Section 22
Cranston, Rhode Island

Wastewater Investigation

May 1992

US Army Corps
of Engineers
New England Division

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This planning study describes a grouping of interrelated wastewater conveyance problems identified in the City of Cranston and Town of Johnston, Rhode Island. Study sites include a mix of landfills, industrial, institutional, and residential wastewater problem areas. Potential plans formulated were: no action; modifications to the existing conveyance system; construction of a new sewer interceptor through western Cranston; construction of new local wastewater treatment facilities; and a wastewater management plan. Reconnaissance level designs and cost estimates were prepared and possible environmental and economic impacts identified. The plans that initially appear feasible as ways to address the problems are modifications to the existing sewer system, construction of a new sewer interceptor and implementation of components of a wastewater management program. The report recommends to the City that the next step is to conduct a detailed engineering study to determine which combination of plan elements is most effective from a cost and environmental impact standpoint.

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Section 22, Cranston, Rhode Island Wastewater Investigation

Department of the Army
Corps of Engineers, New England Division
Waltham, Massachusetts

May 1992

FOREWORD

This study of a regional wastewater connector system to reduce impacts from several pollution sources touches many complex issues both technical and institutional. In defining the problems, environmental impacts associated with wastewater flows were identified at diverse sites which included existing and closed landfills, current and future industrial parks, residential areas as well as a major State of Rhode Island institutional complex.

The study investigation crossed several governmental boundaries with the City of Cranston and the Town of Johnston, together with the State of Rhode Island and the Rhode Island Solid Waste Management Corporation sharing in identified impacts. Similarly, potential solutions cross these boundaries and thus the study adopted a regional perspective for both problems and solutions. Planning for such impacts on a regional scope is an approach often employed in Corps of Engineers studies.

A number of the study sites are the subject of separate investigations which have their independent schedules and decision criteria. The EPA's Superfund Remedial Investigation/Feasibility study at the Central Landfill and the City's Wastewater Facilities Planning study with regional implications for Warwick and West Warwick are examples of ongoing evaluations which could impact on study findings.

This study, therefore, should not be considered the end conclusion, but rather viewed as an important piece of the puzzle, perhaps even a keystone to the ultimate solution for the myriad of problems facing the region.

Importantly, the report can also be viewed in some ways as a "planning model" in its approach and scope. Information contained herein allows policy makers to assess the interdependence of various options in their deliberations: an overview not seen when the problems at the individual sites are considered separately.

EXECUTIVE SUMMARY

This reconnaissance level investigation conducted under the Corps' "Planning Assistance to States program" (Section 22) describes a grouping of interrelated environmental problems identified by the City of Cranston. It formulates and evaluates plans to correct the problems, and suggests future courses of action for the City to undertake in resolving the problems. The study scope is limited to existing and available information. The study effort has been coordinated with all appropriate Federal (EPA & USGS), State, quasi State, and local agencies and interested parties.

Problem sites investigated include a mix of landfills, industrial, institutional, and residential wastewater problem areas. The landfills include the Solid Waste Management Corporation Central landfill, the Vinagro landfill in Johnston and the Capuano landfill in Cranston.

Several potential industrial/commercial growth areas including the existing Western Cranston Industrial area in Cranston and large tract of unsewered potential industrial/ commercial growth area in Johnston are considered in the evaluation.

There is also a large tract of residential development in the western portion of Cranston which is currently not sewered. This area experienced considerable residential development during the 1980's and soils are severely limited for septic system development. It is feared this area may experience frequent septic system failures in the future. This represents a conflict of goals in that while it is desired to solve current and future wastewater disposal problems, the community and state wish to retain the area's rural character, a goal which may be more difficult with the provision of sewers.

The City has suggested that future wastewater flows from these various study sites could possibly be conveyed to the City's existing secondary wastewater treatment facility which has a design capacity of 23 MGD, but is presently operating at 12.1 MGD average daily flow. The City is currently planning improvements to the treatment facility to provide advanced treatment to meet discharge limits for the Pawtuxet River.

A broad range of potential plans were formulated to address the identified wastewater conveyance problems.

- No Action
- Modifications to the Existing System
- Constructing New Local Wastewater Treatment Facilities
- Construction of a Sewer Interceptor through the Western Portion of Cranston
- Wastewater Management Plan

Reconnaissance level designs and cost estimates were prepared and possible impacts were identified. The results of the analysis were used for comparative purposes to suggest

to the City future actions which they may wish to pursue. Use of this "building block" approach allows the evaluation of the interdependence of the solutions as applied to the various study sites and provides information on a step wise approach tied to available budgets.

Ongoing studies which could affect the findings of this report include EPA's Superfund RI/FS study at Central Landfill, the communities comprehensive land use planning efforts and the City of Cranston's ongoing Wastewater Treatment Facilities Planning study which reviews the possibility of providing regional advanced treatment for Warwick and West Warwick. In addition the Vinagro and Capuano sites are awaiting listing site investigations by EPA under the Superfund program.

The report concludes:

- That construction of local treatment facilities to address industrial or residential development does not appear feasible because of restrictive discharge requirements from regulatory agencies.

- That future industrial and institutional flows from the Howard Facilities should be routed to the existing wastewater treatment facility utilizing the existing sewer system with required modifications. Additional studies are required to better define the existing system capacities as well as determine possible system deficiencies.

- That remaining wastewater flows could be conveyed to the existing treatment facility by constructing a sewer interceptor through the western portion of the City or as an alternative providing modifications to the existing sewer system. This study could not identify a clear advantage to construction of one alternative versus the other. Therefore, further detailed analysis is recommended.

- That use of project elements in sewer interceptor design such as energy efficient electric motors, variable frequency drives and low friction plastic force mains and pressure sewer segments is technically feasible and may provide construction and operation cost savings.

- That opportunities to reduce wastewater flows through demand management and reducing inflow and infiltration should be pursued by the City regardless of what specific options are selected to increase the conveyance capacity of the system.

- That future planning studies conducted by the City should address the need for and suitability of establishing a Wastewater Management District in Western Cranston to prevent groundwater contamination.

- That the City should continue to pursue an approach of integrated evaluation and planning to develop and implement a suitable solution for the grouping of interrelated environmental problems. Such an approach will be valuable to governmental agencies at all levels.

In summary, this study addressed and developed a broad array of solutions for a grouping of interrelated environmental problems. The specific plans that initially appear feasible in the Cranston area as ways to address the problems are modifications to the existing sewer system, construction of a sewer interceptor and implementation of components of a wastewater management program. The next step is to conduct a detailed study using an integrated evaluation and planning approach to determine which combination of plan elements is most effective from a cost and environmental impact standpoint.

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I. INTRODUCTION

STUDY AUTHORITY AND BACKGROUND

In 1990, the City of Cranston, through its Congressional delegation, approached the Assistant Secretary of the Army for Civil Works requesting that the Corps of Engineers conduct a reconnaissance study to address several environmental problems by connecting the multiple sources of pollution with a wastewater facility in Cranston, Rhode Island. (See Correspondence, Appendix E.) The Assistant Secretary was also requested that the Corps support the Congressional effort to include authorization language in the Water Resource Development Act of 1990 to conduct a feasibility report and design demonstration project. The Assistant Secretary responded with regard to the feasibility study and design demonstration authorization that "we are unable to support this effort since it lies outside the priority missions of navigation and flood control" and "the demands for these missions of navigation and flood control exceed our present budgetary resources". However, he suggested funds could be made available through the Section 22, "Planning Assistance to States" program (PL 93-251, as amended) for a reconnaissance level study upon written request from the State of Rhode Island to the New England Division indicating the State's support for this work.

The State of Rhode Island Department of Administration requested by letter dated 6 August 1990, that the New England Division undertake a Section 22 reconnaissance level study of a connector system between several pollution sources and the wastewater facility in Cranston.

Subsequent to these actions, legislation was passed in the Water Resources Development Act of 1990, Section 117, to authorize the Corps to conduct a feasibility study of wastewater treatment options for transporting contamination from the Central Landfill site and other sources of pollutants in Rhode Island to a wastewater treatment facility in Cranston through the use of a regional connector system and conduct a technology demonstration project of the connector system.

This report prepared under the Corps' "Planning Assistance to States program" (Section 22) is intended as a stand-alone document separate from the Section 117 legislation and is intended to assist the State and City in their planning efforts for dealing with the wastewater problems at the study sites.

PURPOSE AND SCOPE

This report provides a reconnaissance level review of a grouping of interrelated environmental problems and includes defining the problems identified by the City, formulating and evaluating solutions to correct the problems, and suggests a future course of action for the City to undertake to solve the problems. This project is based solely on existing data and available information obtained from the City, the State of Rhode Island, EPA, and

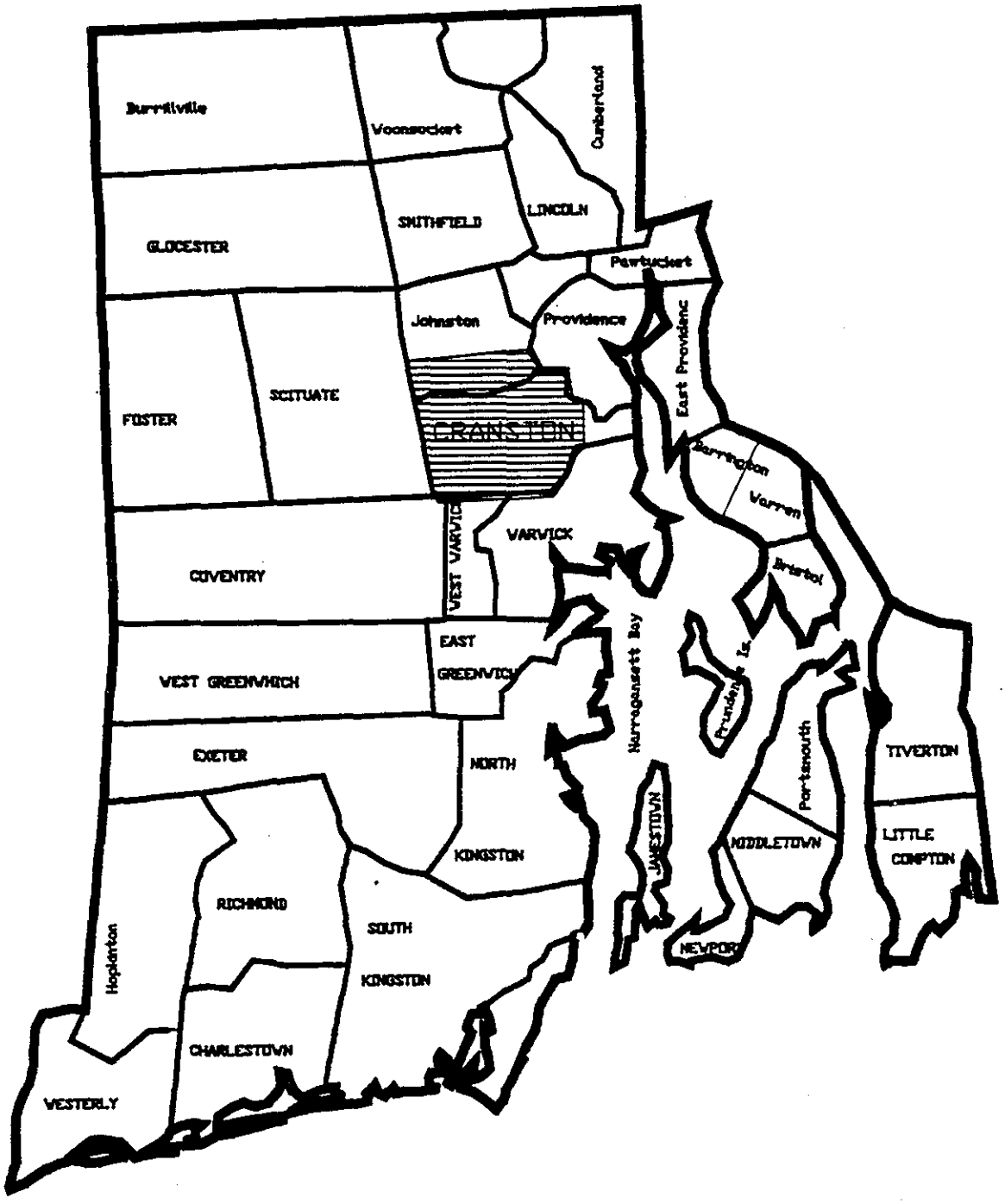
other nonconforming agencies. This project also included coordination efforts with all appropriate Federal (EPA & USGS), State, quasi-State, local agencies and interested parties.

