nominal cost.

If the storage alternative is adopted as most effective, then preliminary engineering investigations should be made of the economic feasibility of constructing a deep rock tunnel for the storage of overflows. This investigation would include geological studies, borings, detailed estimates of cost, and alternative possibilities of subsurface storage to accommodate overflows which now occur.

It is recommended that whatever alternative is adopted regarding overflow, consideration be given to the effect of local overflows in the Paterson and Newark areas which now discharged directly or indirectly into the Passaic River, and which were not included within the scope of this report. This also includes the South Side Interceptor Sewer which is owned by the City of Newark, which now discharges into Newark Bay.

Determination of the most effective method of eliminating this overflow should also be included in any alternative adopted. It would appear that the installation of a deep rock tunnel would be the most effective means of eliminating such overflow, and a tunnel which would lead toward the Newark Bay Pumping Station, with its pumping facilities, could be integrated with the tunnel plan proposed for the combined sewer overflows from the Paterson-Newark area.

SUMMARY REPORT
UPON
OVERFLOWS INTO THE PASSAIC RIVER

SUMMARY REPORT
UPON
OVERFLOWS INTO THE PASSAIC RIVER

INTRODUCTION

One of the basic objectives of this study and report is to determine the most effective, economical, and environmentally acceptable means of controlling "combined" storm water overflows, and other sanitary sewage overflows created by severe inflow to the PVSC interceptor sewer, from the internal sanitary and combined sewer collection systems of the municipalities served by the PVSC.

The Water Pollution Control Act, Public Law 92-500, mandates that there be no overflow and no pollutional discharges by 1985. Although the goals set by the law are to be commended, their attainment within the time limits projected is doubtful from a practical view. The attainment of the objective of the law--elimination of all pollutional discharge by 1985, for all storm conditions--is not probable. The cost of this work is very great, and a massive public works project would be required to accomplish the objectives, insofar as the substantial elimination of all overflows and pollutional discharges is required.

ALTERNATIVES CONSIDERED

1. Relief Interceptor to Accommodate Storm Water Flows

Several alternatives have been considered in an endeavor to establish plans that might be economically feasible and within the ability of the PVSC members to finance, commensurate with the benefits received.

6049

Consideration was given to the construction of a new parallel interceptor or trunk line extending from the upper terminus of the system in Paterson, a distance of about twenty miles, downstream to the Treatment Plant in the City of Newark. Spur lines would also be required under such a plan to substantially eliminate all overflow conditions which prevail within the collection system. Under this plan, it would be necessary to size the relief interceptor to accommodate the peak flow rates which now occur and which are exceptionally high in the Paterson, Newark, and Kearny-Harrison areas where combined sewers are in service.

This alternative has been evaluated and is clearly not economically feasible and should not be considered. A pipeline of this size and magnitude would have to accommodate peak flow rates from the Paterson area of about 5,000 to 7,000 MGD, and from the City of Newark and Kearny area, would have to be large enough to accommodate peak flow rates from 5,500 to 8,000 MGD, and 1,700 to 2,000 MGD, respectively. The cost of such an interceptor would be prohibitive, estimated to be about $1.0 to $1.5 billion. The diameter of the pipe would be exceptionally large, and the construction of such a line would involve deep tunneling in order to avoid disruption of existing utilities, traffic, and commerce.

In addition to the construction problems and tremendous cost of conveying these peak overflow rates to the plant for treatment, it would be necessary to provide expanded treatment facilities to treat the storm water, which would increase the estimated cost by $0.5 - $1.0 billion--which would not be considered economical.

The present treatment plant design calls for expansion and enlargement to handle an average daily flow of 300 MGD. Hydraulically, the plant will be able to accommodate at least twice this rate during peak flow conditions.

It is obvious from the foregoing that the expansion of the treatment plant to handle peak flow rates, which might be as high as 12,000 to 17,000 MGD--for relatively short periods--is not reasonable. For this reason, the installation of a new interceptor sewer to accommodate all overflows, whether from combined sewers in the Paterson, Newark and Kearny-Harrison areas, or inflows from the separate sanitary sewer systems, cannot be justified.

2. Reconstruct Portions of Sanitary and Combined Sewer System (Separation and Replacement)

Another alternative considered, involves the reconstruction and replacement of very old sewer systems in the PVSC service area with new pipelines, especially designed to provide watertight joints and appurtenances. Furthermore, new house connections are proposed in conjunction with the elimination of underdrains or illegal connections. Consideration was also given to separating existing combined sanitary sewers which are conducive to ground water infiltration and leakage. The objective of this plan would be to utilize existing combined sewers as storm sewer systems and provide new watertight separate sanitary sewers which would minimize the entry of ground water infiltration or inflow during periods of rainfall. Under this plan, a major portion of the older sanitary sewer systems would be reconstructed where inflow and infiltration are found to be excessive. The objective of the foregoing would be to reduce the storm flow rates in an attempt to avoid the necessity of paralleling or reconstructing the PVSC interceptor.

It has been estimated that there are approximately 8 million feet of both combined and separate sanitary sewers in the 100-square mile area served by the PVSC system. It has further been estimated that there are about 2.1 million feet of combined sewers in approximately 19 square miles of the District (exclusive of the South Side of the City of Newark), and the balance of the District is provided with separate sanitary sewer systems (5.5 million feet).

The estimated cost of reconstruction and repair of portions of the sanitary and combined sewer systems is about $1.2 billion. The construction of a completely new sanitary sewer system would be more expensive--about $1.8 billion--but this would essentially eliminate all infiltration and inflow. A combination of repair and replacement, as well as combined sewer separation, would significantly reduce both the dry weather flow rates and the peak flow rates (inflow) presently experienced.

Under present-day conditions, the average daily dry weather weekday flow at the plant ranges from about 250 MGD to 280 MGD (dry to wet weather months). Total system peak flow rates under storm conditions have been estimated to range from 2,000 to 15,000 MGD (storm water overflow conditions per occurrence). By new sewer construction and separation of the combined sewer system, it has been estimated that the dry weather flow could be reduced by about 50 MGD. The peak flow rates in the system would also be reduced.

Notwithstanding the reduction of extraneous flows--during dry weather and peak storm conditions--by the expenditure of about $1.8 billion for new sewer systems, it is estimated that overflows would still occur because of the inadequacy of the existing PVSC interceptor to accommodate anticipated peak flow rates.

It would therefore be necessary, under this alternative, to parallel a large portion, if not all, of the PVSC interceptor where capacity is inadequate. Therefore, this alternative is not considered feasible and we would not recommend any further detailed investigation of this concept.

A further consideration with respect to separation of combined sewers, other than expense, involves pollutional discharge during storms from separate storm sewers. Although separation diverts sanitary waste from the overflow, and essentially removes large portions of infiltration/inflow from the system, separate storm sewer discharges from urban runoff produce pollutional loads which are discharged to the River. These loads are variable and are in an order of magnitude which is dependent upon precipitation, road debris, chemicals, and other surface contaminants of a particular area. These contaminants are ultimately washed into and flushed through the storm sewer system, and discharged to the River.

3. Separation of Combined Sewer Systems and Construction of PVSC Relief Interceptor

Under this alternative plan, consideration has been given to a complete separation of combined sewers by the construction of a new, separate sanitary sewer system in approximately 19 square miles of the District now served by combined sewers. This alternative has the advantage of reducing the cost associated with a new sewer system for the entire District, and would eliminate "combined" storm water overflows which now occur with each measurable rainfall.

By eliminating the combined sewers in the Paterson, Newark, and Kearny-Harrison areas (12,200 acres), it has been estimated that the average daily dry weather weekday flows, which now range from 250 MGD to 280 MGD, seasonally, could be reduced to about 230 MGD.

It would still be necessary, however, to provide a parallel relief PVSC trunk sewer to prevent overflows into the river, since the estimated total peak system flow, which would include remaining inflow from the existing separate sanitary sewer collection systems, as well as the flow from the new sanitary sewer systems in the combined sewer districts, would be in excess of the carrying capacity of the existing PVSC interceptor.

Preliminary estimates of the cost of combined sewer separation by constructing separate sanitary sewer systems in the various areas of the District were determined to be as follows:

Paterson (5,100 Acres)	$185 million
City of Newark (5,400 Acres)	215 million
Harrison-Kearny Area (1,700 Acres)	80 million
TOTAL	$480 million

The area and cost shown for the City of Newark does not include the South Side area of the City (3,240 acres).

From the foregoing, it is evident that the cost of separation of the combined sewer systems is high. This is attributed in part to the fact that there will be: disruption to traffic; interference with existing utilities; premium costs for difficult working conditions in congested streets; extensive sheeting requirements; extensive pavement and curbing replacement; necessity to break existing connections to old sewers, maintain flows, rehabilitate old lines and provide complete separation in all combined sewer lines; and the necessity of reconstructing house connections in order to completely eliminate infiltration and to assure complete reduction of system inflow. It is believed that the foregoing preliminary cost estimates are conservative. However, the cost estimates may require modification following a full investigation of the effect of existing underground utilities and actual subsurface conditions, which can only be determined following extensive field surveys required prior to design. Construction cost contingencies in this type of reconstruction project must be higher than normally provided, because of indeterminate and uncharted subsurface conditions and interferen which must be anticipated in highly developed areas.

Under this alternative, it would still be necessary to provide a PVSC relief interceptor to accommodate the peak flow rates to prevent overflows into the Passaic River during storms. The estimated cost of constructing approximately twenty-two miles of relief interceptor sewer and pumping facilities would be in excess of $350 million.

Thus, the total cost of constructing a new PVSC relief interceptor, and providing separate sanitary sewers in areas that are now provided with combined sewers, has been estimated to be about $850 million.

4. Alternative Storage Plans

Under this alternative, several methods have been investigated for handling storm water flows involving storage. The various methods which have been considered are set forth below:

(a) Provide local storage and treatment of storm water flows upstream.

(b) Provide storage and transport with treatment at existing Newark Bay Treatment Plant downstream.

(c) Separate the combined sewers and provide storage and transport with treatment at Newark Bay Treatment Plant.

(a) Provide Local Storage and Treatment of Storm Water Flows Upstream

Under this alternative, all storm water overflows which cannot now be accommodated by the existing PVSC interceptor sewer would be stored, and a local treatment facility for such stored storm water would be provided. A treatment facility would be located in the Paterson area, while similar treatment facilities would be located in Newark, as well as in the Kearny-Harrison area.

Storage facilities (tunnels) would be built underground. The treatment facilities would be activated during each storm to provide for the degree of treatment necessary to meet the requirements for discharge into the Passaic River--if permitted. Under most of these conditions, such discharge would be at times when the river flow is high, and the degree of treatment would be established to conform with the stream water quality conditions which prevail when non-point sources of pollution may predominate.

This plan is obviously not in conformance with the Federal Government mandate of no pollutional discharge into the receiving stream. The storage provided under this alternative would be adequate to accommodate the runoff from a total rainfall of four inches over the 19 square miles of the combined sewer area. A total aggregate storage of about 700 Million Gallons (MG) would be provided.

The pumping station and treatment facilities would be nominally designed with the view of dewatering the storage tunnels in a period of about one week following a four-inch rainfall occurrence. The cost of this alternative has been estimated to be from $750 to $800 million. This cost includes the capitalization of the operating costs.

(b) Provide Storage and Transport with Treatment at Existing Newark Bay Treatment Plant Downstream

This alternative would eliminate discharge of a treated effluent into the Passaic River upstream in Paterson and downstream in the Newark and Kearny-Harrison areas. All of the storm water overflows would be conveyed in a deep, long tunnel to the Newark Bay Pumping Station. Following a rainstorm, the stored combined sewage would be pumped at relatively low flow rates (about 100 MGD or less) into the existing PVSC treatment plant. The tunnel would have a storage capacity of about 700 MG, or equal to the estimated runoff from a four-inch rainfall over a 19 square mile combined sewer area.

The cost of this alternative has been estimated to be about $800 to $850 million. This is slightly higher (6-7 percent) in cost than the plan with local treatment and disposal in the Passaic River. However, this alternative does not require as much operation and maintenance.

(c) Separate the Combined Sewers and Provide Storage and Transport with Treatment at Newark Bay Treatment Plant

Under this alternative, all combined sewers in the Paterson, Newark, and Kearny-Harrison areas (12,200 acres) would be eliminated by constructing new separate sanitary sewers in these areas.

Underground storage tunnels would be constructed to store sewage overflows resulting from inflows into the existing sanitary systems (which would occur for short periods during heavy rainfalls because of the inadequate capacity of the PVSC interceptor). The stored overflows would be pumped at a relatively low rate into the PVSC interceptor in Paterson. This would occur after the rainfall. At the downstream end of the system, the stored water would be pumped directly into the Newark Bay Treatment Plant. The aggregate storage capacity required under this alternative is only about 90 MG.

The estimated cost of this plan--which appears to be the most economical means of eliminating all combined sewage overflow from the Passaic River--is $650 to $700 million. Of the foregoing amount, $480 million would be required for constructing separate sanitary sewers in about 12,200 acres of the District where combined sewers are in service (but not including 3,240 acres of combined sewers in the South Side of the City of Newark). The cost of storage tunnels and pumping facilities has been estimated to be from $170 million to $220 million.

Under this plan--and without reduction of infiltration in the rest of the system which has separate sanitary sewers--the average daily flow during the weekday (wet weather) periods might approximate 240 MGD, with peak flow rates substantially reduced.

It is furthermore estimated that a period of from seven to ten years might be required to implement this massive project. This elimination of combined sewage overflows and reduction of other extraneous flows, as indicated above, cannot be realistically completed before 1985, even if all the funds are made available.

This alternative does not include a cost allowance reflective of the loss to businesses and commerce in the center of Paterson and Newark, as well as in Kearny and Harrison, from the disruption to travel and inconveniences, and outright reduction in trade and commerce in the affected areas, nor does the alternative include the cost to homeowners and businesses for required sanitary plumbing separation within buildings and structures. Many buildings have roof leaders, cellar drains, and internal and external storm drains which would require separation, and this cost would be borne by the individual building owners. The above alternative costs would not be encountered if the tunnel plan--without combined sewer separation--were adopted.

These considerations, combined with environmental factors, must be weighed in selecting the most advantageous plan for elimination of storm water overflows.

A summary of the estimated costs of the various alternatives discussed is included in the following table:

SUMMARY OF ESTIMATED COSTS

Alternative Plans upon Elimination of Storm Water Overflows into the Passaic River

		ESTIMATED COST
1.	Relief Interceptor to Accommodate Storm Water Flows:	$1.5 - $2.5 billion
2.	Reconstruct Portions of Sanitary and Combined Sewer System (Separation and Replacement):	$1.2 - $1.8 billion
3.	Separation of Combined Sewer Systems and Construction of PVSC Relief Interceptor:	$850 million
4.	Alternative Storage Plans:	
	(a) Provide Local Storage and Treatment of Storm Water Flows Upstream:	$750 - $800 million
	(b) Provide Storage and Transport with Treatment at Existing Newark Bay Treatment Plant Downstream:	$800 - $850 million
	(c) Separate the Combined Sewers and Provide Storage and Transport with Treatment at Newark Bay Treatment Plant:	$650 - $700 million

DETAILED REPORT

PURPOSE OF REPORT

The Water Pollution Control Act Public, Law 92-500, mandates that there be no overflow and no pollutional discharges into rivers and streams by 1985. Accordingly, the basic objective of this report is to determine the most effective, economical, and environmentally acceptable means of eliminating the combined storm water overflows which occur along the Passaic Valley Sewerage Commissioners' main and branch interceptors, as well as the severe inflow from the sanitary sewer collection systems of the municipalities served by PVSC.

SCOPE

A detailed study was conducted of the seventy-three (73) combined sewer overflow systems within the jurisdiction of the Passaic Valley Sewerage Commissioners. The work included the indentification and study of these combined sewerage systems in order to determine their location, physical characteristics, and extent of service areas. The methodology of investigation included the physical examination of each overflow/regulator complex to determine its location, and verify demensions, elevations, pipe size and lengths, general condition, as well as other data deemed relevant.

Dry weather and wet weather flow measurements were also conducted (as part of the Infiltration/Inflow work). Overflow measurements were made at each of the overflow stations to relate the overflow to rainfall, where possible, and to develop time-duration pollutional loading curves to establish both peak overflow rates and total quantity of overflow, insofar as was possible.

Sampling of such overflows was undertaken to determine the quality of the bypassed storm water flow and its effect on the Passaic River. Such samples were analyzed at the laboratories of the Passaic Valley Sewerage Commissioners. The results of these analyses are included in the appendices to the individual overflow reports for each major geographical area.

Dry weather (non-rainfall) samples of the tributary sewage flow from the local interceptors at each overflow chamber were also obtained to serve as a baseline of values. These baseline samples were also analyzed at the PVSC Laboratories for the same sewage parameters as for the storm overflow sampling. These results are also presented in the appendices of the individual overflow reports These baseline analyses facilitate a broad comparison of the sewage quality during periods of non-rainfall with that of the overflow to the Passaic River during periods of rainfall.

DEFINITIONS

BYPASS (noun) - An arrangement of pipe, conduit, gates, pumps, valves, etc., whereby the flow may be passed around a hydraulic structure or treatment facility.

(verb) - The act of causing flow to pass around a hydraulic structure or treatment facility.

COMBINED SEWER - A sewer which carries sanitary sewage with any component domestic, commercial, and industrial wastes at all times and which, during wet weather periods, serves as the collector and transporter of storm water from streets or other points of origin, thus serving a "combined" purpose.

DIVERSION CHAMBER - An enclosure within or adjacent to the regulator, which acts to conduct flow from an influent sewage line to the regulator chamber under dry weather conditions. During wet weather (bypass conditions), the flow is directed to the tide gate chamber.

DRY WEATHER FLOW - The combination of sanitary sewage and industrial and commercial wastes normally found in the sanitary sewers during the dry weather season of the year, and sometimes referred to as baseline flow.

FORCE MAIN - A pressure pipe joining the pump outlet at a wastewater pumping station with a point of gravity flow.

INTERCEPTOR SEWER - A sewer that receives dry weather flow from a number of transverse sewers or outlets, and frequently, additional predetermined quantities of storm water admixed with sanitary flows, and conducts such wastewaters to a point for treatment or for disposal.

mg/l - milligrams per liter, or the concentration of pollutional characteristics in sewage.

MGD - Million Gallons per Day -- a common term for rate of wastewater flow.

MG - Millions of Gallons -- a common term for volume of wastewater.

OUTFALL SEWER - The outlet, structure, or sewer through which sewage is finally discharged.

OVERFLOWS - The overflowing of trunk or interceptor sewers resulting from the combination of extraneous flows and normal flows which exceed the diversion capacity of the stop logs, stop planks, dam, or weir.

ACTIVE - An overflow which operates automatically or by manual operation to relieve an overflow condition.

INACTIVE - An overflow that, generally, has been taken out of service, either by closure of a gate or valve, or by an installed plug.

REGULATOR - A semi-automatic or automatic regulator device with movable parts that are sensitive to hydraulic conditions at their points of installation and are capable of adjusting themselves to variations in such conditions.

REGULATOR CHAMBER - An enclosure containing the regulating mechanism.

SAND CATCHER - A chamber located ahead of the regulator connection to the PVSC interceptor which acts as a grit collector. Sand, grit, and other suspended matter are intercepted and retained in this chamber, which is cleaned out periodically.

STOP LOG OR STOP PLANK - A dam or weir, usually constructed of brick, wood planks, or concrete, which is located at the entrance to the overflow outfall line, and which diverts normal sanitary (non-rainfall) flow to the interceptor through the regulator.

TIDE GATE CHAMBER - An enclosure adjacent to the regulator which acts to conduct the sewage flow (usually bypass) through a tide gate to the outfall. A rising tide seats the tide gates, thereby preventing tidal waters from entering the sewerage system.

TRUNK - A large sewer which receives wastewater from tributary branch sewers serving generally one drainage area.

METHODOLOGY

1. A tabulation has been made of the average daily flows measured at the Passaic Valley Treatment Plant for the entire year of 1974-75, including estimates of overflow due to valve closings, and special pumping practice. In addition, the rainfall data has been plotted to determine true dry and wet weather flow conditions, verifying the previously enumerated data regarding dry weather flow conditions.

2. The wet weather flow conditions have been evaluated, determining and tabulating areas tributary to combined sewer overflows into the Passaic River. The catchment areas investigated under various rainfall intensity and storm recurrence frequencies indicate the amount of wet weather or storm flow conveyed by these combined systems, as part of the total flow conveyed. These amounts have also been tabulated.

3. Estimates have been made of the discharge volume to the river, via the overflows under the various storm intensities,and these have been tabulated, as well as tabulating the anticipated peak flow rates.

4. The overflows have been analyzed based on observed conditions and in terms of major discharges to the Passaic River. These have been grouped in the major areas of Paterson, Newark, and all others (being of lesser importance). Additionally, the Second River Overflow (being entirely sanitary) has been studied as a separate entity, but related to PVSC trunk capacities available.

5. The overflows have been studied and analyzed on the basis of available capacities in the PVSC trunk and combined flows have been equated along the trunk on an inflow/outflow basis in an attempt to determine weaknesses of the system.

6. Analyses of water quality measured during the overflow under various rainfall conditions have been tabulated and analyzed with respect to Passaic River water quality under the same conditions.

7. The overflow condition has been analyzed with respect to flow conditions during seasonal wet weather (high water table) periods in order to evaluate the implication of successful future cost-effective rehabilitation programs, insofar as frequency and magnitude of overflows are concerned.

8. Recommendations and costs have been developed as to proposed action regarding overflows based on:
   a) increased capacity of sewers
   b) storage
   c) treatment
   d) separation.

ARRANGEMENT OF REPORT

The detailed report upon overflows is divided into five parts. The first part consists of introductory remarks and contains the background information relevant to the inception of this study, followed by a general discussion of the procedures followed during the overflow chamber field surveys and inspections, the rationale behind the operation of the selected flow measuring and sampling equipment, and a brief description of how a typical overflow operates.

The other four parts are arranged according to the geographical location of the seventy-three overflows along the PVSC Interceptor from its northern terminus in the Paterson area to its southern terminus in the Newark area, as follows:

Paterson Area Overflows
Clifton-Passaic-Rutherford Area Overflows
Newark Area Overflows
Kearny-Harrison-East Newark Area Overflows

These area reports generally include the following features: some introductory comments on the size and extent of the collection areas, and the seasonal dry weather flows associated with each area; estimates of the amount of overflow based on rainfalls of varying amounts and duration; and observations on the capacity of the PVSC Interceptor in its various reaches, in relation to overflow estimates. In addition, findings are presented concerning rainfall intensities producing overflows, and the peak overflow rates and volume of overflow discharge associated with the overflows in each of these four geographical areas. Appropriate summary tables and plates depicting the overflow locations are also included.

Information is also presented on City-owned overflows, which are above and beyond the PVSC overflows along the main interceptor and its branches, and the importance of including a study of the effect of these overflows upon the Passaic River, in addition to the PVSC Overflows, in future investigations.

Some conclusions concerning the significance of overflow and preliminary estimates of cost of separation of combined sewers in each of these geographical areas are also included. A brief description and analysis of the individual overflows in each of these four geographical areas are also included, following the introductory and general information outlined above.

Following these reports are separate sections discussing estimates of total system overflows, as well as estimates of total pollutional load contributions.

The Appendix contains seventy-three individual overflow extract reports, bound together by geographical area. Each extract contains observations which are unique to the particular location, a series of plates and tables depicting representative flow metering (where applicable), and sampling results obtained during the course of recorded observations at each chamber.

These reports are presented in varying format, as follows:

The Ivy Street, Kearny, overflow report was developed in full narrative style. The other reports were presented in "Data Extract" format, whereby the arrangement of the data follows the development in the comprehensive Ivy Street report, but in "short-hand" or "question and answer" format, to facilitate data presentation. Where warranted, extensive plates were prepared depicting water quality and pollutional loading observations in the latter half of the overflow data extract reports.

The Appendix also contains an overflow chamber cross-reference list of the bench-marks used for establishing elevations at each respective overflow chamber, and a Summary of Overflow Valve Closing Actions.

Overall conclusions and recommendations are contained in the "Summary Report upon Overflows into the Passaic River."

OVERFLOW STUDY AREA REPORTS

This section includes the summary of Overflow findings for four Study Areas composed of portions of eleven municipalities. For purposes of reporting, the results are presented for each of the 73 overflow chambers grouped into four geographical regions within the Passaic Valley Sewerage Commissioners Service Area. Because of the extent of the individual overflow studies the findings are presented herein with the detailed overflow data extract reports included as separately bound volumes.

INTRODUCTION

Work began with the inspection of the PVSC system, with cooperation and assistance of line crews of the Passaic Valley Sewerage Commissioners. Information (record of plans, etc.) relating to the overflows were made available by the Passaic Valley Sewerage Commissioners. Other pertinent data were requested and made available by the PVSC and member municipalities, such as siphon details (under the Passaic River), plans, profiles, and details of various sections of the PVSC trunk line, as well as flow records.

After review and analysis of the available records, location surveys were undertaken at each of the regulator chambers. The survey verified information such as sewer sizes, manhole rim elevations, and sewer invert elevations, outfall discharge locations (at the river), flow direction, lengths of lines, and other pertinent information. The condition of the outfall at each overflow was also noted (see overflow reports) and recorded.

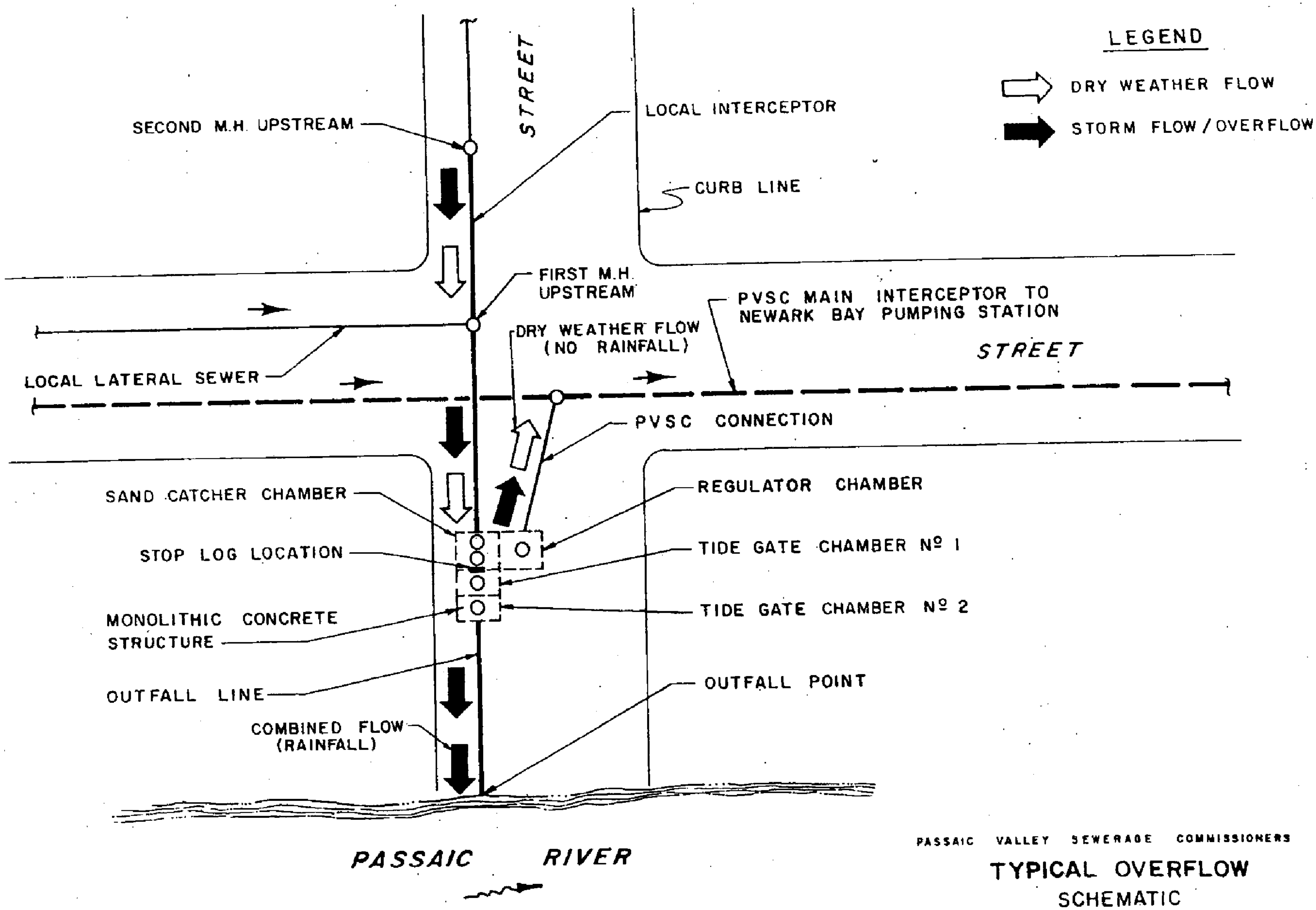
Additionally, tide gates, if any, were inspected from the point of view of condition and workability, as well as observation of possible tidal water inflow into the chambers during high tide conditions. These observations were made during high tide conditions, where applicable. Data was gathered to provide information for the verification of existing conditions and to provide the background to evaluate the effect of various alternatives (conclusions and recommendations).

Recording rain gauges were installed at the Passaic Valley Sewerage Commissioners' maintenance yard in Paterson, and additionally at the Wallington Pumping Station, and other locations in the service area. Storm observations made during the study period were used to determine rainfall intensity and duration. Visual observations were recorded as to the total general effect of the various storms, as an overview of conditions during various rainfall intensities and their apparent effect on the entire system.

A recording tide gauge was installed at the Saybrook Place overflow in Newark. The instrument was installed to obtain an accurate record of tidal variations in the study area. This information was subsequently used to determine tidal effect on the overflow outfall and tide gates.

A typical overflow schematic diagram for the type of overflow employed in the PVSC system is shown on Plate 1. A small pipe diverts a part of the flow into a regulator chamber, activating a float which closes or throttles a gate or opening to the PVSC trunk. Some regulators have a manual flap valve which may be closed, diverting all flow to the river.

Under normal conditions, during high storm flows, the float actuates the regulator, diverting all or part of the combined flow through an outfall line to the river, provided that the regulator is functioning. Under normal dry weather conditions, the sanitary flow enters the PVSC trunk after diversion through the regulator.



PASSAIC VALLEY SEWERAGE COMMISSIONERS

TYPICAL OVERFLOW SCHEMATIC

ELSON T. KILLAM ASSOCIATES INC.
Environmental and Hydraulic Engineers

PLATE 1

A plan and profile drawing of each Active overflow chamber is included in the individual report for each overflow station, showing gradient conditions upstream and downstream of the chambers. The profile indicates ground elevations, manhole rim elevations, pipe inverts, outfall elevations, as well as pipe material, sizes, shapes, lengths, and slopes of all lines. The overflow drawing for the Inactive overflows usually consists of Plan view information only, since flow metering was not required at these locations. Storm sampling was performed at the Inactive overflow locations as required. Under normal conditions, all flow from the local interceptor totally enters the PVSC interceptor at the Inactive locations. No overflow is diverted to Passaic River at these locations, except during emergencies.

A master Overflow Inspection Summary is presented in Table 1, summarizing pertinent recorded observations concerning the condition of the regulator, the stop planks, the tide gates, the outfall lines, etc.

Flow measuring and sampling equipment was utilized during the study, consisting of a liquid level recorder, as well as an automatic composite sampler. The meters were installed at all active overflow locations. An active overflow is defined as one which operates automatically or by manual operation to relieve an overflow condition. An inactive overflow is one that, generally, has been taken out of service, either by closure of a gate, or by an installed plug.

TABLE 1

OVERFLOW INSPECTION SUMMARY

NPDES No.	DESCRIPTION OF CHAMBER LOCATION	OVERFLOW: ACTIVE	OVERFLOW: INACTIVE	DIVERSION CHAMBER PRESENT	REGULATOR: OPERABLE	REGULATOR: INOPERABLE	REGULATOR: REMOVED	SAND CATCHER: STOP LOGS IN PLACE	SAND CATCHER: FLAP VALVE OPERABLE	SAND CATCHER: FLAP VALVE INOPERABLE	SAND CATCHER: FLAP VALVE MISSING	SAND CATCHER: FILLED WITH DEBRIS	TIDE GATE #1: OPERABLE	TIDE GATE #1: LEAKING	TIDE GATE #1: MISSING	TIDE GATE #2: OPERABLE	TIDE GATE #2: LEAKING	TIDE GATE #2: MISSING	OUTFALL: LOCATED	OUTFALL: NOT LOCATED	OUTFALL: PLUGGED	OUTFALL: CLEAR	SURCHARGE CONDITION OCCURS	TIDAL INFLOW NOTED	REMARKS
	KEARNY-HARRISON AREA:																								
008/E-001	Central Ave., E. Newark	x				x		x			x			x				x	x			x	x	x	Surcharge observed @ 4.3' above stop log
010/H-001	New(Hamilton) St., Harrison	x				x		x		x				x			x		x			x	x	x	Surcharge observed @ 2.5' above stop log
011/H-002	Cleveland Ave.,Harrison	x				x		x		x				x			x		x			x	x	x	Surcharge observed @ 4.8' above stop log
012/H-003	Harrison Ave.,Harrison	x				x		x			x			x			x		x			x	x		Surcharge observed @ 1.5' above stop log
013/H-004	Dey St., Harrison	x				x		x		x				x				x	x			x	x	x	T.C. #2 covered when building was built; Surcharge observed @ 2.5' above stop log
014/H-005	Middlesex St.,Harrison	x				x		x	x					x			x		x			x	x	x	Surcharge observed @ 1.6' above stop log
015/H-006	Bergen St., Harrison	x				x		x			x			x				x	x			x	x	x	Tide Gate # 2 is broken off & stuck in Tide Gate Chamber: Surcharge @ 2.7' above stop log
016/H-007	Worthington Ave.,Harr.	x				x		x	x					x			x		x		x				Outfall partially plugged
019/K-008	Bergen Ave.,Kearny	x				x		x			x		----	NONE	----	----	----	----	x			x			
020/K-004	Nairn Ave., Kearny	x		x		x		x			x		Single Chamber						x			x	x		Surcharge observed @ 4.7' above stop log
021/K-005	Marshall St., Kearny	x				x		x		x				x			x		x			x	x	x	Surcharge observed @ 3.0' above stop log
022/K-006	Johnston Ave.,Kearny	x				x		x			x			x			x		x			x	x	x	Surcharge observed @ 3.7' above stop log
023/K-007	Ivy St., Kearny	x		x	x			x	----	** NONE	----				x			x	x			x	x		Surcharge observed @ 5.8' above stop log
024/K-008	Bergen Ave., Kearny	x				x		NONE		x					x			x		x		x	x		Actual location where line empties into Frank's Creek not established; Surcharge @6.6' above S.L.
025/K-009	Tappan St., Kearny	x				x		NONE			x				x			x	x			x	x		Single regulator for both locations
026/K-010	Dukes St., Kearny	x				x		NONE			x				x			x	x			x	x		Outfalls join to one common pipe before emptying into Frank's Creek (surcharge @ 5.7' above S.L.)
	NEWARK AREA:																								
028/N-001	Verona Ave., Newark	x		x		x		x	----	** NONE	----		x			x			x			x	x	x	Stop logs located in Diversion Chamber (dam) Surcharge observed @ 1.2' above stop log
029/N-002	Delavan Ave., Newark	x		x			x	x	----	** NONE	----		----	----	----	NONE	----	----	x			x			Stop logs (brick wall) located in Diversion Chamber
030/N-003	Herbert Pl., Newark	x		x				x	x				----	----	----	NONE	----	----	x			x			
031/N-004	Third Ave., Newark	x				x		x	x				x			x			x			x			

** [illegible] PRESENT IN CHAMBER.

S.L. = Stop Log M.H. = Manhole
T.C. = Tide Gate

TABLE 1

OVERFLOW INSPECTION SUMMARY

NPDES Nº	DESCRIPTION OF CHAMBER LOCATION	OVERFLOW		DIVERSION CHAMBER PRESENT	REGULATOR			SAND CATCHER					TIDE GATE # 1			TIDE GATE # 2			OUTFALL				SURCHARGE CONDITION OCCURS	TIDAL INFLOW NOTED	REMARKS
		ACTIVE	INACTIVE		OPERABLE	INOPERABLE	REMOVED	STOP LOGS IN PLACE	FLAP VALVE OPERABLE	FLAP VALVE INOPERABLE	FLAP VALVE MISSING	FILLED WITH DEBRIS	OPERABLE	LEAKING	MISSING	OPERABLE	LEAKING	MISSING	LOCATED	NOT LOCATED	PLUGGED	CLEAR			
032/N-005	Fourth Ave., Newark	x				x		x	x				x					x	x			x	x		Surcharge observed @ 5.9' above stop log
033/N-006	Clay St., Newark	x		x	MANUAL			x	** NONE				x	hung	open	x	on	step	x			x	x		There are a total of 6 Tide Gates; Surcharge observed @ 6.3' above stop log
033/N-006C	Passaic St., Newark	x				x		x		x		x			x		x		x			x	x	x	Sand Catcher half full of epoxy-like substance; Surcharge observed @ 2.5' above stop log
034/N-007	Orange St., Newark	x				x		x	x				NONE						x			x			
035/N-008	Bridge St., Newark	x				x		x		x			NONE						x			x			
036/N-009	Rector St., Newark	x				x		x	x					x			x		x			x		x	
037/N-010	Saybrook Pl., Newark	x			MANUAL			x	BROKEN OFF					x			x		x			x		x	
038/N-011	City Dock, Newark	x				x		x	** NONE					x			x		x			x	x	x	No Sand Catcher at this location; Surcharge observed @ 2.4' above stop log
039/N-012	Jackson St., Newark	x				x		x	x					x			x		x			x	x	x	Surcharge observed @ 2.5' above stop log
040/N-013	Polk St., Newark	x				x		x	x					x			x		x			x	x	x	Surcharge observed @ 4.0' above stop log
041/N-014	Freeman St., Newark	x				x		x	x					x			x		x			x	x	x	Surcharge observed @ 3.2' above stop log
074/U-001	Union Outlet, Newark	x			MANUAL			NONE	MANUAL GATE				NONE						x			x			
KEARNY-NORTH ARLINGTON BRANCH:																									
017/K-002	Washington Ave., Kearny	x				x		x	x				NONE						x			x			
018/K-001	Stewart Ave., Kearny	x				x		x	x				NONE						x		x				Outfall partially plugged
071/R-001	Woodward Ave., Ruth.		x	x	NONE			NONE	** NONE				x			x			x		x				
072/R-002	Pierrepont Ave., Ruth.	x		x	NONE			NONE	** NONE					x			x		x			x		x	
073/R-003	Rutherford Ave., Ruth.	x		x	NONE			x	** NONE				x			x			x			x			Stop logs (brick dam) located in Diversion Chamber.
003	Yantacaw St., Clifton		x		NONE			NONE	** NONE				NONE						x			x			Manual slide gate controls overflow
004	Yantacaw P.S., Clifton		x		NONE			NONE	** NONE				x			x			x			x			Manual slide gate controls overflow
006	North Arlington Overflow Chamber, N. Arlington		x		NONE			NONE	** NONE					x			x			x	x			x	Outfall covered with debris

** NO FLAP VALVE PRESENT IN CHAMBER

S.L. = Stop Log M.H. = Manhole
T.G. = Tide Gate

TABLE 1

OVERFLOW INSPECTION SUMMARY

NPDES Nº	DESCRIPTION OF CHAMBER LOCATION	OVERFLOW		DIVERSION CHAMBER PRESENT	REGULATOR			SAND CATCHER					TIDE GATE # 1			TIDE GATE # 2			OUTFALL				SURCHARGE CONDITION OCCURS	TIDAL INFLOW NOTED	REMARKS
		ACTIVE	INACTIVE		OPERABLE	INOPERABLE	REMOVED	STOP LOGS IN PLACE	FLAP VALVE OPERABLE	FLAP VALVE INOPERABLE	FLAP VALVE MISSING	FILLED WITH DEBRIS	OPERABLE	LEAKING	MISSING	OPERABLE	LEAKING	MISSING	LOCATED	NOT LOCATED	PLUGGED	CLEAR			
GARFIELD-WALLINGTON-PASSAIC BRANCH:																									
027/L-001	Lodi Force Main, Wall.		x			NONE		NONE		NONE						NONE			x			x			24" Gate Valve on overflow line
069/Q-001	Passaic Tail Race, Pass		x			NONE		NONE		NONE						NONE			x			x			Manual slide gate controls overflow
070/Q-002	Dundee Island, Passaic Garden State	x				NONE		NONE		NONE						NONE				x	x				8 in. outfall line plugged-actual outfall point never located-must be covered with debris
009/G-001	Paper Company, Garfield		x			NONE		NONE		NONE						NONE			x						Manually operated bypass overflow
005	Wallington P.S., Passaic		x			NONE		NONE		NONE						NONE			x			x			Manual slide gate controls overflow
	PATERSON AREA:																								
064/P-023	Second Ave., Paterson	x				x		x	x				x			x			x			x	x		The outlet of T.G. Chamber #2 is controlled by a 2nd set of stop planks which are set at a higher elevation than those in Sand Catcher.
065/P-024	Third Ave., Paterson	x				x		x	x				x			x			x			x	x		Surcharge has been observed at approx. 2' from M.H. Rims.
066/P-025	Tenth Ave., Paterson	x				x		x	x				x			x			x			x			
067/P-026	Twentieth Ave., Paterson	x				x		x		x			x			x			x			x			
068/P-027	Market St., Paterson	x		x		x		x		** NONE					NONE				x			x			Stop logs located in Diversion Chamber
042/P-001	Curtis Pl., Paterson	x			x			x	x						NONE				x			x			
043/P-002	Mulberry St., Paterson	x				x		x	x				x			x			x			x	x		Surcharge observed at M.H. Rim elevation
044/P-003	W.Broadway, Paterson	x				x		x	x				x			x			x			x	x		Surcharge observed at M.H. Rim elevation
045/P-004	Bank St., Paterson	x				x		x		x			x			x				x	x		x		Outfall covered with debris. Surcharge observed @ M.H. Rim elevation
046/P-005	Bridge St., Paterson	x				x		x	x				x			x			x			x	x		Surcharge observed @2.0'below Rim elevation
047/P-006	Montgomery St., Paterson	x				x		x	x				x			x			x			x	x		Surcharge observed @ M.H. Rim elevation
048/P-007	Straight St., Paterson	x				x		x	x				x			x			x			x	x		Surcharge observed @3.2'above stop log
049/P-008	Franklin St., Paterson	x				x		x	x				x			x				x	x		x		Outfall so low that it is covered with river silt. Surcharge observed @3.0' above stop log
050/P-009	Keen St., Paterson	x				x		x		x			x			x			x			x	x		Surcharge observed @7' above stop log
051/P-010	Warren St., Paterson	x					x	x	x				x			x			x			x	x		Surcharge observed @5' above stop log
052/P-011	Sixth Ave., Paterson	x				x		x			x		x			x			x		x		x		Outfall partially blocked with river material Surcharge observed @5' above stop log

** NO FLAP VALVE PRESENT IN CHAMBER

S.L. = Stop Log   M.H. = Manhole
T.G. = Tide Gate

OVERFLOW INSPECTION SUMMARY

NPDES No	DESCRIPTION OF CHAMBER LOCATION	OVERFLOW: ACTIVE	OVERFLOW: INACTIVE	DIVERSION CHAMBER PRESENT	REGULATOR: OPERABLE	REGULATOR: INOPERABLE	REGULATOR: REMOVED	SAND CATCHER: STOP LOGS IN PLACE	SAND CATCHER: FLAP VALVE OPERABLE	SAND CATCHER: FLAP VALVE INOPERABLE	SAND CATCHER: FLAP VALVE MISSING	SAND CATCHER: FILLED WITH DEBRIS	TIDE GATE #1: OPERABLE	TIDE GATE #1: LEAKING	TIDE GATE #1: MISSING	TIDE GATE #2: OPERABLE	TIDE GATE #2: LEAKING	TIDE GATE #2: MISSING	OUTFALL: LOCATED	OUTFALL: NOT LOCATED	OUTFALL: PLUGGED	OUTFALL: CLEAR	SURCHARGE CONDITION OCCURS	TIDAL INFLOW NOTED	REMARKS
053/P-012	East Fifth St.,Paterson	x		x		x		x		x			x			x			x			x	x		Stop logs located in Tide Gate Chamber
054/P-013	East Eleventh St.,Pat.	x				x		x			x		x			x			x			x			
055/P-014	East Twelfth St.,Pat.	x				x		x	x				NONE						x			x			
056/P-015	S.U.M. Park, Paterson	x					x	x	x				NONE						x			x			Outfall was opened up on cave-in
057/P-016	North West St.,Pat.	x			NONE			x	x				x			x			x			x	x		Surcharge observed @ 2.5' below Rim elevation
058/P-017	Arch St.,Paterson	x			NONE			x	x				x			x			x			x	x		Surcharge observed at Rim elevation
059/P-018	Jefferson St.,Paterson	x			NONE			NONE		x			x			x				x	x		x		Sand Catcher outlet to T.G. Chambers plugged with masonry plug. Outfall covered with debris
060/P-019	Stout St.,Paterson	x			NONE			NONE		x			BOTH TIDE GATES BROKEN							x	x		x		Sand Catcher outlet to T.G. Chambers plugged with masonry plug. Outfall covered with debris
061/P-020	N.Straight St.,Pat.	x			NONE			NONE		x					x			x	x			x	x		Sand Catcher plugged with masonry plug. T.G. 1&2 have been removed
062/P-021	Bergan St.,Paterson	x			NONE			x	x				x			x			x			x	x		Surcharge observed @2.6' above stop log
063/P-022	Short St.,Paterson	x			NONE			x	x				x			x			x			x	x		
007	Hudson St.,Paterson	x				x		x	** NONE				x			x			x			x	x		Surcharge observed @ Rim elevation

** NO FLAP VALVE PRESENT IN CHAMBER

S.L. = Stop Log M.H. = Manhole
T.G. = Tide Gate

(19)

Sampling equipment consisted of an automatic type, battery-operated unit, equipped with a vacuum pump to obtain discrete 500-milliliter samples over a pre-set time cycle (one composite sample every fifteen minutes), up to 24 composite samples per cycle. Samplers were installed at all overflow locations, Active and Inactive. The results of sampling may be found in the Appendix to each individual overflow report.