STUDY AREA

The study includes land in the communities of Cranston and Johnston and stretches from the Pawtuxet River in the southeast to the Central Landfill in the west (See Figure 1, "Study Area" and Figure 2, "Study Sites"). The study sites identified by the City of Cranston include:

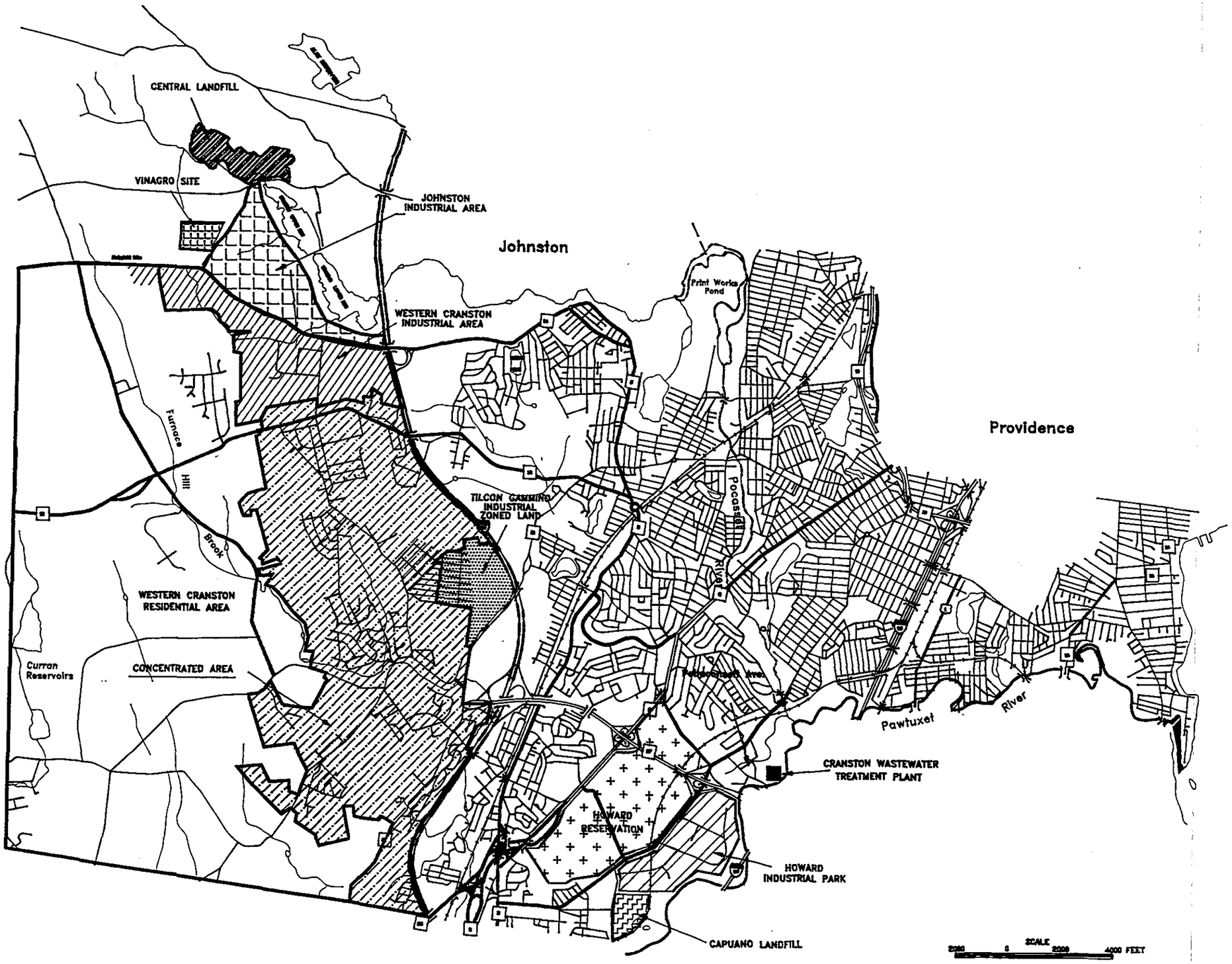
- The Central Landfill just north of the Cranston corporate boundary in the Town of Johnston.
- The zoned industrial area in Western Cranston adjacent to Plainfield Pike and Interstate 295.
- The Vinagro site on Green Hill Avenue south of Central Landfill.
- An area in the Town of Johnston identified as a potential future industrial development opportunity.
- The Western Cranston residential area west of Interstate 295.
- The Tilcon/Gammino gravel operation west of Interstate 295.
- The State's Howard Reservation and associated lands in southern Cranston adjacent to Route 37.
- The Capuano Landfill in southern Cranston adjacent to the Pawtuxet River.

The study area is in the drainage area for the main stem of the Pawtuxet River which flows south to east along the easterly boundary of Cranston and empties into Pawtuxet Cove adjacent to the Providence River. Topography in the study area ranges from rolling uplands in Western Cranston to glacial outwash plains adjacent to the Pawtuxet. Water resources in the area include tributaries to the Pocasset River in central Cranston and Meshanticut Brook in Western Cranston. Both the Meshanticut and Pocasset are tributaries to the Pawtuxet. The Scituate Reservoir, a large water supply reservoir for the State of Rhode Island, is located on the North Branch of the Pawtuxet River, approximately 2.5 miles from the study area.



Section 22, Cranston , Rhode Island
Wastewater Investigation
Study Area

Figure 1



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Section 22 Investigation
Cranston, Rhode Island

STUDY SITES

U.S. Army Corps of Engineers
New England Division

June 1991

Figure 2

PRIOR INVESTIGATIONS

Prior Investigations, which discuss the possibility of a wastewater interceptor system to service the Western Cranston area include:

"Report on Main Sewers and Sleeves Under Interstate 295", prepared in 1966 by Fay, Spofford and Thorndike, Inc;

"The Wastewater Facilities Plan for the City of Cranston", prepared in 1976 by Universal Engineering Corporation;

"The Final EIS on the Proposed Treatment and Collection System" for the City of Cranston, prepared in 1977 by C.E. Maguire for US EPA Region 1;

"The Rhode Island Statewide Planning Program, 208 Water Quality Management Plan for Rhode Island", prepared in 1979 by the Rhode Island Statewide Planning program.

More recently, a letter from the City of Cranston's consultant, Tutela Engineering Associates, to Representative Claudine Schneider dated 23 March 1990 outlined, in general terms, innovative techniques to be applied to a design for a wastewater interceptor system to the Western Cranston area. (See Correspondence, Appendix D.)

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II. EXISTING CONDITIONS

COMMUNITY DESCRIPTION

The City of Cranston is located in central Rhode Island southwest of Providence and abuts this city as well as the communities of Johnston, Scituate, Coventry, West Warwick and Warwick.

Cranston has a current population of approximately 76,000 and occupies a land area of 17,747 acres. Two major highways aligned on a north to south axis through the City provide automobile and truck access to the City, Interstate 295 in the west and Interstate 95 in the east. Route 37 runs west to east and connects these two roadways.

Most of the City is provided with public water supply and the areas east of Interstate 295 and along portions of Plainfield Pike are provided with City sewers. Existing land use includes residential, commercial, industrial, institutional development and farmland. The major potential growth area in the City lies west of Interstate 295.

SURFACE AND GROUNDWATER QUALITY IN STUDY AREA

The following is a summary of the information contained in the Water Quality Evaluation Appendix prepared for this study. For more detailed information see Appendix B.

The Pawtuxet River, except for those upper reaches used for water supply, is possibly the most polluted watercourse in Rhode Island (See Figure 3). The entire length of the main stem and much of the North and South Branches are designated as Class C. Such waters are neither fishable or swimmable, but are suitable for boating, fish habitat and some other uses.

The main stem of the Pawtuxet River does not consistently meet Class C water quality standards. Dissolved oxygen levels are the primary concern. Effects of toxic substances including ammonia and heavy metals are secondary and unresolved concerns.

Water quality in the Pawtuxet basin is primarily degraded by urban drainages and three municipal wastewater treatment facilities (WWTF): Cranston, Warwick, and West Warwick. The Cranston WWTF is of principal concern because of the size of its discharge. All three municipal WWTFs have secondary treatment and are scheduled to be upgraded to tertiary treatment. Wasteload allocation studies have shown that advanced treatment is required to meet minimum Class C goals for the Pawtuxet River. There is also one major industrial point source discharge - Hoechst Celanese Corporation, located on the North Branch. However, the effects of this flow is comparatively minor.

Tributaries to the Pawtuxet River are generally designated Class B or better. An exception is the Pocasset River, which is rated C from Print Works Pond to the Pawtuxet

River in eastern Cranston. Class B water bodies are considered suitable for public water supply with appropriate treatment, agricultural uses, bathing and other primary contact recreational activities, and fish and wildlife habitat.

Groundwater throughout the watershed is generally clean or has trace levels of contaminates. Such organic contaminants as are found in groundwater throughout the watershed are typically substances such as trichlorethylene, which was at one time extensively used as a degreasing compound in septic system tanks, and methyl tertiary butyl, ether which is an anti-knock compound in gasoline. Consequently, many, if not most, of the contaminants found in watershed wells originated in sources other than landfill leachate.

An exception to this is groundwater taken from immediately within or downstream from the Central Landfill. These samples have higher concentrations of organic contaminants and metals. Groundwater monitoring indicate Central Landfill has an adverse impact on water quality in the vicinity of the landfill, with highest levels of contaminants found in shallow wells directly within the landfill.

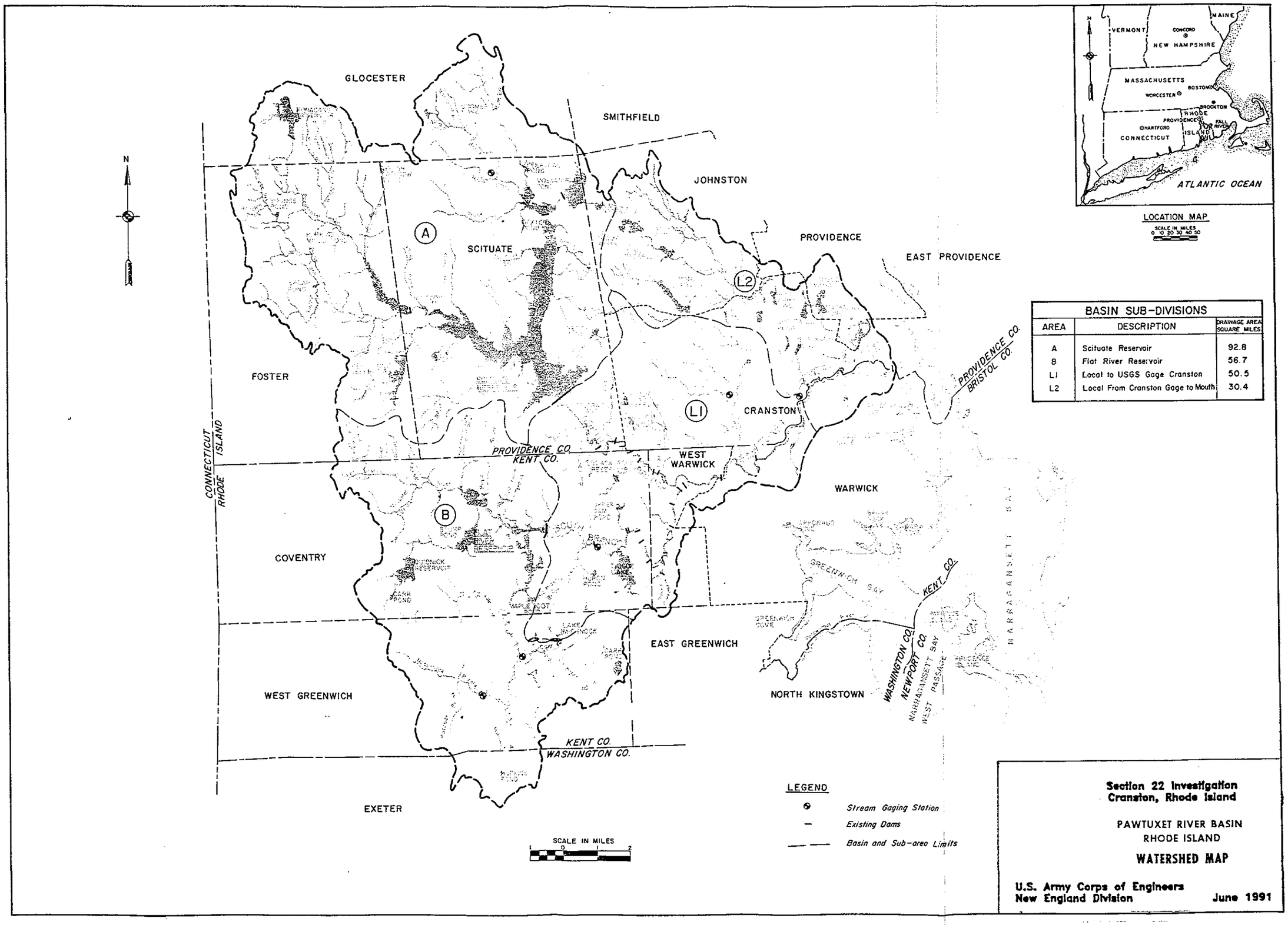
MUNICIPAL WASTEWATER TREATMENT FACILITY IN CRANSTON

The City's existing secondary wastewater treatment facility located on Pettaconsett Avenue in southeastern Cranston has a design capacity of 23 mgd and is presently operating at 12.1 mgd average daily flow. The City is under order by the Rhode Island Department of Environmental Management (DEM) and EPA to provide advanced treatment to meet the discharge limits for the Pawtuxet River. The Site is also being considered as a regional alternative to provide advanced treatment for the wastewater discharges from the cities of Warwick and West Warwick. Each of the three cities are conducting facility plans scheduled for completion in 1992.

The construction of the 23 mgd facility throughout the late 1970's and early 1980's was funded in part by a grant through the EPA's Construction Grants Program. This grant also included expansion and upgrading of two wastewater pumping stations and construction of a new sludge processing facility.

The current WWTF uses an activated sludge process for removal of pollutants and consists of headworks, primary settling tanks, aeration tanks, final clarifiers, and chlorination. Sludge disposal is by on-site incineration. Discharge of treated wastewater is to the Pawtuxet River.

Discharge from the WWTF is regulated by Rhode Island Pollutant Discharge Elimination System (RIPDES) permit from the Rhode Island Department of Environmental Management Division of Water Resources, dated May 1989, which sets effluent limits and monitoring requirements, and a "Judicial Consent Decree for Advanced Wastewater Treatment", dated 20 March 1990, that sets forth the program the City is to undertake to attain compliance with advanced treatment permit limits.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SMITHFIELD
JOHNSTON
PROVIDENCE
EAST PROVIDENCE
SCITUATE
FOSTER
CRANSTON
WEST WARWICK
WARWICK
COVENTRY
EAST GREENWICH
WEST GREENWICH
NORTH KINGSTON
EXETER
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WASHINGTON CO.
NEWPORT CO.
GREENWICH BAY
NARRAGANSETT BAY
WEST PASSAGE
BARRAGANSETT BAY
A
B
L1
L2
N
SCALE IN MILES
LEGEND
Stream Gaging Station
Existing Dams
Basin and Sub-area Limits
LOCATION MAP
SCALE IN MILES
VERMONT
NEW HAMPSHIRE
MAINE
CONCORD
MASSACHUSETTS
BOSTON
WORCESTER
BROCKTON
RHODE ISLAND
PROVIDENCE
FALL RIVER
HARTFORD
CONNECTICUT
ATLANTIC OCEAN
BASIN SUB-DIVISIONS
AREA | DESCRIPTION | DRAINAGE AREA SQUARE MILES
A | Scituate Reservoir | 92.8
B | Flat River Reservoir | 56.7
L1 | Local to USGS Gage Cranston | 50.5
L2 | Local From Cranston Gage to Mouth | 30.4
Section 22 Investigation
Cranston, Rhode Island
PAWTUXET RIVER BASIN
RHODE ISLAND
WATERSHED MAP
U.S. Army Corps of Engineers
New England Division
June 1991

Figure 3

The Judicial Consent Decree requires the City to engage in several activities including a non-point source pollution study to be completed by October 1991; an updated study on the reduction of inflow and infiltration and completion of a facilities plan by April 1992. The facilities planning effort also includes an evaluation of the feasibility of a regional advanced wastewater treatment facility at Cranston to serve Cranston, Warwick and West Warwick.

As discussed earlier, the existing treatment facility was sized and designed in the late 1970's based on a projected average daily design flow of 23 mgd. The WWTF is currently operating at approximately 10.9 mgd below original design capacity. The City believes the lower flow rate may be in part due to the firm of Ciba-Geigy leaving the City, Western Cranston not being provided with sewers, and industrial water conservation due to the City's industrial pretreatment program, and reduction of stormwater infiltration and inflow. The makeup of the forecasted design flows is shown in Table 1.

Table 1
1976 Wastewater Treatment Plant Facilities Plan,
Projected Design Flow for the Year 2000

Sector	mgd
Domestic	9.0
State Institutions	1.1
Ciba-Geigy	1.8
Howard Industrial Park	1.4
Other Industrial	7.7
Infiltration	1.7
Total	22.7

For purposes of this study, it has been assumed that the excess capacity at the Cranston WWTF will be available to handle future flows from the study sites. However, staff at EPA and at the Rhode Island DEM have indicated that this excess capacity might also be used to provide advanced treatment of the existing flows and/or provide capacity for a regional solution to the advanced treatment needs of Warwick and West Warwick. These competing proposals are being evaluated in the ongoing facility planning study being conducted by the City of Cranston and are beyond the scope of this study.

At present, an "Interim Report, Wastewater Facility Plan" prepared for the City of Cranston indicates the Site has adequate space for siting advanced treatment facilities for Cranston, West Warwick and Warwick's secondary effluent flows provided phosphorous removal, if required, is conducted at the communities existing secondary facilities. Projected flows from Cranston in the report are a design average daily flow of 23 mgd. This flow is reported to represent the existing areas of service and the expansion of the collection system to serve unsewered areas of Western Cranston.

Any proposal to construct a regional connector system to convey additional flows from

new growth areas in or adjacent to the City or from existing landfill problem areas is dependent on the final approved results of the facility planning effort being conducted by the three communities. These final reports will not be available until April 1992 and the reader should be cognizant that the findings of those reports could affect the alternatives presented here.

EXISTING WASTEWATER COLLECTION FACILITIES

The existing wastewater collection system in Cranston is composed only of sanitary sewers and was initially constructed in 1939 as a WPA project (Universal Engineering, 1976). Since then, the system has been expanded to service the growing community. Most of the existing system is located east of Interstate 295, however, there is an area of service in Western Cranston along Plainfield Pike. Also, there is a dedicated variable grade sewer in Western Cranston to service the Brigg's Farm School.

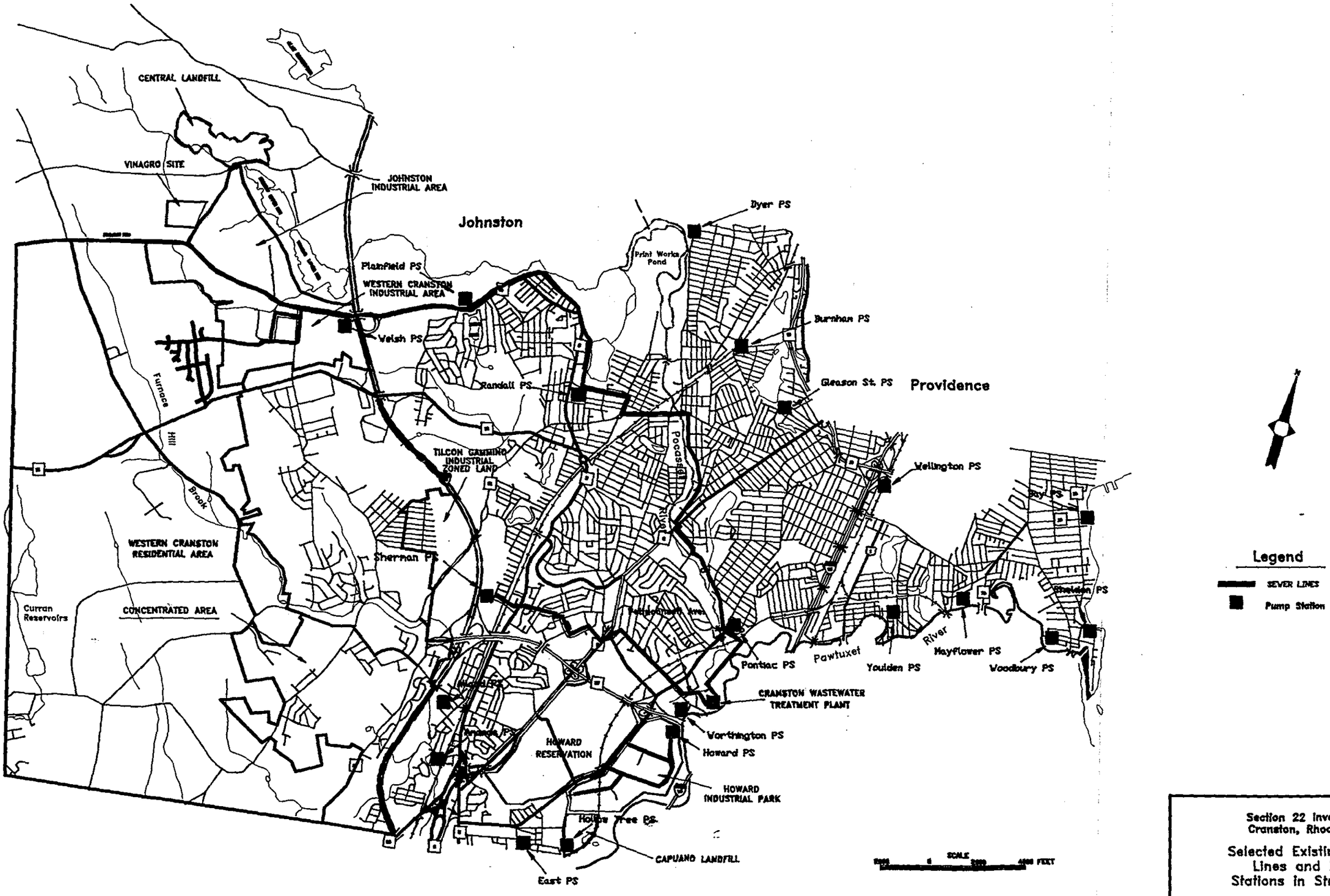
The existing system includes 19 pumping stations, an ejector station, screw pumps at the WWTF and over 240 miles of force mains, interceptor sewer mains, and lateral sewers (See Figure 4).