Liquid level recorders were installed in the Active overflow chambers, with the level-sensing probe for each device positioned at the elevation of the crest of the stop logs (or diversion dams). Where stop logs or planks were removed, the meter probe was set at the level of the invert of the opening to the outfall (above normal flow levels).

When the level of flow in the overflow chamber rises above the level of the stop logs, overflow to the river occurs. Meter readings were obtained whenever the flow reached the stop logs. When the outfall was surcharged, flows were approximated using alternative hydraulic analysis (i.e., orifice flow, etc.).

Additionally, special surcharge devices, called "surcharge sticks" were installed in the overflow chambers, in order to define peak overflow conditions. These devices, protected wooden shafts, coated with a special paint, are enclosed in a length of plastic pipe, open at the bottom to admit the flow. These were installed vertically in the manhole or overflow chamber to determine high water marks during actual surcharge, or high water conditions. The high water condition left visible marks on the painted stick surface inside the protective pipe section, recording a peak flow level during the surcharge conditions.

Sampling of water quality was achieved either automatically in each chamber, or manually where necessary, with a remote sampler start probe set at the crest elevation of the overflow stop planks or dam. Discrete storm samples were obtained automatically, when the flow level exceeded the stop plank/dam elevation, at 15-minute sampling intervals, throughout the course of rainfall occurrence producing an overflow. The samples were analyzed at the laboratories of the Passaic Valley Sewerage Commissioners for Total Suspended Solids (TSS), Chemical Oxygen Demand (COD), and Biochemical Oxygen Demand (BOD), as well as for other parameters. Results of the analysis are included in the Appendix to each report. The results of a typical analysis for a rainfall occurrence of representative significance are also included in the Appendix of each overflow report.

In numerous instances, simultaneous metering and sampling were obtained at one or more times during the course of the study, at particular overflows. Graphical presentations in each overflow report depict such simultaneous results. In other instances, it was not possible to obtain a simultaneous correlation of metering and sampling information in every instance. This situation is predicated on the following: vagaries of the weather, time constraints of this study, and the situation where valid sampling results may have been obtained, but no corresponding simultaneous metering results were obtained due to various causes. These causes in turn may have been due to the interference of tidal intrusions in the overflow chamber, creating a standing surcharge condition at the metering location which is not truly indicative of a "freeboard" overflow condition, the absence of sufficient overflow level to produce a meter reading, possible meter malfunctions, etc. In other cases, valid metering results were obtained, but no corresponding simultaneous sampling results were obtained, again due to sampler malfunctions, etc.

Where it was not possible to obtain simultaneous metering and sampling, a composite package of data was assembled as a graphical presentation in the respective overflow reports. This composite package of data was developed by utilizing metering information from a particular rainfall occurrence, coupled with sampling results from an overflow due to a comparable rainfall. The comparability of the rainfall was based on such factors as total amount of rainfall, duration, overall intensity, etc.

Metering charts which registered as blank during rainfall conditions were obtained in some instances and bore out the absence of an overflow occurrence. This absence of an overflow condition was also verified by actual visual field observation, at times, throughout the study period. For these locations, no flow metering results could be obtained; hence, no data is presented on pollutional loading rates or total pollutional loads discharged to the Passaic River. Samples of combined flow were obtained during rainfall conditions (although no overflow occurred). The sample analyses are presented graphically in the applicable overflow reports as a background condition.

Included in the Extract Report appendices is a plot of overflow rates versus time (levels over the stop plank). The average overflow rate (Million Gallons per Day, MGD) and total volume of overflow (Millions of Gallons, MG) are also shown for each overflow. The corresponding hourly rainfall intensity is also shown, plotted against time. The graphical data for a particular overflow also includes a calibration curve, relating height of flow over stop logs or dam to overflow rates at each location, as well as a plot of the Passaic River tidal levels (at the outfall) during the time of the rainfall, referenced to the stop log elevations.

In some cases, overflow conditions are modified due to tidal levels causing a closure of the tide gates, preventing active free overflow conditions, and causing chamber surcharging. In other cases, particularly in the Paterson area, meter readings (which were activated due to surcharge of the PVSC trunk or branch interceptor) were discounted, because a "free" overflow condition did not exist.

Where repeated surcharge conditions were encountered and samplers were inundated, it was necessary during those rainfall conditions to place samplers on ground level at certain locations to manually activate the sampling cycle.

The graphic presentation of pollutional loading (where applicable) contained in each overflow report represents values derived from either simultaneous metering and sampling results, or favorable composite metering and sampling, resulting from two rainfalls of similar characteristics.

Samples so obtained have been compared to those collected over one 24-hour period, for the tributary sewage flow from the local interceptor at each chamber (Active and Inactive) during non-rainfall conditions, to serve as a baseline of sample values. These samples were analyzed at the PVSC Laboratories for the required parameters. The results have been presented in tabular form for each overflow (see Appendices). This baseline analysis defines the water quality during periods of non-rainfall.

A detailed report upon overflow for each of the major geographical areas along the PVSC interceptor system follows.

p925-80

REPORT UPON

OVERFLOW ANALYSIS

TO

PASSAIC VALLEY SEWERAGE COMMISSIONERS

PASSAIC RIVER OVERFLOWS

PATERSON AREA

1976

ELSON T. KILLAM ASSOCIATES INC
Environmental and Hydraulic Engineers 48 ESSEX STREET MILLBURN NEW JERSEY 07041

2

PATERSON AREA OVERFLOWS

Extent of Area and Peak Overflow Rates

Twenty-eight active overflows were studied and observed in the City of Paterson area. No inactive overflows were observed in this reach of the Passaic River, which extends a distance of approximately six miles. The twenty-eight active overflows serve a total tributary area of 5,100 acres, all of which are served by combined sanitary and storm sewer systems. The majority of these overflows is activated at such times that the combined sewer systems, tributary to these chambers, are under storm flow conditions when rainfall occurs. All of the operable overflows are activated automatically in the Paterson area.

The aggregate capacity of the combined sewer systems is about 2,520 MGD, which is approximately 0.5 cubic feet per second (cfs) per acre of drainage area. This is somewhat below the conventional design for small drainage areas, which normally ranges from about 1.0 cfs to 1.5 cfs per acre. Under periods of heavy rainfall in the City of Paterson, the existing combined sewer system cannot accommodate the storm water inflow, with the result that surcharge of piping and flooding of streets occur when catch basins and combined sewer sizes are inadequate.

The measured average daily dry weather flow in the combined sewer system of the Paterson area, which includes sanitary sewage from separate systems that are connected with the City of Paterson sewer system, or which discharge directly into the PVSC interceptor sewer, is about 51 Million Gallons per Day (MGD) during dry weather months. This compares with a theoretically determined dry weather flow of 35 MGD.

During wet weather months, when the ground water table is high, the average daily dry weather flow (when no rainfall occurs) was found to be about 64 MGD. Ground water infiltration is approximately 29 MGD in the City of Paterson system during a period of approximately seven to eight months of each year, and 16 MGD during dry weather months. This infiltration is attributed to the characteristics of the combined sewer system, which was constructed many decades ago, presumably so as to permit ground water entry into the pipelines. Therefore, the removal of infiltration in a combined sewer system may be found to be both difficult and costly, as well as ineffective.

The total estimated length of combined sewers in the Paterson area is approximately 155 miles, or about 820,000 linear feet. It has been estimated that the cost of construction to provide a separate sanitary sewer system for the City of Paterson would be approximately $185 million. Under such a separation plan, it has been assumed that the existing combined sewer pipelines would be severed from the sanitary sewer lines and that the old combined sewers would be utilized as a separate storm sewer system. In order to effect a meaningful reduction in the infiltration through complete system separation, it would also be necessary to install new house connections, extending at least from the street to the property line, if not all the way to and into the building structures, to assure that old-type building drainage systems with built-in ground water infiltration will have been eliminated from the collection system.

The twenty-eight overflow chambers are served by drainage areas ranging in size from as small as two to four acres to as large as 1,487 acres. The aggregate capacity of the combined storm sewer pipelines, which serve these tributary areas, has been estimated to be about 2,500 MGD. This is equivalent to about 50 times the average daily dry weather flow of about 50 MGD. The estimated aggregate capacity of the overflow pipes from the chambers to the river has been estimated to be about 1,800 MGD. This is equivalent to about 36 times the average daily dry weather flow (essentially sanitary and industrial wastes) in the system. In other words, under conditions of a heavy rainfall or severe storm, where the storm water runoff would inundate and surcharge the entire collection system, a flow of 2,500 MGD, or more, could conceivably enter the twenty-eight overflow chambers, with the probability of a discharge into the river of at least 1,800 MGD, but conceivably more under surcharge conditions and, of course, this could approach the 2,500 MGD capacity of the incoming lines to these overflow chambers. The overflow into the Passaic River is reflective of the combined sewer flow which cannot be carried by the PVSC interceptor sewer.

It will be noted that the interceptor sewer in the City of Paterson at the upper terminus of the collection system has a capacity of only 21 MGD and, at the point of discharge from the City of Paterson, the capacity of this interceptor sewer is only about 82 MGD. It is obvious from the above that the PVSC interceptor sewer cannot accommodate the maximum storm flow rates which occur under severe rainfall conditions in the combined sewer system of Paterson.

Table 2, which is entitled "Tabulation of Passaic Valley Sewerage Commissioners' Overflows in the City of Paterson Area," sets forth a tabulation of each overflow, the tributary area to the overflow, the measured dry weather flow under seasonal conditions, the estimated capacity of the storm sewers tributary to these areas, the estimated overflow capacity from these chambers to the river and, finally, the observed or recorded peak flow rates and volume of discharge into the Passaic River.

Overflow Estimates Based on Rainfall

A study has been made of the theoretical volume and peak flow rate of discharge from the overflows in the Paterson collection system based upon rainfalls of various intensities and durations.

A total rainfall of approximately one inch results in a total volume of water accumulation of approximately 138 MG of storm water over the 5,100 acres. With the drainage area known, and giving due consideration to controlling factors such as rainfall concentration, runoff, number and location of catch basins, storm sewer efficiency, impervious areas, and other relevant factors, the storm water runoff or entry into the collection system can be estimated.

It has been estimated that only twenty of the twenty-eight overflow stations will respond to a rainfall of one inch occurring in a 24-hour period, or at an intensity of 0.04 inches per hour.

Of the portion of rainfall which is intercepted by the combined sewer system (50 to 60 percent), it has been estimated that about 52 to 66 MG will be discharged from the overflow chambers and the balance

TABLE 1

TABULATION OF PVSC OVERFLOWS IN CITY OF PATERSON AREA

Overflow Location	Discharge Permit Number	Tributary Area (Acres)	% of Area with Combined Sewers	DRY WEATHER FLOW: Dry Weather Months (MGD)	DRY WEATHER FLOW: Wet Weather Months (MGD)	Estimated Maximum Storm Capacity (MGD)	Estimated Maximum Overflow Capacity to River (MGD)	Maximum Peak Recorded Overflow to River (MGD)	Maximum Overflow Observed (MG)
Curtis Place	042/P-001	965	100	7.85	9.35	285.0	175.0	175.0	1.3
S.U.M. Park	056/P-015	46	100	0.12	0.28	18.6	18.6	19.5	[illegible]
Mulberry Street	043/P-002	4	100	Neg.	Neg.	22.5	13.0	9.7	0.9
West Broadway	044/P-003	4	100	0.07	0.11	5.1	4.0	7.8	0.4
Bank Street	045/P-004	4	100	Neg.	Neg.	6.5	8.7	---	---
Bridge Street	046/P-005	63	100	0.17	0.33	185.3	57.1	39.5	0.2
Northwest Street	057/P-016	(283)	100	(2.00)	(3.00)	303.6	574.0	90.0	5.5
Arch Street	058/P-017	(32)	100	(0.15)	(0.17)	6.7	6.7	15.0	0.6
Jefferson Street	059/P-018	(38)	100	(0.18)	(0.20)	10.0	---(4)	---	---
Stout Street	060/P-019	(15)	100	(0.08)	(0.08)	10.5	---(4)	---	---
North Straight St.	061/P-020	(82)	100	(0.39	(0.43)	35.0	26.0	---	---
Hudson Street	007	450(3)	100	3.51(3)	4.42(3)	16.7	16.7	18.5	5.3
Montgomery Street	047/P-006	667	100	2.83	3.84	220.0	220.0	44.2	5.4
Straight Street	048/P-007	121	100	0.84	1.80	16.5	66.5	57.0	1.3
Franklin Street	049/P-008	2	100	Neg.	Neg.	4.2	7.6	---	---
Keen Street	050/P-009	11	100	0.33	0.69	7.6	10.3	18.8	0.6
Short Street	063/P-022	32	100	0.51(2)	0.86(2)	49.3	35.8	9.1	0.7
Bergan Street	062/P-021	11	100	0.07	0.18	4.2	15.5	6.4	1.9
Warren Street	051/P-010	81	100	1.40	1.88	60.0	9.7	11.1	1.2
Sixth Avenue	052/P-011	50	90	0.09	0.11	11.2	18.5	18.8	---
East 5th St. & 5th Ave.	053/P-012	10	100	0.13	0.13	5.9	6.5	11.5	0.4
East 11th St.	054/P-013	104	100	0.89	0.89	42.7	41.9	46.0	5.0
East 12th St. & 4th Ave.	055/P-014	19	100	0.27	0.28	57.0	57.0	12.5	0.2
Second Ave.	064/P-023	45	100	0.54	0.53	20.4	29.7	13.1	0.3
Third Avenue	065/P-024	73	100	0.75	0.60	29.7	60.0	20.8	0.7
10th Ave. & 33rd St.	066/P-025	699	100	5.34	6.70	389.0	113.0	91.5	6.6
20th Avenue	067/P-026	96	100	0.13	0.14	155.0	11.4	16.5	0.3
Market Street	068/P-027	1,487	100	13.60	16.20	540.0	223.3	93.0	14.8
Other Areas (tributary to interceptor)		56							
TOTAL		5,100		39.44	49.32	2518.2	1826.5	693.3	54.0

(1) [illegible]

(2) Includes 0.34 MGD from Prospect Park

(3) Hudson Street includes Northwest Street, Arch Street, Jefferson Street, Stout Street and North Straight Street

(4) Outfall plugged with debris and buried

would be conveyed downstream for treatment and disposal.

With a more intense rainfall, namely, a rainfall of about one inch in twelve hours, it has been estimated that approximately 60 to 75 MG will be discharged into the Passaic River, while the balance will be delivered through the interceptor sewer lines downstream for treatment and disposal.

Assuming that a 1-inch rainfall occurs in approximately six hours, which is a storm of higher intensity, namely, 0.17 inches per hour, it has been estimated that approximately twenty overflows will still be activated out of the total of twenty-eight. Under this storm condition, the overflow into the Passaic River would range from about 65 to 80 MG, and the balance of the estimated storm flow would be intercepted by the combined sewer system for treatment and disposal.

With an intense rainfall of one inch per hour, it has been estimated that most of the overflows will discharge in the Paterson area. The estimated overflow into the Passaic River under this type of storm flow condition will range from about 68 to 83 MG, with the balance conveyed downstream for treatment and disposal.

When a rainfall of two inches occurs and deposits 276 MG of water over the 5,100 acres (as contrasted to one inch as set forth above, under various time-duration conditions), and when the total storm water estimated to be handled by the collection system is from 138 to 166 MG, the following estimates have been made of overflow into the Passaic River:

Time Duration of 2-Inch Storm	Estimated Overflow
24 hours	120 MG to 150 MG
12 hours	130 MG to 157 MG
6 hours	134 MG to 162 MG
1 hour	137 MG to 165 MG

Overflow Measurements

During the period of study and observation of each of the twenty-eight overflow chambers, approximately forty to fifty rainfalls, or more, were observed. Depth-recording gauges were installed in twenty-five of the chambers (the outfall line for three of the chambers is bricked up) and measurements of overflow were made at each of these chambers for several of the rainfall occurrences throughout the period of study. By installing temporary continuous-depth measuring equipment in these overflow chambers, it has been possible to determine, generally, the extent and duration of overflows as related to rainfall. Likewise, by installing sampling equipment, it has been possible to obtain samples and to conduct tests of the overflow to determine the extent of pollution discharged into the receiving stream when these overflows occur.

The results of these studies and measurements indicate that the maximum overflow to the river from the twenty-eight chambers during this period of study was approximately 700 MGD. These overflow rates were found to be of short-term duration and do not reflect the volume of discharge into the river.

The volume of discharge from the twenty-eight overflows was determined to be about 54 million gallons (MG) during the period of study and observation.

It would appear from the results of this study that overflow occurs at approximately twenty overflows when the rainfall intensity approaches or exceeds 0.08 inches per hour. No overflow was observed or measured at seven overflow chambers, and it appears that these chambers can be eliminated without any detrimental effect upon the operation of the collection system, or in increasing the overflow discharge to the river.

In general, it was found in the Paterson area that, within a short period after the beginning of a rainfall of modest intensity, overflow occurred at most of the overflow chambers. This overflow would continue during the entire period of rainfall and would terminate shortly after or at about the same time as the rainfall would stop. Thus, the overflows are "rainfall-sensitive," and it can generally be stated that the overflows were of short-term duration, and were related directly to the time of duration and intensity of the rainfall.

The exception to the foregoing was the Market Street overflow which was initially found to be operative on occasions during peak daily dry weather flow conditions. This was attributed to the limited carrying capacity of the interceptor sewer in the Paterson area, but the overflow has been eliminated by raising the overflow weirs in this chamber.

Interceptor Capacity

The location of the interceptor sewer and the location of the twenty-eight overflow chambers along the Passaic River in the Paterson area are shown on Plate 2.

The interceptor sewer which is located in Paterson not only

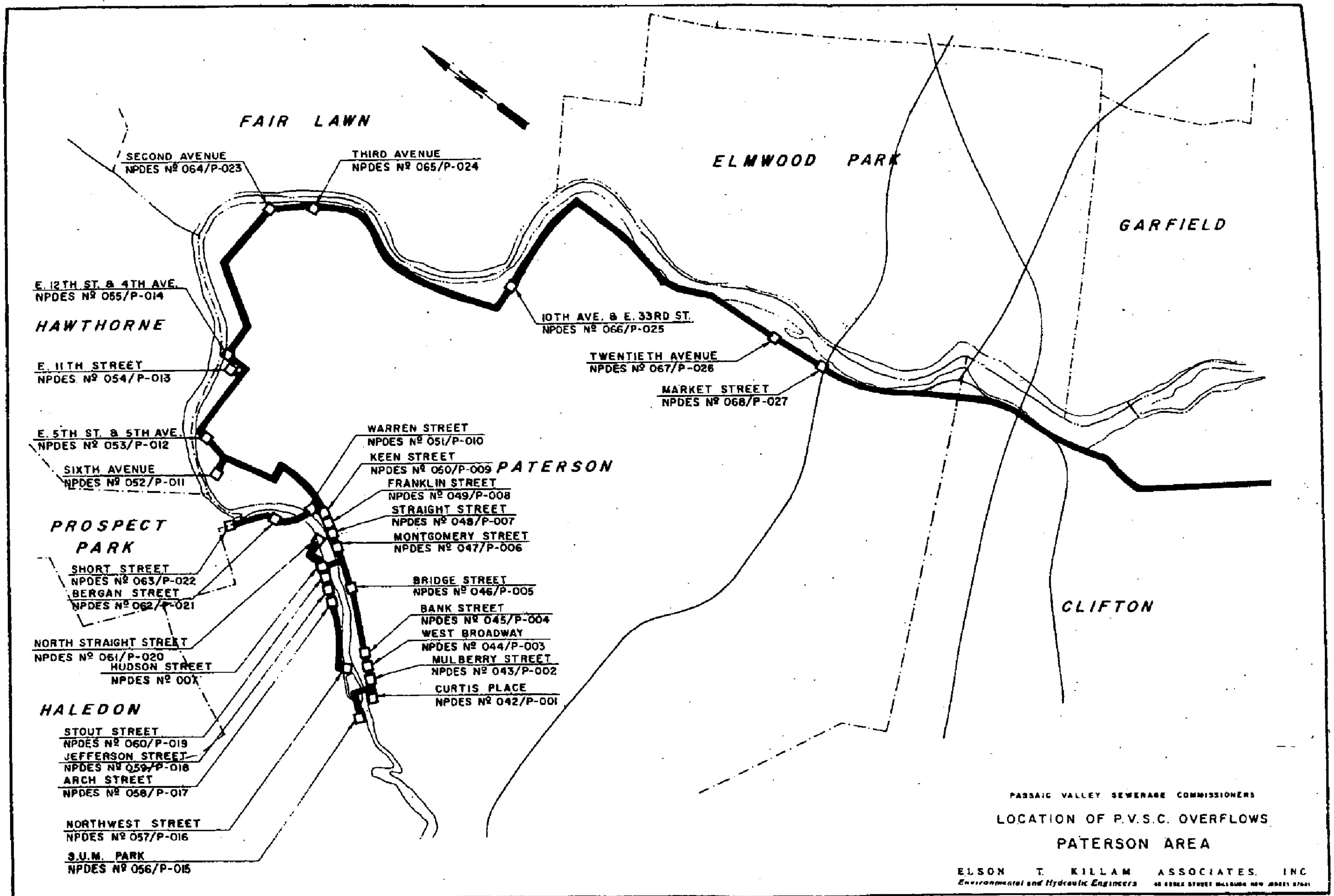

FAIR LAWN
ELMWOOD PARK
GARFIELD
HAWTHORNE
PATERSON
PROSPECT PARK
HALEDON
CLIFTON
SECOND AVENUE
NPDES Nº 064/P-023
THIRD AVENUE
NPDES Nº 065/P-024
E. 12TH ST. & 4TH AVE.
NPDES Nº 055/P-014
E. 11TH STREET
NPDES Nº 054/P-013
E. 5TH ST. & 5TH AVE.
NPDES Nº 053/P-012
SIXTH AVENUE
NPDES Nº 052/P-011
10TH AVE. & E. 33RD ST.
NPDES Nº 066/P-025
TWENTIETH AVENUE
NPDES Nº 067/P-026
MARKET STREET
NPDES Nº 068/P-027
WARREN STREET
NPDES Nº 051/P-010
KEEN STREET
NPDES Nº 050/P-009
FRANKLIN STREET
NPDES Nº 049/P-008
STRAIGHT STREET
NPDES Nº 048/P-007
MONTGOMERY STREET
NPDES Nº 047/P-006
BRIDGE STREET
NPDES Nº 046/P-005
BANK STREET
NPDES Nº 045/P-004
WEST BROADWAY
NPDES Nº 044/P-003
MULBERRY STREET
NPDES Nº 043/P-002
CURTIS PLACE
NPDES Nº 042/P-001
SHORT STREET
NPDES Nº 063/P-022
BERGAN STREET
NPDES Nº 062/P-021
NORTH STRAIGHT STREET
NPDES Nº 061/P-020
HUDSON STREET
NPDES Nº 007
STOUT STREET
NPDES Nº 060/P-019
JEFFERSON STREET
NPDES Nº 059/P-018
ARCH STREET
NPDES Nº 058/P-017
NORTHWEST STREET
NPDES Nº 057/P-016
S.U.M. PARK
NPDES Nº 056/P-015
PASSAIC VALLEY SEWERAGE COMMISSIONERS
LOCATION OF P.V.S.C. OVERFLOWS
PATERSON AREA
ELSON T. KILLAM ASSOCIATES, INC
Environmental and Hydraulic Engineers

PLATE 2

serves as an outlet for the City of Paterson, but also provides an outlet for Haledon, which has an average daily flow of about 1.0 MGD; for Prospect Park, which has an average daily flow of 0.3 MGD; for Hawthorne, which has an average daily flow of about 2.5 MGD; for Fair-lawn Industries, which has an average daily flow of 0.26 MGD; for Glen Rock, which has an average daily flow of 1.0 MGD; for Fair Lawn, which has an average daily flow of about 2.1 MGD; and for Elmwood Park, which discharges an average daily flow of 2.3 MGD. In addition, Marcal Paper Company discharges approximately 3 to 4 MGD, and other industries contribute approximately 0.5 to 1 MGD, or a total flow from outside of the City limits of approximately 13.6 MGD.

It will be noted from Plate 2 that the interceptor sewer at the point of beginning in the upper reaches of the Passaic River in Paterson has a capacity of approximately 20.8 MGD, increasing to 35.9 MGD immediately downstream of the Lawrence Street connection, and thence this capacity increases to 39.9 MGD, to 46.4 MGD, and then increases to about 49.8 MGD at about the midpoint of the interceptor in the City at 10th Avenue and 33rd Street. Immediately downstream of 10th Avenue, the capacity is 57.0 MGD and it increases to 59.4 MGD south to Overlook Avenue. South of 20th Avenue, the capacity increases to 81.6 MGD. The point of metering at the Venturi is located near the City boundary line. The Venturi meter capacity is reported to be 76.0 MGD. When the Venturi capacity of 76.0 MGD is reached, surcharge occurs in the upstream portions of the interceptor sewer through the City of Paterson.

City of Paterson Overflows

The aggregate overflow to the Passaic River in the Paterson area under maximum storm flow conditions observed was somewhat less than anticipated. This can be attributed, in part, to the rainfall occurrences during the study period and the fact that about twenty-three other overflows are located within the City of Paterson system. These overflows discharge into the Passaic River, and the facilities are not a part of the PVSC system. Based upon the studies and observations, it is possible to make projections of what the total system overflow might be, under more severe rainfall conditions than those which were observed during the period of study.

The most important discovery made during this study period was that several major overflows located within the City of Paterson system are presently operative and discharge voluminous quantities of water directly into the Passaic River during periods of rainfall, and these facilities operate entirely independently of the Passaic Valley Sewerage Commissioners' system.

The most important and most critical City of Paterson overflow is located at the intersection of Nineteenth Avenue and Vreeland Avenue. From this point, a 90-inch diameter storm sewer, which extends from this intersection to the Passaic River, conveys the overflow from storms directly to the river. It has been estimated that this outlet pipe can carry a combined storm water flow of approximately 120 to 150 MGD. Observations made at this chamber indicate that this overflow is automatically activated at each and every rainfall, with intensities possibly as low as 0.04 inches per hour. These overflows generally prevail during the entire rainfall period. It is suggested that a study be made of this overflow, in conjunction with the twenty-eight PVSC overflows, to establish not only quantity and quality but, more importantly, to determine how this overflow will be handled in connection with the improvements to be provided in the PVSC interceptor sewer system.

In addition to the foregoing major City of Paterson overflow facilities, it was found that nine other overflow chambers are located generally within the center of the City of Paterson and discharge into the storm sewer constructed primarily to serve as an outlet for these nine overflow chambers. The pipeline serving these nine chambers is 102 inches in diameter and extends from the nine chambers, which are located at Trenton Avenue at the intersections of Maryland Avenue, Florida Avenue, Illinois Avenue, Michigan Avenue, Twenty-Second Avenue, Twenty-Third Avenue, and Twenty-First Avenue, as well as at Maryland Avenue and Vernon Avenue. The estimated capacity of the outfall pipeline is 150 to 200 MGD. While detailed observations were not made at each of the nine overflow chambers during storm flow conditions, observations and reports from the field indicate that essentially all of these chambers overflow under modest rainfall conditions, namely, those with an intensity of about 0.05 inches per hour.

In addition to the foregoing, it has been indicated during the field interviews that the City of Paterson may have as many as thirteen or more additional overflows or interconnections within the City system which are frequently discharged through overflows during storm flows.

it is suggested that further investigations be conducted within the City of Paterson collection system to establish, insofar as possible, the locations of these interconnections, and to ascertain the effect of such overflow upon the Passaic River. This study should also provide for the means of correction which should be coordinated with the proposed PVSC improvements.

It is our opinion that the PVSC overflows which were observed and measured during storm flows at the twenty-eight overflow chambers represent possibly an amount equal to the total overflow occurring in the City of Paterson area from independent overflow chambers and pipelines hereinbefore constructed by the City of Paterson. In other words, in lieu of an overflow discharge during a storm of about 54 MG as observed, it is possible that the total system overflow may be twice this amount. It is suggested that studies be undertaken, as necessary, to verify the existence of all City-owned and operated overflows which must be considered in any plan of improvement undertaken for the elimination of pollution in the Passaic River.

Individual Overflow Chambers

A brief description and analysis of each of the existing overflows in the Paterson area are set forth on the following pages.

CURTIS PLACE OVERFLOW CHAMBER

This chamber serves a tributary area of approximately 965 acres, for which the collection system is combined sewers. The average daily flow tributary to this chamber was found to range seasonally from 7.85 MGD to 9.35 MGD. However, it must be stressed that this includes the dry weather flow from Haledon which was metered and found to range from approximately 1.0 MGD to 1.3 MGD. Thus, the net dry weather flow from the City of Paterson Combined Sewer District ranges from 6.8 MGD to 8.0 MGD, indicative of high infiltration in the area. The connection from Haledon passes through the City of Paterson combined sewer collection system before it reaches the overflow chamber.

Under storm flow conditions, when the combined sewer system is handling the storm water inflow, overflow occurs into a mill tail race near the overflow chamber which discharges into the Passaic River. Measurements and observations were made at this chamber beginning on December 7, 1974 and extending through June 13, 1975. During this period of time, 37 periods of rainfall occurred and overflows were observed or metered on 25 occasions.

It was observed that while overflows were frequent, the volume of discharge into the river was not very great. Measurements range from a low of only 0.1 million gallons to a high of 1.3 million gallons. Peak rates of flow were found to be about 20 MGD and occurred for short periods of time during the maximum intensity of rainfall. In addition, the City of Paterson has constructed storm sewers in portions of the

Curtis Place collection area. These storm sewers were constructed to alleviate flooding in the Hillcrest Section of the City and to serve as relief to the combined sewers discharging directly into the Passaic River. There are eight overflow connections to the storm sewers in the Curtis Place sewer district. These overflows are located on Crosby Avenue, Richmond Avenue, Linwood Avenue, and West Side Park.

Based on the foregoing results, it is estimated that an overflow will occur at the Curtis Place overflow chamber 50 to 60 times per year, based on rainfalls occurring 70 to 90 times per year.

The dry weather flow at the Curtis Place Chamber was sampled and the results indicated primarily domestic sewage combined with some industrial waste. The BOD was found to range from 120 mg/1 to 495 mg/1. The TSS was found to range from about 60 mg/1 to about 300 mg/1.

The quality of the overflow was determined as a result of many samplings at this station. The BOD was found to range from about 121 mg/1 to about 277 mg/1. The total suspended solids were found in some occasions to be very low but, in general, were in excess of 100 mg/1 and as high as 317 mg/1. The Curtis Place overflow chamber is not a major contributor to the pollution of the Passaic River, despite the relatively large drainage area served with combined sewers.

S.U.M. PARK OVERFLOW CHAMBER

This overflow chamber serves a tributary area of approximately 46 acres. The system consists of combined sewers. The average daily flow in this system was found to range seasonally from 0.12 MGD to 0.28 MGD.

Metering facilities were installed in this chamber and measurements of rainfall and overflows were made and observed during a period extending from May 30 to October 19, 1975. It will be noted that 13 rainfalls occurring during this period were observed and it has been estimated that overflows occurred on 5 occasions. Overflows occurred generally when the intensity exceeded 0.10 inches per hour.

It was found that the volume of overflow discharged into the river was very limited and ranged from about 0.1 to 0.5 million gallons. Peak rates of overflow were found to be as high as 50 MGD.

This low overflow volume is attributed to the fact that a very small tributary area is served by this combined sewer system, the pipe size of which is only 36 inches in diameter. The S.U.M. Park overflow chamber is the uppermost facility located on a branch interceptor sewer and is the most upstream overflow discharging into the Passaic River.

Based on the foregoing, it is estimated that this overflow chamber will be activated 25 to 35 times per year based on rainfalls occurring 70 to 90 times per year.

Samples at the overflow were taken under dry weather conditions and the results indicated typical domestic sewage. The TSS concentration averaged 250 mg/1 and the BOD concentration averaged 106 mg/1.

A comparison of the dry weather sampling with the overflow sampling indicated the effect of storm water in diluting the concentration of the wastes under overflow conditions. The sampling results indicated the TSS range to be from 82 mg/1 to 213 mg/1 and the BOD range to be 15 mg/1 to 95 mg/1. The peak concentrations are indicative of the flushing action present in combined sewer collection systems.

MULBERRY STREET OVERFLOW CHAMBER

This chamber serves a tributary area of only 4 acres, consisting of one city block with combined sewers. There is only one building connection to this line and this chamber could readily be eliminated.

Metering and sampling facilities were installed in the Mulberry Street chamber from June 29, 1975 to August 14, 1975. The seven overflows that were recorded during this period were not true overflows but were caused by the interceptor backing up.

Samples of the storm flows into the Mulberry Street chamber were taken and the results indicated minimal amounts of pollution. The suspended solids were found to be about 107 mg/1 and the BOD concentration ranged from 11 mg/1 to 27 mg/1.

WEST BROADWAY OVERFLOW CHAMBER

The West Broadway overflow chamber serves a combined sewer area of only 4 acres. Again, this limited area serves only a few dwellings. The average daily flow ranges seasonally from about 0.07 to 0.11 MGD. The infiltration was found to be exceptionally high in this collection district, since a dry weather flow of 0.02 MGD would be representative of the theoretical flow.

Observations and measurements were made in this chamber for the period of May 13, 1975 to August 17, 1975.

Based on the size of the collection area, no overflow is expected at this chamber. During the aforementioned study period, overflow was recorded nine times. It is believed that this overflow was due to the lack of capacity in the PVSC interceptor sewer causing an overflow through the overflow chamber from the interceptor itself.

This chamber, like the Mulberry Street Chamber, can be eliminated due to the small collection area it serves.

Samples of the storm flows into the West Broadway chamber were taken, and the results indicated an average concentration of suspended solids of 219 mg/l, and a minimal concentration of BOD ranging from a low of 24 mg/l to a high of 42 mg/l.

BANK STREET OVERFLOW CHAMBER

The Bank Street overflow chamber serves a combined sewer area of only 4 acres and relatively few connections. No overflows were measured or observed at this chamber during the period of observation and study, extending from June 29, 1975 to August 7, 1975.

Samples taken of the storm flow into the Bank Street chamber were found to be extremely diluted, being mainly storm water. The average concentration of TSS was found to be about 50 mg/l and the BOD to be about 9 mg/l.

Like the Mulberry Street and West Broadway chambers, the Bank Street overflow chamber is not expected to overflow under any rainfall condition and can be readily eliminated.

BRIDGE STREET OVERFLOW CHAMBER

The Bridge Street overflow chamber serves a tributary area of approximately 63 acres. The sewers in this district are combined and the average daily dry weather flow was found to be 0.17 MGD.

Metering and sampling apparati were installed in this chamber from June 5, 1975 to August 7, 1975. During this period, only one overflow condition was recorded with a peak overflow rate of 2.1 MGD for a total overflow volume of 0.2 MG.

Sampling results of the sewage flow under dry weather conditions, when compared to the characteristics of domestic sewage, revealed a somewhat above average TSS concentration of 392 mg/1 and a below average BOD concentration of 92 mg/1.

Sampling during rainfall conditions indicated the TSS concentration to range from about 25 mg/1 to about 90 mg/1. The BOD concentration ranged from 77 mg/1 to 92 mg/1.

During the observation period, changes in the collection system by urban renewal have resulted in a diminution, if not complete elimination, of overflow at this chamber. Like Mulberry Street, the Bridge Street overflow chamber can be eliminated in the future.

NORTHWEST STREET OVERFLOW CHAMBER

The Northwest Street overflow chamber serves a tributary area of approximately 283 acres. This drainage area is provided with combined sewers, and the average daily dry weather flow was found to be 2.0 MGD.

Metering and sampling facilities were installed in this chamber and were in service from January 18, 1975, through August 7, 1975. During this period of time, 41 rainfall occurences were observed and 35 overflows occurred, indicative of 85 percent probability of overflow as a result of rainfall. Overflows were found to occur whenever the average rainfall intensities were in excess of about 0.06 to 0.07 inches per hour.

At this station, the volume of overflow was found to be nominal, ranging from about 0.2 MG to about 5.5 MG. Peak flow rates were found to be very high, ranging from about 75 to 90 MGD when high rates of rainfall intensity occurred.

It has been estimated that 70 to 90 rainfall occurrences are likely in the average year, which will result in 60 to 70 overflows at the Northwest Street overflow chamber.

During the study period, sampling of the dry weather flow indicated the presence of industrial wastes, as well as domestic sewage. The BOD ranged from 174 mg/l to about 1,300 mg/l. The TSS concentration averaged about 180 mg/l.

The overflow waste characteristics indicated that the average BOD ranged from about 36 mg/l to about 202 mg/l. The suspended solids, however, were found to vary greatly, namely, from 39 mg/l to 687 mg/l, which appears to be a flushing action resulting from high intensity rainfall and high overflow rates.

ARCH STREET OVERFLOW CHAMBER

The Arch Street overflow chamber serves a tributary area of only 32 acres. This area is served entirely by combined sewers. The average daily dry weather flow in the system was estimated to be about 0.15 MGD.

Metering and sampling facilities were installed and were in service in this overflow chamber for the period beginning on March 30, 1975 and ending on August 6, 1975. During this period of time, fifteen rainfall occurrences were observed, in which overflow to the river was metered or observed to have occurred fourteen times.

During this period, the volumetric discharge in the Passaic River was found to be minimal, ranging from about 0.2 MG to 0.6 MG. However, the peak flow rates were found to range from 2.5 MGD to 15.0 MGD during periods of maximum rainfall intensity.

It has been estimated that the Arch Street overflow chamber will be activated 60 to 70 times per year based upon rainfall occurring 70 to 90 times per year.

Sampling of the dry weather flow at the Arch Street chamber indicated somewhat diluted domestic waste, with suspended solids averaging 110 mg/1 and BOD about 140 mg/1. The sampling of the combined storm overflow indicated high concentrations of TSS, at about 500 mg/1, and of BOD, at about 360 mg/1, at peak rainfall intensity rates reflecting the flushing action expected in combined sewers. Following this flushing action, the sampling indicated a dilute effluent, with TSS ranging less than about 50 mg/1, and BOD averaging 87 mg/1.

JEFFERSON STREET OVERFLOW CHAMBER

The Jefferson Street overflow chamber serves a tributary area of about 38 acres which is served with combined sewers. The average daily dry weather flow was estimated to be about 0.2 MGD. There is no outlet to the river from this chamber. The outlet from the chamber to the existing outfall piping has been sealed off with a masonry plug. Thus, with any storm, the system becomes surcharged and the flow is conveyed downstream to the Hudson Street overflow chamber.

The sealing of this overflow chamber was necessitated by the fact that overflow was occurring on a daily basis due to the surcharging of the PVSC branch sewer. The action, taken in the past, of sealing off this chamber and diverting the flow to the Hudson Street chamber, resulted in the elimination of daily discharges to the Passaic River.

The quality of the sewage under dry weather flow conditions was found to be typical of ordinary domestic sewage. The results of the analysis indicated the average TSS concentration to be about 230 mg/l and the BOD concentration, about 240 mg/l.

During storm flow conditions, the results of the analysis indicated a more dilute sewage. The TSS concentration was found to range from 157 mg/l to 420 mg/l, and the BOD concentration from 34 mg/l to 966 mg/l.

STOUT STREET OVERFLOW CHAMBER

The Stout Street overflow chamber serves a tributary area of only 15 acres which is served with combined sewers. The average daily dry weather flow is negligible. This chamber, like the Jefferson Street chamber, has no outlet to the river. The outlet from the chamber to the existing outfall piping has been sealed off with a masonry plug. Thus, with any storm, the system becomes surcharged and the flow is conveyed downstream to the Hudson Street overflow chamber.

The sealing of this overflow chamber was necessitated by the fact that overflow was occurring on a daily basis due to the surcharging of the PVSC branch sewer. The action, taken in the past, of sealing off this chamber and diverting the flow to the Hudson Street chamber, resulted in the elimination of daily discharges to the Passaic River.

The quality of the sewage under dry weather flow conditions was found to be diluted and not typical of ordinary domestic sewage. The results of the analysis indicated the average TSS concentration to be about 83 mg/l and the BOD concentration about 39 mg/l, reflecting a high rate of infiltration in the Stout Street area.

During storm flow conditions, the results of the analysis indicated a more dilute sewage. The TSS concentration was found to range from 12 mg/l to 36 mg/l.

NORTH STRAIGHT STREET OVERFLOW CHAMBER

The North Straight Street overflow chamber serves a tributary area of about 82 acres which is served with combined sewers. The average daily dry weather flow was found to range from 0.39 MGD to 0.43 MGD, seasonally. The variation in measured flows is indicative of the high infiltration rate in this collection area. There is no outlet to the river from this chamber. The outlet from the chamber to the existing outfall piping has been sealed off with a masonry plug. Thus, with any storm, the system becomes surcharged and the flow is conveyed downstream to the Hudson Street overflow chamber.

The sealing of this overflow chamber was necessitated by the fact that overflow was occurring on a daily basis, due to the surcharging of the PVSC branch sewer. The action, taken in the past, of sealing off this chamber and diverting the flow to the Hudson Street chamber resulted in the elimination of daily discharges to the Passaic River.

Sampling of the sewage under dry weather flow conditions indicated the presence of industrial waste periodically in high concentration. The results of the analysis indicated the TSS concentration to vary from 16 mg/1 to 692 mg/1 and the BOD concentration varied from 59 mg/1 to 1620 mg/1. These variations in concentration are indicative of the peak industrial discharges into the system.

During storm flow conditions, the results of the analysis indicated a more dilute sewage. The TSS concentration was found to range from 52 mg/1 to 176 mg/1.