Data on pumping capacity and existing flows at study area pumping stations are presented in Table 2, and a schematic of the pump stations is presented in Figure 5. In addition, there are three screw pumps at the wastewater treatment facility with a capacity of 5200 gpm each.

Table 2
Existing Pumping Stations Data

Pumping Station	No. of Pumps	Pump Rating (gpm)	Existing Average Day Flow through Station(gpm)
Welsh	2	500	180
Plainfield Circle	2	1,000	500
Randall (1)	2	1,220	700
Pontiac Ave.	2 3	5,550 3,700	7,000
Sherman	2	2,550	not available
Howard	4	1,000	1,500

(1) The Randall Street pumping station has a permitted overflow line that can be used in the event of a prolonged power failure or force main break to discharge sanitary waste to Randalls Pond.



Section 22 Investigation
Cranston, Rhode Island

Selected Existing Sewer Lines and Pump Stations in Study Area

U.S. Army Corps of Engineers
New England Division

June 1991

Figure 4

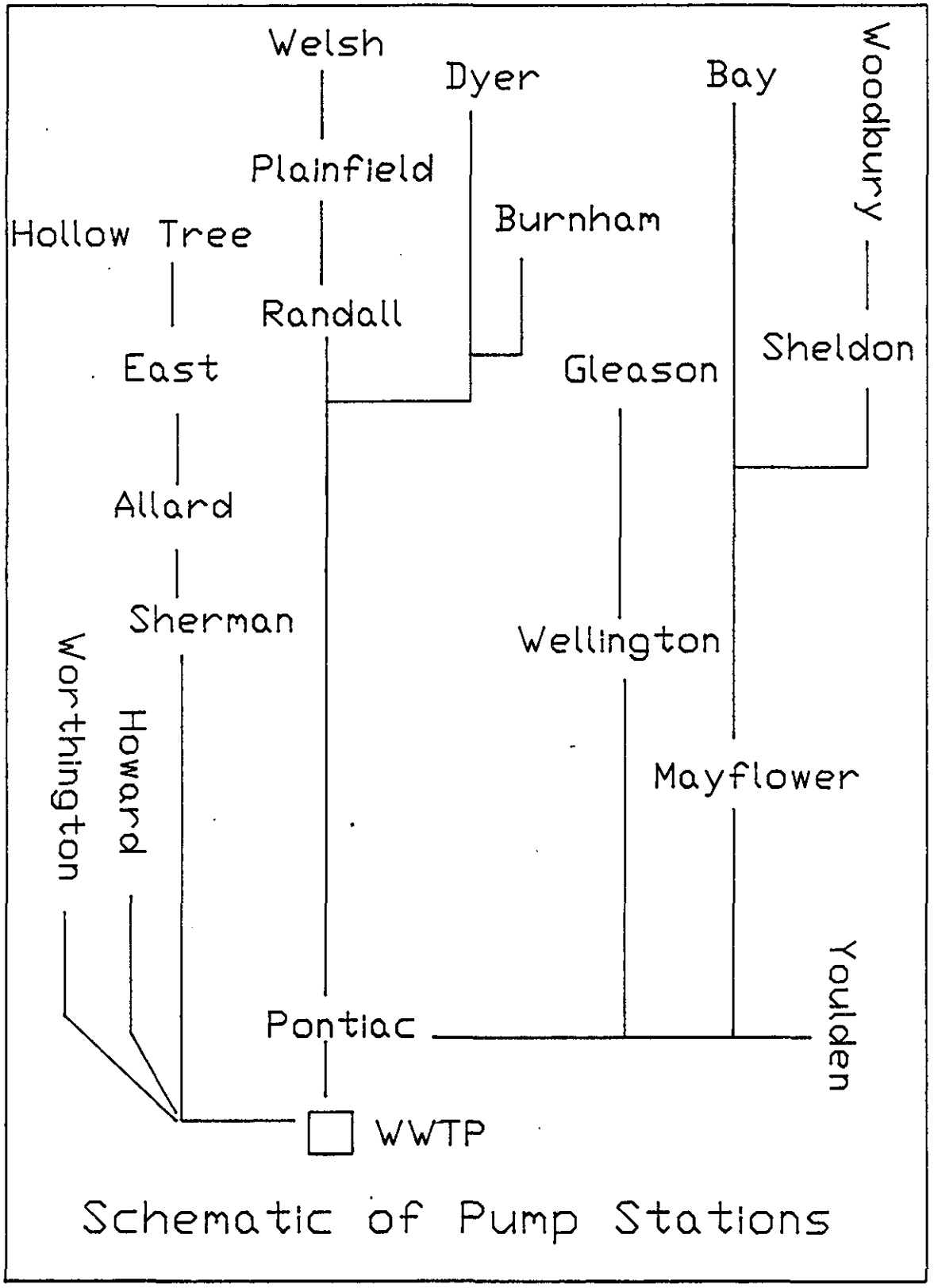

Welsh
Dyer
Bay
Woodbury
Plainfield
Hollow Tree
Burnham
Randall
East
Gleason
Sheldon
Allard
Sherman
Wellington
Worthington
Howard
Mayflower
Youlden
Pontiac
WWTP
Schematic of Pump Stations

Figure 5

III. PROBLEM DEFINITION

CENTRAL LANDFILL

Site Description

The Central Landfill, shown on Figure 2, is located in the Community of Johnston adjacent to Cranston's northern corporate boundary. It is an operating landfill for the State of Rhode Island and is operated by the Rhode Island Solid Waste Management Corporation (SWMC), a public institution established in 1974 by an act of the Rhode Island Legislature. The Corporation was created to provide solid waste management to municipalities and persons within Rhode Island. The operation of the landfill is regulated by the Rhode Island Department of Environmental Management, Division of Solid Waste Management and the Site is currently under investigation by the EPA Superfund program.

SWMC negotiated a contract with the City of Cranston to accept a discharge of 400,000 gallons per day from the Central Landfill into the Cranston sewer system along Plainfield Pike (Agreement dated September 1988). However, the City is concerned that the flow from the Central Landfill along with potential flow from the Western Cranston Industrial area will strain the existing system capacity. The City has proposed a sewer interceptor as an alternative to reconstruction work on the existing system to accommodate this flow.

The Central Landfill site consists of two areas, the operational area and the landfill area. The operational area for the landfill contains the materials recycling facility (MRF), the commercial recycling area (e.g. refrigerators, stoves, tires, waste oil, auto batteries), the scale houses, the new entrance road, the methane recovery building (12 megawatts are generated from this facility), a tree chipping area and composting facility, and the planned Resource Recovery Facility (RRF).

The landfill area is being utilized in three operational phases. Phase I is the existing operation, which consists of recent solid waste disposal and past solid waste disposal. The Phase II landfill area for solid waste is to be constructed outside of the existing border of the Phase I area. The Phase III, the outermost area, will be designed to handle the ash waste from the planned Resource Recovery Facility.

The Central Landfill Superfund site is described by EPA as an approximately 154 acre refuse disposal area, including an approximately one-third of an acre former liquid hazardous waste disposal area. The hazardous waste disposal area was operated from December 1976 until May 1979. Based upon hazardous waste manifests on file at Rhode Island DEM, it is estimated that approximately 1.5 million gallons of hazardous waste were disposed at the site during 1978 and 1979.

In April 1987, the EPA and Rhode Island SWMC entered into a Consent Order to study hazardous substance contamination at the site. Under the terms of the Consent Order, Rhode Island SWMC is conducting a Remedial Investigation to determine the nature and extent of contamination and a Feasibility Study (FS) to evaluate the alternatives for clean-up of the hazardous contamination at the site.

The characterization of contamination at the Site (Remedial Investigation) is expected to be completed in the Fall of 1991. The completion of this phase of the work will be followed by an evaluation of the clean-up alternatives; completion of an FS report; and after public comment, EPA will make a final decision on a clean-up remedy for the Site. The scheduled completion date of the RI/FS and expected EPA record of decision is 1992.

Any plans for wastewater discharges from the site of leachate or groundwater to the Cranston WWTF are subject to the ongoing EPA Conservation Environmental Response, Compensation and Liability Act of 1980 (CERCLA or Superfund) investigation and the final record of decision.

Land adjacent to the landfill is zoned industrial. The SWMC is required by State law to purchase by eminent domain all land within 1,000 feet of the landfill. In addition, SWMC has the option to purchase up to 2,000 feet. The SWMC has suggested that some of the acquired land may be leased to industrial users and wastewater generated from these users discharged to their Green Hill Avenue pump station.

Problem Discussion

Leachate at the landfill is generated from precipitation that infiltrates and percolates through the waste. A landfill acts like a huge sponge with almost two-thirds of rainfall absorbed and then leachate is generated from within the landfill in areas of water saturation. In addition, some groundwater mounding may occur in areas under the landfill and this can result in the generation of additional leachate. In general leachate from a landfill may contain bacteria, dissolved minerals, heavy metals, and organic chemicals.

SWMC has developed a plan to control leachate from the site. Leachate collection from the Phase I area will be along the south and west perimeters. The Phase II area will be double lined and have primary and secondary collection of leachate from the liners. The Phase III area will also be designed for leachate collection.

EPA's Superfund site remedy will focus on controlling the infiltration through the former hazardous waste disposal area and will evaluate remediation of the contaminated groundwater beneath and downgradient of the area. Information available from EPA indicates that a groundwater remediation alternative will be investigated. However, at the time of this report an estimate of the amount of groundwater requiring remediation was not available.

Other wastewater discharges from the site include discharge of sanitary and operational wastes, discharge from the gas recovery facility, and discharge from the proposed air cooled Resource Recovery Facility (originally planned as a water cooled facility).

Based on flow estimates obtained in meetings with the Rhode Island SWMC, it appears that average daily flows from the site will be approximately about 100,000 gpd (approximately 70 gpm on a continuous basis). However, this estimate does not include flows from the Superfund site or possible industrial tenants at the site. The Rhode Island SWMC has indicated that it envisions utilizing the full 400,000 gpd disposal capacity agreed to with the city. (See Wastewater Flows Projections section of report).

In order to connect to the Cranston system, SWMC has built a pump station and installed an 8-inch main down Green Hill Avenue to Plainfield Pike. This is a dedicated connection to the Cranston sewer system and no other users are allowed to use this main. The Central Landfill pump station has 2 pumps rated at 600 gpm, however, the City is currently negotiating down sizing these pumps to 400 gpm.

The City's consultant has identified a capacity problem at the Welsh, Plainfield Circle and Randall pumping stations when this new flow comes on-line. The Welsh pumping station has two 500 gpm pumps and is believed by the City to be approaching its capacity with the rapid development of the adjacent industrial area and other unsewered areas, in addition to the connection to the Central Landfill.

Water Quality Impacts

Concern about the landfill is that it is and will continue to cause significant pollution unless leachate and contaminated groundwater are collected and treated. Water quality impacts of Central Landfill are discussed in detail in the Water Quality Evaluation Report, Appendix B and are summarized here.

Surface water runoff from the site is contaminating local surface waters. Sampling data for Cedar Swamp Brook below the landfill show small increases in metals levels including aluminum, zinc, nickel, and lead; large increases in turbidity and suspended solids; and an enormous increase in fecal coliform bacteria. Cedar Swamp Brook does not meet Class B water quality conditions after receiving runoff and groundwater leachate from the Central Landfill. However, Class B conditions are considered possible after the landfill is capped and runoff and leachate from the landfill are controlled. When the landfill is properly capped, it is expected that conditions in Cedar Swamp Brook will meet Class B conditions except possibly during rainstorms when elevated levels of turbidity and suspended solids may occur in runoff from the Central Landfill Site.