HUDSON STREET OVERFLOW CHAMBER

The Hudson Street chamber overflows whenever the storm flow from Jefferson Street, Stout Street, North Straight Street, and the residual storm flow from Northwest Street and Arch Street surcharges the existing PVSC branch sewer on the north side of the Passaic River. The area essentially served by this overflow consists of 450 acres, serving the following districts:

Jefferson Street	38 acres
Stout Street	15 acres
North Straight Street	82 acres
Northwest Street	283 acres
Arch Street	32 acres
TOTAL	450 acres

The average daily flow in the combined sewer which passes through this chamber, under dry weather flow conditions, is 3.5 MGD. During wet weather months, the average flow increases to about 4.4 MGD, which is indicative of very high infiltration in the collection districts.

Metering and sampling equipment was installed in this chamber and observations were made over a period extending from January 1, 1975, through August 7, 1975. During this period of time, 46 rainfalls were measured or observed and overflows occurred at this chamber on 21 occasions, or 46 percent of the time.

The volume of overflow was not found to be very high at this chamber. The overflow ranged from a low of about 0.2 MG to an overflow in excess of 5.3 MG. The peak overflow rates were not found to be excessive and rates of up to approximately 18.5 MGD were recorded.

From the foregoing results, it has been determined that overflow will occur at the Hudson Street chamber 30 to 40 times per year based on rainfalls occurring 70 to 90 times per year.

The quality of the pollutional load on the river was indicated by the sampling results as being typical domestic sewage, with an average BOD concentration of 185 mg/l and suspended solids of about 205 mg/l.

More meaningful than the overflow readings at the Hudson Street chamber are the composite results of the overflow readings and analysis combined with Northwest Street, Arch Street and Hudson Street.

In reviewing the results of the Northwest Street, Arch Street, and Hudson Street overflow chambers, it was found that all three chambers are triggered under essentially the same storm flow conditions, and that the aggregate overflow from the three chambers, under rainfalls of long-term duration and high intensity, approached about 11.4 MG. The peak overflow rates in the aggregate at these three stations was about 125 MGD. In general, the quality of the effluent discharged into the river was found to be representative of dilute sanitary sewage, with indications of high suspended solids where peak overflow rates were substantially greater than the dry weather flow.

MONTGOMERY STREET OVERFLOW CHAMBER

The tributary area served by the Montgomery Street overflow chamber is 667 acres. This area is served entirely by combined sewers.

The average daily flow was found to range seasonally from 2.83 MGD to 3.84 MGD, compared to an estimated theoretical flow of 1.87 MGD in this district. It is evident that a high infiltration rate exists in the collection system. A small area under an urban renewal program has separate sanitary sewers, but this area is insignificant.

Metering and sampling facilities were installed in this chamber from February 23, 1975, to June 6, 1975. During this period of time, rainfall occurred on 20 occasions. The rainfall ranged from only 0.05 inches to a high of 1.42 inches. During this period of study, 16 overflows were measured or observed to have occurred. Overflows occurred about 80 percent of the time. It was found that, when the average rainfall intensity approached or exceeded 0.06 inches per hour, overflow was likely to occur.

It was observed that the volume of overflow was nominal, ranging from about 0.5 MG to about 5.4 MG per rainfall occurrence. Peak overflow rates, however, were found to range in excess of 44 MGD, depending upon the intensity of the rainfall.

It has been estimated that overflow will occur at this chamber 55 to 75 times per year, based upon rainfall occurring 70 to 90 times per year.

The sewage flow at the Montgomery Street overflow chamber was sampled during dry weather conditions and the results indicate primarily domestic sewage tributary to this chamber. The TSS was found to range from 10 mg/1 to 122 mg/1, and the BOD from 29 mg/1 to 263 mg/1. The low concentrations of TSS and BOD are indicative of the ground water infiltration present in the Montgomery Street collection area.

The results of overflow sampling indicated that the waste concentration was not too severe, with BOD values ranging from about 65 mg/1 to 140 mg/1. The suspended solids, likewise, were found to be nominal, ranging from about 35 to 150 mg/1. The overflow from Montgomery Street appeared to be a typical, dilute sanitary sewage with little, if any, industrial waste.

STRAIGHT STREET OVERFLOW CHAMBER

The Straight Street overflow chamber serves a tributary area of approximately 121 acres. The area is served by a combined sewer system. The average daily flow was found to range seasonally from 0.84 MGD to 1.80 MGD. This variation in flow is indicative of the high infiltration rate in this area, which is typical of combined sewer systems.

Measurements and observations were made at this overflow during the time period from February 23, 1975, through June 1, 1975. Eighteen rainfalls were observed during this period, and it is estimated that overflow occurred on sixteen of these occasions.

The volume of discharge into the river was not very great at this station, ranging from about 0.5 MG to a high of 1.3 MG. However, the peak flow rates were found to range from as low as 5 MGD to as high as 40 to 57 MGD.

Based on the foregoing results, it is estimated that overflow will occur at this location 60 to 75 times per year based on rainfall occurring 70 to 90 times per year.

Results of sampling taken at this overflow chamber under dry weather conditions were typical of diluted domestic sewage. The TSS ranged from 28 mg/l to 298 mg/l and the BOD ranged from 27 mg/l to 330 mg/l.

An analysis of the overflow indicated that the BOD ranged from 110 mg/l to 313 mg/l and that the suspended solids ranged from 100 to 346 mg/l. In general, this area is comprised of residential dwellings, and the test results are indicative of typical domestic sewage overflow combined with storm water.

FRANKLIN STREET OVERFLOW CHAMBER

The Franklin Street Overflow Chamber serves a combined sewer area of only 2 acres, with only one connection. No overflows were measured or observed at this chamber during the period of observation and study, extending from June 29, 1975 to August 7, 1975.

Like the Mulberry Street, West Broadway and Bank Street overflow chambers, the Franklin Street chamber is not expected to overflow under any rainfall condition and can be readily eliminated.

Samples taken of the storm flow into the Franklin Street chamber were found to be somewhat diluted, being mainly storm water. The average concentration of TSS was found to be about 82 mg/1 and the BOD to be about 133 mg/1.

KEEN STREET OVERFLOW CHAMBER

The Keen Street overflow chamber serves a tributary area of approximately 11 acres. The district is served entirely with combined sewers. The average daily dry weather flow was found to range seasonally from 0.33 MGD to 0.69 MGD.

Metering facilities were installed in this chamber and observations were made over a period extending from March 29, 1975 to August 7, 1975. During this period of time, 30 rainfalls were observed and overflow occurred on 22 occasions.

It was observed that overflows did occur during periods of heavy rainfall and high rainfall concentrations. However, the volume of storm water overflow discharged into the river was found to be nominal, ranging from a negligible amount to a maximum of 0.6 MG. The peak overflow rates were found to be approximately 19 MGD.

Based on the foregoing, it is estimated that overflow will occur at this station 50 to 70 times per year, based on rainfall occurring 70 to 90 times per year.

Sampling results of the dry weather flow were indicative of typical domestic sewage, with the average TSS being 155 mg/l and the average BOD being 203 mg/l. The results of the overflow analysis indicated, as expected, a more dilute sewage. The TSS concentration concentration was found to range from 83 mg/l to 270 mg/l and the BOD concentration averaged about 15 mg/l.

SHORT STREET OVERFLOW CHAMBER

The Short Street overflow chamber serves a tributary area of approximately 32 acres. This area consists of combined sewers, and the average daily flow was found to range seasonally from 0.51 MGD to 0.86 MGD. The domestic sewage from Prospect Park connects with the City of Paterson system at this chamber; therefore, the flow which is discharged in the Passaic River at this chamber includes some protions of the Prospect Park domestic waste. The average daily flow from Prospect Park was found to be about 0.3 MGD, year-round.

This vast variation in flow is indicative of the high infiltration rate present in the Short Street collection area during periods of relatively high ground water table. Metering and sampling facilities were installed in this chamber and were observed for the period beginning March 29, 1975 and extending through May 30, 1975. During this period of time, rainfall occurred on thirteen occasions and overflows were found to have occurred on eleven occasions.

Based on the foregoing, it is estimated that overflow will occur at this chamber 60 to 70 times per year with rainfall occurring 70 to 90 times per year.

The overflow volume was found to be very small, ranging fron 0.1 to 0.7 MG. The peak rates of overflow were not excessive, althoug a high storm flow rate of about 9 MGD was measured.

Sampling of the dry weather flow indicated characteristics typical of domestic sewage. The average TSS was found to be 135 mg/l and the average BOD to be 188 mg/l.

Sampling taken during overflow conditions indicated a BOD which ranged from 85 mg/l to 283 mg/l. The suspended solids were found to range from about 20 mg/l to 222 mg/l. The wide range in sampling was indicative of the extended intensity, as well as duration, of the rainfall. In other words, during the initial flushes, the concentrations of waste were found to be greater than those which occurred during periods of heavy rainfall of long-term duration.

BERGAN STREET OVERFLOW CHAMBER

This overflow chamber serves a tributary area of approximately 11 acres. The area is served with combined sewers and the average daily flow was found to be about 0.07 MGD. Measurements and observations of overflow at this chamber extended over a period of time beginning on June 12, 1975, and extending through November 8, 1975. During this period of time, 28 rainfalls occurred and overflows were measured or observed to have occurred on 25 occasions.

It was observed that the branch interceptor sewer extending from the Short Street Overflow Chamber to the Bergan Street Chamber was surcharged, resulting in additional overflow at the Bergan Street Chamber. This was observed to have occurred on some occasions even when no rainfall occurred.

Based on the foregoing, it is estimated that overflow will occur at the Bergan Street chamber 65 to 80 times per year for rainfalls occurring 70 to 90 times per year.

The analysis of the dry weather flow at the Bergan Street overflow chamber indicated erratically high concentrations of TSS and BOD. The TSS concentration ranged from 84 mg/l to 3,872 mg/l. The BOD ranged from 70 mg/l to 2,085 mg/l. These high concentrations of pollutants are attributable to industrial waste discharges in the Bergan Street district.

Sampling results of storm overflows indicated an average TSS concentration of 121 mg/l and an average BOD concentration of 258 mg/l. These results are somewhat lower than the dry weather results, demonstrating the effect of dilution.

WARREN STREET OVERFLOW CHAMBER

The Warren Street chamber has a tributary area of approximately 81 acres. This area is served by combined sewers, and the average daily flow was found to vary seasonally from approximately 1.4 MGD to about 1.9 MGD, indicative of the high infiltration rate present in combined sewers. This chamber serves only the tributary area of 81 acres and is not affected by the in-line interceptor sewer flow which serves the Short Street and Bergan Street tributary areas.

Observations and measurements were made of overflow in this chamber during the period beginning January 29, 1975 and extending through March 24, 1975. Nine rainfalls occurred during this period of time, and overflow at the chamber was measured or observed to have occurred on seven occasions.

The volume of overflow from this chamber was estimated to range from a negligible amount to 2.0 MG, with peak overflow rates reaching about 11 MGD.

Based on the foregoing, it is estimated that overflow will occur at this chamber 55 to 70 times per year with rainfalls occurring 70 to 90 times per year.

Samples were taken of the dry weather flow to obtain the waste characteristics and they were found to be typical of domestic sewage. The TSS average concentration was found to be 180 mg/1 and the BOD tobe 233 mg/1, on an average basis.

Samples were also taken of the overflow which occurred and the results indicated the TSS concentration to range from 121 mg/l to 284 mg/l and the BOD from 86 mg/l to 422 mg/l. The high concentrations of TSS and BOD are representative of the flushing action in combined sewers occurring at peak rainfall intensity rates.

SIXTH AVENUE OVERFLOW CHAMBER

The Sixth Avenue overflow chamber has a tributary area of 50 acres served by combined sewers. The average daily flow at this chamber was found to vary seasonally from about 0.09 MGD to 0.11 MGD.

Metering and sampling facilities were installed in this chamber and observations of overflow were made over the period beginning May 13, 1975 and extending to October 24, 1975. Overflow did not occur at this chamber due to the lack of excessive combined storm flows. The storm water from a portion of the tributary area has been separated from the combined sewers and is conveyed to the river by a storm sewer on Sixth Avenue. Therefore, the combined sewage flow is not as great as in other similar areas. Secondly, the overflow outlet pipe has been clogged with debris and when overflows were about to occur, the clogging prevented a free outlet, resulting in surcharge at these chambers. In addition, the main interceptor backs up into the branch sewers, causing surcharging into the chamber.

It has been estimated, however, that with the debris removed from the outlet line, overflows would have occurred on approximately 15 occasions, based on 26 rainfalls observed during the period of study. It will be noted that this is somewhat less than does occur in other districts where the combined sewer systems serve the entire tributary area.

Based on the foregoing, it is estimated that overflow can occur at the Sixth Avenue chamber from 40 to 50 times per year, for rainfalls occurring 70 to 90 times per year.

Sampling of the sewage flow under dry weather conditions indicated the presence of industrial waste, with peak TSS and BOD concentrations of 644 mg/l and 1342 mg/l, respectively. The minimum TSS reflecting the presence of infiltration in the collection area. Results of storm sampling indicated a diluted waste, with the TSS ranging from a low of 64 mg/l to 318 mg/l. The BOD was found to range from 30 mg/l to 145 mg/l.

EAST FIFTH STREET AND FIFTH AVENUE OVERFLOW CHAMBER

This overflow chamber serves a very small area of approximately 10 acres comprising a few industries. The average daily dry weather flow was found to be about 0.13 MGD.

Metering and sampling facilities were installed in the chamber during the period extending from March 19, 1975, to July 6, 1975. During this period, overflows were found to have occurred on 14 occasions, with rainfall occurring on 18 occasions. The volumetric discharge into the Passaic River was found to be minimal, ranging from a negligible amount to about 0.4 MG. However, the peak overflow rates were found to range from 2.2 MGD to 11.5 MGD, depending on the rainfall intensity.

It has been estimated that overflow will occur at this chamber about 50 to 65 times per year, based upon rainfall occurring 70 to 90 times per year.

Sampling results of the dry weather flow, tributary to this chamber, were indicative of low polluting industrial wastes. The TSS concentrations were found to range from about 22 mg/l to about 288 mg/l. The BOD concentrations ranged from 12 mg/l to 146 mg/l. The low concentrations of TSS and BOD are indicative of the presence of infiltration during the non-operational hours of the industries discharging into this line.

The results of the overflow sampling indicated minimal amounts of pollution being discharged into the river. The TSS concentration was found to vary from 69 mg/l to 212 mg/l and the BOD varied from 21 mg/l to 390 mg/1. The peak concentrations of TSS and BOD are indicative of the flushing action experienced in combined sewers, due to peak rainfall intensity.

Investigations of the East Fifth Street collection area indicated that it would be possible to readily eliminate the storm water connections to the system, thus eliminating all overflow and assuring that the industrial wastes are delivered into the collection system without dilution and subsequent overflow into the Passaic River.

EAST ELEVENTH STREET OVERFLOW CHAMBER

This overflow chamber serves a tributary area of only 104 acres. The collection system consists of combined sewers. The average daily dry weather flow was found to be 0.89 MGD.

The metering and sampling facilities were installed in this chamber and were in service from February 5, 1975, to June 13, 1975, during which time 24 rainfall occurrences were measured or observed. Twenty-one overflows were measured or observed which is indicative and an 88 percent probability of overflow as a result of rainfall. It was found that, when the average intensity approached or exceeded 0.03 inches per hour, overflow was likely to occur.

The volume of overflow from this chamber was found to be nominal, ranging from a low of about 0.1 MG to a high of 5.0 MG. However, the peak overflow rates were found to be in excess of 40 MGD for several storms, where high rates of rainfall intensity occurred. It was observed--and this was noted at other overflow stations--that rainfalls of relatively short-term duration but of very high intensity, would result in peak overflow rates, but in nominal volumetric discharges because of the short time-duration of the storms. On the other hand, rainfalls of modest intensity but of long-term duration resulted in modest peak overflow rates and higher volumetric discharges.

It has been estimated that from 70 to 90 rainfall occurrences are likely in the average year which will cause an overflow at this chamber about 50 to 70 times.

Dry weather sampling of the sewage flow at this overflow chamber indicated the presence of industrial wastes, as well as domestic sewage. The TSS was found to range from 36 mg/l to 446 mg/l and the BOD ranged from 13 mg/l to 485 mg/l. The low concentration of TSS and BOD is indicative of the groundwater infiltration present in the East Eleventh Street collection area.

The pollutional loading of the overflow was found to be nominal at this station, with the BOD ranging from 21 mg/l to a high of 125 mg/l, indicative of the effect of dilution at this chamber. The suspended solids in the overflow were likewise found to be nominal, ranging from about 23 mg/l to 129 mg/l.

EAST 12TH STREET AND FOURTH AVENUE OVERFLOW CHAMBER

This overflow chamber serves an area of approximately 19 acres comprising a combined sewer system. The average daily dry weather flow was found to be 0.27 MGD.

Metering and sampling facilities were installed and observations were carried out at this overflow chamber for the period beginning May 16, 1975 and extending to November 13, 1975. During this period of time, rainfall occurred on 37 occasions and it is estimated that overflows occurred on 28 of those occasions.

The overflow volume at this chamber was found to be minimal, ranging from a negligible amount to 0.20 MG. Peak overflow rates were found to be about 12.5 MGD.

Based on the foregoing, it is estimated that overflow will occur at this chamber from 50 to 70 times per year if rainfall occurs 70 to 90 times per year.

Sampling results of the dry weather daily flow indicated the presence of industrial waste but not in high concentrations. The TSS concentration at minimum daily flow periods was found to be negligible, and at peak daily flows it was found to be as high as 184 mg/l. Likewise, the BOD concentration was found to be as low as 41 mg/l and as high as 444 mg/l, respectively.

Automatic sampling was very difficult to achieve in this chamber because of the condensation conditions which prevail. These conditions, created by the discharge of steam or hot water which probably exceed the limitations of discharge into the collection system, impaired the sampling of the overflow. Therefore, sampling of the storm flow at this location was accomplished manually. The results of the manual sampling indicated a relatively low concentration of TSS, averaging 47 mg/1 and a high concentration of BOD, averaging 649 mg/1. It is evident that the sampling was carried out during periods of peak industrial discharge, resulting in minimal dilution due to storm water.

SECOND AVENUE OVERFLOW CHAMBER

The Second Avenue Overflow Chamber has a tributary area of 45 acres and is served entirely by combined sewers. The average daily flow was found to be about 0.54 MGD.

Metering and sampling facilities were installed in this chamber and overflow observations were made during the period beginning January 18, 1975 and extending through August 25, 1975. During this period of time, rainfall occurred on 43 occasions and overflow into the Passaic River is estimated to have occurred on 28 occasions.

The volumetric overflow from this chamber to the Passaic River was minimal and ranged from a negligible amount to 0.3 MG. Peak overflow rates of approximately 10.0 MGD to 13.1 MGD were observed during periods when the rainfall of high intensity occurred.

It is estimated that overflow will occur at this chamber from 45 to 60 times per year based on rainfalls occurring 70 to 90 times per year.

The dry weather flow waste characteristics are representative of industrial waste in nominal concentration. The average TSS concentration was found to be about 92 mg/1 and the BOD, 443 mg/1.

Samples were also taken of the overflows which occurred at this chamber and the following are typical of the results obtained. The peak pollution loadings occurred shortly after the beginning of the rainfall with TSS concentrations as high as 492 mg/1, and with a BOD concentration of 129 mg/1. These high pollution loadings are indicative of the flushing action present in combined sewers. The pollution was found to decrease as rainfall continued; the TSS decreased to a low of 4 mg/l and the BOD to a low 30 mg/l.

THIRD AVENUE OVERFLOW CHAMBER

The Third Avenue overflow chamber has a tributary area of approximately 73 acres. This district is served entirely by combined sewers. The average daily flow was found to be about 0.7 MGD.

Metering and sampling facilities were installed in this chamber for the period beginning February 12, 1975 and extending through July 9, 1975. During this period of time, rainfall occurred on 15 occasions. Overflow has been estimated to have occurred approximately 13 times during this time period.

The volumetric overflow to the Passaic River was estimated to range from 0.2 MG to 0.7 MG. The peak overflow rates were measured as high as 20.8 MGD.

It is estimated that overflow will occur at this chamber from 60 to 80 times per year based on rainfall occurring 70 to 90 times per year.

The results of the sampling of the dry weather flow indicated the presence of industrial waste intermingled with domestic waste. The average TSS concentration was found to be 316 mg/l and the average COD concentration 1050 mg/l.

Sampling of the overflow also indicated that the waste water characteristics reflected the industrial waste in this tributary district. The sampling results were representative of a diluted sewage. The TSS concentrations ranged from 17 mg/l to 644 mg/l, and the BOD averaged 27 mg/l.

TENTH AVENUE AND EAST THIRTY-THIRD STREET OVERFLOW CHAMBER

This overflow chamber serves a tributary area of 699 acres all of which are served entirely by combined sewers.

The average daily dry weather flow was found to range from 5.34 MGD to 6.70 MGD, seasonally. Compared to the estimated theoretical flow of 2.65 MGD, it is evident that a high infiltration rate exists in the collection system. This condition is typical of combined sewers which were constructed with the intent of allowing extraneous water to enter the system.

The metering facilities and sampling equipment for this overflow chamber were in service beginning on December 7, 1974, and extending through June 6, 1975.

During this period of metering and observation, 34 rainfalls occurred with observed or metered overflows on 23 occasions. Thus, overflows occurred about 68 percent of the time that rainfall occurred. Again, the overflows were related to rainfall duration and intensity. In general, no overflow would occur if the rainfall intensity was about 0.025 inches per hour, or less. At a rainfall intensity of 0.04 inches per hour or more, overflows would occur, and their duration was found to be generally the same as the duration of the rainfall period. Thus, overflow duration generally did not exceed the period of rainfall.

It was found that the volume of overflow was not very great and ranged from only about 0.2 MG to about 6.6 MG. However, the peak rates of overflow were found to be very high and ranged from about 6 MGD to over 90 MGD, with the majority being in the range of 60 to 70 MGD, depending upon rainfall intensity.

Based upon observations at this chamber, it would appear that about 50 to 70 overflows are likely to occur per year, for 70 to 90 rainfall occurrences per year.

The pollutional discharge at this chamber was found to be very high. In general, the suspended solids were in the range of 300 mg/l and higher, which appeared to be indicative of the flushing action resulting from peak discharges during storm flow conditions. The BOD readings were not found to be excessive and were somewhat more dilute than found in other overflow chambers, with values ranging from a low of about 75 mg/l to a high of about 200 mg/l. The results of this study indicated that the Tenth Avenue and East Thirty-Third Street overflow was comprised of a mixture of storm water and domestic sewage with little industrial wastes, as compared with the findings at the Market Street overflow chamber.

20TH AVENUE OVERFLOW CHAMBER

The 20th Avenue overflow chamber serves an area of about 96 acres. The area is served entirely with combined sewers and the average daily flow was found to be only 0.13 MGD.

Metering and sampling facilities were installed in this chamber beginning on April 24, 1975, and extending through October 24, 1975. During this period of time, rainfall occurred on 24 occasions and overflows are estimated to have occurred approximately 16 times. The volume of overflow to the river was found to be minimal, ranging from 0.1 MG to 0.3 MG, with peak rates of overflow approximating 16.5 MGD.

It is estimated that overflow will occur at this chamber from 45 to 60 times per year based on rainfall occurring 70 to 90 times per year.

The waste characteristics of the dry weather flow are indicative of industrial sewage, primarily. The BOD was found to average approximately 1028 mg/l and the TSS, 79 mg/l.

The results of sampling of overflow reflect the dilution effect of storm water comingling with the sanitary wastes. The initial TSS concentration was found to be 1227 mg/l, reflecting the street washing resulting from heavy rainfall. As the rainfall continued, the TSS concentration was found to decrease to 80 mg/l. The BOD concentration was found to average 389 mg/l throughout the rainfall.

MARKET STREET OVERFLOW CHAMBER

The Market Street overflow serves a tributary area of approximately 1,487 acres, all of which are provided with a combined sewer system. The theoretical dry weather flow in this tributary area was determined to be approximately 7.5 MGD, whereas the actual dry weather flow was found to be approximately 13.6 MGD. Under wet weather months, the average daily flow was found to be approximately 16.2 MGD. From the above, it is obvious that very high infiltration occurs in the Market Street area, which is attributed to the type of construction of the combined sewer system and the high water table in this area.

Under storm flow conditions, it was found that this overflow is activated with essentially every rain.

The Market Street overflow chamber is an outlet for the combined sewer system of downtown Paterson. The discharge into the Passaic River from this chamber is located near the Market Street Bridge.

In recent years, the City of Paterson constructed nine overflow chambers located within the downtown area to provide relief from surcharge of the existing inadequate system. These nine overflow chambers discharge into a relief line which carries the combined overflow directly into the Passaic River. The largest and most important overflow chamber is located in the intersection of Vreeland Avenue and 19th Avenue at East 36th Street. This chamber is located at a point where a 72-inch diameter sewer is connected to an 84-inch diameter sewr at said intersection. The overflow chamber was constructed by cutting a twenty-foot long section out of the 72-inch diameter pipe, thus creating a side overflow weir. The chamber discharges into a 90-inch diameter outlet sewer, which extends from the intersection of Vreeland Avenue and 19th Avenue to the Passaic River. The overflow chamber operates automatically whenever the flow in the 72-inch diameter pipe is at a depth greater than the weir elevation, which is only about 4 inches above the nominal daily high water sewage flow in the existing line. Observations made in the field indicate that this chamber operates with every rainfall, coincidentally with, and possibly prior to, the overflow which was measured and sampled at the Market Street outlet. In addition to this overflow chamber, eight other chambers are located in the downtown district of Paterson, of which seven are located in Trenton Avenue, and another is located at the intersection of Vernon Avenue and Maryland Avenue. These overflows likewise were found to be operating automatically and discharging into relief lines constructed for this purpose to discharge the overflow into the Passaic River. The outlet line discharges into the Passaic River near Maryland Avenue.

The metering and sampling facilities which were installed in Market Street, Paterson, were in service from a period beginning December 7, 1974, through April 24, 1975. Thus, for a period of approximately five months, observations were made of overflow at this chamber. Twenty-four rainfalls occurred during the period of metering and observation of various time-durations and rainfall intensity. Overflow occurred at this chamber approximately twenty-one times. No overflow occurred when rainfall was very light, with intensities of approximately 0.01 to 0.05 inches per hour. However, at intensities generally of about 0.06 inches per hour, or more, overflow occurred. An examination of the records of rainfall indicated that a majority of the rainfall intensities during the period of observation ranged from 0.05 to about 0.10 inches per hour and, of course, overflow occurred under these conditions.

The volume of overflow was not very high, and this was attributed to the fact that the overflow facilities constructed by the City of Paterson probably discharged an amount equal to or more than the overflow observed at this chamber. The volume of overflow for most of the storms ranged from about 5 MG to as high as 15 MG. Peak rates of discharge generally ranged from about 60 to 90 MGD during the storms of severe rainfall intensity.

Based upon the observations, it appears that 60 to 75 overflows per year can be anticipated at this overflow chamber dependent upon the number of times that rainfall occurs. In general, overflow is likely to occur approximately 80 to 90 percent of the time that rainfall occurs.

The quality of the overflow was determined by sampling and testing during some of the overflow occurrences. It was observed that there was an extreme variation in the quality of the overflow and, in general, the average quality is considered to be objectionable with BOD values averaging from about 159 mg/l to 543 mg/l. Likewise, the suspended solids were found to be extremely high and, in general, the quality of the overflow is indicative of highly polluted water.

PG 81-111

REPORT UPON

OVERFLOW ANALYSIS

TO

PASSAIC VALLEY SEWERAGE COMMISSIONERS

PASSAIC RIVER OVERFLOWS

CLIFTON • PASSAIC • RUTHERFORD AREA

1976

ELSON T KILLAM ASSOCIATES INC
Environmental and Hydraulic Engineers
48 ESSEX STREET MILLBURN NEW JERSEY 07041

3

CLIFTON-PASSAIC-RUTHERFORD AREA OVERFLOWS

Extent of Area and Peak Overflow Rates

Five Active and eight Inactive overflows were observed and studied in the Clifton-Passaic-Rutherford Area, which is generally the "middle" area of the PVSC system. An overflow condition was only recorded at two of the Active overflows (Washington Avenue and Stewart Avenue overflows). No overflow condition during rainfall periods was observed at the other three Active overflows.

These overflows are located along the PVSC branch interceptor sewers adjacent to the Passaic River in this area. The branch interceptor sewers in this middle area extend a distance of approximately 5.8 miles on the easterly side of the Passaic River.

The five active overflows serve a total tributary area of approximately 513 acres. Of this area, only 71 acres are served by combined sanitary and storm sewer systems. The balance is served by separate sanitary systems. The capacity of the sewer systems in these districts has been estimated to be approximately 60 Million Gallons per Day (MGD).

The estimated average daily dry weather flow in the sewer system in this middle area was found to be about 2.3 MGD. During wet weather months, when the groundwater table is high, the average daily dry weather flow (when no rainfall occurs) was estimated to be approximately 3.0 MGD. This indicates that groundwater infiltration of approximately 0.7 MGD prevails in the collection system of the Clifton-Passaic-Rutherford Area.

This infiltration occurs mainly in separate sanitary sewer systems, since only about 15 per cent of the area is served by combined sewers.

The total estimated piping of combined sewers in the Clifton-Passaic-Rutherford Area which is served with combined sewers and which is tributary to the PVSC branch interceptor sewers, is approximately two miles or 10,000 linear feet. It has been estimated that the cost of construction of separate sanitary sewers for this middle area would be approximately $1.5 million.

However, the combined sewers in this area are not the major contributors of the suspected infiltration. The two overflows on combined sewers exhibited fairly uniform flow throughout the dry and wet weather periods.

Most of the suspected infiltration in this area is associated with the area tributary to the Dundee Island overflow. In this area, the dry weather flow ranged from 1.98 MGD to 2.61 MGD during dry and wet weather months, respectively. This area is served by a separate sanitary sewer system.

The five Active overflow chambers in the Clifton-Passaic-Rutherford Area are served by drainage areas ranging in size from 34 acres to as large as 195 acres. The aggregate capacity of the combined and sanitary sewer pipelines which serve these tributary sewer areas has been estimated to be about 60 MGD. The estimated aggregate capacity of the overflow pipes from the chambers to the river has also been estimated to be about 60 MGD. For the two overflows on combined systems, this latter aggregate capacity is 50 MGD. In other words, under conditions of an extensive storm which would inundate and surcharge the entire collection system, a flow of approximately 50 MGD could enter the two Active overflow chambers, with the possibility of discharge into the river of about an equal amount.

Table 3 has been prepared to show the salient features of the thirteen overflows in the Clifton-Passaic-Rutherford Area located along the PVSC branch interceptors. This table is entitled "Tabulation of Passaic Valley Sewerage Commissioners' Overflows in the Clifton-Passaic-Rutherford Area." This table sets forth a tabulation of the overflow location, the discharge permit number, the area tributary to each overflow chamber, the measured dry weather flow under seasonal conditions, the estimated capacity of the sewers tributary to these Active areas, the estimated overflow capacity from these Active chambers to the river, and finally, the observed recorded peak flow rates and estimated volume of discharge into the Passaic River.

Overflow Measurements

During the period of observation and study of each of the Active overflow chambers, approximately 12 to 19 rainfalls were observed. Depth-recording gauges were installed in essentially all of the Active chambers, and measurements and sampling of overflow were undertaken. Sampling during both dry weather periods and during storm flows was undertaken at the Inactive overflows.

TABLE 8

TABULATION OF PVSC OVERFLOWS IN THE CLIFTON-PASSAIC-RUTHERFORD AREA

Overflow Location	Discharge Permit Number	Tributary Area (Acres)	% of Area with Combined Sewers	DRY WEATHER FLOW: Dry Weather Months (MGD)	DRY WEATHER FLOW: Wet Weather Months (MGD)	Estimated Maximum Storm Capacity (MGD)	Estimated Maximum Overflow Capacity to River (MGD)	Maximum Peak Recorded Overflow to River (MGD)	Maximum Overflow Observed (MG)
Active:									
Dundee Island, Passaic	070/Q-002	195	None (2)	1.98	2.61	5.8	1.0(Est.)	No Overflow (1)	
Pierrepont Avenue, Rutherford	072/R-002	96	None (2)	0.09	0.09	3.1	2.2	No Overflow	
Rutherford Avenue, Rutherford	073/R-003	151	None (2)	0.14	0.15	2.0	3.8	No Overflow	
Stewart Avenue, Kearny	017/K-001	34	100	0.06	0.06	19.6	19.6	8.7	0.4
Washington Avenue, Kearny	018/K-002	37	100	0.06	0.07	29.9	33.5	5.0	0.1
TOTAL		513	-	2.33	2.98	60.4	60.1	13.7	0.5
Inactive:									
Garden State Paper Co., Garfield	009/G-001	Industrial	None	7.60	8.90	-	-	- Inactive -	
Wallington Pump Sta., Wallington	005	2,524	None (2)	8.43	10.56	-	-	- Inactive -	
Passaic Tail Race, Passaic	069/Q-001	6	None (2)	0.10	0.10	-	-	- Inactive -	
Lodi Force Main, Passaic	027/L-001	3,246	None (2)	5.41	5.52	Force Main		- Inactive -	
Woodward Avenue, Rutherford	071/R-001	206	None (2)	0.19	0.20	-	-	- Inactive -	
Yantacaw Street, Clifton	003	Main PVSC Line Overflow		99.20	122.00	-	-	- Inactive -	
Yantacaw Pumping Station, Clifton	004	1,359	None (2)	3.10	3.80	-	-	- Inactive -	
North Arlington Overflow	006	560	None (2)	0.93	1.38	-	-	- Inactive -	

(1) Surcharged due to obstructed outfall.

(2) Area served with separate sanitary sewers

TIERRA-B-007874

The results of these studies and measurements indicate that the maximum recorded overflow to the river from the five Active chambers during this period of study was at the peak rate of approximately 14 MGD. However, this overflow rate was of short-term duration and does not reflect the volume of overflow discharged into the river.

The volume of overflow from the five Active overflow chambers was determined to be only about 500,000 gallons during this period of observation and study under the maximum storm flows observed (not all simultaneously).

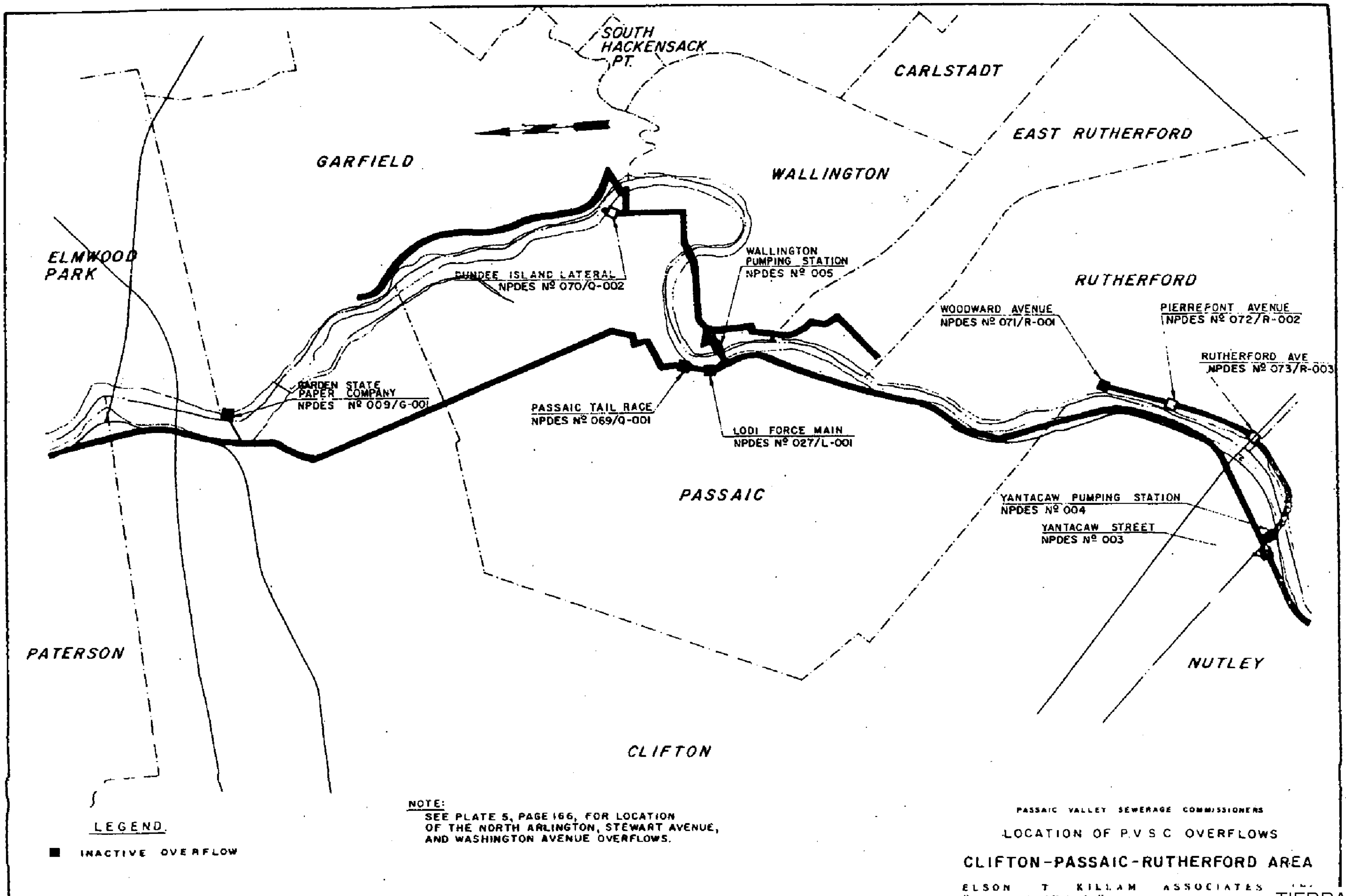
It has been found that only two of the five Active overflow stations are served by combined sewers (the Washington Avenue and Stewart Avenue chambers in Kearny). These chambers respond to a rainfall of approximately one inch occcuring in a 24-hour period, or at an average intensity of about 0.04 inches per hour. The remaining three Active chambers are all tributary to areas served by separate sanitary sewer systems (Pierrepont Avenue, Rutherford Avenue, and Dundee Island).

It was found that the overflow rates of discharge were of short-term duration and generally responded directly to the rainfall. In other words, the overflows generally ceased, following the cessation of rainfall. The aggregate overflow to the Passaic River in the Clifton-Passaic-Rutherford Area under maximum storm flow conditions observed is a very small part of the total system overflow.

The most important overflows located within the Clifton-Passaic-Rutherford area which are tributary to the Passaic Valley branch interceptor sewers are located at Washington Avenue and Stewart Avenue in Kearny. However, even these two active locations produced a recorded aggregate overflow volume of only 500,000 gallons.

The location of the PVSC main and branch interceptor sewers and the overflow chambers along the Passaic River in this middle area of the system is shown on Plate 3. All of the thirteen overflows in this middle area of the system are shown on Plate 3, except the North Arlington, Washington Avenue, and Stewart Avenue overflows which are located in the southerly part of the area. Since these three overflows are located on the Kearny-North Arlington branch interceptor (rather than the branch interceptors which serve the heart of the Kearny-Harrison area through Newark), it was felt appropriate to treat these overflows for discussion purposes with the other overflows which are located on branch interceptors north of the Newark area. The North Arlington, Washington Avenue, and Stewart Avenue overflow locations, therefore, are shown on Plate 5, covering the Kearny-Harrison area.

For the eight Inactive overflows in this middle area, no flow metering facilities were installed, since these overflows are utilized only under extraordinary circumstances, such as for relief during localized flooding or for emergency maintenance purposes. However, sampling of the sewage flow in the immediate area of these overflows was performed during both dry weather (non-rainfall) periods


SOUTH HACKENSACK PT.
CARLSTADT
EAST RUTHERFORD
GARFIELD
WALLINGTON
ELMWOOD PARK
DUNDEE ISLAND LATERAL NPDES Nº 070/Q-002
WALLINGTON PUMPING STATION NPDES Nº 005
RUTHERFORD
WOODWARD AVENUE NPDES Nº 071/R-001
PIERREPONT AVENUE NPDES Nº 072/R-002
RUTHERFORD AVE NPDES Nº 073/R-003
GARDEN STATE PAPER COMPANY NPDES Nº 009/G-001
PASSAIC TAIL RACE NPDES Nº 069/Q-001
LODI FORCE MAIN NPDES Nº 027/L-001
PASSAIC
YANTACAW PUMPING STATION NPDES Nº 004
YANTACAW STREET NPDES Nº 003
PATERSON
NUTLEY
CLIFTON
NOTE:
SEE PLATE 5, PAGE 166, FOR LOCATION OF THE NORTH ARLINGTON, STEWART AVENUE, AND WASHINGTON AVENUE OVERFLOWS.
LEGEND
INACTIVE OVERFLOW
PASSAIC VALLEY SEWERAGE COMMISSIONERS
LOCATION OF P.V.S.C. OVERFLOWS
CLIFTON-PASSAIC-RUTHERFORD AREA
ELSON T. KILLAM ASSOCIATES

(88)

and during periods of rainfall, or storm flow, to effect sewage quality comparisons.

For the Inactive overflow chambers, three chambers are located adjacent to pumping stations and are activated only during emergency conditions for relief of any localized flooding or for maintenance purposes. One overflow is located on the North Arlington-Kearny branch interceptor where it crosses the Passaic River for connection to the PVSC main interceptor. One overflow is located on the Lodi Force Main to serve as possible relief for this line, in the vicinity of the Wallington Pumping Station. One overflow serves a line which emanates from a single industrial source (Garden State Paper Company, Garfield). Another overflow serves a very limited area of six acres (Passaic Tail Race) located just north of the Wallington Pumping Station in Passaic.

Individual Overflow Chambers

A brief description has been prepared of each of the overflow chambers setting forth, in summary form, the results of the observations and study. These descriptions follow.

DUNDEE ISLAND OVERFLOW CHAMBER, PASSAIC

The Dundee Island overflow chamber serving this district of 195 acres is essentially residential in nature, with primarily sanitary flow. The estimated dry weather flow is about 2.0 MGD during the dry weather months, and about 2.6 MGD during wet weather months, reflecting a possible infiltration rate of about 0.6 MGD.

Metering and sampling facilities were installed in this chamber commencing September 12, 1975 and continuing through November 13, 1975. During this time, rainfall occurred on twelve occasions. However, no actual overflows were able to be recorded at this chamber.

Examination of the outflow line from the upstream manhole disclosed that the outfall line is plugged or obstructed. The exact outfall point of the outfall line was not able to be determined, since the expected point of exit to the river is covered with debris. This situation was reported to PVSC. No freeboard overflow was found to occur, only surcharging, thus no valid metering results were able to be obtained. However, sampling was performed during rainfall conditions, although no overflow occurred.

Samples taken of the dry weather flow showed that total suspended solids averaged 178 mg/1, with a BOD concentration averaging 218 mg/1, which is indicative of domestic sewage. During storm flow conditions, the total suspended solids averaged 109 mg/1 and the BOD concentration averaged 164 mg/1, which is indicative of the dilution effect due to storm flows.

The sewer system tributary to this overflow is a separate sanitary system. Consequently, no overflow is necessary, as would be required for combined flows. Whatever high flows which occur during rainfall periods are caused by illegal infiltration/inflow, which should be eliminated with future evaluations. It would appear that once these extraneous flows are eliminated, this overflow can then, in turn, be eliminated as an overflow point into the Passaic River.

PIERREPONT AVENUE OVERFLOW CHAMBER, RUTHERFORD

This overflow chamber serves a drainage area of about 96 acres. The area is served with separate sanitary sewers. It has been estimated that the dry weather flow is about 0.09 MGD during both dry and wet weather months.

Metering and sampling facilities were installed in this chamber commencing on July 12, 1975 and continuing through October 12, 1975. During this period of time, eighteen rainfalls were recorded; however, no overflows were observed. Blank metering charts were obtained which verify this absence of an overflow condition.