Cedar Swamp Brook discharges to Simmons Upper Reservoir which is designated as a Class B water, although it does not presently meet this criteria. EPA, as part of the

Superfund investigation, is assessing impacts of the landfill on water and sediment quality in the reservoir.

Groundwater monitoring data indicate Central Landfill also has an adverse impact on groundwater quality in the vicinity of the landfill. Groundwater taken from immediately within or downstream from Central Landfill has higher concentrations of a variety of contaminants including chloride, nitrate, sulfate, dissolved metals, and volatile and semi-volatile organic compounds (VOCs). However, only VOCs regularly show up in significantly elevated concentrations. Metals levels in monitoring wells during a February 1986 sampling, for example, were found only in concentrations below drinking water criteria (GZA October 1986).

Upgradient wells have shown VOC levels generally below 10 ppb although up to 100 ppb (mostly TCE) have been observed. In wells within and immediately downgradient of the landfill, VOC concentrations from more than 100 to more than 1,000 ppb have been observed. These have been primarily chlorobenzenes, toluene, and total xylenes. Highest concentration of VOCs was in two wells downgradient of the former hazardous waste disposal area. During a May 1986 sampling, 94,000 ppb of chlorobenzene were measured in one of these wells (GZA October 1986). By comparison, drinking water criteria for chlorobenzenes are 5 to 600 ppb depending on the specific compound.

EPA and SWMC, as part of the Superfund remedial investigation, are continuing to investigate the magnitude of the groundwater contamination problem.

Scituate Reservoir Contamination Issue

The City of Cranston, in testimony before the Natural Resources and Environmental Subcommittee, U.S. House of Representatives (statement dated 2 October 1989), stated that tests at the Central Landfill have indicated the presence of substantial groundwater pollution and that there is reasonable concern that groundwater from the site is moving in the direction of aquifers associated with the Scituate Reservoir. Because this is the public water supply source for over sixty percent of the State's population, the City proposed that even a remote possibility of contamination should be taken extremely seriously.

To determine if existing data indicate Central Landfill is a threat to Scituate Reservoir, the Corps of Engineers met with the Rhode Island SWMC, the Providence Water Supply Board, the Rhode Island Department of Health Private Well Surveillance Program, and the Rhode Island Department of Environmental Management, Groundwater Section, and discussed the problem with the U.S. Geological Survey.

During these discussions, existing data was obtained and later reviewed. A review of available information is presented in the Water Quality Evaluation Report, Appendix B. No new data was specifically gathered by the Corps. The Rhode Island SWMC supplied groundwater monitoring data collected by Goldberg-Zoino Associates Inc. The Providence

Water Supply Board supplied a report prepared by engineering consultant CH2M Hill. The Department of Health supplied data from the Private Well Surveillance Program for wells in the vicinity of the landfill.

The Rhode Island DEM supplied an inter-office memo dated 3 October 1988 in which it was concluded that a hydraulic connection between the area underlying the Central Landfill encompassed by the RI/FS study and the Scituate Reservoir is not evident. The USGS supplied its opinion in correspondence dated 6 March 1991 (See Correspondence Appendix). In addition, a policy statement was solicited from the Providence Water Supply Board in a letter dated 21 February 1991, but a reply was never received. (See Correspondence, Appendix D).

Existing available information indicated both surface water and shallow groundwater divides separate the landfill from the reservoir, and existing studies indicate that water in bedrock fractures also flows away from the reservoir. Groundwater flow in the overburden and shallow rock beneath the landfill appears to be towards Upper Simmons Reservoir except for a northern portion of the landfill where groundwater is moving towards Almy Reservoir. Geophysical data confirm the presence of a zone of fractured bedrock extending 350 to 450 feet beneath the Central Landfill. This raises the possibility that leachate could travel along a bedrock fracture to Scituate Reservoir. The longest fracture, lineament No. 1, extends from Almy Reservoir to Scituate Reservoir. An investigation of this fracture found that local topography and groundwater elevations created a groundwater divide separating landfill and reservoir. (See Water Quality Evaluation, Appendix B).

Based on available data, there is no reason to suspect that Central Landfill poses a threat to Scituate Reservoir. However, EPA is continuing to investigate this issue as part of their Superfund site investigation. Its findings on this issue are expected to be available in 1992.

VINAGRO SITE

Site Description

The Vinagro Site, shown on Figure 2 is an approximately 36 acre site located in Johnston on Green Hill Avenue between Plainfield Pike and Central Landfill. The Vinagro site contains a hog farm; a paper, plastic, and glass recycling facility; a construction demolition debris facility and a landfill ordered closed by Rhode Island DEM in 1986. Vinagro has recently received a license for a transfer station, however this facility has not yet been built.

Problem Discussion

The Vinagro site has been identified as a hazardous waste area and some corrective action has been ordered by the Rhode Island DEM. The Rhode Island DEM, Division of

Air and Hazardous Materials, and the owners of the Site recently (14 September 1990) entered into an agreement concerning operation of the transfer station, recycling facility and pig farm.

The Site is also currently listed with the Environmental Protection Agency Superfund program as a potential contaminated hazardous waste site and is awaiting a listing site investigation to determine qualification for and rank on the national priority list (NPL).

Leachate collection from the recycling operations is currently being investigated and treatment may be required by the DEM. Also, potential groundwater pumping and treating might be required as remedial action under future EPA investigations.

Acceptance of flows into the Cranston system for any of the identified problems would require an agreement between the City and the Vinagro site owners. There is no information of any negotiations between the parties at this time.

Water Quality Impacts

The hog farm and landfill have been cited by the Rhode Island DEM for pollution of Cedar Swamp Brook for uncontrolled surface runoff. However, limited data is available on surface water quality in the unnamed brook upstream or downstream from the Vinagro site. The relatively undeveloped nature of the watershed indicates Class B conditions are probably met upstream from the site. However, it is likely that this brook is negatively impacted by the site, particularly during storms. Based on the history of usage at this site and data available from other landfills, it is likely that the Vinagro Site causes high levels of sedimentation, turbidity, and coliform bacteria in the unnamed brook during rainstorms. There are also likely increases in metals and VOCs due to runoff from the site.

Based on what is known about groundwater in the Pawtuxet watershed in general and monitoring results at other landfills, some general predictions can be made regarding this site. Groundwater upgradient from the Vinagro site is probably clean or has trace levels of organic contaminants. Groundwater beneath and downgradient from the Vinagro site is potentially contaminated with nitrate from the pig wastes, dissolved metals from the demolition debris, and VOCs. Groundwater monitoring data for this site from files at the RI DEM Solid Waste Section confirms the presence of volatile organics and metals.

WESTERN CRANSTON INDUSTRIAL AREA

Site Description

The Existing Western Cranston Industrial Park, shown on Figure 2, is located at the interchange of Plainfield Pike and Interstate 295 on the Cranston/Johnston Line and contains the city's largest tract of vacant industrial land. Approximately 190 acres are currently developed and approximately 160 acres are available for development. Access to

the area is along Comstock Parkway and Sailor Way. There are approximately 27 companies in the park and the mix of business is approximately 7 percent construction, 7 percent communications, 22 percent service, 30 percent wholesale, and 34 percent manufacturing. The area is supplied with water and sewer service. There is a small stream that runs west to east just west of the existing park that may limit expansion into this area. There are also approximately 100 acres of industrially zoned land available for development located along Plainfield Pike west of the industrial park.

Problem Discussion

The City of Cranston is concerned that future growth of the existing industrial park and adjacent area zoned for industrial use may be constrained by the capacity of the existing sewer lines and pumping stations. The situation is complicated by the City entering into a contract with SWMC to take flows from the Central Landfill. Both the future flows from the landfill and the flows from the industrial area are routed to the same pump station. In addition, current planning by Johnston under its comprehensive planning effort may result in a compatible industrial/commercial base in Johnston along Plainfield Pike, which could also possibly increase the wastewater flow to the system if Cranston permitted Johnston access to the sewer system.

JOHNSTON SITE

Site Description

The Johnston Site, as shown on Figure 2, is bordered by Plainfield Pike on the south, Greenhill Avenue on the west, Simmons Reservoir on the east and Central Landfill to the north. This area is approximately 325 acres of which approximately 70 acres are developed (determined from 1988 aerial photography). The existing land use is a mix of residential, farmland, commercial and light industrial. The town would like to see this area along Plainfield Pike, west of Interstate 295, develop as a mix of commercial and light industrial consistent with the development occurring on the other side of Plainfield Pike in Western Cranston. However, this area is not currently zoned for this use.

Problem Discussion

Wastewater disposal is by on-site septic systems and there are no unusual problems with failures of these systems. The soils in this area are rated from having slight limitations for septic system absorption fields to some areas with moderate and severe limitations. The City of Cranston has a sewer line in Plainfield Pike, however, Johnston has only one existing connection to the Cranston system. Although a large portion of the town of Johnston relies on septic systems, parts of the south eastern area of Johnston is connected to the Narragansett Bay Commission sewer system. All collection sewers in Johnston are funded by the landowners or by formation of a special sewer district.

The town indicated that providing an alternative to individual septic systems for wastewater disposal would encourage the desired industrial and commercial growth in this area. The town, in meetings with the Corps and Cranston city representatives, requested that potential flows from this area be calculated and included in the planning of the proposed sewer interceptor to the Cranston wastewater treatment facility.

WESTERN CRANSTON RESIDENTIAL AREA

Site Description

The Western Cranston Residential area, as shown on Figure 6, is the area west of Interstate 295 that is currently zoned residential by the city of Cranston. Zoning in this area ranges from 8,000 square foot lots to 80,000 square foot lots.

The topography in Western Cranston consists of a series of hills oriented northwest to southeast and narrow stream valleys with pockets of wetlands in low lying areas. Slopes range from about 2% to greater than 15% with the average about 4%.

Furnace Hill Brook and its tributaries drain the central area of Western Cranston; an unnamed brook, Lippit Brook, and the Curran Reservoir System drain the southern areas.

The State Land Use Plan (June 1989) indicates that most of this area has the potential for low density residential development, however, they do indicate that some scattered areas are candidate for high and moderate density development. The State and City has indicated their preference that the remaining rural character of this area be preserved.

Domestic wastewater disposal in this area is by on-site septic systems. In the past this area was generally agricultural and low density residential, however, in the last 20 years, many homes have been built. A large portion of the new residential development appears to be east of Pippin Orchard Road and along Hope Road.

Problem Discussion

The City of Cranston is concerned that as this area continues to grow residences are being built in soils that are not suitable for septic systems and failing septic systems may be polluting groundwater and surface water resources in the area. They suggest a sewer interceptor through this area would allow for sewering of the area and alleviate the problem.

The possibility of sewering portions of Western Cranston has been evaluated in the past. In Cranston's Facilities Plan prepared in 1976 it was proposed that this area be sewered, and the EIS prepared in conjunction with the plan devoted a chapter to an analysis of the impacts of sewering Western Cranston. While Rhode Island's "208 Water Quality Management Plan" prepared in 1979 indicated localized areas had a high probability of the

Legend

A-80: 80,000 sq ft Residential
A-20: 20,000 sq ft Residential
A-12: 12,000 sq ft Residential
A-8 : 8,000 sq ft Residential
A-6 : 6,000 sq ft Residential
B-1 : Residential
B-2 : Residential
M-1 : Industrial
M-2 : Industrial
S-1 : Open Space or State Owned

Legend

Section 22 Investigation
Cranston, Rhode Island

GENERAL ZONING OF WESTERN CRANSTON

U.S. Army Corps of Engineers
New England Division

June 1991

Figure 6

need for sewers, the report did not recommend sewering Western Cranston and Federal money was never appropriated for this task.