However, samples of storm flow were taken during rainfall conditions, although no overflow occurred. These samples showed that total suspended solids averaged 197 mg/1 and BOD averaged 144 mg/1. Samples of the dry weather flow indicated an average sewage strength for suspended solids of about 50 mg/1, and for BOD the average concentration was 15 mg/1. These values are typical of very dilute sewage.

Since the flow to this chamber is low and is sanitary flow, the lines upstream should be checked for any possible storm connections, and the connections eliminated. This overflow, in turn, may then be eliminated.

RUTHERFORD AVENUE OVERFLOW CHAMBER, RUTHERFORD

This overflow chamber serves a drainage area of about 151 acres. The area is served with separate sanitary sewers. It has been estimated that the dry weather flow is about 0.14 MGD during both dry and wet weather months.

Metering and sampling facilities were installed in this chamber commencing on August 24, 1975 and continuing through October 19, 1975. During this period of time, thirteen rainfalls were recorded; however, no overflows were observed. Blank metering charts were obtained which verify this absence of an overflow condition.

However, samples of storm flow were taken during rainfall conditions, although no overflow occurred. These samples showed total suspended solids averaging 215 mg/l and a BOD averaging 151 mg/l. Samples of the dry weather flow indicated an average sewage strength for suspended solids of about 176 mg/l, and for BOD the average concentration was 135 mg/l. These values are typical of domestic sewage.

Since the flow to this chamber is low and is sanitary flow, the lines upstream should be checked for any possible storm connections, and the connections eliminated. This overflow, in turn, may then be eliminated.

STEWART AVENUE OVERFLOW CHAMBER, KEARNY

This overflow chamber serves a tributary area of only 34 acres. The area is provided entirely with combined sewers. The average daily dry weather flow was estimated to be about 0.06 MGD during both dry and wet weather months.

Metering and sampling facilities were installed in this chamber beginning August 6, 1975, and extending through October 24, 1975. During this period of observation, thirteen rainfalls occurred and overflows are estimated to have occurred on eleven occasions. It has been estimated that overflow will occur at this chamber about 60 to 75 times per year, based upon rainfall occurrences of 70 to 90 times per year.

It was found that approximately 0.06 inches per hour of average rainfall intensity was required to cause overflow. The volume of overflow was found to range from 0.1 to 0.4 MG. However, the peak storm water overflow rate has reached 14 MGD.

Sampling of the dry weather sewage at this chamber showed that suspended solids concentrations averaged 255 mg/l and BOD averaged about 271 mg/l. This area is primarily residential in nature.

The sampling of the storm water overflow showed that total suspended solids concentrations averaged 144 mg/l and BOD values averaged only 36 mg/l. The lower wastewater characteristics for BOD are attributed to the dilution effect in this district due to storm flows.

WASHINGTON AVENUE OVERFLOW CHAMBER, KEARNY

The Washington Avenue overflow chamber serves a tributary area of about 37 acres, all of which are provided with a combined sewer system. The estimated dry weather flow was found to range from about 0.06 to 0.07 MGD during dry and wet weather months, respectively.

Under storm flow conditions in the collection system, it was found that this overflow was activated with essentially rainfalls of intermediate intensity.

Metering and sampling facilities were installed and maintained in this chamber commencing on June 5, 1975, and continuing through August 7, 1975. During this period of time, sixteen rainfall occurrences were observed. The total rainfall ranged from as little as 0.10 inches to as much as 2.55 inches. During this period of observation (which happened to fall at a time of especially heavy rainfalls), it was determined that fifteen overflows occurred at this chamber. It was found that, when the average rainfall intensity approached or exceeded about 0.07 to 0.09 inches per hour, overflow was likely to occur.

It was observed that the volumetric overflow was minimal, ranging from a negligible amount to about 0.1 MG. Peak overflow rates were found to reach 5 MGD.

The results of sampling during non-rainfall conditions showed total suspended solids concentrations averaging about 122 mg/l, while BOD concentrations averaged over 300 mg/l. Sampling during times of storm flow indicated that total suspended solids averaged about 314 mg/l and BOD concentrations averaged about 68 mg/l. The higher total suspended solids values during storm flow were indicative of concentrated pollution due to the flushing action, which is typical of the sewage in combined sewer systems. The lower BOD concentrations during storm flow are attributed to the dilution effect of the increased flow.

GARDEN STATE PAPER COMPANY OVERFLOW CHAMBER, GARFIELD

The Garden State Paper Company overflow chamber is located in the vicinity of the driveway entrance to the Garden State Paper Company in the City of Garfield, over a 30-inch circular cast iron force main interceptor which serves the paper company plant. This interceptor leaves the plant premises and crosses the Passaic River for connection with the PVSC main interceptor, on the westerly side of the Passaic River in this area. A manually operated by-pass gate controls any overflow from this point, which is directed through a 24-inch circular cast iron outfall line to an outfall point at the easterly shoreline of the Passaic River, just south of the plant entrance.

The tributary flow, which is the total plant industrial flow in this individual line, ranged from 7.6 MGD during dry weather months to 8.9 MGD during the wet weather months. However, this difference in readings between the dry and wet weather months is due to variations in plant activity, rather than excessive infiltration in the line, since the line is a cast iron main. The extent of any infiltration in this area will be borne out with further investigation.

This overflow is classified as Inactive by PVSC. Accordingly, no metering facilities were installed at this location and no results can be presented on overflow rates, other than an estimate that, with a full by-pass, the overflow at this point would range from the 7.6 to 8.9 MGD of reported plant flow.

Sampling of the sewage flow, however, was obtained during both dry weather flow periods and during periods of rainfall activity in the area.

Sampling of the dry weather flow (during periods of no rainfall) showed that total suspended solids averaged 2108 mg/l. Sampling of the sewage flow during rainfall conditions, through the chamber screening at the siphon inlet chamber over the plant force main, showed that total suspended solids averaged 2301 mg/l, and BOD values averaged about 1064 mg/l. There was very little difference between suspended solids during dry weather flow periods and during storm flow periods (or rather periods of rainfall activity in the area), and this can be expected because the line is a force main.

This overflow is intended only for emergency use, and as such is classified as Inactive by PVSC.

WALLINGTON PUMPING STATION OVERFLOW, WALLINGTON

The Wallington Pumping Station overflow is located in the Borough of Wallington at a point just north of the inlet where the two siphon lines of the Garfield-Wallington-Passaic branch interceptor sewer begin to cross the Passaic River, prior to entering the Wallington Pumping Station. The manual slide gate located at a concrete headwall controls the overflow at the pier and bulkhead line of the river at this point. The outfall line from the inlet siphon chamber consists of a 48-inch round corrugated metal pipe. The tributary area associated with this overflow is about 2,524 acres, which is served by separate sanitary sewers along this branch interceptor.

The average daily dry weather flow in the tributary area was measured to be about 8.4 MGD during dry weather months and about 10.6 MGD during the wet weather months, reflecting a possible infiltration rate of about 2.2 MGD.

This overflow is classified as Inactive by PVSC. Accordingly, no metering facilities were installed and no results are presented herein on overflow rates.

However, sampling of the sewage flow was obtained at the siphon inlet chamber during both dry weather flow periods and during periods of storm flow. Sampling of the dry weather flow showed that total suspended solids concentrations averaged about 293 mg/l and BOD values averaged 624 mg/l. Sampling during storm flow showed that total suspended solids averaged about 134 mg/l, and BOD concentrations averaged 331 mg/l. These latter results reflect the dilution effect of the storm flows. The high

BOD values are due to the industrial portions of this sewage.

This overflow is available as possible relief for the entire Garfield-Wallington-Passaic branch interceptor, and as such, is only intended for use during emergency situations, for maintenance purposes, etc.

PASSAIC TAIL RACE OVERFLOW, PASSAIC

The Passaic Tail Race Overflow is located just north of the Wallington Pumping Station, along the westerly shore of the Passaic River, in Passaic. This overflow serves as relief for the Tail Race line, which consists of a sanitary sewer running in a north-south direction along the westerly shore of the Passaic River for a distance of about 1,250 feet, north of the Wallington Pumping Station.

The overflow line itself is a short section of pipe about twenty feet in length, constructed at right angles from a sanitary sewer manhole over the Passaic Tail Race, and leading to a concrete headwall outfall point on the edge of the river. A 12-inch manual slide gate controls the overflow. The area tributary to the overflow to the Tail Race line at this point is only about 6 acres.

The average daily dry weather flow was found to be about 0.1 MGD during both dry and wet weather months. This overflow is classified as Inactive by PVSC. Accordingly, metering facilities were not installed and no results are presented herein on overflow rates.

However, sampling of the sewage flow was obtained at the sanitary sewer chamber, at the point where the outfall line is constructed at right angles to the Passaic Tail Race line. Sampling was obtained during both dry weather flow periods and during periods of storm flow. Sampling during dry weather periods showed that total suspended solids averaged only 27 mg/l, with BOD concentrations averaging only 30 mg/l.

Sampling taken during storm flow conditions at this location showed that total suspended solids averaged only about 22 mg/l, and BOD values averaged only about 25 mg/1. The sewage at this location is strictly sanitary sewage, with very low concentrations due to dilution.

This overflow point is very minimal in terms of importance to the system and could be eliminated. However, in the event that industrial development in this area is re-established in future years, this overflow should possibly be kept intact to serve the Tail Race line at this point. The overflow is intended to be used for emergency relief purposes, or for maintenance purposes.

LODI FORCE MAIN OVERFLOW, PASSAIC

The Lodi Force Main overflow is located at the point where the Lodi Force Main reaches the westerly shore of the Passaic River, just ahead of the Lodi Venturi Meter, adjacent to the Wallington Pumping Station in Passaic. The outfall line for the overflow consists of a 24-inch cast iron pipe leading to a concrete headwall and manual flap gate on the westerly shore of the Passaic River, adjacent to the Wallington Pumping Station. Being so situated, this overflow can bypass the entire Lodi Force Main flow, which consists of separate sanitary sewage.

The tributary area associated with this overflow is about 3,246 acres, serving the municipalities of Saddle Brook, South Hackensack, Lodi, and a portion of Wood-Ridge. The average daily dry weather flow associated with this tributary area was found to be about 5.41 MGD during the dry weather months, and about 5.52 MGD during the wet weather months.

This overflow is classified as Inactive by PVSC. Accordingly, no metering facilities were installed on the force main and no results are presented herein on overflow rates.

However, sampling of the sewage flow was obtained during both dry weather flow periods and during storm flow periods. The sewage samples were taken at the wet wells for the two pumping stations which are the major contributors to the sanitary sewage flowing in the Lodi Force Main. These pumping stations were the Mayhill Street station in Saddle Brook, and the Richmond Station in Lodi.

Sampling of the dry weather flow showed a total suspended solids average of 172 mg/1, and BOD values averaging 189 mg/1. Samples taken during storm flow conditions indicated total suspended solids averaging 187 mg/l. No BOD results were obtained from the storm samples.

This overflow is only used for purposes of emergency relief, for possible localized flooding conditions, or for maintenance purposes.

WOODWARD AVENUE OVERFLOW CHAMBER, RUTHERFORD

The Woodward Avenue overflow chamber serves a sewer district of 206 acres. The area is residential in nature and is served entirely by sanitary sewers. The estimated average daily flow during both dry and wet weather months was about 0.19 and 0.20 MGD, respectively.

The overflow outfall line to the Passaic River was found to be obstructed somewhere between the tide gate chamber and the outfall point. The tide gate chamber was filled with water from a fire hose and the outfall point at the river was inspected for signs of flow; however, none was observed. Therefore, this overflow has been classified as Inactive by PVSC. No flow metering facilities were installed in this overflow chamber. Therefore, no results are presented on overflow rates.

Sampling of the flow was performed, however, during both dry weather periods and periods of storm flow. The dry weather sampling showed that total suspended solids averaged about 247 mg/l, with BOD values averaging about 393 mg/l. The samples taken during storm flow showed that total suspended solids averaged 135 mg/l and BOD averaged 139 mg/l. These latter concentrations reflect the dilution effect due to the storm flows.

YANTACAW STREET OVERFLOW, CLIFTON

The Yantacaw Street overflow is located in the City of Clifton on the inlet siphon chamber where the PVSC main interceptor crosses the Third River, adjacent to the Yantacaw Pumping Station. A manual slide gate controls the overflow at this point. The outfall consists of two 5'-6" by 6'-0" arched concrete conduits which can conduct the overflow to an excavated channel leading to the Third River, and thence to the Passaic River. Being so situated, this overflow can bypass the entire flow upstream of this point tributary to the PVSC main and branch interceptor system all the way to its northern terminus in the City of Paterson. This tributary area is about thirty-eight square miles. The average daily dry weather flow was 99 MGD during dry weather months and 122 MGD during wet weather months for this entire upstream tributary area.

This overflow is classified as inactive by PVSC. Accordingly, no metering facilities were installed and no results are presented herein on overflow rates.

However, sampling of the sewage flow was obtained during both dry weather flow periods and storm flow conditions. The sampling of the dry weather flow showed total suspended solids concentrations averaging 538 mg/l and BOD values averaging 280 mg/l.

Sampling of the sewage flow during storm conditions showed that total suspended solids averaged 451 mg/l, and that BOD values averaged 259 mg/l. Dependent upon the time of sampling, the higher values indicated herein for the storm sampling would tend to reflect concentrations due to flushing action.

This overflow should be maintained, as is, for both emergency relief and maintenance purposes.

YANTACAW PUMPING STATION OVERFLOW, CLIFTON

The Yantacaw Pumping Station overflow is located at the Yantacaw Pumping Station in Clifton. This overflow is a relief line for the Rutherford-Lyndhurst branch intercepting sewer at the point where this branch interceptor crosses the Passaic River and enters the Yantacaw Pumping Station. A manual slide gate controls the overflow at this point, which is through a 30-inch circular outfall line to an excavated overflow channel leading from the vicinity of the pumping station to the Third River, and thence to the Passaic River. This overflow can bypass all of the flow entering the Yantacaw Pumping Station through the Rutherford-Lyndhurst branch intercepting sewer.

The tributary area associated with the branch interceptor is about 1,359 acres, all of which consists of separate sanitary sewers. The average daily dry weather flow at this point was found to be about 3.1 MGD during dry weather months and about 3.8 MGD during wet weather months, reflecting a possible infiltration rate of about 0.7 MGD.

This overflow is classified as Inactive by PVSC. Accordingly, no metering facilities were installed and no results are presented herein on overflow rates. However, sampling of the sewage flow was obtained during both dry weather flow periods and during storm flow periods. Samples which were taken during dry weather flow periods showed total suspended solids averaging 130 mg/l and BOD values averaging 592 mg/l.

Samples of the sewage taken at the screen chamber of the pumping station during storm flow conditions showed total suspended solids concentrations averaging 133 mg/l, and BOD values averaging 422 mg/l. These figures reflect somewhat the effects of dilution of concentrations due to storm flow.

This overflow is used only for localized pumping station relief purposes in the event of an emergency, and for maintenance purposes.

NORTH ARLINGTON OVERFLOW CHAMBER, NORTH ARLINGTON

The North Arlington overflow chamber serves a tributary area of 560 acres. The area is provided with separate sanitary and storm sewers. The estimated average daily dry weather flow was found to be 0.93 MGD during dry weather months and 1.38 MGD during the wet weather months. This difference of 0.45 MGD represents possible excessive infiltration/inflow.

This chamber is located at the point where the Kearny-North Arlingtor PVSC branch interceptor sewer begins to cross the Passaic River for connection with the PVSC main interceptor on the westerly side of the river.

The overflow chamber consists of an outfall line, which is located immediately above the siphon line at the start of the river crossing at this point. The exact point of outfall for the overflow could not be determined, as the expected point of exit was covered with debris. It was determined from investigation that the outfall line is obstructed. Accordingly, this overflow has been classified as Inactive by PVSC. Since no metering was performed for this location, no data are presented herein on overflow rates. No overflow was observed at this location.

Samples of the sewage flow were obtained during dry weather and storm flow conditions. The dry weather flow sampling showed total suspending solids averaging 102 mg/1 and BOD concentrations averaging 242 mg/1. which is typical of domestic sewage. The sample obtained during storm flow conditions in the overflow chamber showed total suspended solids averaging 71 mg/1 and BOD values averaging 149 mg/1, reflecting the dilution effect of these sewage concentrations during storm flow conditions.

The excessive infiltration/inflow in this area should be eliminated with future investigation. Under the present conditions, this overflow chamber does have the capacity to overflow automatically, in the sense that there is a physical connection from the overflow chamber to the river (which is nonetheless obstructed at the present time). However, provisions could be made for this overflow to be operated manually, similar to the overflow arrangements at the pumping stations, so that relief for this branch interceptor can be controlled whenever emergency or maintenance conditions dictate doing so.

Pg 112-157

REPORT UPON

OVERFLOW ANALYSIS

TO

PASSAIC VALLEY SEWERAGE COMMISSIONERS

PASSAIC RIVER OVERFLOWS

NEWARK AREA

1976

ELSON T. KILLAM ASSOCIATES INC

Environmental and Hydraulic Engineers

4

TIERRA-B-007901

NEWARK AREA OVERFLOWS

Extent of Area and Peak Overflow Rates

Fifteen active overflows were observed and studied in the City of Newark area. There are no inactive overflows in the City of Newark.

These overflows are located along the Passaic Valley Sewerage Commissioners' interceptor sewer adjacent to the Passaic River. The interceptor sewer in the City of Newark extends a distance of approximately 3.8 miles to the most southerly PVSC overflow.

The fifteen active overflows serve a total tributary area of approximately 3,955 acres, essentially all of which are served by combined sanitary and storm sewer systems. These overflows are activated during storm flow conditions in the combined sewer collection systems when rainfall occurs.

A majority of the overflows is activated automatically in the City of Newark. However, due to extremely heavy flow, it is necessary to bypass directly to the Passaic River the entire flow from up to as many as eight of the combined sewer systems which are tributary to overflow chambers.

In addition to the fifteen overflow chambers, the Second River Union Outlet sewer is manually regulated, with resultant discharge into the Passaic River during storms, and this regulation is necessary to alleviate surcharge in the PVSC interceptor sewer. This overflow is discussed separately following the Newark overflows.

In addition to this area, approximately 1,400 acres in the City are provided with combined sewers and connect directly to the PVSC interceptor sewers without benefit of PVSC overflow chambers. This area is located downstream of the 3,955 acres which are provided with overflow chambers. It is apparent that the inflow from this area creates surcharge in the PVSC interceptor sewer and subsequent storm water overflow at the low-lying upstream overflow chambers. However, the discovery of several overflows located within the City of Newark system may explain how "relief" is obtained from surcharge which would otherwise occur. The necessity for study and elimination of these overflows in conjunction with the PVSC overflow control is obvious if pollution of the Passaic River overflows is to be eliminated.

The capacity of the combined sewer system in these fifteen districts has been estimated to be approximately 3,250 Million Gallons per Day (MGD). It is interesting to note that this carrying capacity approximates 1 cubic foot per second (cfs) per acre of drainage area, which is indicative of a faily well designed storm sewer system.

The measured average daily dry weather flow in the combined sewer systems (3,955 acres) tributary to the fifteen overflows in the City of Newark was found to be about 52 MGD, which includes sanitary sewage from separate sewer systems outside of the City of Newark limits that are connected into the City's system.

During wet weather months, when the ground water table is high, the average daily dry weather flow (when no rainfall occurs) was found to be approximately 61 MGD. This indicates that additional ground water infiltration of approximately 9 MGD prevails in the collection system of the City of Newark, and in upstream areas which connect through the City's system. This infiltration is attributed to the combined sewer system, which was constructed so as to permit ground water entry into the pipeline, and does not include comparison with theoretical flow. This is generally found to prevail in combined sewer systems where little attention is normally provided in constructing tight joints. Therefore, removal of infiltration in a combined sewer system may be found to be difficult, costly, and ineffective.

The total estimated piping of combined sewers in the City of Newark which is served with combined sewers and which is tributary to the PVSC interceptor sewer is approximately 187 miles or 989,000 linear feet. It has been estimated that the cost of construction of separate sanitary sewers for the City of Newark would be approximately $215 million. Under such a separation plan, it has been assumed that the existing combined sewer pipelines would be severed from any sanitary sewer lines, and that the old combined sewer lines would be utilized as separate storm sewer facilities. In order to effect a meaningful reduction in the infiltration through complete system separation, it would also be necessary to install new house connections extending from the street to the property line, if not all the way into the building structure, to assure that old-type building drainage systems with built-in ground water infiltration will have been eliminated from the collection system.

The fifteen overflow chambers in the City of Newark are served by drainage areas ranging in size from as little as eight acres to as large as 1,621 acres. The aggregate capacity of the combined storm sewer pipelines which serve these tributary combined sewer areas has been estimated to be 3,250 MGD. This is equivalent to about 62 times the average daily dry weather flow measured in the tributary area. The estimated aggregate capacity of the overflow pipes from the chambers to the river has also been estimated to be 3,250 MGD. In other words, under conditions of an extensive storm which would inundate and surcharge the entire collection system, a flow of approximately 3,250 MGD or more could enter the fifteen overflow chambers with the possibility of discharge into the river of about the same flow rate. With a rainfall intensity of 1 inch per hour, all of the 15 combined sewer systems will flow full and many of the pipelines are under surcharge. The overflow into the Passaic River would be at a high rate and would be indicative of the fact that the interceptor sewer would be flowing full and unable to accomodate such overflow.

It will be noted that the interceptor sewer at the upstream or northerly terminus of the City of Newark has a carrying capacity of only about 370 MGD. It is obvious that this interceptor sewer is entirely inadequate to carry but a very small portion of the total storm flow potential from the combined sewers in the City of Newark.

Table 4 has been prepared to show the salient features of the fifteen overflows in the City of Newark. This table is entitled "Tabulation of Passaic Valley Sewerage Commissioners' Overflows in the Newark Area." This table sets forth a tabulation of the overflow location and discharge permit number, the area tributary to each overflow chamber, the measured dry weather flow under seasonal conditions, the estimated capacity of the combined sewers tributary to these areas, the estimated overflow capacity from these chambers to the river, and finally the observed recorded peak flow rates and estimated volume of discharge into the Passaic River.

Overflow Estimates Based on Rainfall

A study has been made of the theoretical volume and peak flow rate of discharge from the overflows in the Newark collection system, based upon rainfalls of various intensities and durations. A rainfall of approximately one inch occurring at a uniform rate over a 24-hour period will result in a total volume of approximately 27,000 gallons of water on each acre. Based upon the drainage area of each district, and giving due consideration to factors such as coefficient of runoff, quantity of catch basins, storm sewer interception efficiency, and other relevant factors, it has been estimated that from such a rainfall, approximately 50 percent to 60 percent of the rainfall will enter the collection system. It has been estimated that only 11 of the 15 overflow stations will respond to a rainfall of this relatively low intensity

TABLE 4

TABULATION OF PVSC OVERFLOWS IN THE NEWARK AREA

Overflow Location	Discharge Permit Number	Tributary Area (Acres)	% of Area with Combined Sewers	DRY WEATHER FLOW Dry Weather Months (MGD)	Wet Weather Months (MGD)	Estimated Maximum Storm Capacity (MGD)	Estimated Maximum Overflow Capacity to River (MGD)	Maximum Peak Recorded Overflow to River (MGD)	Maximum Overflow Observed (MG)
Clay Street	033/N-006	2874/1621	56% (1621)	27.20	31.60	727.4	490.0	337	48.0
Saybrook Place	037/N-010	306	100	4.82	4.90	375.0	415.0	89	8.1
Rector Street	036/N-009	177	100	1.88	1.90	244.0	414.0	68	7.9
Fourth Avenue	032/N-005	225	100	1.60	1.95	262.1	71.6	62	6.0
Herbert Place	030/N-003	298	100	1.20	1.85	135.6	368.1	110	4.9
Polk Street	040/N-013	199	100	1.63	1.66	586.0	394.0	62	3.5
City Dock	038/N-011	380	100	9.78	11.66	511.0	409.7	111	3.4
Freeman Street	041/N-014	149	100	1.00	1.20	55.3	55.3	16	2.9
Verona Avenue	028/N-001	367	100	1.59	2.28	143.8	222.0	80	2.2
Jackson Street	039/N-012	83	100	1.06	1.06 (Est.)	174.0	174.0	67	0.6
Passaic Street	033/N-006C	31	100	0.30	0.34	5.0	----*	7	0.4
Orange Street	034/N-007	13	100	Neg.	Neg.	15.9	37.9	None	---
Bridge Street	035/N-008	10	100	Neg.	Neg.	6.3	13.6	None	---
Delavan Avenue	029/N-002	88	100	0.20	0.38	3.5	180.0	None	---
Third Avenue	031/N-004	8	100	(Included in Fourth Avenue)		3.4	2.6	(See Fourth Ave.)	
TOTAL		5,208/3,955		52.26	60.78	3,248.3	3,247.8	1,009	87.9

*In common with Clay Street

(1 inch in 24 hours or 0.04 inches per hour). Of the estimated portion of the rainfall which is intercepted by the combined sewer system, it has further been estimated that about 6-16 Million Gallons (MG) will be discharged from the overflow chambers in the Newark Area, and the balance would be conveyed downstream for treatment and disposal. With a more intense rainfall, namely, 1 inch occurring in 12 hours, it has been estimated that approximately 108 to 128 million gallons of storm water will be collected by the combined sewer system in the Newark Area. Of this amount, together with dry weather sewage flows, it has been estimated that approximately 30 to 40 million gallons will be discharged into the Passaic River in the Newark Area, with the balance delivered downstream through the interceptor sewer for treatment and disposal. Assuming that a 1-inch rainfall occurs in approximately 6 hours, with a higher intensity, namely, 0.17 inches per hour, it has been estimated that approximately 11 overflows will be activated out of the total of 15. Under this storm condition, the overflow into the Passaic River in the Newark Area would range from about 42 to 51 million gallons, and the balance of the estimated storm flow would be intercepted by the combined sewer system and would be carried downstream for treatment and disposal.

With a more intense rainfall of one inch per hour, it has been estimated that most of the overflows would discharge. The estimate of flow into the Passaic River in the Newark Area under this storm flow condition would range from about 52 to 61 million gallons, with the balance carried downstream for treatment and disposal. When a rainfall of 2 inches occurs (as contrasted to 1 inch as set forth under the various time-duration conditions) the following estimates have been made of the overflow into the Passaic River from the overflows in the City of Newark:

Time Duration of 2-inch Storm	Estimated Overflow
24 hours	61 to 79 MG
12 hours	84 to 104 MG
6 hours	96 to 116 MG
1 hour	106 to 126 MG

A study has also been made of the theoretical volume and peak flow rate of discharge from the Jabez Street area of about 1400 acres not served with PVSC overflows. With a rainfall of one inch occurring in 12 hours, it has been estimated that approximately 5 to 9 million gallons will be discharged into the Passaic River at an overflow on the City of Newark system, with the balance delivered downstream through the interceptor sewer for treatment and disposal. Assuming that a one-inch rainfall occurs in approximately 6 hours with a higher intensity, namely 0.17 inches per hour, it has been estimated that the overflow into the Passaic River from this area would range from 12 to 16 million gallons, and the balance of the estimated storm flow would be intercepted by the combined sewer system and carried downstream for treatment and disposal. With a more intense rainfall of one inch per hour, the estimate of flow into the Passaic River from this area would range from about 18 to 22 million gallons, with the balance carried downstream for treatment and disposal. It is obvious that the PVSC interceptor sewer is inadequate to carry but a limited amount of the total storm flow potential from the Newark combined sewers in this 1400-acre area not served by PVSC overflows.

Overflow Measurements

During the periods of observation and study of each of the fifteen overflow chambers, approximately 45 to 70 rainfalls were observed at the various overflows. Installation of depth-recording gauges in these overflow chambers provides a means for measuring the overflow. Automatic recording charts were utilized to determine the time, duration, and volume of overflows which occurred during rainfall periods. Automatic sampling equipment was also installed in these chambers so that samples could be collected and analysis made of the overflow to determine the extent of the pollution discharged into the Passaic River.

The results of these studies and measurements indicate that the maximum recorded overflow to the river from the fifteen chambers during this period of study was at the peak rate of approximately 1,000 MGD. However, this overflow rate was of short-term duration and does not reflect the volume of overflow discharged into the river.

The volume of overflow from the fifteen overflow chambers was determined to be almost 90 Million Gallons (MG) during this period of observation and study under the maximum storm flows observed.

It would appear from the results of this study that overflow does occur at approximately eleven overflows whenever the rainfall approaches or exceeds 0.08 inches per hour. No overflow was observed or measured at four overflow chambers and it appears that these chambers could be eliminated without detrimental effect upon the operation of the collection system, or in increasing overflow to the river.

The aggregate overflow to the Passaic River in the City of Newark under maximum storm flow conditions observed was somewhat less than anticipated. Based upon the observations and studies, it is possible, however, to make some projections of what the overflow might be under more severe rainfall conditions than those observed during the period of study. An attempt has been made to do this in the overflow chambers which are considered to be most critical in the collection system.

In general, it was found that, in the City of Newark area with combined sewer systems, overflow occurred shortly after the start of rainfall of even modest intensity (0.05 - 0.08 inches per hour). The overflow would continue, generally, during the entire period of rainfall, but would terminate shortly after, or at the same time that the rainfall stopped. Thus, all of the overflows were found to be rainfall-sensitive, and it can also be stated that the overflows were of relatively short-term duration, and were related directly to the time, duration, and intensity of rainfall.

The most important overflows located within the City of Newark which are tributary to the Passaic Valley interceptor sewer are Clay Street, Saybrook Place, Rector Street, Fourth Avenue, and Herbert Place. Clay Street is by far the most important and critical overflow because of its large tributary area. It has been estimated that the outlet pipe from

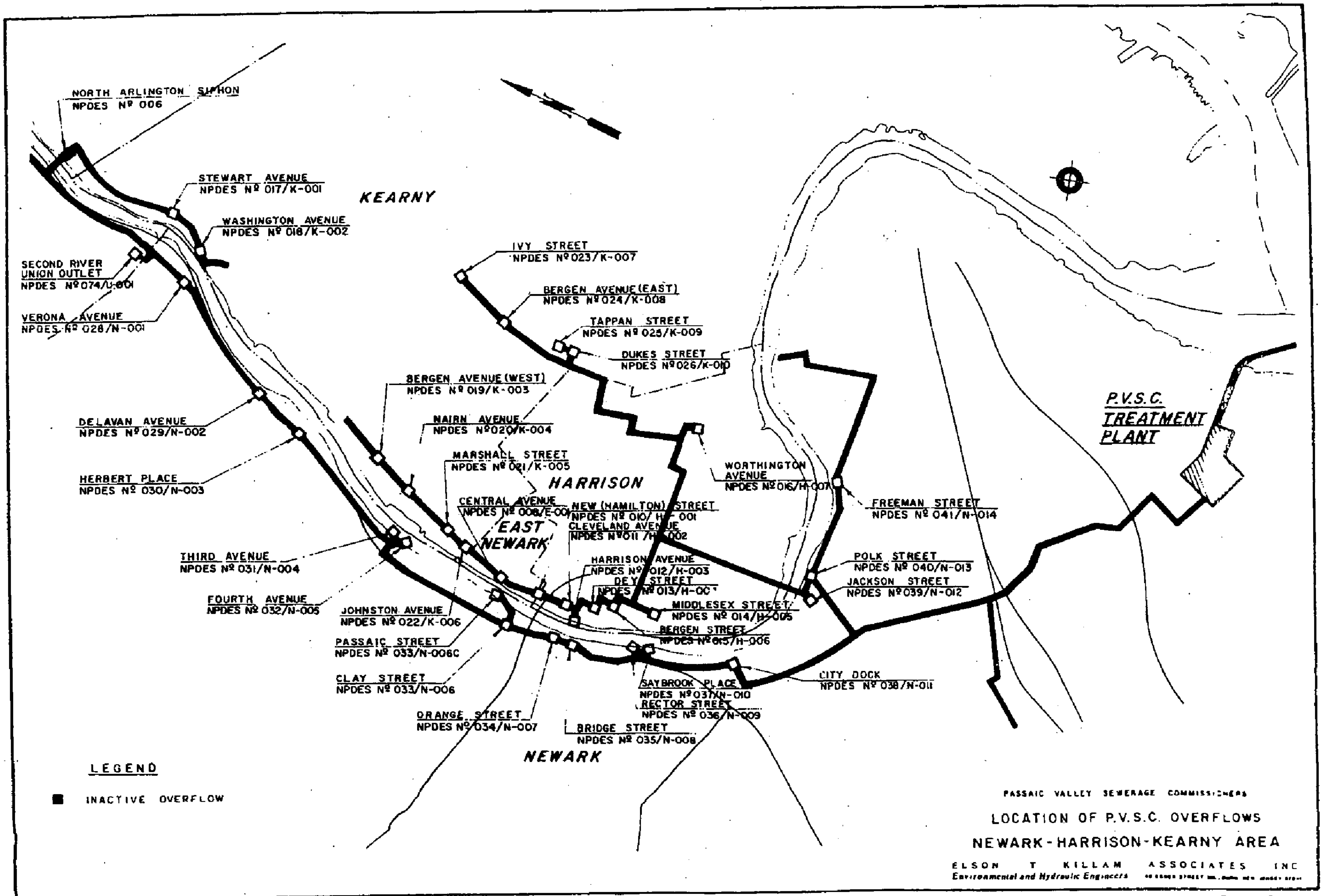

NORTH ARLINGTON SIPHON
NPDES Nº 006
STEWART AVENUE
NPDES Nº 017/K-001
KEARNY
WASHINGTON AVENUE
NPDES Nº 018/K-002
SECOND RIVER
UNION OUTLET
NPDES Nº 074/U-001
VERONA AVENUE
NPDES Nº 028/N-001
IVY STREET
NPDES Nº 023/K-007
BERGEN AVENUE (EAST)
NPDES Nº 024/K-008
TAPPAN STREET
NPDES Nº 025/K-009
DUKES STREET
NPDES Nº 026/K-010
BERGEN AVENUE (WEST)
NPDES Nº 019/K-003
NAIRN AVENUE
NPDES Nº 020/K-004
DELAVAN AVENUE
NPDES Nº 029/N-002
MARSHALL STREET
NPDES Nº 021/K-005
HERBERT PLACE
NPDES Nº 030/N-003
HARRISON
WORTHINGTON
AVENUE
NPDES Nº 016/H-007
FREEMAN STREET
NPDES Nº 041/N-014
P.V.S.C.
TREATMENT
PLANT
CENTRAL AVENUE
NPDES Nº 008/E-001
NEW (HAMILTON) STREET
NPDES Nº 010/H-001
CLEVELAND AVENUE
NPDES Nº 011/H-002
EAST
NEWARK
THIRD AVENUE
NPDES Nº 031/N-004
HARRISON AVENUE
NPDES Nº 012/H-003
DEY STREET
NPDES Nº 013/H-004
POLK STREET
NPDES Nº 040/N-013
JACKSON STREET
NPDES Nº 039/N-012
FOURTH AVENUE
NPDES Nº 032/N-005
JOHNSTON AVENUE
NPDES Nº 022/K-006
MIDDLESEX STREET
NPDES Nº 014/H-005
BERGEN STREET
NPDES Nº 015/H-006
PASSAIC STREET
NPDES Nº 033/N-006C
CLAY STREET
NPDES Nº 033/N-006
CITY DOCK
NPDES Nº 038/N-011
SAYBROOK PLACE
NPDES Nº 037/N-010
RECTOR STREET
NPDES Nº 036/N-009
ORANGE STREET
NPDES Nº 034/N-007
BRIDGE STREET
NPDES Nº 035/N-008
NEWARK
LEGEND
INACTIVE OVERFLOW
PASSAIC VALLEY SEWERAGE COMMISSIONERS
LOCATION OF P.V.S.C. OVERFLOWS
NEWARK-HARRISON-KEARNY AREA
ELSON T KILLAM ASSOCIATES INC
Environmental and Hydraulic Engineers

PLATE 4

Clay Street has a carrying capacity of 490 MGD. The estimated capacity of the incoming combined sewer which flows through this chamber is approximately 728 MGD. Thus, with periods of heavy rainfall it is apparent that discharges of high frequency and fairly large volume must occur at this overflow chamber.

Interceptor Capacity

The location of the interceptor sewer and the fifteen overflow chambers along the Passaic River in the Newark area is shown on Plate 4.

The interceptor sewer passing through the City of Newark varies in size and capacity. At the northern boundary of the City, where the Second River Union Outlet sewer enters the PVSC interceptor sewer line, the capacity is about 216 MGD. This capacity increases at a gradual rate and is approximately 300 MGD where the Kearny-Harrison connection connects with the interceptor sewer line. In the downstream reaches, the interceptor sewer has a capacity of approximately 370 MGD. Under surcharge conditions and with maximum pumping at the pumping station, it has been estimated that the capacity of the lower reaches of this interceptor sewer is about 400 - 450 MGD.

It is obvious that the interceptor sewer is inadequate to carry but a limited amount of the total storm flow potential from the City of Newark combined sewers.

City of Newark Overflows

A very important discovery during this study period was that many overflows are located within the City of Newark system which discharge directly into the Passaic River through the internal overflow lines. It has been estimated that approximately fourteen such overflows occur within the City's system. These operate entirely independently of the Passaic Valley Sewerage Commissioners' system, and are located as follows:

Doremus Avenue near Roanoke Avenue
Sixth Avenue near Thirteenth Street
Grafton Street at McCarter Highway
Delavan Avenue at Erie-Lackawanna Railway
Summer Avenue at Elwood Avenue
Academy Street at Newark Street
Second Avenue at Broadway
South Street at Dawson Street
Earl Street at Frelinghuysen Avenue
Peddie Street Chamber
Queen Street Chamber
Waverly District Chamber
Wheeler Creek
Adam's Creek

Three of these City of Newark overflows (Grafton Street, Delavan Avenue, and Summer Avenue) are located in the vicinity of the area tributary to the PVSC Delavan Avenue overflow. One of these overflows (Second Avenue) is located in the area tributary to the PVSC Fourth Avenue overflow. Another of these overflows (Academy Street) is located in the area tributary to the Saybrook Place PVSC overflow.

Also, the Sixth Avenue Newark overflow is located at the Newark-East Orange boundary in the area which is tributary to the Clay Street PVSC overflow. Being so situated, whatever overflows which do occur at these locations are not reflected in the flow measurements which were performed at the downstream points of connection to the PVSC main interceptor. The remaining eight overflows are not located in areas which are directly tributary to PVSC overflows in the Newark area. They are located generally in the greater Waverly, Queen, and Peddie Districts of Newark, and are tributary to the Newark South Side intercepting sewer.

It is suggested that a determination be made at this time by the concerned regulatory agencies concerning the authorization of a more detailed evaluation of the quantity and quality of these discharges outside the Commissioners' jurisdiction, so that the findings and the possible remedies to these conditions may be considered under an integrated plan.

Individual Overflow Chambers

A condensed description and analysis of each of the existing overflows in the Newark area are set forth on the following pages. The Second River Union Outlet Overflow narrative is included here as the last narrative.

CLAY STREET OVERFLOW CHAMBER

The Clay Street overflow serves a tributary area of approximately 2,874 acres, 1,621 acres of which contain combined sewers. The theoretical dry weather flow in this tributary area was determined to be approximately 14.6 MGD. The actual dry weather flow was found to be 27.2 MGD during dry weather months and 31.6 MGD during wet weather months. Therefore, it has been determined that the infiltration in this tributary area ranges from about 12.6 to 17 MGD, compared with theoretical flows.

Under storm flow conditions, it was found that this overflow is activated with essentially every rain.

The Clay Street overflow chamber is an outlet for the largest combined sewer system and drainage area tributary to the Passaic Valley interceptor sewer. The discharge is into the Passaic River at a point opposite Clay Street.

Depth measurement facilities were installed in the Clay Street overflow chamber and were maintained in service from a period beginning September 13, 1974 through September 21, 1975. During this period of time, rainfall was measured on 70 occasions. Overflow was determined, therefore, to have occurred approximately 56 times or about 80 percent of the time. No overflow occurred when rainfall was very light and of short duration, with intensities of approximately 0.01 to 0.04 inches per hour. However, at intensities generally of about 0.06 inches per hour or more, overflow occurred. An examination of the records of rainfall will indicate that a majority of the rainfall intensities during the period of observation ranged from about 0.05 to as high as 1.8 inches per hour and, under these conditions, overflow occurred. During the period of study, it was observed that the manual control of overflow at this chamber was required on approximately 18 to 20 occasions.

The Clay Street overflow chamber is required to be manually controlled to increase the overflow which would otherwise occur under automatic operation in order to prevent surcharge and damage in the collection system.

During the period of observation and study, it was observed that the volume of overflow under automatic conditions approached 50 million gallons, while occurrences of 10 million gallons were not uncommon. The peak rate of discharge was found to be in excess of 300 MGD on two separate occasions.

Since this chamber must be manually controlled, the closing of the valve results in the discharge of all tributary flow into the Passaic River. Measurements were, therefore, taken to establish both peak flow rates and volume of overflow under these conditions. As a result of the closing of the valves, the volume of overflow ranged from 25 million gallons to 45 million gallons on many occasions. The peak flow rates were likewise higher when the valve was closed and these were found to be in excess of about 50 percent greater than what would occur under automatic conditions of overflow--200 MGD in lieu of 120 MGD, and 220 MGD in lieu of 140 MGD.

At the Clay Street overflow chamber, surcharge was observed in the outfall line at such times as high tide and high river stages occurred in the Passaic River. Under these conditions, the backwater from the Passaic River controlled the volume of overflow which would otherwise occur at this chamber. At no time was inflow or river water intrusion observed at this chamber.

The quality of the overflow was also determined by automatic sampling during some of the overflow occurrences. In general, it was observed that there was an extreme variation in the quality of the overflow, but the quality was considered to be very objectionable because of the high BOD, high TSS, and high COD, all of which are attributed in great part to the heavy concentration of industrial waste. For example, the average BOD in the overflow ranged from 124 mg/1 to as high as 275 mg/1. Peak concentrations of individual samples almost as high as 700 mg/1 were not uncommon. The COD ranged from about 276 mg/1 to as high as 879 mg/1. The suspended solids ranged from about 125 mg/1 to as high as 960 mg/1. The wide range in storm water overflow quality is attributed to the flushing effect which occurs in the initial sampling, during periods of high storm flow runoff, and the high concentration of industrial and sanitary wastes in the tributary area.

It will be noted that approximately 1300 acres are tributary from the City of East Orange, and this increment of flow is strictly sanitary sewage. The major portion of the Newark area (90 percent) has combined sewers and the balance in the City in this district is separate sanitary sewer lines.

Based upon the observations at this overflow chamber, it appears that 46 to over 60 overflows per year can be anticipated at this location--depending upon the number of times, of course, that rainfall occurs. It appears that overflow is likely to occur approximately 66 percent of the time that rainfall occurs.

SAYBROOK PLACE OVERFLOW CHAMBER

The Saybrook Place overflow chamber serves a tributary area of 306 acres, all of which are provided with a combined sewer system.

The theoretical dry weather flow in this tributary area was determined to be approximately 1.5 MGD. The actual dry weather flow was found to range from about 4.8 to 4.9 MGD. From the above, it appears that the infiltration in this district is approximately 3.4 MGD.

Under storm flow conditions in the collection system, it was found that the overflow was activated with essentially most rainfalls of even moderate intensity.

The Saybrook Place overflow chamber is required to be manually controlled to increase the overflow which would otherwise occur under automatic operation in order to prevent surcharge and damage in the collection system.

Metering and sampling facilities were installed and maintained in this chamber from January 8, 1975 to June 29, 1975. During this period of time, 47 periods of rainfall occurred. The total rainfall ranged from about 0.04 to 1.85 inches. During this period of observation, 23 overflows were measured or determined to have occurred. It was found that, when the average rainfall intensity approached or exceeded about 0.05 inches per hour for a long duration, overflow was likely to occur. Thus, overflows occurred about 50 percent of the time.

It was observed that the volumetric overflow ranged from 0.2 to 8.1 MG per rainfall occurrence. Peak overflow rates were found to be as high as 89 MGD.

It is estimated that overflow will occur from 35 to 45 times at this chamber, based upon rainfall occurrences ranging from 70 to 90 times per year.

Sampling during dry weather periods indicated that the total suspended solids ranged from 41 mg/1 to 196 mg/1, with BOD ranging from 61 mg/1 to 340 mg/1.

The results of the sampling indicated that the storm water concentration was not too severe, with BOD values ranging from about 16 mg/1 to as high as 228 mg/1. The Total Suspended Solids (TSS) were found to range from a low of 48 mg/1 to a peak of 460 mg/1, which was indicative of concentrated pollution due to flushing action.

The Saybrook Place overflow chamber serves an area which is primarily domestic sewage with industrial waste (about 40 percent of flow) connected to this system.

Some surcharge from high tide at the Saybrook Place overflow chamber was observed. In this chamber, infiltration or river water intrusion was observed in the initial stages of this study. However, this has been corrected by the staff of the PVSC. The result of surcharges at this chamber under high tide conditions is to reduce the freedom of overflow which would occur under either automatic operation or manually operated valve operation, resulting in the surcharge of the PVSC interceptor sewer line.

RECTOR STREET OVERFLOW CHAMBER

This overflow chamber serves a tributary area of approximately 177 acres. The collection system in this district is a combined sewer. The theoretical average daily flow was found to be 1.3 MGD. Metering of the system flow indicated average daily dry weather flow to be 1.9 MGD. This appears to indicate a relatively constant infiltration rate of about 0.6 MGD year-round.

Metering and sampling facilities were installed in this chamber from January 25, 1975 to August 7, 1975, during which time 48 rainfall occurrences were measured or observed. Thirty-one overflows were measured or observed which is indicative of 65 percent probability of overflow during periods of rainfall. It was further estimated that from 70 to 90 rainfall occurrences are likely in the average year which will cause overflows at this chamber.

The volume of overflow ranged from about 0.1 MG to 7.9 MG. However, by operating the flap gates, this chamber, like others in the City of Newark, is regulated to prevent system surcharge. This gate or valve action results in an increase in the overflow that would occur under automatic operation. However, observations made during our period of study indicated that this was not a controlling factor at this overflow chamber. For example, the overflow measured at 1.9 MGD under automatic operation totaled 2.5 MGD on that occasion as a result of valve control. Peak flow rates were found to be fairly high at this overflow, ranging up to 68 MGD during periods of very intense rainfall.

The Rector Street overflow is sometimes influenced by high tide in the Passaic River. At periods of high tide in the Passaic River coincident with high overflows, a surcharge occurs which limits the outflow from the chamber and tends to increase the flow into the interceptor sewer. It was never observed that surcharge conditions caused infiltration of the Passaic River into this chamber.

Sampling during dry weather periods indicated that suspended solids ranged from 38 mg/1 to 410 mg/1, and BOD ranged from a low of 11 mg/1 to 189 mg/1.

An analysis of the overflow waste characteristics indicated that the BOD ranged from about 40 mg/1 to over 200 mg/1. Samples representative of total suspended solids were obtained in this chamber, and ranged from a low of 42 mg/1 to a high of 279 mg/1. It was observed that the overflow was typical and indicative of dilute domestic sewage.

FOURTH AVENUE OVERFLOW CHAMBER

The Fourth Avenue overflow serves a tributary area of approximately 225 acres, all of which contain combined sewers. The theoretical dry weather flow in this tributary area was determined to be approximately 1.0 MGD. The metered dry weather flow was found to be 1.60 to 1.95 MGD during the dry weather months and wet weather months, respectively. Therefore, the infiltration in this tributary area ranges from about 0.6 to 0.9 MGD.

Measurements were made at this overflow chamber beginning on December 31, 1974, and extending through July 31, 1975. During this period of time, rainfall was measured on 56 occasions. Overflow was determined to have occurred approximately 46 times. Overflow was found to occur with rainfall intensities of approximately 0.05 to 0.07 inches per hour.

An examination of the records of rainfall indicates that the overflow ranged from 0.1 to 4.7 million gallons during the period of observation, where peak overflow rates were found to be as high as 62 MGD.

It is estimated that overflows will occur from 55 to 70 times at this chamber, based upon rainfall occurrences ranging from 70 to 90 times yearly.

This overflow chamber is an actively operated and controlled overflow chamber because of the necessity to avoid further surcharge of the interceptor sewer at critical time periods. The time duration of the overflows was not found to be excessive and, in general, was limited to the hours of rainfall when automatic overflow occurred. Likewise, the manual operation to control overflow was found to be for limited time periods, and generally as required to minimize system surcharge.

Samples of the sewage taken during the dry weather periods indicated that suspended solids ranged from less than 10 mg/l to about 80 mg/l, while BOD concentrations ranged from 17 mg/l to 282 mg/l.

Collected samples of the overflow indicated the following wastewater characteristics: BOD values ranged from 22 to 150 mg/l; TSS values ranged from 150 to 273 mg/l. This collection area is primarily residential in nature.

HERBERT PLACE OVERFLOW CHAMBER

The Herbert Place overflow chamber serves a tributary area of approximately 298 acres. This drainage area is served with combined sewers, and the theoretical average daily dry weather flow was determined to be 1.1 MGD. Measurements of the dry weather flow in the collection system indicated that the average daily flow was 1.2 MGD to 1.85 MGD during wet weather months. This indicated an infiltration of approximately 0.1 to 0.7 MGD in the collection system.

Metering facilities were installed in this chamber and were in service from December 31, 1974 through June 29, 1975. During this period of time, 49 rainfall occurrences were observed and 31 overflows occurred, or about 63 percent of the time.

Overflows were found to occur whenever the rainfalls were about 0.05 inches per hour, with durations of 10-12 hours. At this overflow chamber, the volume of overflow was found to range from about 0.1 to 3.0 MGD under automatic overflow conditions. However, this chamber, when manually controlled, resulted in increased overflow which was found to be as high as 4.9 MGD. This overflow chamber is an actively operated and controlled overflow chamber because of the necessity to avoid further surcharge of the interceptor sewer at critical time periods. The time duration of the overflows was not found to be excessive and, in general, was limited to the hours of rainfall when automatic overflow occurred. Likewise, the manual operation to control overflow was found to be for limited time periods, and generally as required to minimize system surcharge.

The peak rates of flow in this overflow chamber were found to be fairly high, approaching 100 MGD on several occasions, with a maximum of 110 MGD.

Sampling during dry weather periods indicated that suspended solids ranged from 134 mg/1 to over 300 mg/1; BOD concentrations ranged from 99 mg/1 to about 245 mg/1.

The overflow characteristics indicated that the BOD ranged from a low of 17 mg/1 to over 200 mg/1. Suspended solids ranged from a low of 38 mg/1 to a high of 479 mg/1. It was apparent from the results of the sampling and testing that flushing or self-cleansing action resulting from peak storm flow rates resulted in high pollutional loadings for short time periods.

POLK STREET OVERFLOW CHAMBER

The Polk Street overflow chamber serves a tributary area of approximately 199 acres. This area is served with combined sewers. The theoretical average daily flow in the district was determined to be 1.3 MGD. Measurements indicated the average daily flow to be 1.6 MGD. This indicates an infiltration of only about 0.3 MGD.

Metering and sampling facilities were installed and maintained in this overflow chamber from February 2, 1975 through August 7, 1975. During this period of time, 44 rainfalls occurred. Overflows were measured or observed on 28 occasions. Overflows were found to occur whenever the rainfalls were in excess of about 0.07 inches per hour provided that there was no tidal effect upon the outfall. The overflow from this chamber was generally controlled by the high tide in the Passaic River. High river stages resulted in surcharge which closed the tide gates and prevented outflow from the chamber on many occasions during periods of rainfall. Subsequently, this overflow chamber is not typical of most which have a fairly free outlet in the City of Newark. The Polk Street outlet, like the Freeman Street and Jackson Street outlets, is located in the downstream reach of the Passaic River and is closest to the treatment plant.

This overflow chamber is an actively operated and controlled overflow chamber because of the necessity to avoid further surcharge of the interceptor sewer at critical time periods. The time duration of the overflows was not found to be excessive and, in general, was limited to the hours of rainfall when automatic overflow occurred. Likewise, the manual operation to control overflow was found to be for limited time periods, and generally as required to minimize system surcharge.

However, during the period when overflow did occur at this chamber, it was found that the volume was not excessive and a peak measurement of about 3.5 MG was made. It appears that the storm flow in this district stores in the rather large combined sewer which passes through this chamber. Subsequently, most of this flow enters the PVSC system after the storm, and this occurs particularly when little overflow can occur from this chamber because of high tide conditions.

Peak storm flow rates of as high as 62 MGD were recorded, but these were of short-term duration, coincident with the period of intense rainfall.

It is estimated that overflow will occur from 45 to 60 times at this chamber, based upon rainfall occurrences ranging from 70 to 90 times yearly.

Sampling of the sewage during the dry weather periods indicated that suspended solids ranged from less than 10 mg/1 to 182 mg/1, and BOD concentrations from 73 mg/1 to 677 mg/1.

The overflow waste characteristics were indicative of typical domestic sewage with the effective dilution indicated by low BOD's of 2[illegible] mg/1 and as high as 144 mg/1. No reliable readings were obtained of the suspended solids, but visual observations indicated fairly dilute overflows at this chamber.

CITY DOCK OVERFLOW CHAMBER

The City Dock overflow chamber serves a tributary area of approximately 380 acres. This area is served by combined sewers and the theoretical average daily flow is approximately 2.2 MGD. Measurements in the system indicated that the average daily dry weather flow was 9.8 MGD during dry weather months and about 11.7 MGD during wet weather months. This extreme variation of over 7 to 9 MGD daily is indicative of severe infiltration into the system, which warrants immediate investigation.

Metering and sampling facilities were installed in this chamber from December 31, 1974 through July 21, 1975. During the period that this chamber was studied, rainfall occurred 56 times. Overflows were measured or observed on 35 occasions. In this chamber, infiltration or river water intrusion in the chamber was observed in the initial stages of this study. However, this has been corrected by the staff of the PVSC. It was found that this chamber was affected by high tides in the Passaic River. No overflow occurred from this chamber at such times as the high tide in the river caused backwater which completely closed the tide gates. The closing of the tide gates resulted in equalized flow on either side of the tide gates as the surcharged and stored combined sewer flow in the PVSC interceptor sewer reached equilibrium, commensurate with the ability of the pumps at the treatment plant to pump these unusually high storm flows.

The observations at this overflow chamber indicated that when overflow does occur (low tide conditions in the Passaic River), this condition approximates 3.4 MG. Peak discharge rates in excess of 100 MGD were measured during periods of fairly intense rainfall conditions (0.26 inches per hour).

It is estimated that overflows will occur at this chamber from 45 to 55 times based upon rainfalls occurring from 70 to 90 times yearly.

Sampling of the sewage during dry weather periods indicated that suspended solids ranged from less than 10 mg/1 to 670 mg/1, with BOD values ranging from less than 10 mg/1 to 439 mg/1.

The results of the storm sampling indicated that the waste concentration of the average BOD ranged from about 25 to 410 mg/1. The suspended solids were found to range from about 17 to 841 mg/1.

FREEMAN STREET OVERFLOW CHAMBER

The Freeman Street overflow chamber serves a tributary area of approximately 149 acres. This drainage area is also provided with combined sewers. The theoretical average daily dry weather flow in this district was determined to be 0.5 MGD. Measurements of the dry weather flow resulted in readings of 1.0 MGD to about 1.2 MGD. Therefore, the infiltration appears to be excessive, ranging from 0.5 to 0.7 MGD. This district is 75 percent residential and about 25 percent industrial in terms of flow contributions.

Metering and sampling facilities were installed in this chamber from February 23, 1975 to April 26, 1975. Fourteen rainfalls were measured and overflows were determined to have occurred on only five occasions. The reason for this low overflow frequency is that the period of observation was one in which the rainfalls were relatively low, except for two storms.

Overflows were found to occur whenever the rainfalls were in excess of about 0.06 to 0.07 inches per hour.

This overflow chamber, like Polk Street, is affected by high tide conditions in the Passaic River. The resultant backwater prevented overflow on numerous occasions, and this was observed during the period of study.

Some tidal intrusion was observed during the initial stages of our studies, but by adjusting the overflow weir in the chambers and repairing the tide gates, the inflow from the Passaic River has been stopped.

This overflow chamber is an actively operated and controlled overflow chamber because of the necessity to avoid further surcharge of the interceptor sewer at critical time periods. The time duration of the overflows was not found to be excessive and, in general, was limited to the hours of rainfall when automatic overflow occurred. Likewise, the manual operation to control overflow was found to be for limited time periods, and generally as required to minimize system surcharge.

Peak flow rates of up to 16 MGD were recorded at times when high tides were not prevalent during a rainfall, resulting in an overflow volume of only about 2.4 MG.

Sampling of the sewage during the dry weather periods indicated that total suspended solids ranged from less than 10 mg/l to 388 mg/l, and BOD concentrations ranged from 17 mg/l to 539 mg/l.

The overflow waste characteristics indicated that the average BOD ranged from about 63 mg/l to 359 mg/l. The suspended solids were found to be fairly high, with readings ranging from a low of 225 mg/l to a high of 690 mg/l, indicative of the flushing action resulting from high storm flows in the collection system.

VERONA AVENUE OVERFLOW CHAMBER

The Verona Avenue overflow chamber serves a tributary area of 367 acres. This area is provided with combined sewers, and the average daily dry weather flow was determined to be 1.4 MGD. The measured average daily dry weather flow was found to be 1.6 MGD during dry weather months and about 2.3 MGD during wet weather months. The high infiltration of approximately 0.9 MGD during wet weather months is indicative of typical combined sewer construction, with joints that are not tight and which permit infiltration.

Metering and sampling facilities were installed and maintained in this chamber from December 31, 1974, extending through June 29, 1975. During this period of time, 50 rainfalls occurred. Overflows were measured or observed on 36 occasions. Overflows were found to occur whenever the average rainfall intensity was in excess of about 0.05 inches per hour.

The overflow at this station was found to range from a low of only a negligible amount to a high of about 2.2 MG. A peak flow rate of 80 MGD was measured. This occurred during a period of extremely intense rainfall (1.9 inches per hour). However, under this condition, because of the short time duration, the overflow into the river was only 1.5 MG.

Dry weather sampling resulted in suspended solids averaging about 572 mg/l, and BOD concentrations averaging 418 mg/l.

Waste characteristics of the storm flow indicated that the average BOD ranged from about 163 mg/l to 333 mg.l. The suspended solids were found to range from a low of 11 mg/l to a high of 609 mg/l.

JACKSON STREET OVERFLOW CHAMBER

The Jackson Street Overflow serves a tributary area of approximately 83 acres. This area is provided with combined sewers. The theoretical average daily dry weather flow was determined to be approximately 0.5 MGD. Measured dry weather flow was found to be 1.0 MGD. This would indicate that the infiltration in this area is about 0.5 MGD.

Metering and sampling facilities were installed in this overflow chamber from May 1, 1975 through September 24, 1975. During this period of time, rainfall occurred on 35 occasions. The overflows which occurred at this chamber were controlled by the high tides in the Passaic River. During periods of high tide when the outfall line was surcharged, the tide gates were closed, resulting in no overflow on the majority of these occasions when rainfall occurred. Overflow only occurred when the tide level was low and a free outlet was provided from this chamber. Basically, the Jackson Street Overflow Chamber is operative only under limited and controlled low water conditions in the Passaic River, and the results observed at this chamber are similar to those found at Polk Street and Freeman Street.

Measurements under low tide conditions indicated that a peak discharge of approximately 0.6 MG did occur. Peak flow rates, however, as high as 67 MGD, were also measured. In general, it was found that overflow would occur under low tide conditions when rainfall intensity was in excess of about 0.07 to 0.08 inches per hour.

The Jackson Street overflow chamber is one of the few in the City of Newark system which is subjected to a potential of river water intrusion into the PVSC interceptor sewer system during periods of high tide, or high river stage in the Passaic River. During the early period of our study, it was found that river water entered through the tide gates and into the sewer under dry weather flow conditions. However, corrective action has been taken by the staff of the PVSC to eliminate this condition.

This overflow chamber is an actively operated and controlled overflow chamber because of the necessity to avoid further surcharge of the interceptor sewer at critical time periods. The time duration of the overflows was not found to be excessive and, in general, was limited to the hours of rainfall when automatic overflow occurred. Likewise, the manual operation to control overflow was found to be for limited time periods, and generally as required to minimize system surcharge.

Samples taken during dry weather flow periods indicated that suspended solids ranged from about 52 mg/l to 368 mg/l, with BOD concentration ranging from a low of 66 mg/l to 339 mg/l.

Samples of the overflow were collected at this chamber. The results indicated a rather dilute overflow, with BOD ranging from about 50 to 75 mg/l, and TSS ranging from about 67 to 134 mg/l. This area appeared to have primarily domestic sewage and, as a result, the readings which were obtained are typical of a dilute mixture of storm water and sanitary sewage.

PASSAIC STREET OVERFLOW CHAMBER

The Passaic Street overflow serves a tributary area of approximately 31 acres. This area is provided with combined sewers. The theoretical average daily flow in this district is 0.24 MGD. The measured average daily dry weather flow was found to be about 0.30 to 0.34 MGD. It has been determined that the infiltration in this tributary area is only about 0.1 MGD.

During the period of study, measurements were made of rainfall and overflow from the period commencing July 6, 1975 through October 18, 1975. During this period of time, rainfall occurred on eleven occasions. It was observed that overflow at this chamber was affected by the high tide conditions in the Passaic River. No overflow occurred when the tide was high under storm flow conditions, where the backwater resulted in closing of the tide gates.

However, measurements taken under low tide conditions indicated that overflows ranged up to 0.4 MG, with peak rates of 10.0 MGD.

Samples taken during dry weather flow periods indicated that suspended solids ranged from 42 mg/l to 240 mg/l, while BOD concentrations ranged from 12 mg/l to 191 mg/l.

Samples were taken of the overflow to establish typical wastewater characteristics. The average BOD was found to range from about 44 to 55 mg/l, and TSS from about 268 to 293 mg/l. This district is primarily industrial, but the results of the overflow sampling do not reflect a major pollutional loading. This condition may be attributed to the fact that high dilution prevailed during the period of sampling and testing.

It has been observed at this station that overflow under low tide conditions can occur even under dry weather flow. This is attributed to the fact that peak industrial discharges result in surcharging of the chamber and resultant overflow. This condition was observed on one occasion when no rainfall occurred. While the overflow was not substantial in volume, nor were the waste characteristics extremely severe, it does appear that this condition should be corrected by further study and investigation.

ORANGE STREET OVERFLOW CHAMBER

The Orange Street overflow serves a drainage area of approximately 13 acres. The dry weather flow in the collection system was found to be negligible and no measurements were made.

Metering was not conducted at this chamber and observations made during storms indicated no overflow that could be measured.

Samples taken of the flow during dry weather flow periods indicated that suspended solids ranged from less than 10 mg/1 to only about 72 mg/1, with one reading of 164 mg/1. Dry weather BOD values ranged from less than 10 mg/1 to only about 36 mg/1. These concentrations are indicative of very dilute sewage.

Samples taken of the storm water flow in the pipeline showed the BOD to average only 26 mg/1 and the suspended solids to average less than 100 mg/1. This district is relatively small and the overflow can, in effect, be eliminated.

BRIDGE STREET OVERFLOW CHAMBER

The Bridge Street overflow serves a tributary area of approximately 10 acres. While this district was served initially with a combined sewer system, separation by the installation of storm sewers in this district has resulted in a condition where no overflow now occurs.

The theoretical average daily flow in this area was found to be essentially negligible. Likewise, the average daily flow under dry weather conditions was found to be so low that it could not be measured accurately.

Metering facilities were installed in this chamber during the period June 5, 1975, through August 6, 1975. During this time, rainfall occurred on at least 16 occasions. The rainfall intensity was particularly severe during the period of observation, namely, ranging from 0.3 inches per hour to as high as 1.3 inches per hour. Despite this severe rainfall, no overflow occurred at any time during the study and observation of this chamber. Consequently, with no overflow, no sampling of any overflow was possible.

Sampling of the dry weather flow indicated that suspended solids ranged from less than 10 mg/1 to 404 mg/1 with BOD concentrations ranging from about 25 mg/1 to about 423 mg/1.

Sampling was undertaken of the flow in the system sewer to determine the wastewater characteristics during storm flow conditions. The results indicate that the BOD averaged 153 mg/1, and that the suspended solids averaged 275 mg/1. This range of values would appear to be indicative of the fact that very little storm water inflow is entering the system at the present time. This district is relatively small and the overflow can, in effect, be eliminated.

DELAVAN AVENUE OVERFLOW CHAMBER

The Delavan Avenue overflow serves a tributary area of approximately 88 acres. This district is served with combined sewers. The theoretical average daily flow in the district was determined to be 0.22 MGD. The average daily flow in this district was found to range from 0.2 to 0.4 MGD. Infiltration appears to be servere during the wet weather months, ammounting to 0.2 MGD.

Metering facilities were installed in this chamber from July 12, 1975, through September 9, 1975. During this period of time, at least eight rainfalls occurred with most rainfalls of very substantial intensity. However, no overflow was observed. As a result, a further investigation was made of the upstream collection system, and it was found that an overflow facility located within the City of Newark upstream of this chamber was activated during periods of rainfall. Such overflow is discharged into the Passaic River near Delavan Avenue. This overflow is one of approximately fourteen overflows located within the City of Newark which require additional study to determine the volume and the effect of this pollutional loading upon the Passaic River.

Samples were taken of the dry weather flow which indicated that total suspended solids ranged from less than 10 mg/l up to 320 mg/l, with BOD concentrations varying from a low of 21 mg/l up to 217 mg/l.

Samples were taken of the flow in the sewer during periods of heavy rainfall. It was found that the BOD average was 19 mg/l, but the suspended solids were found to average 125 mg/l.

From the above, it appears that the dilution effect during this storm was apparent. This area is both residential and industrial and the characteristics of the waste under storm flow conditions indicate that serious pollution does not occur. As a matter of fact, no overflow occurs at Delavan Avenue, and the resultant storm overflow from this district must be established from existing overflows within the City system.

THIRD AVENUE OVERFLOW CHAMBER

The Third Avenue overflow serves a very small area of only eight acres. The flow in this system is negligible and could not be measured.

Metering facilities were installed within the chamber to determine the extent and duration of any overflow. These facilities were maintained from June 5, 1975 through September 24, 1975. During this period of time, rainfall occurred on at least 17 occasions.

No overflow was observed. This is attributed to the fact that the drainage area is extremely small. The catch basins appeared to be clogged and prevented the entry of large amounts of storm water into the combined sewer system, and most of the runoff in the district is overland with direct discharge into the Passaic River.

Samples taken during the dry weather flow indicated that suspended solids ranged from 144 mg/1 up to 650 mg/1, with BOD values ranging from 162 mg/1 up to 715 mg/1.

A sample was taken of the flow under storm flow conditions. The BOD was found to average 146 mg/1 and the suspended solids to average approximately 150 mg/1. This district is relatively small and the overflow can, in effect, be eliminated.

UNION OUTLET OVERFLOW CHAMBER

The Union Outlet Overflow Chamber serves a total tributary area of 10,227 acres. The collection area, comprising nine municipalities either totally or in part, is served entirely by separate sanitary sewers. The municipalities involved and their respective tributary areas are tabulated below:

MUNICIPALITY	TRIBUTARY AREA (ACRES)
Montclair	3,960
Bloomfield	2,781
Orange	1,190
Belleville	647
Glen Ridge	838
East Orange	325
Newark	246
West Orange	200
Little Falls	40
TOTAL	10,227

The aggregate dry weather flow tributary to the Union Outlet Chamber was found to vary from 16.80 MGD to 20.34 MGD, reflecting the seasonal change of the relative ground water table. From the foregoing, it is evident that a high rate of infiltration exists in the Union Outlet Collection Area.

The location of the Union Outlet overflow is shown on Plate 4, to be found on page 124 in the section on Newark Area Overflows.

The overflow chamber is manually operated, and is activated only when necessary to prevent flooding, which would result in extensive damage through surcharge of the PVSC facilities and overload at Newark Bay Pumping Station.

Observations of this overflow were made for the period from October 1, 1974 to October 1, 1975. During this period, 81 rainfalls occurred, for which activation of the overflow was necessitated on 36 occasions.

The volumetric overflow discharged into the Passaic River ranged from a minimum of 2.0 MG to a maximum of 128.3 MG, per occurrance. The total volume discharged into the river, during the observation period, amounted to 595 MG. The estimated peak rates of overflow ranged from 30 MGD to 80 MGD.

It has been estimated that it may be necessary to activate the Union Outlet overflow from 30 to 40 times per year with rainfall occurrences ranging from 70 to 90 times per year.

Samples were obtained of the dry weather flow, and the results were indicative of typical domestic sewage. The TSS concentrations were found to range from 20 mg/1 to 348 mg/1, with an average of 174 mg/1. The BOD concentrations were found to range from 89 mg/1 to 680 mg/1, with an average of 358 mg/1.

Sampling results of the overflow indicated characteristics somewhat more severe than the dry weather sampling. The TSS concentrations were found to range from 133 mg/l to 327 mg/l, with an average of 217 mg/l. The BOD concentrations were found to range from 15 mg/l to 434 mg/l, with an average of 227 mg/l. From the foregoing, it is evident that minimal storm water dilution of the sewage is present in the overflow from Union Outlet, resulting in highly polluting overflow into the Passaic River.

XG 158-191

REPORT UPON

OVERFLOW ANALYSIS

TO

PASSAIC VALLEY SEWERAGE COMMISSIONERS

PASSAIC RIVER OVERFLOWS

KEARNY - HARRISON - EAST NEWARK AREA

1976

ELSON T. KILLAM ASSOCIATES, INC.
Environmental and Hydraulic Engineers
48 ESSEX STREET MILLBURN NEW JERSEY 07041

5

KEARNY-HARRISON-EAST NEWARK AREA OVERFLOWS

Extent of Area and Peak Overflow Rates

Sixteen active overflows were observed and studied in the Kearny-Harrison Area (two other overflows location in North Kearny on the Kearny-North Arlington Branch interceptor are reported upon with the overflows in the "middle" area of the system). There are no inactive overflows in the Kearny-Harrison Area.

These overflows are located along the PVSC branch interceptor sewers adjacent to the Passaic River in this area. The branch interceptor sewers in the Kearny-Harrison Area extend a distance of approximately 4.4 miles (see Plate 5).

The sixteen active overflows serve a total tributary area of approximately 1,650 acres, most of which is served by combined sanitary and storm sewer systems. However, this area also has separate sanitary and storm sewers interwoven with combined sewers throughout the area. The capacity of the combined sewer system in these districts has been estimated to be approximately 604 Million Gallons per Day (MGD).

The measured average daily dry weather flow in the combined sewer systems in the Kearny-Harrison Area was found to be about 10.3 MGD.

During wet weather months, when the ground water table is high, the average daily dry weather flow (when no rainfall occurs) was found to be approximately 13.4 MGD. This indicates that ground water infiltration of approximately 3.1 MGD prevails in the collection system of the Kearny-Harrison Area. This infiltration is attributed to the combined sewer system, which was constructed so as to permit ground water entry into the pipeline.

The total estimated piping of combined sewers in the Kearny-Harrison Area which is served with combined sewers and which is tributary to the PVSC branch interceptor sewers, is approximately 62.3 miles or 329,000 linear feet. It has been estimated that the cost of construction of separate sanitary sewers for the Kearny-Harrison Area would be approximately $80 million. Each overflow collection area must be analyzed independently to determine the extent and relationship of the various separate sanitary, separate storm, and combined systems which exist interwoven in close proximity throughout the Kearny-Harrison area. In some cases, the best economic decision may be to continue to use the combined system for sanitary sewage only, disconnecting existing storm drainage inlets and reconnecting to new separate storm sewers. In other areas, the reverse situation may prevail, whereby all sanitary connections would best be reconnected to new sanitary sewers, and the existing combined system continued for usage as a storm sewer only. In order to effect a meaningful reduction in the infiltration through complete system separation, it may also be necessary to install new house connections extending from the street to the property line, if not all the way into the building structure, to assure that old-type building drainage systems with built-in ground water infiltration will have been eliminated from the collection system.

The sixteen overflow chambers in the Kearny-Harrison Area are served by drainage areas ranging in size from as little as six acres to as large as 607 acres. The aggregate capacity of the combined storm sewer pipelines which serve these tributary combined sewer areas has been estimated to be about 604 MGD. The estimated aggregate capacity of the overflow pipes from the chambers to the river has also been estimated to be 564 MGD. In other words, under conditions of an extensive storm which would inundate and surcharge the entire collection system, a flow of approximately 604 MGD or more could enter the sixteen overflow chambers, with the possibility of discharge into the river of about 564 MGD.

It will be noted that the branch interceptor sewer at the downstream or southerly terminus of the Kearny-Harrison Area has a carrying capacity of only about 28 MGD. It is obvious that this branch interceptor sewer is entirely inadequate to carry but a very small portion of the total storm flow potential from the combined sewers in the Kearny-Harrison Area.

Table 5 has been prepared to show the salient features of the sixteen overflows in the Kearny-Harrison Area located along the PVSC Kearny-Harrison branch interceptors. This table is entitled "Tabulation of Passaic Valley Sewerage Commissioners' Overflows in the Kearny-Harrison - East Newark Area." This table sets forth a tabulation of the overflow location, discharge permit number, the area tributary to each overflow chamber, the measured dry weather flow under seasonal con-

TABLE 5

TABULATION OF PVSC OVERFLOWS IN THE KEARNY-HARRISON-EAST NEWARK AREA

Overflow Location	Discharge Permit Number	Tributary Area (Acres)	% of Area with Combined Sewers	DRY WEATHER FLOW Dry Weather Months (MGD)	DRY WEATHER FLOW Wet Weather Months (MGD)	Estimated Maximum Storm Capacity (MGD)	Estimated Maximum Overflow Capacity to River (MGD)	Maximum Peak Recorded Overflow to River (MGD)	Maximum Overflow Observed (MG)
Ivy Street, Kearny	023/K-007	607	85	3.00	3.50	260.7	260.7	244.0	22.8
Johnston Ave., Kearny	022/K-006	207	80	0.63	0.80	167.0	122.3	112.0	13.5
Harrison Ave., Harrison	012/H-003	67	100	0.77	1.08	29.4	29.4	20.0	3.0
Bergen Ave., Kearny	024/K-008	110	90	0.62	0.72	22.7	22.7	29.0	2.6
Central Ave., E. Newark	008/E-001	26	100	0.14	0.27	43.4	43.4	61.6	1.2
New (Hamilton) St., Harrison	010/H-001	32	100	0.17	0.33	6.9	6.9	18.0	1.1
Dukes Street, Kearny	026/K-010	25	100	0.17	0.20	9.6	8.7	6.5	0.8
Bergen Street, Harrison	015/H-006	72	100	0.83	1.13	11.0	10.9	16.7	0.5
Middlesex St., Harrison	014/H-005	62	100	0.72	0.98	5.8	5.8	12.6	0.5
Marshall Street, Kearny	021/K-005	24	100	0.09	0.12	2.8	2.8	5.0	0.4
Dey Street, Harrison	013/H-004	6	100	0.09	0.12	1.7	1.7	8.0	0.3
Cleveland Ave., Harrison	011/H-002	11	100	0.14	0.19	6.6	9.8	12.2	0.3
Tappan Street, Kearny	025/K-009	35	100	0.35	0.41	9.5	6.0	8.7	0.2
Bergen Ave., Kearny	019/K-003	12	10	0.05	0.06	10.1	21.0	2.4	0.1
Nairn Avenue, Kearny	020/K-004	176	85	0.54	0.69	8.3	2.6	2.6	Negligible
Worthington Ave., Harrison	016/K-004	177	95	2.02	2.80	9.0	9.0	9.0 Est.	1.0 Est.
TOTAL		1,649		10.33	10.40	604.5	563.7	568.3	48.3

ditions, the estimated capacity of the combined sewers tributary to these areas, the estimated overflow capacity from these chambers to the river, and finally the observed recorded peak flow rates and estimated volume of discharge into the Passaic River.

Overflow Measurements

During the period of observation and study of each of the overflow chambers, approximately 20 to 45 rainfalls were observed. Depth recording gauges were installed in essentially all of the chambers, and measurements and observations of overflow were made, including sampling.

The results of these studies and measurements indicate that the maximum recorded overflow to the river from the sixteen chambers during this period of study was at the peak rate of approximately 568 MGD. However, this overflow rate was of short-term duration and does not reflect the volume of overflow discharged into the river.

The volume of overflow from the sixteen overflow chambers was determined to be about 48 Million Gallons (MG) during this period of observation and study under the maximum storm flows observed (not all simultaneously).

It would appear from the results of this study that overflow does occur at approximately fifteen overflows whenever the rainfall approaches or exceeds 0.04 inches per hour. A very negligible overflow was observed or measured at two overflow chambers (Nairn Avenue and Bergen Avenue - 019/K-003).

It was found that the overflow rates of discharge were of short-term duration and generally responded directly to the rainfall. In other words, the overflows generally ceased, following the cessation of rainfall. Likewise, overflows occurred shortly after the onset of rainfall and at such times that the intensity exceeded about 0.04 inches per hour.

The aggregate overflow to the Passaic River in the Kearny-Harrison Area under maximum storm flow conditions observed was somewhat less than anticipated. Based upon the observations and studies, it is possible, however, to make some projections of what the overflow might be under more severe rainfall conditions than observed during the period of study. An attempt has been made to do this in the overflow chambers which are considered to be most critical in the collection system.

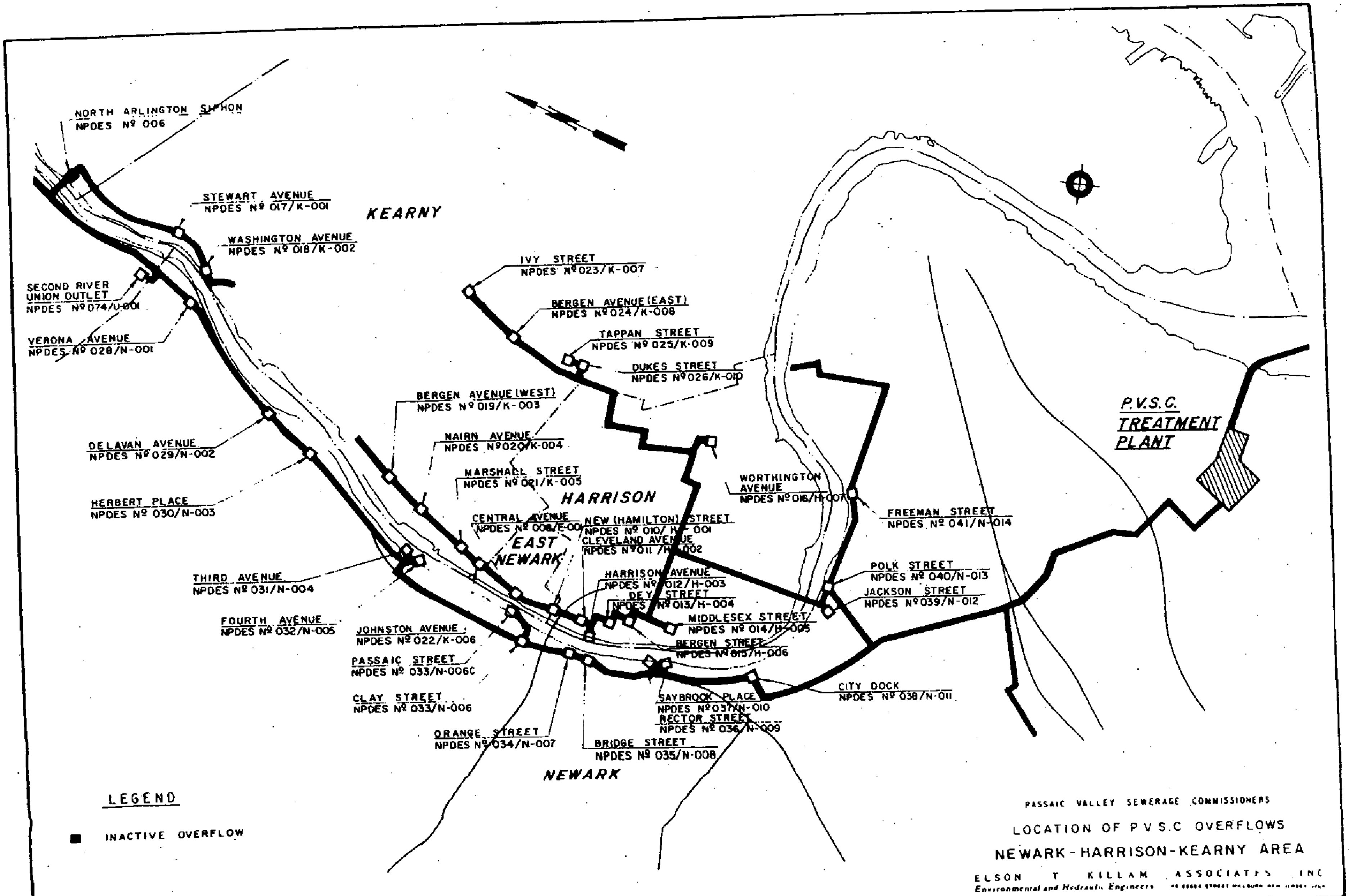
The most important overflows located within the Kearny-Harrison Area which are tributary to the Passaic Valley branch interceptor sewers are located at Ivy Street and Bergen Avenue on the east branch, and at Johnston Avenue and Harrison Avenue on the west branch. Ivy Street is, by far, the most important and critical overflow because of its large tributary area. It has been estimated that the outlet pipe from Ivy Street has a carrying capacity of about 260 MGD. The estimated capacity of the incoming combined sewer which flows through this chamber is approximately 260 MGD. Thus, with periods of heavy rainfall, it is apparent that discharges of high frequency and fairly large volume must occur at this overflow chamber.

The location of the PVSC branch interceptor sewers and the sixteen overflow chambers along the Passaic River and its tributaries in the Kearny-Harrison area is shown on Plate 5.

Individual Overflow Chambers

A description has been prepared of each of the overflow chambers setting forth, in summary form, the results of the observations and study. These descriptions follow.

(991)



NORTH ARLINGTON SIPHON
NPDES Nº 006
STEWART AVENUE
NPDES Nº 017/K-001
KEARNY
WASHINGTON AVENUE
NPDES Nº 018/K-002
SECOND RIVER
UNION OUTLET
NPDES Nº 074/U-001
VERONA AVENUE
NPDES Nº 028/N-001
IVY STREET
NPDES Nº 023/K-007
BERGEN AVENUE (EAST)
NPDES Nº 024/K-008
TAPPAN STREET
NPDES Nº 025/K-009
DUKES STREET
NPDES Nº 026/K-010
BERGEN AVENUE (WEST)
NPDES Nº 019/K-003
DELAVAN AVENUE
NPDES Nº 029/N-002
NAIRN AVENUE
NPDES Nº 020/K-004
MARSHALL STREET
NPDES Nº 021/K-005
HARRISON
HERBERT PLACE
NPDES Nº 030/N-003
WORTHINGTON
AVENUE
NPDES Nº 016/H-007
FREEMAN STREET
NPDES Nº 041/N-014
P.V.S.C.
TREATMENT
PLANT
CENTRAL AVENUE
NPDES Nº 008/E-001
NEW (HAMILTON) STREET
NPDES Nº 010/H-001
CLEVELAND AVENUE
NPDES Nº 011/H-002
EAST
NEWARK
THIRD AVENUE
NPDES Nº 031/N-004
HARRISON AVENUE
NPDES Nº 012/H-003
DEY STREET
NPDES Nº 013/H-004
POLK STREET
NPDES Nº 040/N-013
JACKSON STREET
NPDES Nº 039/N-012
FOURTH AVENUE
NPDES Nº 032/N-005
JOHNSTON AVENUE
NPDES Nº 022/K-006
MIDDLESEX STREET
NPDES Nº 014/H-005
BERGEN STREET
NPDES Nº 015/H-006
PASSAIC STREET
NPDES Nº 033/N-006C
CLAY STREET
NPDES Nº 033/N-006
SAYBROOK PLACE
NPDES Nº 037/N-010
RECTOR STREET
NPDES Nº 036/N-009
CITY DOCK
NPDES Nº 038/N-011
ORANGE STREET
NPDES Nº 034/N-007
BRIDGE STREET
NPDES Nº 035/N-008
NEWARK
LEGEND
INACTIVE OVERFLOW
PASSAIC VALLEY SEWERAGE COMMISSIONERS
LOCATION OF P.V.S.C. OVERFLOWS
NEWARK-HARRISON-KEARNY AREA
ELSON T. KILLAM ASSOCIATES INC
Environmental and Hydraulic Engineers

PLATE 5

IVY STREET OVERFLOW CHAMBER, KEARNY

The Ivy Street overflow chamber serves a tributary area of approximately 607 acres which is the largest collection area among all of the Kearny-Harrison area overflows. Approximately 85 percent of this area is served with combined sewers and the balance is served with sepatate sanitary and storm sewers.

The dry weather flow was estimated to be approximately 3.0 MGD during dry weather months and 3.5 MGD during wet weather months. This is indicative of high infiltration from high ground water tables which is to be expected in a combined sewer system.

Under storm flow conditions, it was found that this overflow was active with essentially every rain. The overflow discharges into Frank's Creek and travels in this creek a distance of approximately one mile before entering the Passaic River.

Observations were started at this chamber on December 31, 1974 and extended through June 16, 1975. During the period of study, 45 rainfalls occurred. It has been estimated that overflows occurred on 32 occasions. It is also estimated that overflow will occur from 50 to 65 times per year at this chamber on the probability that rainfalls may occur 70 to 90 times per year. It was found that a rainfall intensity of only 0.02 inches per hour resulted in overflows, but with a rainfall duration of 16 or more hours.

The peak rate of overflow was found to be approximately 244 MGD. The overflow volume at this station was found to be as high as 23 MG.

Samples were taken of the sewage under dry weather flow conditions. An analysis indicated that the average BOD was approximately 258 mg/1 but the total suspended solids was only 100 mg/1.

Samples taken during storm flow conditions indicated a range of results for BOD from a low of 51 mg/1 to a high of 258 mg/1, while the suspended solids ranged from a low of 40 mg/1 to a high of 297 mg/1. The foregoing would appear to reflect the effect of dilution, except that the effect of flushing action is also indicated by the higher suspended solids.

JOHNSTON AVENUE OVERFLOW CHAMBER, KEARNY

The Johnston Avenue overflow serves a tributary area of approximately 207 acres. An estimated 80 percent of this area is served with a combined sewer system and the balance is served with separate sanitary and storm sewers.

The dry weather flow was estimated to be approximately 0.63 MGD during the dry weather months and 0.80 MGD during the wet weather months.

Metering and sampling equipment for this overflow chamber was in service beginning on December 31, 1974 and extending through June 16, 1975. During this period of metering and observation, 45 rainfalls occurred with observed or metered overflows on 33 occasions. In general, it was found that overflows would occur whenever the intensity of rainfall exceeded about 0.03 inches per hour. Based upon the observations, it is estimated that rainfall will occur at this station about 70 to 90 times per year, and that the number of overflows will range from 50 to 65 times. It was found that the overflow ranged as high as 13.5 MG. Peak flow rates as high as 112 MGD were measured.

It was found that backwater from the Passaic River entered this chamber and the sewer system during periods of exceptionally high tide. The staff of the PVSC has taken corrective action in order to reduce and eliminate this occurrence, which was of short-term duration.

Samples were collected of the dry weather flow at this chamber and the samples were found to be fairly dilute. The suspended solids averaged about 72 mg/1 and the BOD was 104 mg/1.

The storm water sampling also indicated a fairly dilute waste. The suspended solids was found to range from a low of 14 mg/1 to a high of 114 mg/1 and the BOD was found to range from a low of 30 mg/1 to a high of 86 mg/1.

HARRISON AVENUE OVERFLOW CHAMBER, HARRISON

This overflow chamber serves a relatively small area of only 67 acres. The area is provided entirely with combined sewers.