In order to assess the effect of recent growth in Western Cranston the City's building permit data from 1960 to 1989 was reviewed. The Rhode Island Department of Environmental Management and the Rhode Island Department of Health were contacted for information to assess the septic system failure problem in the area.

Building Permit Data

Building permit data for the City is organized by Census tract. The census tracts 145 and 146 cover the Western Cranston study area and also include some land area east of Interstate 295. However, the City's Planning Department in providing the data suggested most of the new development in these census tracts is occurring west of Interstate 295. This information is summarized in Table 3. As shown, a large portion of this development occurred in the 1980's.

Table 3
Building Permit Data, 1960-1990

Census Tract	Total Units 1960	Permits 1960-69	Permits 1970-79	Total Units 1980	Permits 1980-1989
No. 145	1237	316	281	1935	1069
No. 146	532	219	321	1035	512

Septic Systems

The Western Cranston soils are derived from glacial till and are relatively impermeable. The soils in this area have severe limitations for suitability for septic tank absorption fields. (USDA, SCS, 1981).

The Rhode Island DEM, Division of Groundwater and Wetlands, Individual Septic Disposal Section (ISDS), permits every septic system in the State. For a new home, the application and design plan is submitted by the developer to ISDS for their review and approval. The ISDS also inspects the installation of each system.

ISDS requires a three-foot separation between the top of the water table and the system. The percolation rate at the site and the design loading rate is used to estimate the size of the bed.

If a system fails, the Rhode Island Health Department reports this failure to the ISDS who investigates the failure. A violation is issued and the owner is required to fix the problem.

The ISDS representative said that several problem areas have been noted in Western Cranston. He noted that the water tables are perched and seasonally high and that soils are relatively impermeable. He suggested that failures were likely to occur in the next 10 years due to the development that took place in the 1980's.

The Department of Health, Division of Food Protection complaint files for the last 3 years (June 1987 to September 1990) were reviewed to determine the number of system failures in Western Cranston. The number of complaints recorded for suspected sewage overflow was 36, of which 19 were referred to the Department of Environmental Management for administrative action because of continuing failure of the septic system. One new subdivision in particular was brought to the Corps' attention where septic systems in 7 adjacent lots experienced septic system problems.

Water Quality Impacts

Furnace Hill Brook and small tributaries in the concentrated area of development in Western Cranston drain to Meshanticut Brook. Meshanticut Brook, and by implication its tributaries, are rated Class B, but there is little other information on the condition of these streams. A groundwater map for the area shows Furnace Hill Brook watershed as being entirely glacial till, where it isn't exposed bedrock. Glacial till has very low permeability, making it of poor quality for wells or septic tanks. Consequently, as the area relies excessively on septic tanks it could cause pollution of surface waters including Furnace Hill Brook, however, there is no documentation of an existing problem.

Public Health

The public health problem is probably limited to the actual sewage overflow incidences as the area is served by public water supply. Therefore, private well contamination should not be an issue.

TILCON GAMMINO INDUSTRIAL ZONED LAND

Site Description

This Site, as shown on Figure 2, is an approximately 170 acre existing stone mining operation on Phoenix Avenue. The area is currently zoned for industrial use and the areas surrounding the Site are zoned residential. The Site is conveniently located near the interchange of Interstate 295 and Route 37. The City expects the stone mining site to be exhausted within 15 years at which time the City anticipates zoning for light industrial or office use.

Problem Discussion

Presently there are no sewers in this area, however, the City foresees this site being developed if the area can be sewered. It would be difficult to locate on-site systems in this

area because of the presence of ledge. There are no existing public water supply lines at the site so water mains would also need to be constructed to bring water into the area.

HOWARD RESERVATION AND INDUSTRIAL PARK

Site Description

The Howard Reservation and Howard Industrial Park, as illustrated in Figure 2, are located in eastern Cranston adjacent to Route 37. The Howard Reservation is State-owned property located west of Pontiac Avenue. Ownership of this land currently rests with the Rhode Island Port Authority. State institutions at the Site accommodate adult and juvenile criminal offenders, geriatric/chronically ill, substance abusers, homeless, mentally ill, multiple-handicapped, and the criminally insane. The State agencies located here have plans to expand the inmate population. Also, the Rhode Island Office of Strategic Planning suggests that present vacant space be used as future state office space.

Howard Industrial Park is located east of Pontiac Avenue and was at one time State owned land. In 1970, this land was declared surplus by the State of Rhode Island and development of an industrial park in this area was begun. The park is fully developed except for two small lots. Currently, land adjacent to the Site formerly used by the Department of Transportation is being proposed for commercial development.

The State is also considering surplusing two other pieces of land at the Howard Complex. One is the Site of the old Training School on Sockanosset Cross Road across the street from the Garden City Shopping Center and near the Route 37, Route 2 interchange. The City would like to see this area developed as an office park or another high value use compatible to adjacent land uses. The other piece of property is located in an area known as "the Cornfields". This was originally about a 100-acre parcel leased for farming, but recent construction of a prison facility has decreased the amount of potentially developable land to approximately 70 acres.

Problem Discussion

The State of Rhode Island has plans for expansion at the Howard Reservation. There are three possible areas of growth which would result in an increase wastewater flow from the site: 1) increase in inmate population; 2) increase in employees to care for increased inmate population; and 3) use of vacant space for State office space.

There are currently approximately 3,450 inmates at the Howard Reservation and the number of employees at the facility for the three departments is approximately 3,500. This includes people on all three shifts. A list of construction/renovation projects planned by the various departments at the facility is included in Table 4.

Table 4
Construction/Renovation Projects Planned at the Howard Reservation

Department of Corrections (DOC):	Additional Inmate Population
Construct new Medium Security Prison to house 575 inmates, to be operational in Spring of 1992.	575
Expansion of the existing Intake Service Center to house approximately 750-800 newly sentenced inmates	800
Renovate space for approximately 120 offenders.	120
Renovation/Construction projects at Maximum Security Prison. Construct 15,000 sf recreational building " 17,500 sf industries building	
Renovation/Construction projects at Medium Security Prison. Construct 15,000 sf industries building. Renovate existing space into dormitory for approximately 65 inmates.	65
Construct 10,000 sf administration building at Minimum Security Prision	
Upgrade MHRH's central food plant and satellite kitchens.	
Renovate Dix Building to minimum security prison for females (62,022 s.f.). This will result in approximately 400 new inmates.	400
TOTAL DOC	**1960**
Department of Children and Their Families (DCF):	
The total number of clients is expected to increase by approximately 100. Undertake renovation/expansion of Maximum Security facility. Construct two residential modular units. Construct modular facility for counseling purposes.	100
TOTAL DCF	**100**
Department of Mental Health, Retardation, and Hospitals (MHRH):	
No construction/renovations planned.	
GRAND TOTAL	**2060**

The increase in the total number of inmates is projected to be approximately 2,100. This is due to expansion of facilities at both the Department of Corrections (1,960 inmates) and the Department of Children and Families (100 inmates). This would also result in an increase in the workforce to care for these inmates.

The present amount of vacant space at the Howard facility was estimated from the "State Owned Buildings Inventory" supplied to the Corps from the Division of Planning. The total square footage of the facility is estimated at 2,487,000. The estimated vacant space in the buildings is 259,000 sf. Therefore, approximately 10.4% of the total square footage is vacant. The Office of Strategic Planning suggests that the present vacant space be used as offices.

The State also has plans to surplus lands at the Site for possible future commercial/ industrial development. The Howard Industrial Park Areas identified under the site description are summarized in Table 5.

Table 5
Areas Potentially Available for
Future Development at the Howard Sites*

Areas Potentially Available	Approximate Acreage	Potential Use
Howard Industrial Park - 2 lots	10 acres	Industrial
Former DOT location	12 acres	Commercial
Training School Site	13 acres	Office/Hotel/ Retail Mix
Cornfields	70 acres	Light Industrial

* Source Rhode Island Port Authority.

The City of Cranston is concerned that with expansion of institutional population and State employees, potential future industrial/commercial growth may be limited by the existing wastewater conveyance capacity in these areas.

CAPUANO LANDFILL

Site Description

The Capuano Landfill site, as seen in Figure 2, is approximately 47 acres located adjacent to the Pawtuxet River, east of Pontiac Avenue and south of the Howard Industrial

Development. Residential land use abuts the landfill on the southwest edge. This is a closed capped landfill with an operating transfer station.

The landfill was operated from approximately 1943 to 1985 and contains mixed industrial and municipal wastes. In 1975, in compliance with Rhode Island Department of Health regulations, an unlined lagoon used for the disposal of chemical wastes was filled in.

In 1980 a leachate collection system was installed along the northeast edge of the landfill. Contaminated runoff and contaminated groundwater leaching from the toe of the landfill was collected in a buried pipe and channeled to holding tanks. From there it could be pumped into tankers and hauled to the Cranston treatment facility. The landfill and the City negotiated an agreement to accept leachate from the site. The system was designed to handle 72,000 gallons of leachate per day, but less than 1,000 gallons accumulated at that time.

The landfill was closed in 1985 by order of the DEM, however, illegal dumping of "auto fluff" continued after the landfill closure. The fluff is the nonmetallic material remaining after autos are shredded. In 1988, the landfill was investigated by the DEM and the Attorney General's Office for disposal in violation of State law. The resultant proceedings resulted in indictment and prosecution of the landfill owners and others associated with the auto fluff dumping. The case was disposed of in 1989 with total fines of 1.4 million dollars being levied.

A transfer station is currently operated at the Site by Chambers United Waste System Inc. who lease the transfer station land from the landfill owners.

The landfill owners and the DEM have agreed on a closure procedure at the landfill. This Consent Order includes fencing of landfill area, installation of an impermeable cap over the landfill, slope stabilization and seeding, drainage system for runoff from the top of the landfill, installation of monitoring wells, and plan development for methane control.

The Site is also under investigation by EPA's Superfund preremedial group. This investigation was begun in 1980 and a preliminary site assessment was completed in 1982, however, the investigation has not proceeded further to date. The next step in the EPA investigation is a listing site investigation. If the Site is listed on the National Priority List, a Remedial Investigation and Design Feasibility Study would be conducted.

Problem Discussion

The Capuano site has been identified by the Rhode Island DEM as a hazardous waste area. Several studies and some remedial actions have been undertaken as a result of legal actions taken by the State. A landfill closure plan has been agreed upon by the Rhode Island DEM and the owner. The Site is also currently listed with the Environmental Protection Agency Superfund program as a potential contaminated hazardous waste site and is awaiting a listing site investigation to determine qualification for and rank on the National Priority List (NPL).

The impermeable cover is intended to control leachate generation from the site. However, if EPA investigates this Site at some time in the future, they may recommend groundwater collection and treatment. Collection of surface runoff from the Transfer Station is planned to be routed into an existing sewer line on Sharpe Drive.

Acceptance of flows into the Cranston system for any of the identified problems would require an agreement with the City of Cranston. According to the RI DEM Solid Waste Management Section, Chambers Waste Systems of Rhode Island, operators of the site transfer station are negotiating with the City of Cranston for a sewer connection for the transfer station.

Water Quality Impacts

The Capuano Landfill site appears to be contaminating ground and surface water with organic compounds and heavy metals. Areas of heaviest contamination are along the east and northeast sides. Vegetative stress has been observed on the Pawtuxet River floodplain downgradient of the landfill.

Review of the study prepared for EPA in 1982 indicates the direction of groundwater flow in the area of the landfill is northwest to the southeast and east towards the Pawtuxet River. In the report the hypothesis was presented that a contamination plume was moving into the glacial outwash aquifer at the Site and possibly into the Pawtuxet River. (Ecology and the Environment Inc. 1982)

More detailed information is presented in the Water Quality Evaluation, Appendix B.