The estimated average daily flow was about 0.8 MGD during the dry weather months and it is estimated that it is about 1.1 MGD during wet weather months.

Metering facilities and automatic sampling equipment were installed in this chamber and observations made for a period extending from April 24, 1975 through June 6, 1975. During this period of time, rainfall occurred on eighteen occasions and it was determined that eleven overflows occurred. It is estimated that overflows at this chamber occur from 45 to 55 times per year, and that rainfalls occur on about 70 to 90 occasions per year. It was found that the average rainfall intensity required to cause overflow was approximately 0.04 inches per hour.

It was found that the peak rates of overflow ranged up to about 20 MGD, and that the overflow volume was as high as 3 MG.

Samples were taken of the wastes and it was found that under dry weather flow conditions the suspended solids were about 194 mg/1, and the BOD approximately 188 mg/1.

Under storm flow conditions, the suspended solids was found to range from a low of 69 mg/1 to a high of 260 mg/1 and BOD ranged from a low of 49 mg/1 to a high of 203 mg/1. It would appear, from the above, that the dilution effect resulted in a less concentrated effluent under storm flow conditions.

BERGEN AVENUE OVERFLOW CHAMBER, KEARNY

This overflow chamber serves a tributary area of 110 acres. Approximately 90 percent of this area is served with combined sewers with the balance of the area served by separate sanitary and storm sewers. This overflow is located at the easterly end of Bergen Avenue.

It has been estimated that the dry weather flow is approximately 0.62 MGD. The estimated flow during wet weather months is about 0.72 MGD. This overflow discharges into Frank's Creek.

During the period of study and observation, which extended from January 6, 1975 through July 21, 1975, rainfall occurred on 54 occasions. It has been estimated that overflow occurred at this chamber on 40 occasions during this period. It has been estimated that overflows will occur at this chamber from 50 to 70 times per year on the assumption that rainfalls will occur from 70 to 90 times per year. The peak overflow rates were found to be as high as 32 MGD, and the volume of overflow was found to be as high as 2.6 MG.

Samples taken of the dry weather flow indicated that the average suspended solids was about 68 mg/1 and the BOD averaged approximately 139 mg/1. Under storm flow conditions, it was found that while the BOD ranged from a low of 47 mg/1 to a high of 57 mg/1, the suspended solids ranged from a low of 260 mg/1 to a high of 282 mg/1. This clearly reflects the effect of flushing under high flow and high velocity conditions in the combined sewer system.

CENTRAL AVENUE OVERFLOW CHAMBER, EAST NEWARK

This overflow chamber serves a very small drainage area, namely, 26 acres. The area is served with combined sewers. The average daily flow has been estimated to be only 0.14 MGD under dry weather flow conditions, but as high as 0.27 MGD during the wet weather months.

Metering and sampling facilities were installed in this chamber and were maintained during the period extending from April 24, 1975 through June 6, 1975. During this period of time, rainfalls occurred on seventeen occasions. It has been estimated or found that overflows occurred on twelve occasions. It has also been estimated that overflows will occur at this chamber approximately 50 to 65 times per year, based on rainfalls occurring from 70 to 90 times per year.

It was found that the average rainfall intensity required to cause overflow ranged from about 0.04 to 0.05 inches per hour, for a rainfall duration of about 8 hours or longer.

The peak rate of overflow was found to be about 62 MGD. The total volume of discharge was found to be as high as 1.2 MG.

It was found that backwater from the Passaic River entered this chamber and the sewer system during periods of exceptionally high tide. The staff of the PVSC has taken corrective action in order to reduce and eliminate this occurrence, which was of short-term duration.

The sample of the dry weather flows indicated an unusually dilute waste. The suspended solids was found to be only 60 mg/1 as an average, and BOD was found to average only 47 mg/1.

The storm flow conditions indicated that the suspended solids and BOD again were relatively low, the former being found to range from a low of 36 mg/1 to a high of 103 mg/1, and the latter ranging from a low of 34 mg/1 to a high of 88 mg/1.

NEW (HAMILTON) STREET OVERFLOW CHAMBER, HARRISON

This overflow chamber serves a tributary area of only 32 acres. It is provided with combined sewer facilities.

The estimated average daily dry weather flow is about 0.17 MGD and during wet weather months, it was estimated to be 0.33 MGD. This is an unusually high flow and is indicative of high infiltration in this small collection system (0.16 MGD).

Metering facilities and sampling equipment were installed in this chamber during the period May 12, 1975, and extending through July 6, 1975. During this period of time, rainfall occurred on seventeen separate occasions. It has been estimated that overflows occurred at this chamber on thirteen occasions. It has also been estimated that overflows will occur at this chamber about 55 to 70 times per year when rainfalls occur about 70 to 90 times per year.

It was found that the rainfall intensity required to cause overflow was about 0.07 inches per hour. The peak overflow rate as this chamber was found to be as high as 18 MGD. The volume of overflow, under the worst recorded storm conditions, was found to be about 1.1 MG.

Samples of the dry weather flow indicated suspended solids averaged about 191 mg/1, and BOD concentrations averaged 138 mg/1.

Samples taken during a storm flow condition indicated a range of BOD from a low of 47 mg/1 to a high of 66 mg/1, and a range of suspended solids from a low of 106 mg/1 to a high of 326 mg/1. It would appear from the above that the suspended solids during the storm flow period reflects flushing action from the peak storm flow rates. The BOD reflects the effect of pollution.

DUKES STREET OVERFLOW CHAMBER, KEARNY

This overflow chamber serves a small area of only 25 acres. This area is served entirely with combined sewers.

The average daily dry weather flow was estimated to be 0.17 MGD, and during wet weather periods was estimated to be 0.20 MGD. This overflow joins the overflow from Tappan Street, merging into a common outfall line which discharges into an open ditch leading to Frank's Creek.

Metering and sampling facilities were installed in this overflow chamber beginning May 1, 1975, and extending through October 24, 1975. During this period of time, 41 rainfalls were recorded. It has been estimated that overflow occurred on 37 occasions. On the basis of 70 to 90 rainfalls occurring in one year, it has also been estimated that from 65 to 80 overflows would occur at this chamber.

It was found that the rainfall intensity required to cause overflow was only about 0.03 to 0.04 inches per hour. Peak overflow rates of 6.5 MGD were recorded, and the volume of overflow was found to be only about 0.8 MG.

The sample of the dry weather flow indicated that suspended solids averaged 263 mg/l and the BOD averaged 234 mg/l.

The storm sample which was collected indicated an average concentration of 178 mg/l for suspended solids, and 189 mg/l for BOD. The lower storm sample values would appear to reflect the dilution effects of storm flows.

BERGEN STREET OVERFLOW CHAMBER, HARRISON

This overflow chamber serves a drainage area of about 72 acres. The area is served with combined sewers. It has been estimated that the dry weather flow is about 0.83 MGD during the dry weather months, and that the average daily flow is about 1.13 MGD during wet weather months, reflecting possible infiltration of about 0.30 MGD.

Metering facilities were installed in this chamber starting July 6, 1975, and were maintained in operation through September 12, 1975. During this period of time, thirteen rainfalls were recorded and it has been estimated that overflows occurred on eleven occasions. Based on an estimated range of from 70 to 90 rainfalls occurring during the year, it is estimated that overflow would occur at this chamber about 60 to 75 times.

It was found that a rainfall of intensity of about 0.09 inches per hour was experienced before overflow would occur at this chamber. The maximum overflow rate was found to be about 17 MGD, and the volume of overflow during the storm of most severe intensity was found to be only 0.5 MG.

It was found that backwater from the Passaic River entered this chamber and the sewer system during periods of exceptionally high tide. The staff of the PVSC has taken corrective action in order to reduce and eliminate this occurrence, which was of short-term duration.

Samples of the dry weather flow indicated an average sewage strength for suspended solids of 136 mg/1 and for BOD the average concentration was about 170 mg/1. The sampling of the overflow during storm or rainfall conditions indicated that suspended solids ranged from a low of 100 mg/l to a high of 144 mg/l and BOD concentrations ranged from a low of 23 mg/l to a high of 37 mg/l, reflecting the dilution effect.

MIDDLESEX STREET OVERFLOW CHAMBER, HARRISON

The Middlesex Street overflow chamber serves a drainage area of 62 acres. This drainage area is served with combined sewers.

The estimated dry weather flow in this district is about 0.72 MGD during dry weather months, and during the wet weather months is about 0.98 MGD, reflecting a possible infiltration rate of about 0.26 MGD.

Metering facilities were installed on April 24, 1975 and were maintained through July 6, 1975. During this period of time, 25 rainfalls were recorded and overflows were estimated to have occurred on 17 occasions. It was found that a rainfall intensity of about 0.07 to 0.08 inches per hour usually caused overflow, but lesser intensities sometimes caused overflow if the rainfall duration was protracted. The maximum overflow rate which was measured was about 14 MGD, and the overflow volume was found to be 0.5 MG. It has been estimated that overflows will occur at this chamber about 50 to 60 times per year when rainfall occurrences range from 70 to 90 times per year.

It was found that backwater from the Passaic River entered this chamber and the sewer system during periods of exceptionally high tide. The staff of the PVSC has taken corrective action in order to reduce and eliminate this occurrence, which was of short-term duration.

The sampling of the dry weather flow revealed an extremely dilute sewage. The suspended solids was found to be only about 42 mg/1 and the BOD about 44 mg/1, based on average values.

A sampling of the storm flow waste showed that the suspended solids ranged from a low of 32 mg/l to a high of 59 mg/l, and the BOD ranged from a low of 9 mg/l to a high of 50 mg/l, reflecting again not only the very dilute dry weather flow, but the further effect of dilution during storm flows.

MARSHALL STREET OVERFLOW CHAMBER, KEARNY

The overflow chamber serving this district of only 24 acres is served with a combined sewer system. The estimated dry weather flow is only about 0.09 MGD and, in wet weather months, about 0.12 MGD.

Metering and sampling facilities were installed in this chamber from February 5, 1975 through April 3, 1975, during which time rainfall occurred on thirteen occasions. Overflows, however, occurred only on six occasions. It was found that the overflows occurred whenever the rainfall exceeded about 0.05 inches per hour.

The peak overflow rate was found to be about 5.0 MGD, but the actual volume of overflow under the worst recorded storm was only about 0.4 MG. It has been estimated that overflow will occur at this chamber from 30 to 40 times per year on the basis of 70 to 90 rainfall occurrences per year.

It was found that backwater from the Passaic River entered this chamber and the sewer system during periods of exceptionally high tide. The staff of the PVSC has taken corrective action in order to reduce and eliminate this occurrence, which was of short-term duration.

Samples taken of the dry weather flow show a typical domestic sewage with suspended solids of only 120 mg/l and a BOD of about 206 mg/l, based on average values.

During storm flow, the suspended solids were slightly higher, ranging from a low of 66 mg/l to a high of 418 mg/l, with the BOD ranging from a low of 16 mg/l to a high of 167 mg/l.

DEY STREET OVERFLOW CHAMBER, HARRISON

This overflow chamber serves an extremely small tributary area of only 6 acres, which is served entirely by combined sewers. The dry weather average daily flow is nominal, estimated to be about 0.09 MGD in the dry weather months and about 0.12 MGD in wet weather months.

Metering facilities were maintained in this chamber for the period beginning June 5, 1975 and extending through July 6, 1975. Rainfalls occurred on ten occasions, with overflows observed on six occasions. It is estimated that overflow could occur from 40 to 55 times per year at this chamber, based upon the probability that rainfalls may occur from 70 to 90 times per year.

It was found that a rainfall intensity of about 0.07 to 0.08 inches per hour was required to cause overflow. The overflow volume is nominal, with a maximum of 0.3 MG measured during this observation period, and a maximum peak storm overflow rate of about 8 MGD recorded.

It was found that backwater from the Passaic River entered this chamber and the sewer system during periods of exceptionally high tide. The staff of the PVSC has taken corrective action in order to reduce and eliminate this occurrence, which was of short-term duration.

It was found that the dry weather flow waste reflected a very high degree of dilution. For example, the BOD was found to be only about 25 mg/l.

Likewise, the sampling of the storm flow reflected suspended solids of only 25 mg/l. It would appear that this district has a tremendous amount of infiltration, although for a very small area (six acres), and the characteristics of the waste reflect this entry of infiltration into the system.

The area tributary to this overflow is small. A separate sanitary sewer is recommended for connection to the PVSC branch interceptor, with elimination of this combined overflow.

CLEVELAND AVENUE OVERFLOW CHAMBER, HARRISON

This overflow chamber serves a very small district of only 11 acres. The district is served with combined sewers.

The estimated average daily dry weather flow was about 0.14 MGD, and during wet weather months was about 0.19 MGD, which reflects a relatively high infiltration rate (0.05 MGD).

During the period of study, which extended from February 5, 1975 through June 16, 1975, rainfall occurred on 32 occasions. It has been estimated that overflow occurred on 18 of these occasions. It was found that the intensity of rainfall required to cause overflow was about 0.04 inches per hour. It has been estimated that overflows at this chamber will occur about 40 to 50 times per year, based upon rainfalls occurring 70 to 90 times per year.

Under overflow conditions, it was found that the peak rates of overflow were as high as 12.2 MGD, and that the volume of overflow was as high as 0.3 MG.

It was found that backwater from the Passaic River entered this chamber and the sewer system during periods of exceptionally high tide. The staff of the PVSC has taken corrective action in order to reduce and eliminate this occurrence, which was of short-term duration.

The average characteristics of the waste under dry flow conditions were found to be 101 mg/l for suspended solids and 170 mg/l for BOD.

Under storm flow conditions, the suspended solids were found to be unusually low, ranging from a low of 39 mg/1 to a high of 68 mg/1, and the BOD was found to be about 94 mg/1 on the average. This would appear to reflect the effect of storm water dilution upon the wastewater characteristics.

TAPPAN STREET OVERFLOW CHAMBER, KEARNY

The Tappan Street overflow chamber serves a tributary area of only 35 acres. The area is served with combined sewers. This overflow joins the overflow from Dukes Street, merging into a common outfall line which discharges into an open ditch leading to Frank's Creek.

The average daily flow was estimated to be 0.35 MGD in the dry weather months and 0.41 MGD in the wet weather months.

Metering facilities and sampling equipment for this chamber were in service beginning February 23, 1975, and extending through August 24, 1975. During this period of time, rainfalls were recorded on 45 occasions, and overflows are estimated to have occurred on 28 occasions.

It has also been estimated that overflows at this chamber will occur from 45 to 55 times per year when the rainfall occurrences range from 70 to 90 times yearly.

It was found that an average rainfall intensity of only about 0.03 inches per hour caused overflow. The maximum peak rate of overflow was found to be 8.7 MGD, but the volume of overflow was found to be only 0.2 MG under the worst storm recorded during the period.

Sampling of the average daily flow under dry weather conditions indicated a suspended solids concentration of about 137 mg/1 and a BOD value of about 194 mg/1, which reflects basically, a domestic sewage waste.

Sampling of the storm water overflow indicated a suspended solids concentration of only about 88 mg/1 and a BOD value of about 67 mg/1, reflecting the extent of dilution due to storm flows.

BERGEN AVENUE OVERFLOW CHAMBER, KEARNY

This overflow chamber serves a tributary area of only about 12 acres. It is estimated that only about ten percent of this system is served by combined sewers. The dry weather flow is negligible, being estimated to be about 50,000 gallons per day (gpd). This overflow is located at the westerly end of Bergen Avenue at the Passaic River.

Facilities for metering and sampling the waste were operative from April 24, 1975 through May 7, 1975. During this period of observation, rainfall occurred on eight occasions, during which six overflows were estimated to have occurred. It has been estimated that overflows will occur at this chamber from 50 to 65 times per year when the rainfall occurrences range from 70 to 90 times per year. It was found that an average rainfall intensity of about 0.05 to 0.07 inches per hour caused overflow.

The overflow volume is negligible, having been found to be about 0.1 MG during the worst storm recorded during the period. The peak overflow rate was determined to be 2.4 MGD, coincidentally, when 0.1 MG overflow volume was recorded.

Sampling of the waste reflected an extremely dilute sewage, both under dry weather flow conditions and during overflow conditions. These low concentrations are attributed to the extremely high infiltration which occurs in this system, dispite the fact that only about ten percent of the system has combined sewers.

Sampling of the flow under dry weather conditions indicated a BOD concentration of 18 mg/1. Sampling of the flow during storm overflow conditions indicated a BOD average value of about 16 mg/1.

The sanitary line which discharges into the chamber serves a vacant industrial complex. Whatever flow that discharges here is suspected of being either infiltration or inflow, which should be located and eliminated. This overflow, in turn, may then be eliminated.

NAIRN AVENUE OVERFLOW CHAMBER, KEARNY

This overflow chamber serves a tributary area of 176 acres. The area is provided entirely with combined sewers. The average daily dry weather flow is estimated to be about 0.54 MGD during dry weather months, and 0.69 MGD during wet weather months.

Metering and sampling facilities were in service in this chamber beginning on June 5, 1975 and extending through August 7, 1975. During this period of observation, 17 rainfalls occurred and overflows are estimated to have occurred on 15 occasions. It has been estimated that overflow will occur about 60 to 80 times per year based upon rainfall occurrences of 70 to 90 times per year.

It was found that approximately 0.09 inches per hour of rain was required to cause overflow. The volume of overflow was found to be very little, namely, about 0.1 MG, and the peak stormwater overflow rate was measured at only 2.6 MGD.

Sampling of the dry weather sewage at this chamber indicated a very dilute waste, with a suspended solids average of 58 mg/l and BOD values averaging about 78 mg/l. The sampling of the stormwater overflow was likewise found to be fairly dilute, with a suspended solids concentration of only 93 mg/l and a BOD of about 61 mg/l, based on average values.

These very low wastewater characteristics are attributed to high dilution in this district due to storm flows and infiltration.

WORTHINGTON AVENUE OVERFLOW CHAMBER, HARRISON

The Worthington Avenue overflow chamber serves a tributary area of 177 acres, of which area about 95 percent is served with combined sewers, the balance being composed of separate sanitary and storm sewers.

The average daily dry weather flow was estimated to be about 2.0 MGD during dry weather months, and about 2.8 MGD during wet weather months. This reflects a fairly high infiltration rate due to the higher ground water table during the wet weather months.

No measurable overflows were recorded at this chamber because of the fact that the outfall line, which extends some 1,350 feet into the Meadowlands, is clogged with debris. Due to the obstructed outfall line, the overflow chamber becomes surcharged during periods of storm flow, thereby negating metering attempts, since no "free board" overflow condition existed. In other words, with the occurrences of high storm flows, the stormwater is carried on downstream.

Sampling of the waste during dry weather flow conditions revealed an extremely dilute sewage, with the suspended solids averaging only about 42 mg/1. Sampling of the waste during storm flow conditions indicated that BOD concentrations averaged 59 to 75 mg/1, reflecting the dilution effect.

REPORT UPON

OVERFLOW ANALYSIS

TO

PASSAIC VALLEY SEWERAGE COMMISSIONERS

PASSAIC RIVER OVERFLOWS

KEARNY - HARRISON - EAST NEWARK AREA

1976

ELSON T KILLAM ASSOCIATES INC
Environmental and Hydraulic Engineers 48 ESSEX STREET MILLBURN NEW JERSEY 0704[illegible]

KEARNY-HARRISON-EAST NEWARK AREA OVERFLOWS

Extent of Area and Peak Overflow Rates

Sixteen active overflows were observed and studied in the Kearny-Harrison Area (two other overflows location in North Kearny on the Kearny-North Arlington Branch interceptor are reported upon with the overflows in the "middle" area of the system). There are no inactive overflows in the Kearny-Harrison Area.

These overflows are located along the PVSC branch interceptor sewers adjacent to the Passaic River in this area. The branch interceptor sewers in the Kearny-Harrison Area extend a distance of approximately 4.4 miles (see Plate 5).

The sixteen active overflows serve a total tributary area of approximately 1,650 acres, most of which is served by combined sanitary and storm sewer systems. However, this area also has separate sanitary and storm sewers interwoven with combined sewers throughout the area. The capacity of the combined sewer system in these districts has been estimated to be approximately 604 Million Gallons per Day (MGD).

The measured average daily dry weather flow in the combined sewer systems in the Kearny-Harrison Area was found to be about 10.3 MGD.

During wet weather months, when the ground water table is high, the average daily dry weather flow (when no rainfall occurs) was found to be approximately 13.4 MGD. This indicates that ground water infiltration of approximately 3.1 MGD prevails in the collection system of the Kearny-Harrison Area. This infiltration is attributed to the combined sewer system, which was constructed so as to permit ground water entry into the pipeline.

The total estimated piping of combined sewers in the Kearny-Harrison Area which is served with combined sewers and which is tributary to the PVSC branch interceptor sewers, is approximately 62.3 miles or 329,000 linear feet. It has been estimated that the cost of construction of separate sanitary sewers for the Kearny-Harrison Area would be approximately $80 million. Each overflow collection area must be analyzed independently to determine the extent and relationship of the various separate sanitary, separate storm, and combined systems which exist interwoven in close proximity throughout the Kearny-Harrison area. In some cases, the best economic decision may be to continue to use the combined system for sanitary sewage only, disconnecting existing storm drainage inlets and reconnecting to new separate storm sewers. In other areas, the reverse situation may prevail, whereby all sanitary connections would best be reconnected to new sanitary sewers, and the existing combined system continued for usage as a storm sewer only. In order to effect a meaningful reduction in the infiltration through complete system separation, it may also be necessary to install new house connections extending from the street to the property line, if not all the way into the building structure, to assure that old-type building drainage systems with built-in ground water infiltration will have been eliminated from the collection system.

The sixteen overflow chambers in the Kearny-Harrison Area are served by drainage areas ranging in size from as little as six acres to as large as 607 acres. The aggregate capacity of the combined storm sewer pipelines which serve these tributary combined sewer areas has been estimated to be about 604 MGD. The estimated aggregate capacity of the overflow pipes from the chambers to the river has also been estimated to be 564 MGD. In other words, under conditions of an extensive storm which would inundate and surcharge the entire collection system, a flow of approximately 604 MGD or more could enter the sixteen overflow chambers, with the possibility of discharge into the river of about 564 MGD.

It will be noted that the branch interceptor sewer at the downstream or southerly terminus of the Kearny-Harrison Area has a carrying capacity of only about 28 MGD. It is obvious that this branch interceptor sewer is entirely inadequate to carry but a very small portion of the total storm flow potential from the combined sewers in the Kearny-Harrison Area.

Table 5 has been prepared to show the salient features of the sixteen overflows in the Kearny-Harrison Area located along the PVSC Kearny-Harrison branch interceptors. This table is entitled "Tabulation of Passaic Valley Sewerage Commissioners' Overflows in the Kearny-Harrison - East Newark Area." This table sets forth a tabulation of the overflow location, discharge permit number, the area tributary to each overflow chamber, the measured dry weather flow under seasonal con-

TABLE 5

TABULATION OF PVSC OVERFLOWS IN THE KEARNY-HARRISON-EAST NEWARK AREA

Overflow Location	Discharge Permit Number	Tributary Area (Acres)	% of Area with Combined Sewers	DRY WEATHER FLOW: Dry Weather Months (MGD)	DRY WEATHER FLOW: Wet Weather Months (MGD)	Estimated Maximum Storm Capacity (MGD)	Estimated Maximum Overflow Capacity to River (MGD)	Maximum Peak Recorded Overflow to River (MGD)	Maximum Overflow Observed (MG)
Ivy Street, Kearny	023/K-007	607	85	3.00	3.50	260.7	260.7	244.0	22.8
Johnston Ave., Kearny	022/K-006	207	80	0.63	0.80	167.0	122.3	112.0	13.5
Harrison Ave., Harrison	012/H-003	67	100	0.77	1.08	29.4	29.4	20.0	3.0
Bergen Ave., Kearny	024/K-008	110	90	0.62	0.72	22.7	22.7	29.0	2.6
Central Ave., E. Newark	008/E-001	26	100	0.14	0.27	43.4	43.4	61.6	1.2
New (Hamilton) St., Harrison	010/H-001	32	100	0.17	0.33	6.9	6.9	18.0	1.1
Dukes Street, Kearny	026/K-010	25	100	0.17	0.20	9.6	8.7	6.5	0.8
Bergen Street, Harrison	015/H-006	72	100	0.83	1.13	11.0	10.9	16.7	0.5
Middlesex St., Harrison	014/H-005	62	100	0.72	0.98	5.8	5.8	12.6	0.5
Marshall Street, Kearny	021/K-005	24	100	0.09	0.12	2.8	2.8	5.0	0.4
Dey Street, Harrison	013/H-004	6	100	0.09	0.12	1.7	1.7	8.0	0.3
Cleveland Ave., Harrison	011/H-002	11	100	0.14	0.19	6.6	9.8	12.2	0.3
Tappan Street, Kearny	025/K-009	35	100	0.35	0.41	9.5	6.0	8.7	0.2
Bergen Ave., Kearny	019/K-003	12	10	0.05	0.06	10.1	21.0	2.4	0.1
Nairn Avenue, Kearny	020/K-004	176	85	0.54	0.69	8.3	2.6	2.6	Negligible
Worthington Ave., Harrison	016/K-004	177	95	2.02	2.80	9.0	9.0	9.0 Est.	1.0 Est.
TOTAL		1,643		10.33	10.40	604.5	563.7	568.3	48.3

ditions, the estimated capacity of the combined sewers tributary to these areas, the estimated overflow capacity from these chambers to the river, and finally the observed recorded peak flow rates and estimated volume of discharge into the Passaic River.

Overflow Measurements

During the period of observation and study of each of the overflow chambers, approximately 20 to 45 rainfalls were observed. Depth recording gauges were installed in essentially all of the chambers, and measurements and observations of overflow were made, including sampling.

The results of these studies and measurements indicate that the maximum recorded overflow to the river from the sixteen chambers during this period of study was at the peak rate of approximately 568 MGD. However, this overflow rate was of short-term duration and does not reflect the volume of overflow discharged into the river.

The volume of overflow from the sixteen overflow chambers was determined to be about 48 Million Gallons (MG) during this period of observation and study under the maximum storm flows observed (not all simultaneously).

It would appear from the results of this study that overflow does occur at approximately fifteen overflows whenever the rainfall approaches or exceeds 0.04 inches per hour. A very negligible overflow was observed or measured at two overflow chambers (Nairn Avenue and Bergen Avenue- 019/K-003).

It was found that the overflow rates of discharge were of short-term duration and generally responded directly to the rainfall. In other words, the overflows generally ceased, following the cessation of rainfall. Likewise, overflows occurred shortly after the onset of rainfall and at such times that the intensity exceeded about 0.04 inches per hour.

The aggregate overflow to the Passaic River in the Kearny-Harrison Area under maximum storm flow conditions observed was somewhat less than anticipated. Based upon the observations and studies, it is possible, however, to make some projections of what the overflow might be under more severe rainfall conditions than observed during the period of study. An attempt has been made to do this in the overflow chambers which are considered to be most critical in the collection system.

The most important overflows located within the Kearny-Harrison Area which are tributary to the Passaic Valley branch interceptor sewers are located at Ivy Street and Bergen Avenue on the east branch, and at Johnston Avenue and Harrison Avenue on the west branch. Ivy Street is, by far, the most important and critical overflow because of its large tributary area. It has been estimated that the outlet pipe from Ivy Street has a carrying capacity of about 260 MGD. The estimated capacity of the incoming combined sewer which flows through this chamber is approximately 260 MGD. Thus, with periods of heavy rainfall, it is apparent that discharges of high frequency and fairly large volume must occur at this overflow chamber.

The location of the PVSC branch interceptor sewers and the sixteen overflow chambers along the Passaic River and its tributaries in the Kearny-Harrison area is shown on Plate 5.

Individual Overflow Chambers

A description has been prepared of each of the overflow chambers setting forth, in summary form, the results of the observations and study. These descriptions follow.

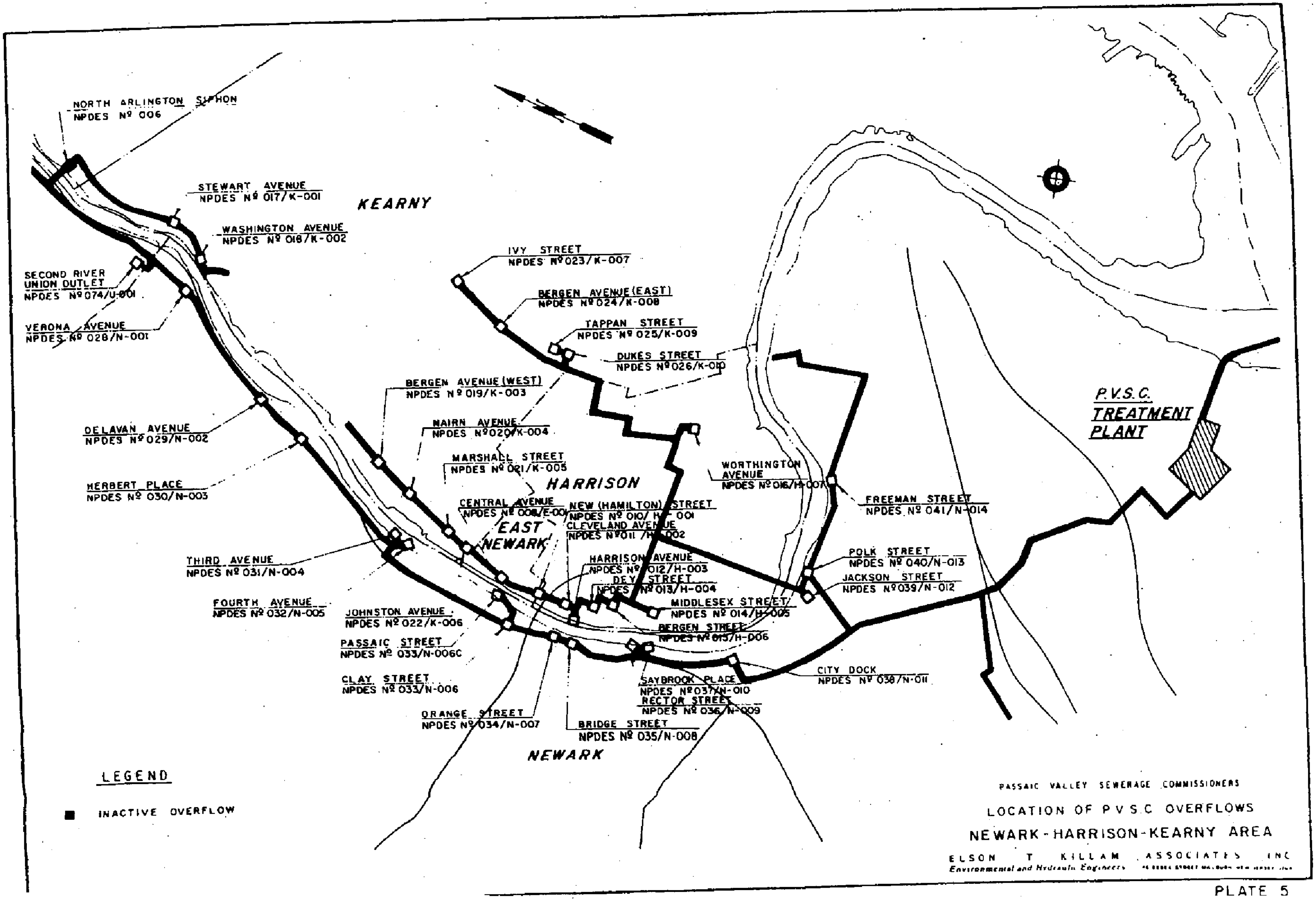


PLATE 5

TIERRA-B-007989

IVY STREET OVERFLOW CHAMBER, KEARNY

The Ivy Street overflow chamber serves a tributary area of approximately 607 acres which is the largest collection area among all of the Kearny-Harrison area overflows. Approximately 85 percent of this area is served with combined sewers and the balance is served with sepatate sanitary and storm sewers.

The dry weather flow was estimated to be approximately 3.0 MGD during dry weather months and 3.5 MGD during wet weather months. This is indicative of high infiltration from high ground water tables which is to be expected in a combined sewer system.

Under storm flow conditions, it was found that this overflow was active with essentially every rain. The overflow discharges into Frank's Creek and travels in this creek a distance of approximately one mile before entering the Passaic River.

Observations were started at this chamber on December 31, 1974 and extended through June 16, 1975. During the period of study, 45 rainfalls occurred. It has been estimated that overflows occurred on 32 occasions. It is also estimated that overflow will occur from 50 to 65 times per year at this chamber on the probability that rainfalls may occur 70 to 90 times per year. It was found that a rainfall intensity of only 0.02 inches per hour resulted in overflows, but with a rainfall duration of 16 or more hours.

The peak rate of overflow was found to be approximately 244 MGD. The overflow volume at this station was found to be as high as 23 MG.

Samples were taken of the sewage under dry weather flow conditions. An analysis indicated that the average BOD was approximately 258 mg/1 but the total suspended solids was only 100 mg/1.

Samples taken during storm flow conditions indicated a range of results for BOD from a low of 51 mg/1 to a high of 258 mg/1, while the suspended solids ranged from a low of 40 mg/1 to a high of 297 mg/1. The foregoing would appear to reflect the effect of dilution, except that the effect of flushing action is also indicated by the higher suspended solids.

JOHNSTON AVENUE OVERFLOW CHAMBER, KEARNY

The Johnston Avenue overflow serves a tributary area of approximately 207 acres. An estimated 80 percent of this area is served with a combined sewer system and the balance is served with separate sanitary and storm sewers.

The dry weather flow was estimated to be approximately 0.63 MGD during the dry weather months and 0.80 MGD during the wet weather months.

Metering and sampling equipment for this overflow chamber was in service beginning on December 31, 1974 and extending through June 16, 1975. During this period of metering and observation, 45 rainfalls occurred with observed or metered overflows on 33 occasions. In general, it was found that overflows would occur whenever the intensity of rainfall exceeded about 0.03 inches per hour. Based upon the observations, it is estimated that rainfall will occur at this station about 70 to 90 times per year, and that the number of overflows will range from 50 to 65 times. It was found that the overflow ranged as high as 13.5 MG. Peak flow rates as high as 112 MGD were measured.

It was found that backwater from the Passaic River entered this chamber and the sewer system during periods of exceptionally high tide. The staff of the PVSC has taken corrective action in order to reduce and eliminate this occurrence, which was of short-term duration.

Samples were collected of the dry weather flow at this chamber and the samples were found to be fairly dilute. The suspended solids averaged about 72 mg/1 and the BOD was 104 mg/1.

The storm water sampling also indicated a fairly dilute waste. The suspended solids was found to range from a low of 14 mg/1 to a high of 114 mg/1 and the BOD was found to range from a low of 30 mg/1 to a high of 86 mg/1.

HARRISON AVENUE OVERFLOW CHAMBER, HARRISON

This overflow chamber serves a relatively small area of only 67 acres. The area is provided entirely with combined sewers.

The estimated average daily flow was about 0.8 MGD during the dry weather months and it is estimated that it is about 1.1 MGD during wet weather months.

Metering facilities and automatic sampling equipment were installed in this chamber and observations made for a period extending from April 24, 1975 through June 6, 1975. During this period of time, rainfall occurred on eighteen occasions and it was determined that eleven overflows occurred. It is estimated that overflows at this chamber occur from 45 to 55 times per year, and that rainfalls occur on about 70 to 90 occasions per year. It was found that the average rainfall intensity required to cause overflow was approximately 0.04 inches per hour.

It was found that the peak rates of overflow ranged up to about 20 MGD, and that the overflow volume was as high as 3 MG.

Samples were taken of the wastes and it was found that under dry weather flow conditions the suspended solids were about 194 mg/l, and the BOD approximately 188 mg/l.

Under storm flow conditions, the suspended solids was found to range from a low of 69 mg/l to a high of 260 mg/l and BOD ranged from a low of 49 mg/l to a high of 203 mg/l. It would appear, from the above, that the dilution effect resulted in a less concentrated effluent under storm flow conditions.

BERGEN AVENUE OVERFLOW CHAMBER, KEARNY

This overflow chamber serves a tributary area of 110 acres. Approximately 90 percent of this area is served with combined sewers with the balance of the area served by separate sanitary and storm sewers. This overflow is located at the easterly end of Bergen Avenue.

It has been estimated that the dry weather flow is approximately 0.62 MGD. The estimated flow during wet weather months is about 0.72 MGD. This overflow discharges into Frank's Creek.

During the period of study and observation, which extended from January 6, 1975 through July 21, 1975, rainfall occurred on 54 occasions. It has been estimated that overflow occurred at this chamber on 40 occasions during this period. It has been estimated that overflows will occur at this chamber from 50 to 70 times per year on the assumption that rainfalls will occur from 70 to 90 times per year. The peak overflow rates were found to be as high as 32 MGD, and the volume of overflow was found to be as high as 2.6 MG.

Samples taken of the dry weather flow indicated that the average suspended solids was about 68 mg/1 and the BOD averaged approximately 139 mg/1. Under storm flow conditions, it was found that while the BOD ranged from a low of 47 mg/1 to a high of 57 mg/1, the suspended solids ranged from a low of 260 mg/1 to a high of 282 mg/1. This clearly reflects the effect of flushing under high flow and high velocity conditions in the combined sewer system.

CENTRAL AVENUE OVERFLOW CHAMBER, EAST NEWARK

This overflow chamber serves a very small drainage area, namely, 26 acres. The area is served with combined sewers. The average daily flow has been estimated to be only 0.14 MGD under dry weather flow conditions, but as high as 0.27 MGD during the wet weather months.

Metering and sampling facilities were installed in this chamber and were maintained during the period extending from April 24, 1975 through June 6, 1975. During this period of time, rainfalls occurred on seventeen occasions. It has been estimated or found that overflows occurred on twelve occasions. It has also been estimated that overflows will occur at this chamber approximately 50 to 65 times per year, based on rainfalls occurring from 70 to 90 times per year.

It was found that the average rainfall intensity required to cause overflow ranged from about 0.04 to 0.05 inches per hour, for a rainfall duration of about 8 hours or longer.

The peak rate of overflow was found to be about 62 MGD. The total volume of discharge was found to be as high as 1.2 MG.

It was found that backwater from the Passaic River entered this chamber and the sewer system during periods of exceptionally high tide. The staff of the PVSC has taken corrective action in order to reduce and eliminate this occurrence, which was of short-term duration.

The sample of the dry weather flows indicated an unusually dilute waste. The suspended solids was found to be only 60 mg/1 as an average, and BOD was found to average only 47 mg/1.

The storm flow conditions indicated that the suspended solids and BOD again were relatively low, the former being found to range from a low of 36 mg/1 to a high of 103 mg/1, and the latter ranging from a low of 34 mg/1 to a high of 88 mg/1.

NEW (HAMILTON) STREET OVERFLOW CHAMBER, HARRISON

This overflow chamber serves a tributary area of only 32 acres. It is provided with combined sewer facilities.

The estimated average daily dry weather flow is about 0.17 MGD and during wet weather months, it was estimated to be 0.33 MGD. This is an unusually high flow and is indicative of high infiltration in this small collection system (0.16 MGD).

Metering facilities and sampling equipment were installed in this chamber during the period May 12, 1975, and extending through July 6, 1975. During this period of time, rainfall occurred on seventeen separate occasions. It has been estimated that overflows occurred at this chamber on thirteen occasions. It has also been estimated that overflows will occur at this chamber about 55 to 70 times per year when rainfalls occur about 70 to 90 times per year.

It was found that the rainfall intensity required to cause overflow was about 0.07 inches per hour. The peak overflow rate as this chamber was found to be as high as 18 MGD. The volume of overflow, under the worst recorded storm conditions, was found to be about 1.1 MG.

Samples of the dry weather flow indicated suspended solids averaged about 191 mg/1, and BOD concentrations averaged 138 mg/1.

Samples taken during a storm flow condition indicated a range of BOD from a low of 47 mg/1 to a high of 66 mg/1, and a range of suspended solids from a low of 106 mg/1 to a high of 326 mg/1. It would appear from the above that the suspended solids during the storm flow period reflects flushing action from the peak storm flow rates. The BOD reflects the effect of pollution.

DUKES STREET OVERFLOW CHAMBER, KEARNY

This overflow chamber serves a small area of only 25 acres. This area is served entirely with combined sewers.

The average daily dry weather flow was estimated to be 0.17 MGD, and during wet weather periods was estimated to be 0.20 MGD. This overflow joins the overflow from Tappan Street, merging into a common outfall line which discharges into an open ditch leading to Frank's Creek.

Metering and sampling facilities were installed in this overflow chamber beginning May 1, 1975, and extending through October 24, 1975. During this period of time, 41 rainfalls were recorded. It has been estimated that overflow occurred on 37 occasions. On the basis of 70 to 90 rainfalls occurring in one year, it has also been estimated that from 65 to 80 overflows would occur at this chamber.

It was found that the rainfall intensity required to cause overflow was only about 0.03 to 0.04 inches per hour. Peak overflow rates of 6.5 MGD were recorded, and the volume of overflow was found to be only about 0.8 MG.

The sample of the dry weather flow indicated that suspended solids averaged 263 mg/l and the BOD averaged 234 mg/l.

The storm sample which was collected indicated an average concentration of 178 mg/l for suspended solids, and 189 mg/l for BOD. The lower storm sample values would appear to reflect the dilution effects of storm flows.

BERGEN STREET OVERFLOW CHAMBER, HARRISON

This overflow chamber serves a drainage area of about 72 acres. The area is served with combined sewers. It has been estimated that the dry weather flow is about 0.83 MGD during the dry weather months, and that the average daily flow is about 1.13 MGD during wet weather months, reflecting possible infiltration of about 0.30 MGD.

Metering facilities were installed in this chamber starting July 6, 1975, and were maintained in operation through September 12, 1975. During this period of time, thirteen rainfalls were recorded and it has been estimated that overflows occurred on eleven occasions. Based on an estimated range of from 70 to 90 rainfalls occurring during the year, it is estimated that overflow would occur at this chamber about 60 to 75 times.

It was found that a rainfall of intensity of about 0.09 inches per hour was experienced before overflow would occur at this chamber. The maximum overflow rate was found to be about 17 MGD, and the volume of overflow during the storm of most severe intensity was found to be only 0.5 MG.

It was found that backwater from the Passaic River entered this chamber and the sewer system during periods of exceptionally high tide. The staff of the PVSC has taken corrective action in order to reduce and eliminate this occurrence, which was of short-term duration.

Samples of the dry weather flow indicated an average sewage strength for suspended solids of 136 mg/1 and for BOD the average concentration was about 170 mg/1. The sampling of the overflow during storm or rainfall conditions indicated that suspended solids ranged from a low of 100 mg/l to a high of 144 mg/l and BOD concentrations ranged from a low of 23 mg/l to a high of 37 mg/l, reflecting the dilution effect.

MIDDLESEX STREET OVERFLOW CHAMBER, HARRISON

The Middlesex Street overflow chamber serves a drainage area of 62 acres. This drainage area is served with combined sewers.

The estimated dry weather flow in this district is about 0.72 MGD during dry weather months, and during the wet weather months is about 0.98 MGD, reflecting a possible infiltration rate of about 0.26 MGD.

Metering facilities were installed on April 24, 1975 and were maintained through July 6, 1975. During this period of time, 25 rainfalls were recorded and overflows were estimated to have occurred on 17 occasions. It was found that a rainfall intensity of about 0.07 to 0.08 inches per hour usually caused overflow, but lesser intensities sometimes caused overflow if the rainfall duration was protracted. The maximum overflow rate which was measured was about 14 MGD, and the overflow volume was found to be 0.5 MG. It has been estimated that overflows will occur at this chamber about 50 to 60 times per year when rainfall occurrences range from 70 to 90 times per year.

It was found that backwater from the Passaic River entered this chamber and the sewer system during periods of exceptionally high tide. The staff of the PVSC has taken corrective action in order to reduce and eliminate this occurrence, which was of short-term duration.

The sampling of the dry weather flow revealed an extremely dilute sewage. The suspended solids was found to be only about 42 mg/1 and the BOD about 44 mg/1, based on average values.