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IV. PLAN FORMULATION

The City of Cranston and State of Rhode Island face a variety of complex environmental and economic issues in solving the grouping of interrelated environmental problems discussed in this study. The City and the State must weigh the economic and environmental benefits of addressing the wastewater conveyance problems while trying to solve the water quality problems of the Pawtuxet River and its local tributaries. The City has also stated a desire to retain the rural character of western Cranston which could be difficult with the introduction of sewers. The City and State must also resolve the problem of providing advanced treatment at Cranston's existing wastewater treatment facility and perhaps provide a regional solution for advanced treatment for the cities of Warwick and West Warwick. The intent of this Section 22 study is to focus on one problem area, the wastewater conveyance problems at the study sites, thus providing a piece of the overall puzzle facing the region.

In this section, a broad range of possible solutions to the wastewater flow problems at the sites are described as well as the planning constraints and assumptions used in formulating the plans.

PLANNING CONSTRAINTS

Planning constraints are those conditions imposed upon the planning process that limit the range of feasible alternatives available to the planner. These constraints may be legal, public policy, economic, social or environmental factors of such importance that to violate them would compromise the entire planning effort. Some of the planning constraints include:

1. One legal constraint on the planning process is the contract between the City of Cranston and the Rhode Island Solid Waste Management Corporation in which the City has agreed to reserve 400,000 gallons per day capacity for the Corporation in its sewage treatment facilities and its sewage collection and pumping station facilities and to accept that volume or less into those facilities.

2. A public policy constraint is the goal of the City of Cranston and the State of Rhode Island to support contained development while preserving as much of their open spaces and rural character as is feasible to support a growing and vital economy and population. In particular, the City and the State desire to preserve the rural character of western Cranston.

3. Regulatory constraints on wastewater effluent limitations to the City's sewer system and to the Pawtuxet River from the City's wastewater treatment facility are contained in the City's Sewer Use Ordinance effective 26 August 1985 and the City's Rhode Island Pollutant Discharge Elimination System Permit effective 1 May 1989. The City is also under a Judicial Consent Decree to attain compliance with the limits of this discharge permit.

4. The three landfill sites - Central, Capuano, and Vinagro are regulated and permitted under State and Federal environmental laws including hazardous waste laws and solid waste management facilities rules and regulations. The EPA is currently conducting an RI/FS study of Central Landfill under the Superfund program. The Vinagro and Capuano sites are subject to State of Rhode Island Consent Judgements for site remediation. In addition Vinagro and Capuano sites are currently listed with the EPA Superfund program and are awaiting listing site investigations to determine qualifications for and rank on the national priority list.

PLANNING ASSUMPTIONS

Planning assumptions are those assumptions made in the analysis in order to predict the probable future conditions. Assumptions to be included in this study are:

1. The period of analysis for the proposed plans for the evaluation of future flows, costs, and impacts associated with the proposed plans is 50 years (1990 to 2040).

2. Population and economic growth projections for the study sites are based on the State of Rhode Island planning figures as presented in the report entitled "Land Use 2010, State Land Use Policies and Plan, 1989" and the preliminary "Industrial Land Use Plan, 1990". These documents project growth through 2010. Growth beyond this year is assumed to continue at the same rate.

3. Industrial and commercial wastewater flow projections assume the continuation of the same mix of industries and commercial establishments as are currently located in the industrial parks.

4. It is assumed that compliance of study site wastewater flow discharges with pretreatment program effluent standards required under the City's Sewer Use Ordinance or State and Federal regulations will be complied with by the site operators and dischargers will be able to obtain permits to discharge into the municipal sewer system.

5. The existing excess capacity (approximately 10.9 mgd average daily flow) at Cranston's Wastewater Treatment Facility is available to handle the probable future flows from the study sites with no additional capital cost, however, there will be cost associated with providing advanced treatment of these flows.

GENERAL DESCRIPTION OF PLANS

Developing the proposed plans involved identifying possible measures for solving the wastewater problems at the study sites. Measures that initially appeared to be reasonable are organized by plan and summarized below. These plans are evaluated in more detail on a site by site basis in following sections of the report.

No Action Condition

- The No Action plan assumes that the existing conditions continue with no action taken by the City of Cranston or any other agency to increase the sewer system capacity or decrease the wastewater flows to the system.

Modifications to the Sewer System

- This plan looks at modifying the existing sewer system to accommodate the projected flows from the identified sites. Flows from Central Landfill, Vinagro site, and West Cranston Industrial Park and Johnston site are routed to the Welsh pump station and through the sewer system to the wastewater treatment facility. Flows from Western Cranston Residential area and Tilcon Gammino are routed to the existing Sherman Avenue pump station and through the existing system to the wastewater treatment facility. Flows from the Howard Reservation and Industrial Park and the Capuano site are routed to the existing Howard Pump station and through the sewer system to the WWTF

Local Wastewater Treatment

- This plan looks at the possibility of providing local wastewater treatment facilities to treat wastewater flows and discharge them to a receiving water or to the groundwater. This plan considers two options: construction of local wastewater treatment facilities and use of package treatment facilities

Sewer Interceptor Proposal

- This plan looked at the construction of a sewer interceptor in the western Cranston area. An alignment through western Cranston similar to the city's proposal was selected for the purposes of this study. The sewer system would include a combination of force mains and gravity lines to convey flows to the existing treatment facility. The City of Cranston proposed that this interceptor be constructed using innovative and alternative features. These features include: the use of energy efficient electric motors and variable frequency drives at the pump stations; the use of low friction plastic force mains; and the

use of a force main/pressure sewer versus a force main/gravity sewer over approximately 14,000 feet at the end of the interceptor.

Wastewater Flow Management

- This plan looks at measures to reduce the future wastewater flows to the Cranston sewer system. Measures considered include a demand management program (domestic water conservation), rezoning, decreasing infiltration and inflow and establishing a Wastewater Management District in western Cranston. Domestic water conservation through a implementation of domestic device retrofit program are considered both in western Cranston and city wide.

V. WASTEWATER FLOW PROJECTIONS

INTRODUCTION

Average day wastewater flows are calculated for each study site in 1995, 2010 and 2040. These flow estimates are for plan comparison purposes of the Section 22 study only and are based on limited existing available data and assumptions concerning future growth and landfill discharges. These assumptions will be impacted by on-going studies being conducted by the City, State and EPA.

Sewer design is based on the estimated 2040 average day flow multiplied by an appropriate peak factor plus an estimate of infiltration and inflow. Peak factors were calculated based on Figure 1, page 2-3 of TR-16 guide and based on flow data from existing pumping stations provided by the City. (New England Interstate Water Pollution Control Commission, 1980). Wastewater flow projections for the study sites for the year 2040 are summarized in Table 6 and discussed by site in the following sections of the report.

Table 6
Summary of Projected Wastewater Flows (1)

	2040 average day flow (gpd)	2040 design flow (gpm)
Central Landfill		
Leachate collection	77,000	53
Sanitary and Operations	3,200	6
Gas Recovery Facility	1,500	1
Prop. Res. Recovery Facility	15,000	10
Groundwater pumping	230,000	160
Future Industrial Flow	73,300	127
Total	400,000	357
Vinagro Site		
Sanitary and Operations	800	1
Leachate collection	700	<1
Groundwater pumping	35,000	24
Total	36,500	25
West Cranston Ind. Park		
Industrial/Commercial flow (2)	478,000	923
Other areas along Plainfield Pike		
Johnston Site	212,000	410
Areas adjacent to WCIP	91,000	180
Total	303,000	590
Western Cranston Residential Concentrated Area of Development(3)		
Land Use 2010 data projection	760,000	1,576
Building permit data projection	1,060,000	2,086
Tilcon - Gammino		
Industrial/Commercial flow (2)	42,000	81
Howard Reservation and Industrial Park		
Howard Industrial Park	490,000	681
Howard Reservation	2,170,000	3,014
Total (4)	2,660,000	3,695
Capuano Site		
Sanitary and Operations	1,000	2
Groundwater pumping	60,000	42
Total	61,000	44
Total for Study Sites	5,040,500	7,801

(1) These flow estimates are for plan comparison purposes of the Section 22 study only and are based on limited existing available data and assumptions concerning future growth and landfill discharges.
(2) Includes existing flow to Welsh pump station.
(3) Flow projections limited to area south of Scituate Avenue, west of Phenix Avenue/Natick Avenue, east of Pipin Orchard Road and north of the Cranston Warwick Boundary as delineated on Figure 2.
(4) Includes existing flow to Howard pump station.
(5) Includes building permit data wastewater flow projection from Western Cranston Concentrated Area of Development.

CENTRAL LANDFILL

Wastewater flows from Central Landfill include discharge from the sanitary and operation facilities, discharge from the gas recovery facility, discharge from the proposed leachate collection facilities, discharge from the proposed air cooled resource recovery facility, potential groundwater pumping from the Superfund site, and future industrial discharge. Stormwater runoff from the surface of the landfill is not included as a wastewater flow as it is assumed that this flow will continue to be routed to Upper Simmons Reservoir.

Expected leachate generation from each of the landfill phases is presented in Table 7. Estimated wastewater discharges from the site including discharge of sanitary and operational wastes, discharge from the gas recovery facility, and discharge from the proposed air cooled Resource Recovery Facility (originally planned as a water cooled facility) are presented in Table 8. A gross estimate of future groundwater pumping from under the Superfund site was roughly estimated at 230,000 gpd. This is the estimated amount of pumping required to keep the plume from moving off site. (See Hydraulics Report, Appendix C, Section 3.b) A summary of future wastewater flow estimates for the Central Landfill is presented in Table 9.

Table 7
Estimated Leachate Generation from Landfill Areas (1)
(gpd)

Operational Year	1991	1992	1993	1994	1995 to closure
Phase I	85000	62000	18000	18000	18000
Phase II and III	0	15000	50000	56000	59000
Total Leachate(2)	85000	77000	68000	74000	77000

(1) Source: Rhode Island Solid Waste Management Corporation, 1990.
(2) Does not include flow estimate for Superfund site remediation.

Table 8
Estimated Wastewater Flows from Central Landfill
Flows in gpd

Existing Sanitary and Operation	3,200
Existing Gas Recovery Facility	1,500
Proposed Res. Rec. Facility (1)	15,000
Total (2)	19,700

(1) Estimated to be on line in 1995.
(2) Source: Rhode Island Solid Waste Management Corporation, 1990.

Table 9
Central Landfill Projected Wastewater Flows

	Average Day Flow (gpd)			Design Flow (gpm)
	1995	**2010**	**2040**	**2040**
Central Landfill				
Sanitary and Operations	3,200	3,200	3,200	6
Gas Recovery	1,500	1,500	1,500	1
Leachate Collection	77,000	77,000	77,000	53
Prop. Res. Recovery	15,000	15,000	15,000	10
Groundwater Pumping	230,000	230,000	230,000	160
Future Industrial Flow	0	73,300	73,300	127
Total(1)	326,700	400,000	400,000	357

(1) For the purposes of estimating flows for the alternatives it is assumed that the landfill facilities will be discharging wastewater flow in 2040.

VINAGRO SITE

Wastewater flow estimates from the Vinagro Site include sanitary and operational facility discharges, and possible leachate collection and groundwater pumping. Gross estimates of sanitary and operational flow and potential leachate generation are calculated based on the area of the site. Possible future groundwater pumping from the site is roughly estimated at 35,000 gpd. This is the amount of pumping required to keep the plume from moving off site. A summary of future wastewater flow estimates for the Vinagro Site is presented in Table 10.

Table 10
Vinagro Site Projected Wastewater Flows

	Average Day Flow (gpd)			Design Flow (gpm)
	1995	2010	2040	2040
Sanitary and Operations	800	800	800	1
Leachate collection		700	700	<1
Groundwater pumping		35,000	35,000	24
Total(1)	800	36,500	36,500	25

(1) For the purposes of estimating design flows for the alternatives, it is assumed that the landfill facilities will be discharging wastewater flow in 2040.