A sampling of the storm flow waste showed that the suspended solids ranged from a low of 32 mg/1 to a high of 59 mg/1, and the BOD ranged from a low of 9 mg/1 to a high of 50 mg/1, reflecting again not only the very dilute dry weather flow, but the further effect of dilution during storm flows.

MARSHALL STREET OVERFLOW CHAMBER, KEARNY

The overflow chamber serving this district of only 24 acres is served with a combined sewer system. The estimated dry weather flow is only about 0.09 MGD and, in wet weather months, about 0.12 MGD.

Metering and sampling facilities were installed in this chamber from February 5, 1975 through April 3, 1975, during which time rainfall occurred on thirteen occasions. Overflows, however, occurred only on six occasions. It was found that the overflows occurred whenever the rainfall exceeded about 0.05 inches per hour.

The peak overflow rate was found to be about 5.0 MGD, but the actual volume of overflow under the worst recorded storm was only about 0.4 MG. It has been estimated that overflow will occur at this chamber from 30 to 40 times per year on the basis of 70 to 90 rainfall occurrences per year.

It was found that backwater from the Passaic River entered this chamber and the sewer system during periods of exceptionally high tide. The staff of the PVSC has taken corrective action in order to reduce and eliminate this occurrence, which was of short-term duration.

Samples taken of the dry weather flow show a typical domestic sewage with suspended solids of only 120 mg/l and a BOD of about 206 mg/l, based on average values.

During storm flow, the suspended solids were slightly higher, ranging from a low of 66 mg/l to a high of 418 mg/l, with the BOD ranging from a low of 16 mg/l to a high of 167 mg/l.

DEY STREET OVERFLOW CHAMBER, HARRISON

This overflow chamber serves an extremely small tributary area of only 6 acres, which is served entirely by combined sewers. The dry weather average daily flow is nominal, estimated to be about 0.09 MGD in the dry weather months and about 0.12 MGD in wet weather months.

Metering facilities were maintained in this chamber for the period beginning June 5, 1975 and extending through July 6, 1975. Rainfalls occurred on ten occasions, with overflows observed on six occasions. It is estimated that overflow could occur from 40 to 55 times per year at this chamber, based upon the probability that rainfalls may occur from 70 to 90 times per year.

It was found that a rainfall intensity of about 0.07 to 0.08 inches per hour was required to cause overflow. The overflow volume is nominal, with a maximum of 0.3 MG measured during this observation period, and a maximum peak storm overflow rate of about 8 MGD recorded.

It was found that backwater from the Passaic River entered this chamber and the sewer system during periods of exceptionally high tide. The staff of the PVSC has taken corrective action in order to reduce and eliminate this occurrence, which was of short-term duration.

It was found that the dry weather flow waste reflected a very high degree of dilution. For example, the BOD was found to be only about 25 mg/1.

Likewise, the sampling of the storm flow reflected suspended solids of only 25 mg/l. It would appear that this district has a tremendous amount of infiltration, although for a very small area (six acres), and the characteristics of the waste reflect this entry of infiltration into the system.

The area tributary to this overflow is small. A separate sanitary sewer is recommended for connection to the PVSC branch interceptor, with elimination of this combined overflow.

CLEVELAND AVENUE OVERFLOW CHAMBER, HARRISON

This overflow chamber serves a very small district of only 11 acres. The district is served with combined sewers.

The estimated average daily dry weather flow was about 0.14 MGD, and during wet weather months was about 0.19 MGD, which reflects a relatively high infiltration rate (0.05 MGD).

During the period of study, which extended from February 5, 1975 through June 16, 1975, rainfall occurred on 32 occasions. It has been estimated that overflow occurred on 18 of these occasions. It was found that the intensity of rainfall required to cause overflow was about 0.04 inches per hour. It has been estimated that overflows at this chamber will occur about 40 to 50 times per year, based upon rainfalls occurring 70 to 90 times per year.

Under overflow conditions, it was found that the peak rates of overflow were as high as 12.2 MGD, and that the volume of overflow was as high as 0.3 MG.

It was found that backwater from the Passaic River entered this chamber and the sewer system during periods of exceptionally high tide. The staff of the PVSC has taken corrective action in order to reduce and eliminate this occurrence, which was of short-term duration.

The average characteristics of the waste under dry flow conditions were found to be 101 mg/1 for suspended solids and 170 mg/1 for BOD.

Under storm flow conditions, the suspended solids were found to be unusually low, ranging from a low of 39 mg/1 to a high of 68 mg/1, and the BOD was found to be about 94 mg/1 on the average. This would appear to reflect the effect of storm water dilution upon the wastewater characteristics.

TAPPAN STREET OVERFLOW CHAMBER, KEARNY

The Tappan Street overflow chamber serves a tributary area of only 35 acres. The area is served with combined sewers. This overflow joins the overflow from Dukes Street, merging into a common outfall line which discharges into an open ditch leading to Frank's Creek.

The average daily flow was estimated to be 0.35 MGD in the dry weather months and 0.41 MGD in the wet weather months.

Metering facilities and sampling equipment for this chamber were in service beginning February 23, 1975, and extending through August 24, 1975. During this period of time, rainfalls were recorded on 45 occasions, and overflows are estimated to have occurred on 28 occasions.

It has also been estimated that overflows at this chamber will occur from 45 to 55 times per year when the rainfall occurrences range from 70 to 90 times yearly.

It was found that an average rainfall intensity of only about 0.03 inches per hour caused overflow. The maximum peak rate of overflow was found to be 8.7 MGD, but the volume of overflow was found to be only 0.2 MG under the worst storm recorded during the period.

Sampling of the average daily flow under dry weather conditions indicated a suspended solids concentration of about 137 mg/l and a BOD value of about 194 mg/l, which reflects basically, a domestic sewage waste.

Sampling of the storm water overflow indicated a suspended solids concentration of only about 88 mg/l and a BOD value of about 67 mg/l, reflecting the extent of dilution due to storm flows.

BERGEN AVENUE OVERFLOW CHAMBER, KEARNY

This overflow chamber serves a tributary area of only about 12 acres. It is estimated that only about ten percent of this system is served by combined sewers. The dry weather flow is negligible, being estimated to be about 50,000 gallons per day (gpd). This overflow is located at the westerly end of Bergen Avenue at the Passaic River.

Facilities for metering and sampling the waste were operative from April 24, 1975 through May 7, 1975. During this period of observation, rainfall occurred on eight occasions, during which six overflows were estimated to have occurred. It has been estimated that overflows will occur at this chamber from 50 to 65 times per year when the rainfall occurrences range from 70 to 90 times per year. It was found that an average rainfall intensity of about 0.05 to 0.07 inches per hour caused overflow.

The overflow volume is negligible, having been found to be about 0.1 MG during the worst storm recorded during the period. The peak overflow rate was determined to be 2.4 MGD, coincidentally, when 0.1 MG overflow volume was recorded.

Sampling of the waste reflected an extremely dilute sewage, both under dry weather flow conditions and during overflow conditions. These low concentrations are attributed to the extremely high infiltration which occurs in this system, dispite the fact that only about ten percent of the system has combined sewers.

Sampling of the flow under dry weather conditions indicated a BOD concentration of 18 mg/l. Sampling of the flow during storm overflow conditions indicated a BOD average value of about 16 mg/l.

The sanitary line which discharges into the chamber serves a vacant industrial complex. Whatever flow that discharges here is suspected of being either infiltration or inflow, which should be located and eliminated. This overflow, in turn, may then be eliminated.

NAIRN AVENUE OVERFLOW CHAMBER, KEARNY

This overflow chamber serves a tributary area of 176 acres. The area is provided entirely with combined sewers. The average daily dry weather flow is estimated to be about 0.54 MGD during dry weather months, and 0.69 MGD during wet weather months.

Metering and sampling facilities were in service in this chamber beginning on June 5, 1975 and extending through August 7, 1975. During this period of observation, 17 rainfalls occurred and overflows are estimated to have occurred on 15 occasions. It has been estimated that overflow will occur about 60 to 80 times per year based upon rainfall occurrences of 70 to 90 times per year.

It was found that approximately 0.09 inches per hour of rain was required to cause overflow. The volume of overflow was found to be very little, namely, about 0.1 MG, and the peak stormwater overflow rate was measured at only 2.6 MGD.

Sampling of the dry weather sewage at this chamber indicated a very dilute waste, with a suspended solids average of 58 mg/l and BOD values averaging about 78 mg/l. The sampling of the stormwater overflow was likewise found to be fairly dilute, with a suspended solids concentration of only 93 mg/l and a BOD of about 61 mg/l, based on average values.

These very low wastewater characteristics are attributed to high dilution in this district due to storm flows and infiltration.

WORTHINGTON AVENUE OVERFLOW CHAMBER, HARRISON

The Worthington Avenue overflow chamber serves a tributary area of 177 acres, of which area about 95 percent is served with combined sewers, the balance being composed of separate sanitary and storm sewers.

The average daily dry weather flow was estimated to be about 2.0 MGD during dry weather months, and about 2.8 MGD during wet weather months. This reflects a fairly high infiltration rate due to the higher ground water table during the wet weather months.

No measurable overflows were recorded at this chamber because of the fact that the outfall line, which extends some 1,350 feet into the Meadowlands, is clogged with debris. Due to the obstructed outfall line, the overflow chamber becomes surcharged during periods of storm flow, thereby negating metering attempts, since no "free board" overflow condition existed. In other words, with the occurrences of high storm flows, the stormwater is carried on downstream.

Sampling of the waste during dry weather flow conditions revealed an extremely dilute sewage, with the suspended solids averaging only about 42 mg/1. Sampling of the waste during storm flow conditions indicated that BOD concentrations averaged 59 to 75 mg/1, reflecting the dilution effect.

pg 192

END

ESTIMATE OF TOTAL SYSTEM OVERFLOWS

An estimate has been made of the total overflow into the Passaic River from the combined sewer systems tributary to the PVSC collection systems. This covers a total drainage area of approximately 12,200 acres, of which 5,100 acres are located in Paterson, 3,950 acres are located in Newark tributary to PVSC overflows, 1,400 acres are located in Newark tributary to the PVSC interceptor, but not directly connected to PVSC overflows, 1,650 acres are located in the Harrison-Kearny area, and about 100 acres are located in the middle portion of the system. In addition to the above, and not included in the PVSC overflow studies, are approximately 3,240 acres located in the South Side of the City of Newark which are served with combined sewers. This large area is tributary to the Peddie, Waverly, and Queen ditches where overflow chambers are provided for storm water overflows which ultimately are discharged into Newark Bay--not the Passaic River. The dry weather flow is conveyed through the City of Newark's South Side interceptor sewer directly to the PVSC Newark Bay Pumping Station.

Based upon a study of the period from October 1, 1974, through September 30, 1975, it has been estimated that the total volume of sewage treated at the PVSC treatment plant is approximately 91.6 billion gallons. This is an average daily flow of approximately 251.0 MGD for this twelve-month period. During the year, a total of 54.74 inches of rainfall was recorded.

The storm water overflow into the Passaic River from this total drainage area of approximately 12,200 acres has been estimated

6

to be about 7,500 million gallons annually. This is approximately 8.2 percent of the yearly flow. The estimated overflow from the Second River Union Outlet is about 600 million gallons per year.

The foregoing does not include the estimated overflow from the combined sewer systems in the Waverly Avenue District, the Peddie Street District, and the Queens Street District, which are located in the South Side of the City of Newark. Preliminary estimates indicate that the annual storm water overflow from this City of Newark area of about 3,240 acres will be in excess of 2,000 million gallons per year.

In addition to the above, sanitary sewer overflows occur within the collection system during exceptionally severe rainfalls as a result of inflow which is in excess of local interceptor sewer carrying capacities. These inflows may aggregate in excess of 250 million gallons annually.

Tabulations have been prepared for the twelve-month period of observation and study (October, 1974 through September, 1975). These tables show the rainfall occurrences (81) with one hundred and four days of precipitation recorded. (See Table 6 on pages 196-207).

Overflows to the Passaic River are estimated to have occurred on eighty-five days during this period of time at the sixty-five active overflow chambers. Overflows did not occur at each chamber for each storm. The intensity of the rainfall dictated the conditions, extent, duration, and volume of overflow at each chamber.

Table 6 shows the total rainfall for each storm, the maximum intensity for a thirty-minute duration, and the estimated storm water runoff and aggregate overflow into the Passaic River and its tributaries. Table 6 also shows the estimated storm water overflow and sanitary sewage diversion from the South Side area of the City of Newark which is discharged into Newark Bay. The estimated overflows from the Second River Union Outlet are also shown, as well as the average daily flow treated at the PVSC Newark Bay Treatment Plant. The tabulations are shown on a monthly basis and the totals for the twelve-month period are also shown.

In summary, while a total of over 91,000 million gallons of sewage were treated in a twelve-month period at the PVSC treatment plant, combined overflows into the Passaic River from PVSC and other system overflow facilities were estimated to be in excess of 7,500 million gallons per year, or about 8.2 percent of the total.

The estimated overflow from the Union Outlet was about 600 million gallons per year, or about 0.7 percent of the total flow treated. The estimated storm water and sanitary overflow from the combined sewers in the South Side of the City of Newark into Newark Bay was estimated to be greater than 2,300 million gallons per year, or about 2.5 percent of the total. The estimated overflows within the collection systems where sanitary sewers are inadequate have been estimated to be about 250 million gallons per year, or about 0.27 percent of the total system flow.

The total estimated overflow from all sources (from the PVSC combined sewer areas, the South Side interceptor overflows and diversions from valve closings, the Second River Union Outlet sanitary bypass, and other sanitary system overflows) amounts to about 11,000 million gallons per year, or about twelve percent of the Newark Bay Pumping Station yearly plant flow.

TABLE 6

RAINFALL, ESTIMATED OVERFLOW TO PASSAIC RIVER, AND PLANT FLOWS

Month: October, 1974

Date/ Day of Week	Total Rainfall (Inches)	Rainfall Duration (Hours)	Average Rainfall Intensity (In./hr.)	Maximum Rainfall Intensity (in 30 mins.) (In./hr.)	Estimated Tributary Runoff into Combined Sewers* 40% (MG)	Estimated Tributary Runoff into Combined Sewers* 60% (MG)	Estimated Overflow to River (MG)	South Side Interceptor** Estimated Sanitary Flow Diverted (MG)	South Side Interceptor** Estimated Tributary Runoff 40% (MG)	South Side Interceptor** Estimated Tributary Runoff 60% (MG)	Estimated*** Second River Union Outlet Flow to River (MG)	Total Estimated Overflow+ (MG)	Average Daily Plant Flow (MGD)
1 Tu								RECORDS SHOWED THAT NO MANUAL BYPASS ACTION WAS TAKEN DURING THIS PERIOD.					260
2 W	T												251
3 Th													253
4 F													243
5 S													218
6 S													205
7 M													231
8 Tu													236
9 W													235
10 Th													234
11 F													232
12 S													213
13 S	T												194
14 M													230
15 Tu	0.20	3.00	0.067	0.10	27	40	5		7	11	) 39	)422	235
16 W	1.90	22.00	0.086	0.25	252	376	285		67	100	)	)	234
17 Th													233
18 F													246
19 S													223
20 S													232
21 M													238
22 Tu													236
23 W													237
24 Th													236
25 F	0.08	7.00	0.011	0.08	11	16	-		3	4		4	240
26 S													223
27 S													198
28 M													227
29 Tu													238
30 W	T												239
31 Th	0.04	2.00	0.020	0.02	5	9	-		1	2	—	2	244
TOTAL	2.22				295	441	290		78	117	39	428	7,243 MG/Month
													234 Average

T = Trace

Note: * 12,200 Acres - combined sewers (tributary to PVSC interceptor)

Newark	5,400
Paterson	5,100
Kearny-Harrison	1,700
	12,200

** 3240 Acres - combined sewers not tributary to PVSC interceptor

*** Manually controlled (not combined sewers)

+ The "Total Estimated Overflow" column is derived by adding columns 8, 9, an average of columns 10 and 11, and column 12.

TABLE 6

RAINFALL, ESTIMATED OVERFLOW TO PASSAIC RIVER, AND PLANT FLOWS

Month: November, 1974

Date/ Day of Week	Total Rainfall (Inches)	Rainfall Duration (Hours)	Average Rainfall Intensity (In./hr.)	Maximum Rainfall Intensity (in 30 mins.) (In./hr.)	Estimated Tributary Runoff into Combined Sewers 40% (MG)	Estimated Tributary Runoff into Combined Sewers 60% (MG)	Estimated Overflow to River (MG)	South Side Interceptor: Estimated Sanitary Flow Diverted (MG)	South Side Interceptor: Estimated Tributary Runoff 40% (MG)	South Side Interceptor: Estimated Tributary Runoff 60% (MG)		Second River Union Outlet Flow to River (MG)	Total Estimated Overflow + (MG)	Average Daily Plant Flow (MGD)
1 F														241
2 S									-	1			1	215
3 S	0.01	1.00	0.010	0.01	1	2	--		-	-			-	199
4 M	T								1	2			2	238
5 Tu	0.04	3.00	0.013	0.02	5	8	--		-	1			1	250
6 W	0.01	1.00	0.010	0.01	1	2	--							238
7 Th														238
8 F														240
9 S														213
10 S														197
11 M									14	21	)		)	232
12 Tu	0.40	5.00	0.080	0.40	53	79	35	3	2	3	)	6	) 64	283
13 W	0.05	5.00	0.010	0.02	7	10	--							241
14 Th									1	1			1	244
15 F	0.02	1.00	0.020	0.02	2	4	--							234
16 S														204
17 S														194
18 M														231
19 Tu								3	10	15			36	244
20 W	0.28	10.00	0.028	0.07	37	55	20	2	1	1			3	262
21 Th	0.02	2.00	0.010	0.01	2	4	--							251
22 F														231
23 S														217
24 S														192
25 M	0.02	2.00	0.010	0.01	2	4	--		1	1			1	234
26 Tu														242
27 W														238
28 Th														188
29 F														195
30 S														192
TOTAL	0.85				108	168	55	8	30	45		6	109	5,819 MG/Month
														227 Average

TABLE 6

RAINFALL, ESTIMATED OVERFLOW TO PASSAIC RIVER, AND PLANT FLOWS

Month: December, 1974

Date/ Day of Week	Total Rainfall (Inches)	Rainfall Duration (Hours)	Average Rainfall Intensity (In./hr.)	Maximum Rainfall Intensity (in 30 mins.) (In./hr.)	Estimated Tributary Runoff into Combined Sewers 40%(MG)	60%(MG)	Estimated Overflow to River (MG)	South Side Interceptor: Estimated Sanitary Flow Diverted (MG)	South Side Interceptor: Estimated Tributary Runoff 40%(MG)	60%(MG)	Second River Union Outlet Flow to River (MG)	Total Estimated Overflow + (MG)	Average Daily Plant Flow (MGD)
1 S	0.45	6.00	0.075	0.17	60	89	50	1	16	24)	14	)	271
2 M	1.60	6.00	0.267	0.70	212	317	250	11	56	84)		) 416	270
3 Tu													236
4 W													240
5 Th													248
6 F													237
7 S	0.18	3.00	0.060	0.15	24	36	15		6	10)	20	)	232
8 S	1.17	9.00	0.130	0.40	155	232	175	8	41	62)		) 278	262
9 M													247
10 Tu													253
11 W													243
12 Th													243
13 F													241
14 S													212
15 S													203
16 M	1.35	13.00	0.104	0.26	179	268	180	11	48	71	21	272	310
17 Tu													263
18 W													254
19 Th													259
20 F													254
21 S								4				4	219
22 S													204
23 M													225
24 Tu													213
25 W	0.30	5.00	0.060	0.09	40	60	40		10	16		53	208
26 Th													218
27 F													221
28 S													212
29 S													190
30 M													225
31 Tu	0.10	2.00	0.050	0.05	13	20	5	—	4	5	—	10	240
TOTAL	5.15				683	1,022	715	35	181	272	55	1,033	7,353 MG/Month
													237 Average

TIERRA-B-008021

TABLE 6

RAINFALL, ESTIMATED OVERFLOW TO PASSAIC RIVER, AND PLANT FLOWS

Month: January, 1975

Date/ Day of Week	Total Rainfall (Inches)	Rainfall Duration (Hours)	Average Rainfall Intensity (In./hr.)	Maximum Rainfall Intensity (in 30 mins.) (In./hr.)	Estimated Tributary Runoff into Combined Sewers 40% (MG)	Estimated Tributary Runoff into Combined Sewers 60% (MG)	Estimated Overflow to River (MG)	South Side Interceptor: Estimated Sanitary Flow Diverted (MG)	South Side Interceptor: Estimated Tributary Runoff 40% (MG)	South Side Interceptor: Estimated Tributary Runoff 60% (MG)	Second River Union Outlet Flow to River (MG)	Total Estimated Overflow + (MG)	Average Daily Plant Flow (MGD)
1 W	0.25	9.00	0.028	0.06	34	50	25		9	13		36	195
2 Th													220
3 F	0.02	2.00	0.010	0.01	2	4	--		1	1		1	232
4 S													202
5 S													193
6 M	0.14	2.00	0.070	0.09	18	28	10		5	7)		)	285
7 Tu	0.41	7.00	0.059	0.11	54	81	30	6	14	22)	3	) 73	257
8 W	0.05	0.50	0.100	0.20	6	10	5		2	3)		)	286
9 Th	0.67	9.00	0.074	0.14	89	132	100	8	24	35)	10	) 155	263
10 F								1				1	262
11 S	0.08	3.00	0.027	0.04	11	16	5		3	4		8	222
12 S													234
13 M	0.77	16.00	0.048	0.14	102	153	110		27	41	19	163	264
14 Tu													253
15 W													251
16 Th													253
17 F													252
18 S	0.73	6.00	0.122	0.19	97	144	100	5	26	39	13	150	250
19 S	0.17	5.00	0.034	0.06	23	34	10		6	9)	11	36	254
20 M	0.05	2.00	0.025	0.04	7	10	5		2	3)			253
21 Tu													258
22 W													256
23 Th								2				2	254
24 F													265
25 S	0.64	13.50	0.047	0.19	85	127	80	7	23	34		116	286
26 S													219
27 M													258
28 Tu													239
29 W	0.55	7.00	0.079	0.13	73	109	75	2	19	29	19	120	263
30 Th													255
31 F													203
TOTAL	4.53				601	898	555	31	161	240	75	861	7,637 MG/Month
													246 Average

TIERRA-B-008023

TABLE 6

RAINFALL, ESTIMATED OVERFLOW TO PASSAIC RIVER, AND PLANT FLOWS

Month: February, 1975

Date/ Day of Week	Total Rainfall (Inches)	Rainfall Duration (Hours)	Average Rainfall Intensity (In./hr.)	Maximum Rainfall Intensity (in 30 mins.) (In./hr.)	Estimated Tributary Runoff into Combined Sewers 40%(MG)	Estimated Tributary Runoff into Combined Sewers 60%(MG)	Estimated Overflow to River (MG)	South Side Interceptor: Estimated Sanitary Flow Diverted (MG)	South Side Interceptor: Estimated Tributary Runoff 40%(MG)	South Side Interceptor: Estimated Tributary Runoff 60%(MG)	Second River Union Outlet Flow to River (MG)	Total Estimated Overflow + (MG)	Average Daily Plant Flows (MGD)
1 S								RECORDS SHOWED THAT NO MANUAL BYPASS ACTION WAS TAKEN DURING THIS PERIOD.					210
2 S											46**	46	219
3 M													251
4 Tu													250
5 W	0.48	13.00	0.037	0.08	64	96	60		17	25		81	273
6 Th													279
7 F													251
8 S													221
9 S													207
10 M													238
11 Tu													245
12 W	0.62	7.00	0.089	0.15	82	123	100		22	33		128	241
13 Th													254
14 F													251
15 S													228
16 S													227
17 M	0.20	4.00	0.050	0.10	27	40	5		7	11	4	18	256
18 Tu	0.02	1.00	0.020	0.02	2	4	-		1	1		1	275
19 W	0.15	2.00	0.075	0.12	20	29	10		5	8		16	257
20 Th													249
21 F													248
22 S													228*
23 S	0.40	3.50	0.114	0.18	53	79	50		14	21		68	228*
24 M	1.15	22.00	0.052	0.60	152	228	160		40	61	28	238	322
25 Tu													277
26 W													268
27 Th													263
28 F													257
TOTAL	3.02				400	599	385		106	160	78	596	6,976 MG/Month
													249 Average

*Estimated value--no reading available.
**Breakdown of Newark Bay Pumping Station.

TABLE 6

RAINFALL, ESTIMATED OVERFLOW TO PASSAIC RIVER, AND PLANT FLOWS

Month: March, 1975

Date/ Day of Week	Total Rainfall (Inches)	Rainfall Duration (Hours)	Average Rainfall Intensity (In./hr.)	Maximum Rainfall Intensity (in 30 mins.) (In./hr.)	Estimated Tributary Runoff into Combined Sewers 40%(MG)	Estimated Tributary Runoff into Combined Sewers 60%(MG)	Estimated Overflow to River (MG)	South Side Interceptor: Estimated Sanitary Flow Diverted (MG)	South Side Interceptor: Estimated Tributary Runoff 40%(MG)	South Side Interceptor: Estimated Tributary Runoff 60%(MG)	Second River Union Outlet Flow to River (MG)	Total Estimated Overflow + (MG)	Average Daily Plant Flow (MGD)
1 S													233
2 S													213
3 M													253
4 Tu													253
5 W													255
6 Th													247
7 F													249
8 S													218
9 S													205
10 M													240
11 Tu													236
12 W	0.62	6.50	0.095	0.26	82	123	90	4	22	33	15	136	274
13 Th													244
14 F	0.35	5.25	0.067	0.20	47	70	50		12	18		65	257
15 S													252
16 S													210*
17 M													237
18 Tu													250
19 W	0.85	9.50	0.089	0.20	113	168	130	4	30	45	) 24	) 300	292
20 Th	0.55	13.50	0.041	0.20	73	108	80		19	29	)	)	286
21 F	0.10	1.75	0.057	0.08	13	20	10		4	5		14	259
22 S													248
23 S													215
24 M	0.19	8.75	0.022	0.04	25	38	20		7	10		28	291
25 Tu													264
26 W													261
27 Th													256
28 F													225
29 S	0.07	1.00	0.070	0.10	10	14	5		2	4		8	257
30 S	0.38	4.50	0.084	0.18	50	75	50		13	20		66	239
31 M													248
TOTAL	3.11				413	616	435	8	109	164	39	617	7,667 MG/Month 247 Average

*Estimated value--no reading available.

TABLE 6

RAINFALL, ESTIMATED OVERFLOW TO PASSAIC RIVER, AND PLANT FLOWS

Month: April, 1975

Date/ Day of Week	Total Rainfall (Inches)	Rainfall Duration (Hours)	Average Rainfall Intensity (In./hr.)	Maximum Rainfall Intensity (in 30 mins.) (In./hr.)	Estimated Tributary Runoff into Combined Sewers 40%(MG)	Estimated Tributary Runoff into Combined Sewers 60%(MG)	Estimated Overflow to River (MG)	South Side Interceptor: Estimated Sanitary Flow Diverted (MG)	South Side Interceptor: Estimated Tributary Runoff 40%(MG)	South Side Interceptor: Estimated Tributary Runoff 60%(MG)	Second River Union Outlet Flow to River (MG)	Total Estimated Overflow + (MG)	Average Daily Plant Flow (MGD)
1 Tu													259
2 W													268
3 Th	0.75	6.00	0.125	0.23	99	149	100	2	26	40	12	147	282
4 F													252
5 S													230
6 S													225
7 M													251
8 Tu													250
9 W													247
10 Th													246
11 F													246
12 S													222
13 S													207
14 M													236
15 Tu	0.14	8.00	0.018	0.04	18	28	10		5	7		16	259
16 W	0.01	1.00	0.010	0.01	1	2	--		—	1		1	244
17 Th													243
18 F	0.01	1.00	0.010	0.01	1	2	--		—	1		1	245
19 S	0.03	2.00	0.015	0.02	4	7	--		1	2		2	214
20 S													193
21 M													221
22 Tu													239
23 W	0.04	0.5	0.080	0.08	5	8	--		1	2	2	4	274
24 Th	1.34	14.67	0.091	0.26	177	266	200	2	47	71	7	268	307
25 F	0.41	7.75	0.053	0.08	54	81	50	6	14	22	) 6	82	290
26 S	0.04	1.00	0.040	0.04	5	7	--	1	1	2	)		219
27 S													197
28 M													239
29 Tu													245
30 W													242
TOTAL	2.77				364	550	360	11	95	148	27	521	7,292 MG/Month
													243 Average

202

TABLE 6

RAINFALL, ESTIMATED OVERFLOW TO PASSAIC RIVER, AND PLANT FLOWS

Month: May, 1975

Date/ Day of Week	Total Rainfall (Inches)	Rainfall Duration (Hours)	Average Rainfall Intensity (In./hr.)	Maximum Rainfall Intensity (in 30 mins.) (In./hr.)	Estimated Tributary Runoff into Combined Sewers 40%(MG)	Estimated Tributary Runoff into Combined Sewers 60%(MG)	Estimated Overflow to River (MG)	South Side Interceptor: Estimated Sanitary Flow Diverted (MG)	South Side Interceptor: Estimated Tributary Runoff 40%(MG)	South Side Interceptor: Estimated Tributary Runoff 60%(MG)	Second River Union Outlet Flow to River (MG)	Total Estimated Overflow + (MG)	Average Daily Plant Flow (MGD)
1 Th													246
2 F	0.12	0.75	0.160	0.16	16	24	-		4	6		5	262
3 S													219
4 S	0.97	19.75	0.049	0.14	128	192	130	9	34	51)		)	296
5 M	0.08	6.00	0.013	0.03	11	16	5		3	4)	11	)240	244
6 Tu	0.21	1.20	0.175	0.32	28	41	30		7	11)		)	283
7 W													259
8 Th													254
9 F													245
10 S													212
11 S													199
12 M	0.20	3.50	0.057	0.10	26	40	-		7	11		9	299
13 Tu	1.32	6.75	0.196	0.54	175	262	125	6	46	70	5	194	304
14 W													284
15 Th													315
16 F	0.63	5.17	0.122	0.28	84	125	40	6	22	33		74	298
17 S													241
18 S													219
19 M													251
20 Tu													252
21 W	0.08	2.00	0.040	0.07	11	16	-		3	4		4	268
22 Th													253
23 F													255
24 S													223
25 S	0.32	1.75	0.183	0.48	42	64	20		11	17		34	190
26 M													207
27 Tu													249
28 W													254
29 Th													240
30 F	0.22	8.75	0.025	0.08	29	43	30		8	12		40	262
31 S													270
TOTAL	4.15				550	823	380	21	145	219	16	600	7,853 MG/Month
													253 Average

TABLE 6

RAINFALL, ESTIMATED OVERFLOW TO PASSAIC RIVER, AND PLANT FLOWS

Month: June, 1975

Date/ Day of Week	Total Rainfall (Inches)	Rainfall Duration (Hours)	Average Rainfall Intensity (In./hr.)	Maximum Rainfall Intensity (in 30 mins.) (In./hr.)	Estimated Tributary Runoff into Combined Sewers 40%(MG)	60%(MG)	Estimated Overflow to River (MG)	South Side Interceptor: Estimated Sanitary Flow Diverted (MG)	Estimated Tributary Runoff 40%(MG)	60%(MG)	Second River Union Outlet Flow to River (MG)	Total Estimated Overflow + (MG)	Average Daily Plant Flow (MGD)
1 S	1.60	12.00	0.133	1.34	212	317	220	3	56	84	5	298	231
2 M													254
3 Tu													252
4 W													267
5 Th	1.37	7.00	0.196	0.78	181	272	180	1	48	72	20		332
6 F	0.98	7.17	0.137	0.66	129	194	160	6	34	52		470	289
7 S													242
8 S													211
9 M													256
10 Tu													263
11 W													287
12 Th	1.81	23.00	0.079	0.15	239	359	270	5	64	96	21	382	353
13 F	0.04	2.00	0.020	0.02	5	8	5		1	2			290
14 S													247
15 S													216
16 M	0.10	1.00	0.100	0.10	13	19	10	6	4	5		20	284
17 Tu													275
18 W													278
19 Th	0.81	0.63	1.279	1.28	107	161	125	6	29	43		167	303
20 F													274
21 S													239
22 S													206
23 M													262
24 Tu	0.36	1.25	0.288	0.29	48	72	50		13	19		66	292
25 W													272
26 Th													262
27 F													259
28 S	0.75	2.30	0.326	1.20	99	149	120		26	40	2	155	247
29 S	0.45	0.67	0.675	0.85	60	89	70		16	24		90	217
30 M													244
TOTAL	8.27				1,093	1,640	1,210	27	291	437	48	1,648	7,904 MG/Month
													263 Average

TABLE 6

RAINFALL, ESTIMATED OVERFLOW TO PASSAIC RIVER, AND PLANT FLOWS

Month: July, 1975

Date/ Day of Week	Total Rainfall (Inches)	Rainfall Duration (Hours)	Average Rainfall Intensity (In./hr.)	Maximum Rainfall Intensity (in 30 mins.) (In./hr.)	Estimated Tributary Runoff into Combined Sewers 40%(MG)	Estimated Tributary Runoff into Combined Sewers 60%(MG)	Estimated Overflow to River (MG)	South Side Interceptor: Estimated Sanitary Flow Diverted (MG)	South Side Interceptor: Estimated Tributary Runoff 40%(MG)	South Side Interceptor: Estimated Tributary Runoff 60%(MG)	Second River Union Outlet Flow to River (MG)	Total Estimated Overflow + (MG)	Average Daily Plant Flows (MGD)
1 Tu													248
2 W													252
3 Th	0.18	2.00	0.090	0.16	24	36	25		6	10		33	237
4 F													185
5 S													189
6 S	0.14	1.50	0.093	0.18	18	28	20		5	7	13**	39	227
7 M													197
8 Tu								2				2	233
9 W	0.20	0.50	0.400	0.40	26	39	30	2	7	11	4	45	284
10 Th													243
11 F													239
12 S	0.12	2.75	0.044	0.14	16	24	15		4	6	19	39	215
13 S	2.57	13.50	0.190	2.30	340	510	400	4	90	136	11	528	283
14 M	1.48	5.50	0.269	0.82	195	293	250	2	52	78	8	325	337
15 Tu	1.55	5.00	0.310	1.20	205	307	260	11	55	82		340	290
16 W													267
17 Th													317
18 F													293
19 S													250
20 S	0.30	0.50	0.600	0.60	39	60	45		11	16	)	)	279
21 M	0.40	2.50	0.160	0.60	53	79	55	3	14	21	) 4	) 138	292
22 Tu													288
23 W													285
24 Th	0.20	0.25	0.800	0.40	26	39	30		7	11	)		334
25 F	1.90	3.75	0.507	1.00	252	377	295	9	67	100	) 20	446	324
26 S													275
27 S													244
28 M													272
29 Tu													267
30 W													259
31 Th													268
TOTAL	9.04				1,194	1,792	1,425	33	318	478	79	1,935	8,173 MG/Month
													264 Average

** Breakdown in N. B. Pumping Station

TABLE 6

RAINFALL, ESTIMATED OVERFLOW TO PASSAIC RIVER, AND PLANT FLOWS

Month: August, 1975

Date/ Day of Week	Total Rainfall (Inches)	Rainfall Duration (Hours)	Average Rainfall Intensity (In./hr.)	Maximum Rainfall Intensity (in 30 mins.) (In./hr.)	Estimated Tributary Runoff into Combined Sewers 40%(MG)	60%(MG)	Estimated Overflow to River (MG)	South Side Interceptor: Estimated Sanitary Flow Diverted (MG)	South Side Interceptor: Estimated Tributary Runoff 40%(MG)	60%(MC)	Second River Union Outlet Flow to River (MG)	Total Estimated Overflow + (MG)	Average Daily Plant Flow (MGD)
1 F													278
2 S													275
3 S													278
4 M													294
5 Tu	0.20	2.00	0.100	0.20	26	40	25		7	11		34	313
6 W													331
7 Th	0.50	6.00	0.083	0.30	66	99	70	2	18	26		94	269
8 F	0.25	2.25	0.111	0.2C	34	50	35		9	13		46	281
9 S													252
10 S													212
11 M													274
12 Tu													280
13 W	0.10	0.25	0.400	0.20	13	20	5		4	5		10	266
14 Th													271
15 F													255
16 S													265
17 S													213
18 M													267
19 Tu													265
20 W													251
21 Th													251
22 F													268
23 S													226
24 S	1.35	0.75	1.800	2.50	178	267	180		48	71)	)	)	305
25 M	0.40	2.50	0.160	0.50	53	79	50	1	14	21)	7	) 388	335
26 Tu	0.40	0.75	0.533	0.60	53	79	50	6	14	21)	)	)	311
27 W													292
28 Th													277
29 F													278
30 S													240
31 S													206
TOTAL	3.20				423	634	415	9	114	168	7	572	8,379 MG/Month
													270 Average

TABLE 6

RAINFALL, ESTIMATED OVERFLOW TO PASSAIC RIVER, AND PLANT FLOWS

Month: September, 1975

Date/ Day of Week	Total Rainfall (Inches)	Rainfall Duration (Hours)	Average Rainfall Intensity (In./hr.)	Maximum Rainfall Intensity (in 30 mins.) (In./hr.)	Estimated Tributary Runoff into Combined Sewers 40%(MG)	Estimated Tributary Runoff into Combined Sewers 60%(MG)	Estimated Overflow to River (MG)	South Side Interceptor: Estimated Sanitary Flow Diverted (MG)	South Side Interceptor: Estimated Tributary Runoff 40%(MG)	South Side Interceptor: Estimated Tributary Runoff 60%(MG)	Second River Union Outlet Flow to River (MG)	Total Estimated Overflow + (MG)	Average Daily Plant Flow (MGD)
1 M													203
2 Tu													252
3 W													260
4 Th													255
5 F													257
6 S													222
7 S													204
8 M													264
9 Tu													259
10 W													265
11 Th	T							5				5	260
12 F	0.20	1.00	0.200	0.30	26	40	25	3	7	11		37	290
13 S													230
14 S													201
15 M													246
16 Tu													251
17 W													255
18 Th													271
19 F	0.40	7.50	0.052	0.10	53	79	50		14	21		68	293
20 S	T							2				2	244
21 S	0.85	5.75	0.148	0.30	113	168	120	4	30	45		162	246
22 M	0.18	1.50	0.120	0.12	24	36	20		6	10	)	)	338
23 Tu	2.22	24.00	0.093	0.40	293	441	350	7	78	117	)	)	356
24 W	1.63	21.50	0.076	0.30	216	324	250		57	86	) 128	) 1,614	351
25 Th	1.15	17.25	0.067	0.20	152	228	200	16	40	61	)	)	348
26 F	1.45	24.00	0.060	0.80	192	288	250	20	51	77	)	)	389
27 S	0.35	3.75	0.093	0.40	46	70	50	17	12	18	)	)	343
28 S													336
29 M													318
30 Tu													308
TOTAL	8.43				1,115	1,674	1,315	74	295	446	128	1.888	8,315 MG Month; 277 Average
GRAND TOTAL: (Oct. 1, 1974 through Sep. 30, 1975)	54.74				7,239	10,857	7,540	257	1,923	2,894	597	10,808	91,611 MG Year; 251 Average

THE SIGNIFICANCE OF THE PVSC OVERFLOWS

The scope of work for evaluating the significance of the PVSC overflows contemplated the utilization of the State of New Jersey, Department of Environmental Protection computer model developed by "Teledyne", to determine the impact of the overflows on the Lower Passaic River. The model is used for the prediction of dissolved oxygen profiles under the various loading conditions within the Lower Passaic River and Newark Bay estuarine system. A copy of the Teledyne model was obtained and reviewed. It was found to be a two-dimensional, steady state model which is not adaptable to the multiple intermittent and irregular (weather dependent) inputs of the Passaic Valley overflow system, and therefore, could not accurately predict the dissolved oxygen profile in the complex estuarine system.

It is recommended that the New Jersey Department of Environmental Protection develop a dynamic model to study the impact of the Passaic Valley Sewerage Commissioner's overflows on the Lower Passaic River and the associated estuarine system. In the meantime, it is recommended that a comprehensive data gathering effort be undertaken to supplement the extensive information gathered by the Passaic Valley Sewerage Commissioners to more fully relate the significance of the PVSC overflows on the Lower Passaic River and Newark Bay estuarine complex. This study should examine the interrelationship of the various chemical and biological parameters to the physical dynamics of the system (ie., stream flow and tidal cycle). The data developed could be used in the model developed for the Lower Passaic River Basin area. In this manner, the impact of the Passaic Valley overflows may be able to be fully understood.

The present contract with the Passaic Valley Sewerage Commissioners does not provide for this level of effort to determine the associated impact of the overflows. It appears logical that this effort could be effectively administered in an areawide wastewater management study (PL-92:500, Sec. 208) and/or the northeast water quality management study (PL-92:500, Sec. 303e).

Investigations undertaken in the overflow study have yielded information which will be useful as an input into the computer model to be developed if the recommendations of this study are carried out. As a result of these studies, the BOD_5 load discharged to the Passaic River from the overflows has been determined. It was found that approximately 4,800 tons of BOD_5 were discharged from the overflows to the Passaic River during the year of study, October, 1974 to September, 1975 (Table 7). The PVSC treats approximately 123,911 tons of BOD_5 per year at the wastewater treatment facility. This figure is based upon a BOD_5 concentration of 319 mg/l and an average daily flow of 255 MGD (most recent STP data extracted from PVSC, March 1975 - March 1976). Consequently, the load discharged to the river from the overflows is equivalent to approximately 3.9% of the BOD_5 load received by the treatment plant on a yearly basis. It must be kept in mind that the load, discharged to the Passaic River is intermintant, occuring only during periods of rainfall, and terminating when rainfall ceases. During the year of study the overflows functioned 84 times for a duration never exceeding six hours.

It becomes evident that under such conditions of discharge to the river, simplistic approaches will not yield meaningful results.

It is strongly recommended that studies be undertaken either under the auspices of Sec. 208 or 303e of PL 92-500 to develop the required mathematical models to accurately predict the impact of the overflows on the lower Passaic River and estuarine complex.

TABLE 7

POLLUTION LOAD FROM PVSC OVERFLOWS

Month/Yr.	Total Rainfall (Inches)	BOD_5 to River from Overflows (Tons)
Oct. /74	2.22	184.9
Nov. /74	0.85	35.1
Dec. /74	5.15	456.0
Jan. /75	4.53	353.9
Feb. /75	3.02	242.4
Mar. /75	3.11	277.5
Apr. /75	2.77	229.6
May /75	4.15	242.3
June /75	8.27	771.6
July /75	9.04	908.6
Aug. /75	3.20	264.6
Sept./75	8.43	838.5
	54.74	4,805.0*

* Total yearly load contributed from overflows located in PVSC combined sewer areas

Rainfall Data for Newark Airport

APPENDIX

CONTENTS OF APPENDIX

APPENDIX
OVERFLOW CHAMBER
BENCH MARK CROSS-REFERENCE

NPDES NO.	OVERFLOW LOCATION	B.M. NO.
HARRISON-KEARNY AREA:		
008/E-001	Central Avenue, E. Newark	1264
010/H-001	New (Hamilton)Street, Harrison	1264
011/H-002	Cleveland Street, Harrison	1264
012/H-003	Harrison Avenue, Harrison	1264
013/H-004	Dey Street, Harrison	1264
014/H-005	Middlesex Street, Harrison	1264
015/H-006	Bergen Street,Harrison	1264
016/H-007	Worthington Avenue, Harrison	1287
019/K-003	Bergen Avenue, Kearny	1261
020/K-004	Nairn Avenue, Kearny	1261
021/K-005	Marshall Street, Kearny	1261
022/K-006	Johnston Avenue, Kearny	1264
023/K-007	Ivy Street, Kearny	1291
024/K-008	Bergen Avenue, Kearny	1291
025/K-009	Tappan Street, Kearny	1291
026/K-010	Dukes Street, Kearny	1291
NEWARK AREA:		
028/N-001	Verona Avenue, Newark	1252
029/N-002	Delavan Avenue, Newark	1252
030/N-003	Herbert Place, Newark	1252
031/N-004	Third Avenue, Newark	9660A
032/N-005	Fourth Avenue, Newark	9660A
033/N-006	Clay Street, Newark	9660A
033/N-006C	Passaic Street, Newark	9660A
034/N-007	Orange Street, Newark	9658
035/N-008	Bridge Street, Newark	9658
036/N-009	Rector Street, Newark	9655
037/N-010	Saybrook Place, Newark	9655
038/N-011	City Dock, Newark	9655
039/N-012	Jackson Street, Newark	RV1102
040/N-013	Polk Street, Newark	RV1102
041/N-014	Freeman Street, Newark	RV1102
074/U-001	Second River Union Outlet, Newark	1252
KEARNY-NORTH ARLINGTON BRANCH:		
017/K-001	Stewart Avenue, Kearny	1279
018/K-002	Washington Avenue, Kearny	1279
071/R-001	Woodward Avenue, Rutherford	RV14
072/R-002	Pierrepont Avenue, Rutherford	RV14
073/R-003	Rutherford Avenue,Rutherford	RV14

APPENDIX
OVERFLOW CHAMBER
BENCH MARK CROSS-REFERENCE

(Continued)

NPDES NO.	OVERFLOW LOCATION	B.M. NO.
003	Yantacaw Street, Clifton	--
004	Yantacaw Pump Station, Clifton	--
006	North Arlington Chamber & Syphon, North Arlington	1279
GARFIELD-WALLINGTON-PASSAIC BRANCH:		
009/G-001	Garden State Paper Company, Garfield	--
027/L-001	Lodi Force Main, Wallington	--
069/Q-001	Passaic Tail Race, Passaic	--
070/Q-002	Dundee Island, Passaic	Assumed Datum
005	Wallington Pump Station, Passaic	--
PATERSON AREA:		
042/P-001	Curtis Place, Paterson	11A
043/P-002	Mulberry Street, Paterson	11A
044/P-003	West Broadway, Paterson	11A
045/P-004	Bank Street, Paterson	11A
046/P-005	Bridge Street, Paterson	6A
047/P-006	Montgomery Street, Paterson	4A
048/P-007	Straight Street, Paterson	3A
049/P-008	Franklin Street, Paterson	2A
050/P-009	Keen Street, Paterson	2A
051/P-010	Warren Street, Paterson	1
052/P-011	Sixth Avenue, Paterson	8
053/P-012	East Fifth Street & Fifth Avenue Paterson	10
054/P-013	East 11th Street, Paterson	14
055/P-014	East 12th Street & 4th Avenue, Paterson	19
056/P-015	S.U.M. Park, Paterson	69
057/P-016	N. West Street, Paterson	11A
058/P-017	Arch Street, Paterson	6A
059/P-018	Jefferson Street, Paterson	6A
060/P-019	Stout Street, Paterson	6A
061/P-020	N. Straight Street, Paterson	3A
062/P-021	Bergan Street, Paterson	68
063/P-022	Short Street, Paterson	68
064/P-023	Second Avenue, Paterson	26
065/P-024	Third Avenue, Paterson	27
066/P-025	10th Avenue & 33rd Street, Paterson	38
067/P-026	20th Avenue, Paterson	55
068/P-027	Market Street, Paterson	58
007	Hudson Street, Paterson	6A

APPENDIX
OVERFLOW CHAMBER
BENCH MARK CROSS-REFERENCE
(Continued)

NOTE:

All Bench Mark elevations as listed in this Appendix were increased by a factor of 100.00 feet to obviate the appearance of negative invert elevations on The Plan and Profile drawings in the Individual Overflow Reports.

APPENDIX
NEW JERSEY GEODETIC CONTROL SURVEY BENCH MARKS

B.M. NO.	DESCRIPTION	ELEVATION
RV. 14	At Rutherford, Bergen County, at the northeast corner of the intersection of Van Ness and Park Avenue, 50 feet southwest of the southwest corner of the residence at 338 Park Ave., 27 feet east of the center line of Van Ness Ave., 24 feet north of the center line of Park Ave., and in the top of the concrete curb. A standard monel-metal rivet.	77.959
RV. 1102	At Newark, Essex County, about 50 feet north of the north curb of Raymond Blvd., at the Jackson Street approach to the bridge over the Passaic River, on the southeast corner of the concrete base of the second concrete pier north of the Boulevard; 0.25 feet north of the south face, and 0.31 feet west of the east face, of the base. A standard monel-metal rivet.	10.126
1252	At Newark, Essex County, a standard U.S.C. & G.S. & S.S bronze disk, stamped "1252" and set in the top of a concrete post, level with the ground surface; on the southwest corner of Verona Avenue, and Riverside Avenue (State Highway Route 21). This monument is 13.10 feet south of the south curb of Verona Ave.; 10.45 feet southwest of pole No. 69857, and 13.50 feet west of the west curb of Riverside Avenue.	12.440
1261	At Kearny, Hudson County, 7.62 feet east of the east curb of Passaic Avenue; 5.50 feet north of the north curb of Bergen Avenue; 6 feet southeast of pole K-61775; and level with grade. A standard U.S.C. & G.S. & S.S. disk set in concrete.	9.800
1264	Harrison, Hudson County, 9.98 feet south of the curb of Harrison Avenue, about 300 feet east of the east end of the Bridge Street bridge over the Passaic River, 13.56 feet southwest of pole PS 407-H, and level with the sidewalk. A standard U.S.C. & G.S. & S.S. disk set in concrete.	8.637 Elevati (1939) 8.490 Revised (1940)

APPENDIX
NEW JERSEY GEODETIC CONTROL SURVEY BENCH MARKS
(Continued)

B.M. NO.	DESCRIPTION	ELEVATION
1279	Kearny, Hudson County, on the west side of Passaic Avenue, about 25 feet south of the tracks of the Erie Railroad; 17.55 feet east of the southeast corner of the West Arlington station; 5.59 feet southwest of a concrete wall which runs parallel to and south of the tracks; and level with grade. A standard U. S. C. and G. S. and S. S. disk, set in concrete.	50.834
1287	Harrison, Hudson County, at the southwest corner of Harrison Avenue and Worthington Avenue, flush with the ground, 63.70 feet south of the southwest corner of the intersection, 64.22 feet north of the northeast corner of the brick building on the southwest corner of the intersection.	15.322
1291	Kearny, Hudson County, at the southwest corner of Schuyler Avenue and Hoyt Street, flush with the ground surface, 48.96 feet south of the corner, at the entrance of a frame building at 141 Schuyler Avenue on the northwest corner of the intersection; 8.02 feet south of a cross cut on the south curb of Hoyt Street, and 8.57 feet west of a cross cut on the west curb of Schuyler Avenue. A standard U.S.C. and G. S. and S. S. disk, set in concrete.	9.689
9655	Newark, Essex County, at the easterly side of the intersection of McCarter Highway and East Park Street, flush with the ground surface; 37.95 feet east of the center line of McCarter Highway; 31.70 feet northeast of pole number 846 HM; 78.40 feet southeast of king bolt on fire hydrant; 2.14 feet northeast of hole drilled in easterly curb of McCarter Highway, and 1.59 feet southeast of hole drilled in curb of McCarter Highway. A standard N.J.G.C.S. disk, set in concrete.	33.683
9658	Newark, Essex County, a standard N.J.G.C.S. disk set in concrete flush with the curb. This monument is located 27.75 feet east of the centerline of McCarter Highway, 74.40 feet north of a cross on hydrant; 12.59 feet south of tack in pole; 2.22 feet northeast of a drill hole in the curb, and 2.64 feet southeast of drill hole in curb.	15.914

APPENDIX
NEW JERSEY GEODETIC CONTROL SURVEY BENCH MARKS
(Continued)

B.M. NO.	DESCRIPTION	ELEVATION
9660A	Newark, Essex County, a standard N.J.G.C.S. disk set in concrete sidewalk. At the northeast corner of the intersection of Route 21 and East Mill Street; 7.4 feet northeast of the northeast corner of the catch basin on the northerly corner of the intersection; 27.4 feet northwest of the southwest corner of a two-story brick office building, and 54.0 feet southwest of the northeast corner of a two-story brick factory.	19.851

APPENDIX
PAUL J. EMILIUS & ASSOCTATES BENCH MARKS, PATERSON

B.M. No.	DESCRIPTION	ELEVATION
1	The "arrow" on top of the fire hydrant at the northeast corner of River St., and Warren St.	55.107
2A	The "arrow" on top of the fire hydrant at the southeast corner of River St., and Franklin St.	49.199
3A	The "O" in word "Corey" on top of the fire hydrant at the southeast corner of River St., and Straight St.	45.987
4A	The "arrow" on top of the fire hydrant on the southeast corner of River St., and Montgomery St.	43.777
6A	The "arrow" on top of the fire hydrant on the east side of River St., in front of Building #164.	44.454
8	The northwest corner of catch basin head on the west side of 5th St., at the intersection with 6th Ave.	46.214
10	The "arrow" on top of the fire hydrant on the east side of 5th St., in front of Building #19 (Tenneco Chemical Company).	43.154
11A	The "arrow" on top of the fire hydrant at the southeast corner of River St., and West Broadway.	49.703
14	The "arrow" on top of the fire hydrant at the northeast corner of 5th Ave., and East 11th St.	54.492
19	The "arrow" on top of the fire hydrant at the northeast corner of River St., and 16th St.	67.473
26	A railroad spike in pole #PS 7856P, on the east side of McLean Boulevard.	40.140
27	The northeast corner of catch basin head at the southwest corner of McLean Blvd., and 3rd Ave.	39.173

APPENDIX
PAUL J. EMILIUS & ASSOCIATES BENCH MARKS, PATERSON

B.M. No.	DESCRIPTION	ELEVATION
38	The "arrow" on top of the fire hydrant in the median on McLean Blvd., opposite East 33rd St.	47.047
55	The northwest corner of catch basin head on the east side of McLean Blvd., in front of the Coca-Cola Bottling Company.	41.976
58	The southeast corner of catch basin head on west side of McLean Blvd., at intersection of Market St.	42.295
68	The southwest bolt on plate of last guard rail post at southwest end of bridge at Hillman St.	44.726
69	Southerly side of rim of P.C.S. manhole behind northeast corner of animal shelter.	67.625

APPENDIX

NOTE:

Seventy-three individual Overflow Reports are bound separately, by geographical area, as follows:

Area	Number of Reports
Paterson Area Overflows	28
Clifton-Passaic-Rutherford Area Overflows	13
Newark Area Overflows	16
Kearny-Harrison-East Newark Area Overflows	16
Total:	73

SUMMARY OF PLANT FLOWS AND BYPASS VALVE CLOSING ACTIONS - NEWARK BAY PUMPING STATION-1974

MONTH: October

TIMES OF BYPASS VALVE ACTION, BY LOCATION (Times of Day: 24-Hour Clock)

Date	Day of Week	Average Flow (MGD)	Peak Flow During Rainfall (MGD)	Amount of Rainfall (Inches)	South Side Interceptor Newark Closed	South Side Interceptor Newark Open	Union Outlet Newark (074/U-001) Closed	Union Outlet Newark (074/U-001) Open	Jackson Ave., Newark (039/N-012) Closed	Jackson Ave., Newark (039/N-012) Open	Rector St., Newark (036/N-009) Closed	Rector St., Newark (036/N-009) Open	Clay St., Newark (033/N-006) Closed	Clay St., Newark (033/N-006) Open	Polk St., Newark (040/N-013) Closed	Polk St., Newark (040/N-013) Open	Saybrook Pl., Newark (037/N-010) Closed	Saybrook Pl., Newark (037/N-010) Open	Herbert Pl., Newark (030/N-003) Closed	Herbert Pl., Newark (030/N-003) Open	Fourth Ave., Newark (032/N-005) Closed	Fourth Ave., Newark (032/N-005) Open	Freeman St., Newark (041/N-014) Closed	Freeman St., Newark (041/N-014) Open
1	Tu	260																						
2	W	251	360	T																				
3	Th	253																						
4	F	243																						
5	S	218																						
6	S	205																						
7	M	231																						
8	Tu	236																						
9	W	235																						
10	Th	234																						
11	F	232																						
12	S	213																						
13	S	194	230	T																				
14	M	230																						
15	Tu	295	340	0.20																				
16	W	264	380	1.90			100	2000	1100	2200	900	2100	400	2100	1000	2200	1000	2100	400	2000	400	2000	1000	2100
17	Th	223																						
18	F	246																						
19	S	223																						
20	S	202																						
21	M	238																						
22	Tu	236																						
23	W	237																						
24	Th	236																						
25	F	240	365	0.08																				
26	S	223																						
27	S	198																						
28	M	227																						
29	Tu	238																						
30	W	239	320	T																				
31	Th	244	331	0.04																				
				2.22 (Total)																				

SUMMARY OF PLANT FLOWS AND BYPASS VALVE CLOSING ACTIONS - NEWARK BAY PUMPING STATION-1974

MONTH: November

TIMES OF BYPASS VALVE ACTION, BY LOCATION (Times of Day: 24-Hour Clock)

Date	Day of Week	Average Flow (MGD)	Peak Flow During Rainfall (MGD)	Amount of Rainfall (Inches)	South Side Interceptor Newark Closed	South Side Interceptor Newark Open	Union Outlet Newark (074/U-001) Closed	Union Outlet Newark (074/U-001) Open	Jackson Ave., Newark (039/N-012) Closed	Jackson Ave., Newark (039/N-012) Open	Rector St., Newark (036/N-009) Closed	Rector St., Newark (036/N-009) Open	Clay St., Newark (033/N-006) Closed	Clay St., Newark (033/N-006) Open	Polk St., Newark (040/N-013) Closed	Polk St., Newark (040/N-013) Open	Saybrook Pl., Newark (037/N-010) Closed	Saybrook Pl., Newark (037/N-010) Open	Herbert Pl., Newark (030/N-003) Closed	Herbert Pl., Newark (030/N-003) Open	Fourth Ave., Newark (032/N-005) Closed	Fourth Ave., Newark (032/N-005) Open	Freeman St. Newark (041/N-014) Closed	Freeman St. Newark (041/N-014) Open
1	F	241																						
2	S	215																						
3	S	199	230	0.01																				
4	M	238	340	T																				
5	Tu	250	326	0.04																				
6	W	238	335	0.01																				
7	Th	238																						
8	F	240																						
9	S	213																						
10	S	197																						
11	M	232																						
12	Tu	283	312	0.40	2400																			
13	W	241	352	0.05		300	200	700																
14	Th	244																						
15	F	234	350	0.02																				
16	S	204																						
17	S	194																						
18	M	231																						
19	Tu	244																						
20	W	262	357	0.28	1800	2100																		
21	Th	251	317	0.02	1700	1900																		
22	F	231																						
23	S	217																						
24	S	192																						
25	M	234	330	0.02																				
26	Tu	242																						
27	W	238																						
28	Th	188																						
29	F	195																						
30	S	192																						
				0.85 (Total)																				

SUMMARY OF PLANT FLOWS AND BYPASS VALVE CLOSING ACTIONS - NEWARK BAY PUMPING STATION-1974

MONTH: December

TIMES OF BYPASS VALVE ACTION, BY LOCATION

(Times of Day: 24-Hour Clock)

Date	Day of Week	Average Flow (MGD)	Peak Flow During Rainfall (MGD)	Amount of Rainfall (Inches)	South Side Interceptor Newark Closed	South Side Interceptor Newark Open	Union Outlet Newark (074/U-001) Closed	Union Outlet Newark (074/U-001) Open	Jackson Ave., Newark (039/N-012) Closed	Jackson Ave., Newark (039/N-012) Open	Rector St., Newark (036/N-009) Closed	Rector St., Newark (036/N-009) Open	Clay St., Newark (033/N-006) Closed	Clay St., Newark (033/N-006) Open	Polk St., Newark (040/N-013) Closed	Polk St., Newark (040/N-013) Open	Saybrook Pl., Newark (037/N-010) Closed	Saybrook Pl., Newark (037/N-010) Open	Herbert Pl., Newark (030/N-003) Closed	Herbert Pl., Newark (030/N-003) Open	Fourth Ave., Newark (032/N-005) Closed	Fourth Ave., Newark (032/N-005) Open	Freeman St., Newark (041/N-014) Closed	Freeman St., Newark (041/N-014) Open
1	S	271	373	0.45	2300		2300		600		500		100	800	600		600		100		100		600	
2	M	270	383	1.60		1200		1400		900		900				900		1000		800		800		900
3	Tu	236																						
4	W	240																						
5	Th	248																						
6	F	237																						
7	S	232	355	0.18																				
8	S	262	402	1.17	1200	1900	1200	700	1400	900	1300	800	1300	800	1400	900			1500	900	1300	800	1400	900
9	M	247																						
10	Tu	253																						
11	W	243																						
12	Th	243																						
13	F	241																						
14	S	212																						
15	S	203																						
16	M	310	370	1.35	1200	2200	1100	700	1300	1000	1200	900	1100	800	1300	900			1100	900	1100	800	1300	900
17	Tu	263																						
18	W	254																						
19	Th	259																						
20	F	254																						
21	S	219			1700	2100																		
22	S	204																						
23	M	225																						
24	Tu	213																						
25	W	208	319	0.30																				
26	Th	218																						
27	F	221																						
28	S	212																						
29	S	190																						
30	M	225																						
31	Tu	240	343	1.10																				
				5.15 (Total)																				

SUMMARY OF PLANT FLOWS AND BYPASS VALVE CLOSING ACTIONS - NEWARK BAY PUMPING STATION-1975

MONTH: January

TIMES OF BYPASS VALVE ACTION, BY LOCATION (Times of Day: 24-Hour Clock)

Date	Day of Week	Average Flow (MGD)	Peak Flow During Rainfall (MGD)	Amount of Rainfall (Inches)	South Side Interceptor Newark		Union Outlet Newark (074/U-001)		Jackson Ave., Newark (039/N-012)		Rector St., Newark (036/N-009)		Clay St., Newark (033/N-006)		Polk St., Newark (040/N-013)		Saybrook Pl., Newark (037/N-010)		Herbert Pl., Newark (030/N-003)		Fourth Ave., Newark (032/N-005)		Freeman St., Newark (041/N-014)	
					Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open
1	W	195	315	0.25																				
2	Th	220																						
3	F	232	330	0.02																				
4	S	202																						
5	S	193																						
6	M	285	320	0.14																				
7	Tu	257	340	0.41			800	1100																
8	W	286	330	0.05																				
9	Th	263	342	0.67			000	1300					600	1300					600	1300	600	1300		
10	F	262																						
11	S	222	320	0.08																				
12	S	234																						
13	M	264	343	0.77			900		1100				1000		1100				1000		1000		1100	
14	Tu	253						700		900				900		900				800		800		900
15	W	251																						
16	Th	253																						
17	F	252																						
18	S	250	391	0.73			1500		1600				1500		1600				1500		1500		1600	
19	S	254	357	0.17			2200	500		700				600		700				600		600		600
20	M	253	369	0.05				800																
21	Tu	258																						
22	W	256																						
23	Th	254																						
24	F	265																						
25	S	286	334	0.64																				
26	S	219																						
27	M	258																						
28	Tu	239																						
29	W	263	342	0.55			1600		700	1100	700	1200	600	1600	700	1100			600	1500	600	1500	600	1100
30	Th	255						900																
31	F	203																						
				4.53																				

TIERRA-B-008050

MONTH: February

SUMMARY OF PLANT FLOWS AND BYPASS VALVE CLOSING ACTIONS - NEWARK BAY PUMPING STATION-1975

TIMES OF BYPASS VALVE ACTION, BY LOCATION (Times of Day: 24-Hour Clock)

Date	Day of Week	Average Flow (MGD)	Peak Flow During Rainfall (MGD)	Amount of Rainfall (Inches)	South Side Interceptor Newark Closed	South Side Interceptor Newark Open	Union Outlet Newark (074/U-001) Closed	Union Outlet Newark (074/U-001) Open	Jackson Ave., Newark (039/N-012) Closed	Jackson Ave., Newark (039/N-012) Open	Rector St., Newark (036/N-009) Closed	Rector St., Newark (036/N-009) Open	Clay St., Newark (033/N-006) Closed	Clay St., Newark (033/N-006) Open	Polk St., Newark (040/N-013) Closed	Polk St., Newark (040/N-013) Open	Saybrook Pl., Newark (037/N-010) Closed	Saybrook Pl., Newark (037/N-010) Open	Herbert Pl., Newark (030/N-003) Closed	Herbert Pl., Newark (030/N-003) Open	Fourth Ave., Newark (032/N-005) Closed	Fourth Ave., Newark (032/N-005) Open	Freeman St., Newark (041/N-014) Closed	Freeman St., Newark (041/N-014) Open
1	S	210																						
2	S	219																						
3	M	251																						
4	Tu	250																						
5	W	273	345	0.48																				
6	Th	279																						
7	F	251																						
8	S	221																						
9	S	207																						
10	M	238																						
11	Tu	245																						
12	W	244	337	0.62																				
13	Th	254																						
14	F	251																						
15	S	228																						
16	S	227																						
17	M	256	358	0.20			2100																	
18	Tu	275	335	0.02				200																
19	W	257	330	0.15																				
20	Th	249																						
21	F	248																						
22	S	228*																						
23	S	228*	361	0.40																				
24	M	322	383	1.15			500						500						500		500			
25	Tu	277						500						600						600		600		
26	W	268																						
27	Th	263																						
28	F	257																						
				3.02 (Total)																				

*Estimated value--no reading available

SUMMARY OF PLANT FLOWS AND BYPASS VALVE CLOSING ACTIONS – NEWARK BAY PUMPING STATION-1975

MONTH: March

TIMES OF BYPASS VALVE ACTION, BY LOCATION (Times of Day: 24-Hour Clock)

Date	Day of Week	Average Flow (MGD)	Peak Flow During Rainfall (MGD)	Amount of Rainfall (Inches)	South Side Interceptor Newark		Union Outlet Newark (074/U-001)		Jackson Ave., Newark (039/N-012)		Rector St., Newark (036/N-009)		Clay St., Newark (033/N-006)		Polk St., Newark (040/N-013)		Saybrook Pl., Newark (037/N-010)		Herbert Pl., Newark (030/N-003)		Fourth Ave., Newark (032/N-005)		Freeman St., Newark (041/N-014)	
					Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open
1	S	233																						
2	S	213																						
3	M	253																						
4	Tu	253																						
5	W	255																						
6	Th	247																						
7	F	249																						
8	S	218																						
9	S	205																						
10	M	240																						
11	Tu	236																						
12	W	274	385	0.62																				
13	Th	244																						
14	F	257	342	0.35																				
15	S	252																						
16	S	210*																						
17	M	237																						
18	Tu	250																						
19	W	292	390	0.85			1600		1900		1800		1700		1800				1600		1600		1800	
20	Th	286	390	0.55			1400	700/1900		900		900		1300		900				1300		1200		800
21	F	259																						
22	S	248	350	0.10																				
23	S	215																						
24	M	291	360	0.19																				
25	Tu	264																						
26	W	261																						
27	Th	256																						
28	F	225																						
29	S	257	300	0.07																				
30	S	239	302	0.38																				
31	M	248																						
				3.11 (Total)																				

* Estimated value-no reading available

SUMMARY OF PLANT FLOWS AND BYPASS VALVE CLOSING ACTIONS - NEWARK BAY PUMPING STATION-1975

MONTH: April

TIMES OF BYPASS VALVE ACTION, BY LOCATION (Times of Day: 24-Hour Clock)

Date	Day of Week	Average Flow (MGD)	Peak Flow During Rainfall (MGD)	Amount of Rainfall (Inches)	South Side Interceptor Newark		Union Outlet Newark (074/U-001)		Jackson Ave., Newark (039/N-012)		Rector St., Newark (036/N-009)		Clay St., Newark (033/N-006)		Polk St., Newark (040/N-013)		Saybrook Pl., Newark (037/N-010)		Herbert Pl., Newark (030/N-003)		Fourth Ave., Newark (032/N-005)		Freeman St., Newark (041/N-014)	
					Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open
1	Tu	259																						
2	W	268																						
3	Th	282	395	0.75	2000	2100	700	2000	1000	000	900	2300	900	1700	1000	000	900	2400	800	1700	800	1700	900	2400
4	F	252																						
5	S	230																						
6	S	225																						
7	M	251																						
8	Tu	250																						
9	W	247																						
10	Th	246																						
11	F	246																						
12	S	222																						
13	S	207																						
14	M	236																						
15	Tu	259	312	0.14																				
16	W	244	306	0.01																				
17	Th	243																						
18	F	245	322	0.01																				
19	S	214	240	0.03																				
20	S	193																						
21	M	221																						
22	Tu	239																						
23	W	274	333	0.04	2000	2200	300/2200	700					400	900					300	800	400	800		
24	Th	307	375	1.34	**000	200	2400	700					200	900					200	800	200	900		
25	F	290	367	0.41	100			800																
26	S	219	375	0.04																				
27	S	197																						
28	M	239																						
29	Tu	245																						
30	W	242																						
				2.77 (Total)																				

** Interceptor action also at 2100 - 2300

TIERRA-B-008053

SUMMARY OF PLANT FLOWS AND BYPASS VALVE CLOSING ACTIONS - NEWARK BAY PUMPING STATION-1975

MONTH: May

TIMES OF BYPASS VALVE ACTION, BY LOCATION (Times of Day: 24-Hour Clock)

Date	Day of Week	Average Flow (MGD)	Peak Flow During Rainfall (MGD)	Amount of Rainfall (Inches)	South Side Interceptor Newark Closed	South Side Interceptor Newark Open	Union Outlet Newark (074/U-001) Closed	Union Outlet Newark (074/U-001) Open	Jackson Ave., Newark (039/N-012) Closed	Jackson Ave., Newark (039/N-012) Open	Rector St., Newark (036/N-009) Closed	Rector St., Newark (036/N-009) Open	Clay St., Newark (033/N-006) Closed	Clay St., Newark (033/N-006) Open	Polk St., Newark (040/N-013) Closed	Polk St., Newark (040/N-013) Open	Saybrook Pl., Newark (037/N-010) Closed	Saybrook Pl., Newark (037/N-010) Open	Herbert Pl., Newark (030/N-003) Closed	Herbert Pl., Newark (030/N-003) Open	Fourth Ave., Newark (032/N-005) Closed	Fourth Ave., Newark (032/N-005) Open	Freeman St., Newark (041/N-014) Closed	Freeman St., Newark (041/N-014) Open
1	Th	246																						
2	F	262	350	0.12																				
3	S	219																						
4	S	296	370	0.97	1800	2100																		
5	M	244	355	0.08	100																			
6	Tu	283	370	0.21																				
7	W	259																						
8	Th	254																						
9	F	245																						
10	S	212																						
11	S	199																						
12	M	299	340	0.20		2100								2300					2200		2200			
13	Tu	304	380	1.32	100		2000								900					800		900		
14	W	284						000																
15	Th	315																						
16	F	298	390	0.63	600	500																		
17	S	241																						
18	S	219																						
19	M	251																						
20	Tu	252																						
21	W	268	355	0.08																				
22	Th	253																						
23	F	255																						
24	S	223																						
25	S	190	313	0.32																				
26	M	207																						
27	Tu	249																						
28	W	254																						
29	Th	240																						
30	F	262	325	0.22																				
31	S	270																						
				4.15 (Total)																				

SUMMARY OF PLANT FLOWS AND BYPASS VALVE CLOSING ACTIONS - NEWARK BAY PUMPING STATION-1975

MONTH: June

TIMES OF BYPASS VALVE ACTION, BY LOCATION (Times of Day: 24-Hour Clock)

Date	Day of Week	Average Flow (MGD)	Peak Flow During Rainfall (MGD)	Amount of Rainfall (Inches)	South Side Interceptor Newark Closed	South Side Interceptor Newark Open	Union Outlet Newark (074/U-001) Closed	Union Outlet Newark (074/U-001) Open	Jackson Ave., Newark (039/N-012) Closed	Jackson Ave., Newark (039/N-012) Open	Rector St., Newark (036/N-009) Closed	Rector St., Newark (036/N-009) Open
1	S	231	397	1.60	200	800	500	1100				
2	M	254										
3	Tu	252										
4	W	267										
5	Th	332	405	1.37	2000	2100	2000					
6	F	289	363	0.98	1500	2000	1500	800/2400	100/1600	900	100/1700	900
7	S	242								200		100
8	S	211	240									
9	M	256	355									
10	Tu	263										
11	W	287										
12	Th	353	428	1.81	1000	1300	1000		1100		1100	
13	F	290	340	0.04				800		1500		1400
14	S	247										
15	S	216										
16	M	284	365	0.10	1600	2100						
17	Tu	275										
18	W	278										
19	Th	303	380	0.81	1600	2300						
20	F	274										
21	S	239										
22	S	206										
23	M	262										
24	Tu	292	355	0.36								
25	W	272										
26	Th	262										
27	F	259					1700	1900				
28	S	247	385	0.75								
29	S	217	350	0.45								
30	M	244										
				8.27 (Total)								

Date	Clay St., Newark (033/N-006) Closed	Clay St., Newark (033/N-006) Open	Polk St., Newark (040/N-013) Closed	Polk St., Newark (040/N-013) Open	Saybrook Pl., Newark (037/N-010) Closed	Saybrook Pl., Newark (037/N-010) Open	Herbert Pl., Newark (030/N-003) Closed	Herbert Pl., Newark (030/N-003) Open	Fourth Ave., Newark (032/N-005) Closed	Fourth Ave., Newark (032/N-005) Open	Freeman St., Newark (041/N-014) Closed	Freeman St., Newark (041/N-014) Open
1	700	1700					700	1600	700	1600		
5	2000						2200		2000			
6	1500	1100	100/1600	800	100/1700	900	1700	1100	1500	1100	100/1000	800
7		800		200		100		800		800		100
12	1000		1000		1100		1100		1000		1000	
13		900		1500		1400		2100		800		1400

SUMMARY OF PLANT FLOWS AND BYPASS VALVE CLOSING ACTIONS - NEWARK BAY PUMPING STATION-1975

MONTH: July

TIMES OF BYPASS VALVE ACTION, BY LOCATION (Times of Day: 24-Hour Clock)

Date	Day of Week	Average Flow (MGD)	Peak Flow During Rainfall (MGD)	Amount of Rainfall (Inches)	South Side Interceptor Newark		Union Outlet Newark (074/U-001)		Jackson Ave., Newark (039/N-012)		Rector St., Newark (036/N-009)		Clay St., Newark (033/N-006)		Polk St., Newark (040/N-013)		Saybrook Pl., Newark (037/N-010)		Herbert Pl., Newark (030/N-003)		Fourth Ave., Newark (032/N-005)		Freeman St., Newark (041/N-014)	
					Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open
1	T	248																						
2	W	252																						
3	Th	237	350	0.18																				
4	F	185							500	1300	500	1200	400	1200	500	1300			600	1300	400	1200	500	1300
5	S	189																						
6	S	227	362	0.14																				
7	M	197					800	2100	900	2200	900	2200	800	2200	900	2200	900	2200	1000	2300	800	2200	900	2200
8	Tu	233			1300	1500																		
9	W	284	450	0.20	1800	2000	1700	2200	2000		1900		1800		1900		1900		2000		1800		1900	
10	Th	243								300		300		200		300		300		200		200		300
11	F	239																						
12	S	215	315	0.12																				
13	S	283	400	2.57	1100	1500	1100		1400		1400		1200		1400		1400		1200		1100		1400	
14	M	337	413	1.48				1200	1200	900	1200	1000			1100	900	1200	900					1100	900
15	Tu	290	440	1.55			700																	
16	W	267						1600						1700						1700		1700		
17	Th	317								900		900				800		900						800
18	F	293																						
19	S	250																						
20	S	279	290	0.30																				
21	M	292	430	0.40	100	400	100	500																
22	Tu	288																						
23	W	285																						
24	Th	334	350	0.20			100																	
25	F	324	508	1.90	100	2000		1400	300	1400	200	1400	200	1500	300	1400	200	1400	300	1500	200	1400	300	1400
26	S	275																						
27	S	244																						
28	M	272																						
29	Tu	267																						
30	W	259																						
31	Th	268																						
				9.04 (Total)																				

SUMMARY OF PLANT FLOWS AND BYPASS VALVE CLOSING ACTIONS - NEWARK BAY PUMPING STATION-1975

MONTH: August

TIMES OF BYPASS VALVE ACTION, BY LOCATION (Times of Day: 24-Hour Clock)

Date	Day of Week	Average Flow (MGD)	Peak Flow During Rainfall (MGD)	Amount of Rainfall (Inches)	South Side Interceptor Newark Closed	South Side Interceptor Newark Open	Union Outlet Newark (074/U-001) Closed	Union Outlet Newark (074/U-001) Open	Jackson Ave., Newark (039/N-012) Closed	Jackson Ave., Newark (039/N-012) Open	Rector St., Newark (036/N-009) Closed	Rector St., Newark (036/N-009) Open	Clay St., Newark (033/N-006) Closed	Clay St., Newark (033/N-006) Open	Polk St., Newark (040/N-013) Closed	Polk St., Newark (040/N-013) Open	Saybrook Pl., Newark (037/N-010) Closed	Saybrook Pl., Newark (037/N-010) Open	Herbert Pl., Newark (030/N-003) Closed	Herbert Pl., Newark (030/N-003) Open	Fourth Ave., Newark (032/N-005) Closed	Fourth Ave., Newark (032/N-005) Open	Freeman St., Newark (041/N-014) Closed	Freeman St., Newark (041/N-014) Open
1	F	278																						
2	S	275																						
3	S	278																						
4	M	294																						
5	Tu	313	385	0.20																				
6	W	331																						
7	Th	269	615	0.50	200	400																		
8	F	281	320	0.25																				
9	S	252																						
10	S	212																						
11	M	274																						
12	Tu	280																						
13	W	266	330	0.10																				
14	Th	271																						
15	F	255																						
16	S	265																						
17	S	213																						
18	M	267																						
19	Tu	265																						
20	W	251																						
21	Th	251																						
22	F	268			1700	1800																		
23	S	226											2400						2400		2400			
24	S	305	400	1.35			2400							800						900		800		
25	M	335	400	0.40	2300			700																
26	Tu	311	370	0.40		500																		
27	W	292																						
28	Th	277																						
29	F	278																						
30	S	240																						
31	S	206																						
				3.20 (Total)																				

SUMMARY OF PLANT FLOWS AND BYPASS VALVE CLOSING ACTIONS - NEWARK BAY PUMPING STATION-1975

MONTH: September

TIMES OF BYPASS VALVE ACTION, BY LOCATION (Times of Day: 24-Hour Clock)

Date	Day of Week	Average Flow (MGD)	Peak Flow During Rainfall (MGD)	Amount of Rainfall (Inches)	South Side Interceptor Newark: Closed	South Side Interceptor Newark: Open	Union Outlet Newark (074/U-001): Closed	Union Outlet Newark (074/U-001): Open	Jackson Ave., Newark (039/N-012): Closed	Jackson Ave., Newark (039/N-012): Open	Rector St., Newark (036/N-009): Closed	Rector St., Newark (036/N-009): Open	Clay St., Newark (033/N-006): Closed	Clay St., Newark (033/N-006): Open	Polk St., Newark (040/N-013): Closed	Polk St., Newark (040/N-013): Open	Saybrook Pl., Newark (037/N-010): Closed	Saybrook Pl., Newark (037/N-010): Open	Herbert Pl., Newark (030/N-003): Closed	Herbert Pl., Newark (030/N-003): Open	Fourth Ave., Newark (032/N-005): Closed	Fourth Ave., Newark (032/N-005): Open	Freeman St., Newark (041/N-014): Closed	Freeman St., Newark (041/N-014): Open
1	M	203																						
2	Tu	252																						
3	W	260																						
4	Th	255																						
5	F	257																						
6	S	222																						
7	S	204																						
8	M	264																						
9	Tu	259																						
10	W	265																						
11	Th	260	340	T																				
12	F	290	370	0.20																				
13	S	230																						
14	S	201																						
15	M	246																						
16	Tu	251																						
17	W	255																						
18	Th	271																						
19	F	293	360	0.40																				
20	S	244	360	T																				
21	S	246	360	0.85																				
22	M	338	335	0.18																				
23	Tu	356	395	2.22			000		300		000				300		300		300		000		300	
24	W	351	415	1.63																				
25	Th	348	405	1.15			1400	1000																
26	F	389	440	1.45				1000																
27	S	343	385	0.35																				
28	S	336								1100		1000				1100		1000		1100		1000		1100
29	M	318																						
30	Tu	308																						
				8.43 (Total)																				

TIERRA-B-008058

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

JUN - 8 2006

GENERAL NOTICE LETTER
URGENT LEGAL MATTER
PROMPT REPLY NECESSARY
CERTIFIED MAIL-RETURN RECEIPT REQUESTED

Chris Bernhardt, President
ITT Industries, Inc.
100 Kingsland Drive
Clifton, NJ 07014

Re: Diamond Alkali Superfund Site
Notice of Potential Liability for
Response Actions in the Lower Passaic River Study Area, New Jersey

Dear Mr. Bernhardt:

The United States Environmental Protection Agency ("EPA") is charged with responding to the release and/or threatened release of hazardous substances, pollutants, and contaminants into the environment and with enforcement responsibilities under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended ("CERCLA"), 42 U.S.C. § 9601 et seq. EPA is seeking your cooperation in an innovative approach to environmental remediation and restoration activities for the Lower Passaic River.

EPA has documented the release or threatened release of hazardous substances, pollutants and contaminants into the six-mile stretch of the river known as the Passaic River Study Area, which is part of the Diamond Alkali Superfund Site ("Site") located in Newark, New Jersey. Based on the results of previous CERCLA remedial investigation activities and other environmental studies, including a reconnaissance study of the Passaic River conducted by the United States Army Corps of Engineers ("USACE"), EPA has further determined that contaminated sediments and other potential sources of hazardous substances exist along the entire 17-mile tidal reach of the Lower Passaic River. Thus, EPA has decided to expand the area of study to include the entire Lower Passaic River and its tributaries from Dundee Dam to Newark Bay ("Lower Passaic River Study Area").

By this letter, EPA is notifying ITT Industries, Inc. of its potential liability relating to the Site pursuant to Section 107(a) of CERCLA, 42 U.S.C. § 9607(a). Under CERCLA, potentially responsible parties ("PRPs") include current and past owners and operators of a facility, as well as persons who arranged for the disposal or treatment of hazardous substances at the Site, or the transport of hazardous substances to the Site.

In recognition of our complementary roles, EPA has formed a partnership with USACE and the New Jersey Department of Transportation-Office of Maritime Resources ("OMR") ["the governmental partnership"] to identify and address water quality improvement, remediation, and restoration opportunities in the 17-mile Lower Passaic River Study Area. This governmental partnership is consistent with a national Memorandum of Understanding ("MOU") executed on July 2, 2002 between EPA and USACE. This MOU calls for the two agencies to cooperate, where appropriate, on environmental remediation and restoration of degraded urban rivers and related resources. In agreeing to implement the MOU, the EPA and USACE will use their existing statutory and regulatory authorities in a coordinated manner. These authorities for EPA include CERCLA, the Clean Water Act, and the Resource Conservation and Recovery Act. The USACE's authority stems from the Water Resources Development Act ("WRDA"). WRDA allows for the use of some federal funds to pay for a portion of the USACE's approved projects related to ecosystem restoration.

For the first phase of the Lower Passaic River Restoration Project, the governmental partners are proceeding with an integrated five-to-seven-year study to determine an appropriate remediation and restoration plan for the river. The study will involve investigation of environmental impacts and pollution sources, as well as evaluation of alternative actions, leading to recommendations of environmental remediation and restoration activities. The study is being conducted pursuant to CERCLA and WRDA.

Based on information that EPA evaluated during the course of its investigation of the Site, EPA believes that hazardous substances were released from the ITT Industries, Inc. facility located at 100 Kingsland Road, in Clifton, New Jersey, into the Lower Passaic River Study Area. Hazardous substances, pollutants and contaminants released from the facility into the river present a risk to the environment and the humans who may ingest contaminated fish and shellfish. Therefore, ITT Industries, Inc. may be potentially liable for response costs which the government may incur relating to the study of the Lower Passaic River. In addition, responsible parties may be required to pay damages for injury to, destruction of, or loss of natural resources, including the cost of assessing such damages.

EPA is aware that the financial ability of some PRPs to contribute toward the payment of response costs at the Site may be substantially limited. If you believe, and can document, that you fall within that category, please inform Sarah Flanagan and William Hyatt in writing at the addresses identified below in this letter. You will be asked to submit financial records including federal income tax returns as well as audited financial statements to substantiate such a claim.

Please note that, because EPA has a potential claim against you, you must include EPA as a creditor if you file for bankruptcy. You are also requested to preserve and retain any documents now in the possession or control of your Company or its agents that relate in any manner to your facility or the Site or to the liability of any person under CERCLA for response actions or response costs at or in connection with the facility or the Site, regardless of any corporate document retention policy to the contrary.

Enclosed is a list of the other PRPs who have received notices of potential liability. This list represents EPA's findings on the identities of PRPs to date. We are continuing efforts to locate additional PRPs who have released hazardous substances, directly or indirectly, into the Lower Passaic River Study Area. Exclusion from the list does not constitute a final determination by EPA concerning the liability of any party for the release or threat of release of hazardous substances at the Site. Please be advised that notice of your potential liability at the Site may be forwarded to all parties on this list as well as to the Natural Resource Trustees.

We request that you become a "cooperating party" for the Lower Passaic River Restoration Project. As a cooperating party, you, along with many other such parties, will be expected to fund the CERCLA study. Upon completion of the study, it is expected that CERCLA and WRDA processes will be used to identify the required remediation and restoration programs, as well as the assignment of remediation and restoration costs. At this time, the commitments of the cooperating parties will apply only to the study. For those who choose not to cooperate, EPA may apply the CERCLA enforcement process, pursuant to Sections 106(a) and 107(a) of CERCLA, 42 U.S.C. § 9606(a) and § 9607(a) and other laws.

You may become a cooperating party by participating in the Cooperating Parties Group ("Group") that has already formed to fund the CERCLA study portion of the Lower Passaic River Restoration Project.

We strongly encourage you to contact the Group to discuss your participation. You may do so by contacting:

William H. Hyatt, Esq.
Common Counsel for the Lower Passaic River Study Area Cooperating Parties Group
Kirkpatrick & Lockhart LLP
One Newark Center, 10th Floor
Newark, New Jersey 07102
(973) 848-4045
whyatt@kl.com

Written notification should be provided to EPA and Mr. Hyatt documenting your intention to join the Group and settle with EPA no later than 30 calendar days from your receipt of this letter. The result of any agreement between EPA and your Company as part of the Group will need to be memorialized in an Administrative Order on Consent. Your written notification to EPA should be mailed to:

Sarah Flanagan, Assistant Regional Counsel
Office of Regional Counsel
U.S. Environmental Protection Agency
290 Broadway - 17th Floor
New York, New York 10007-1866

Pursuant to CERCLA Section 113(k), EPA must establish an administrative record that contains documents that form the basis of EPA's decision on the selection of a response action for a site. The administrative record file and the Site file are located at EPA's Region 2 Superfund Records Center, at 290 Broadway, New York, NY, on the 18th floor. You may call the Records Center at (212) 637-4308 to make an appointment to view the administrative record and/or the Site file for the Diamond Alkali Site, Passaic River.

As you may be aware, the Superfund Small Business Liability Relief and Brownfields Revitalization Act became effective on January 11, 2002. This Act contains several exemptions and defenses to CERCLA liability, which we suggest that all parties evaluate. You may obtain a copy of the law via the Internet at **http://www.epa.gov/swerosps/bf/sblrbra.htm** and review EPA guidances regarding these exemptions at **http://www.epa.gov/compliance/resources/policies/cleanup/superfund.**

Inquiries by counsel or inquiries of a legal nature should be directed to Ms. Flanagan at (212) 637-3136. Questions of a technical nature should be directed to Elizabeth Butler, Remedial Project Manager, at (212) 637-4396.

Sincerely yours,

R Basso

Ray Basso, Strategic Integration Manager
Emergency and Remedial Response Division

Enclosure 6-06