INDUSTRIAL AREAS ALONG PLAINFIELD PIKE

The Western Cranston Industrial Park and adjacent areas along Plainfield Pike including a residential area are currently served by sewers which flow into the Welsh pumping station. The projected flow estimates for the Western Cranston Industrial Park include this existing flow as well as future development at the park. Projected flow estimates from the park are based on the number of acres available for development, projected number of employees and an assumed wastewater flow factor of 132 gpd per employee. This wastewater flow factor was calculated from data for the Western Cranston Industrial Park and from the Welsh pumping station. It is estimated that the West Cranston Industrial Park will be fully developed by 2040. The projected flows from the western Cranston industrial areas are summarized in Table 11.

Table 11
Western Cranston Industrial Park Projected Wastewater Flows

	Average Day Flow (gpd)			Design Flow (gpm)
	1995	2010	2040	2040
West Cranston Ind. Ind/Comm Flow (1)	270,000	303,000	478,000	923

(1) Includes all existing flows to Welsh pumping station and includes infiltration and inflow.

In addition to the Western Cranston Industrial Park there is other land available for development in Cranston and Johnston along Plainfield Pike that may also generate additional wastewater flows. Projected flows were also calculated assuming this additional growth. These flows are presented in Table 12.

Table 12
Additional Growth along Plainfield Pike Projected Wastewater Flows

	Average Day Flow (gpd)			Design Flow (gpm)
	1995	2010	2040	2040
Johnston Site Flow	99,000	112,000	212,000	410
Areas adj. to WCIP	43,000	48,000	91,000	180
Total (1)	142,000	160,000	303,000	590

(1) Includes infiltration and inflow.

WESTERN CRANSTON RESIDENTIAL AREA

The area in Western Cranston that is considered for municipal sewer service and thus for projection of wastewater flows is the area south of Scituate Avenue, west of Phenix Avenue/Natick Avenue, east of Pipin Orchard Road and north of the Cranston Warwick Boundary. (See Figure 2). This service area is called the Western Cranston Residential Concentrated Area of Development. The delineation of this service area is based on the stated desire of the State and the City to maintain the rural character in western Cranston. The on-going facilities planning effort is considering a service area that extends beyond the service area considered in this study. Ultimate delineation of the area to be served by a future municipal sewer system is dependent upon the results of the City's ongoing comprehensive land use planning effort and the desire of City and State officials.

Several different methods were considered for projecting residential growth in this area. Reports and data examined included past building permit data for the area, the Rhode Island Office of State Planning's "Land Use 2010" and information for population growth and water use data contained in the report "Water Supply Analysis For the State of Rhode Island, Task 500 Series - Forecast of Water Use and Unmet Needs", Draft Report, dated December 14, 1989, prepared by Arthur D. Little, Inc. (ADL).

Two growth projections are used for the purposes of this study: 1) the Land Use - 2010 projection for Cranston which tracked with the ADL study water use projections; and 2) a higher growth projection calculated from the buildings permit data for the area. Calculations using the building permit growth data and the existing zoning indicated that this area would be fully developed by 2030.

As there are no existing sewers in the western Cranston residential concentrated area of development existing metering data could not be used to select an average day domestic wastewater flow factor for the area, so the selection of an average day domestic flow factor was based on the following information.

Metcalf and Eddy (1979), Viessman and Hammer (1985) and the TR-16 guidelines suggest that in the absence of actual domestic wastewater flow data water withdrawal data can be used. Information in ADL's Water Use report for the area showed average day domestic water use to be 80 gallons per capita per day, (gpcd) in 1988 and projected to decrease to 75, gpcd in 2010 as a result of 1980 and 1990 plumbing codes requiring low flow sanitation fixtures.

Metcalf and Eddy (1979) suggest an average home has a typical wastewater flow of 74 gpcd. The TR-16 guidelines suggest a minimum average day flow factor of 70 gpcd.

The 1976 Cranston Wastewater Facility Plan used an average day domestic wastewater flow factor of 100 gpcd. Since publication of the 1976 Facility Plan plumbing codes have been put into effect in Rhode Island which decrease the average day domestic wastewater flow, in 1980, 3.5 gallons per flush toilet and in 1990, 1.6 gallons per flush toilet.

Taking all these estimates into consideration the selection of an average day domestic wastewater flow factor for the western Cranston residential concentrated area of development of 75 gpcd appeared reasonable. Better water use data for this area would provide for a more accurate estimate of an average day domestic wastewater flow factor.

The average day domestic wastewater flow factor was then multiplied by a peak factor of 3 obtained from the TR-16 guide plus an additional allowance of 500 gpd/in diameter/per mile of sewer for infiltration to obtain the sewer design basis for the western Cranston residential area of about 230 gpcd.

The "Gravity Sanitary Sewer Design and Construction Manual" (ASCE and WPCF, 1982) lists the City of Cranston as having an average sewage flow of 152 gpcd and a sewer design basis of 150 gpcd, however no reference is provided for this listing. The selected average day domestic wastewater flow factor of 75 gpcd is less than the listed 152 gpcd, but the 230 gpcd sewer design basis is greater than the listed 150 gpcd.

The projected wastewater flows for the Western Cranston Concentrated Residential Area are summarized in Table 13.

Table 13
Western Cranston Residential Concentrated Area of Development
Projected Wastewater Flows (1)(2)

	Average Day Flow (gpd)			Design Flow (gpm)
	1995	**2010**	**2040**	**2040**
Land Use 2010 data	660,000	690,000	760,000	1,576
Building permit data	660,000	780,000	1,060,000	2,086

(1) Includes an estimate of infiltration and inflow.
(2) Flow projections presented are based on assumptions concerning future population growth, the future municipal sewer service area and an assumed domestic per capita wastewater flow factor and peak factor.

TILCON GAMMINO INDUSTRIAL ZONED LAND

This site is an operating stoneworks and city officials have projected that this operation will close in about 10 to 15 years. Therefore, it has been assumed for purposes of this study that wastewater discharge from commercial and industrial development would begin in 2010. The city has indicated they would like to see a mix of commercial and light industrial development occur in this area that is compatible with adjacent residential property. Projected flow estimates for this site are included in Table 14.

Table 14
Tilcon Gammino Site Projected Wastewater Flows

	Average Day Flow (gpd)			Design Flow (gpm)
	1995	**2010**	**2040**	**2040**
Total (1)	0	22,000	42,000	81

(1) Includes an estimate of infiltration and Inflow.

HOWARD RESERVATION AND HOWARD INDUSTRIAL PARK

The Howard Industrial Park and the State operated Howard Reservation are areas with existing sewers which discharge to Cranston's existing sewer system. Wastewater flow projections for these areas are developed based on future institutional growth and industrial/commercial growth on available State land.

Projected wastewater flows for the Howard Industrial Park are estimated based on the amount of acres available for development in the existing Park (10 acres) as well as the number of acres available for commercial/industrial development at the training school, at the cornfields and at the former DOT location (95 acres). The acreage available for industrial and commercial development is expected to be fully developed by 2030. Projected flow estimates for this new development are based on a wastewater flow factor of 85 gpd/employee. This wastewater flow factor was calculated based on existing data provided for the Howard pumping station.

Projected wastewater flows for the Howard Reservation (State facilities) is based on projected growth in the inmate population and projected use of the vacant space at the facility (provided by the Office of State Planning). Wastewater flow projections are based on a wastewater flow factor of 119 gpd per inmate and 11 gpd/employee (Metcalf & Eddy, 1979). Projected flow estimates for these sites are included in Table 15.

Table 15
Howard Industrial Park and Howard Reservation, Projected Wastewater Flows

	Average Day Flow (gpd)			Design Flow (gpm)
	1995	2010	2040	2040
H.Ind Park	290,000	330,000	490,000	681
H. Reservation	2,010,000	2,140,000	2,170,000	3,014
Total (1)	2,300,000	2,470,000	2,660,000	3,695

(1) Includes existing flow to Howard pump station and infiltration and inflow.

CAPUANO LANDFILL

Wastewater flow estimates from the Capuano site include sanitary and operational facility discharges and possible groundwater pumping. A gross estimate of sanitary and operational flow generation are calculated based on the area of the site. Possible future groundwater pumping from the site is roughly estimated at 60,000 gpd. The amount of pumping required to keep a contamination plume from moving off site. A summary of future wastewater flow estimates for the Capuano Site is presented in Table 16.

Table 16
Capuano Landfill, Projected Wastewater Flows

	Average Day Flow (gpd)			Design Flow (gpm)
	1995	**2010**	**2040**	**2040**
Sanitary and Operations	1,000	1,000	1,000	2
Groundwater pumping	0	60,000	60,000	42
Total(1)	1,000	61,000	61,000	44

(1) For the purposes of estimating design flows for the alternatives, it is assumed that the landfill facilities will be discharging wastewater flow in 2040.

VI. ENGINEERING AND OPERATIONAL EVALUATION

NO ACTION

The No Action plan looks at the continuation of existing conditions with no action taken by the City of Cranston or any other agency to increase the sewer system capacity or decrease the wastewater flows to the system.

Under No Action, areas currently served by the existing sewer system in the western Cranston Industrial area continue to be served and Central Landfill flow is collected, pretreated as necessary, and routed to the sewer system at Plainfield Pike. Based on existing available information, it appears existing flows from this area along with the estimated sewer design flow from the Central Landfill site will exceed the design conveyance capacity of segments of the existing system between Welsh pump stations and Pontiac pump station. (See Figure 4 for location of existing major pipeline and pump stations).

Under No Action the Vinagro site, the Johnston site, the Western Cranston Residential Concentrated Area of Development, the Tilcon Gammino site and the Capuano site are not provided with sewers or treatment other than on-site septic systems.

The Howard Reservation and Howard Industrial Park continue to be served by the existing system, however, some future growth at the sites may be limited by the design conveyance capacity of the existing system in this area depending on the location of the new inflows to the system.

MODIFICATIONS TO THE EXISTING SYSTEM

This plan looks at modifying the existing system to carry projected wastewater flows from the study sites to the Cranston WWTF. Information on pipe replacement and additional pump requirements for this plan are presented in the Hydraulics Report, Appendix C. Also see Figure 4 for the general layout of the existing system.

This plan involves replacing over 10,000 feet of pipe with larger diameter pipe between Welsh and Pontiac pump stations and upgrading the Welsh pump station by adding pumps or replacing existing pumps with larger capacity pumps. Increased pump capacity would also need to be provided at Plainfield, Randall, and Pontiac pump stations. In order to connect Western Cranston Residential Concentrated Area of Development and Tilcon Gammino to the Sherman pump stations a new collection system and mains to Sherman pump station would be required and the Sherman pump station would need to be provided with reserve pump capacity. Approximately 4,000 feet of gravity main would need to be replaced prior to the Howard pump station to meet design criteria and carry future flows. The Howard pump station would also need to be provided with backup pump capacity.

Modifications to Cranston's existing sewer system in densely developed areas could result in major disruptions to both vehicular and pedestrian traffic. Also, other utilities in the streets may cause construction problems.

LOCAL WASTEWATER TREATMENT

This plan looks at the possibility of constructing local treatment facilities to treat the wastewater flows and discharge them to a receiving water. Two different options were considered: building new advanced treatment facilities near the study sites or using decentralized package treatment facilities at study sites.

Study sites for the construction of local wastewater treatment facility options are divided into three groups: group I includes Central Landfill, the Western Cranston Industrial area, the Vinagro site, and the Johnston site; group II includes Western Cranston Residential Concentrated Area of Development and Tilcon Gammino; and group III includes the Howard Industrial Park and Howard Reservation and the Capuano site.

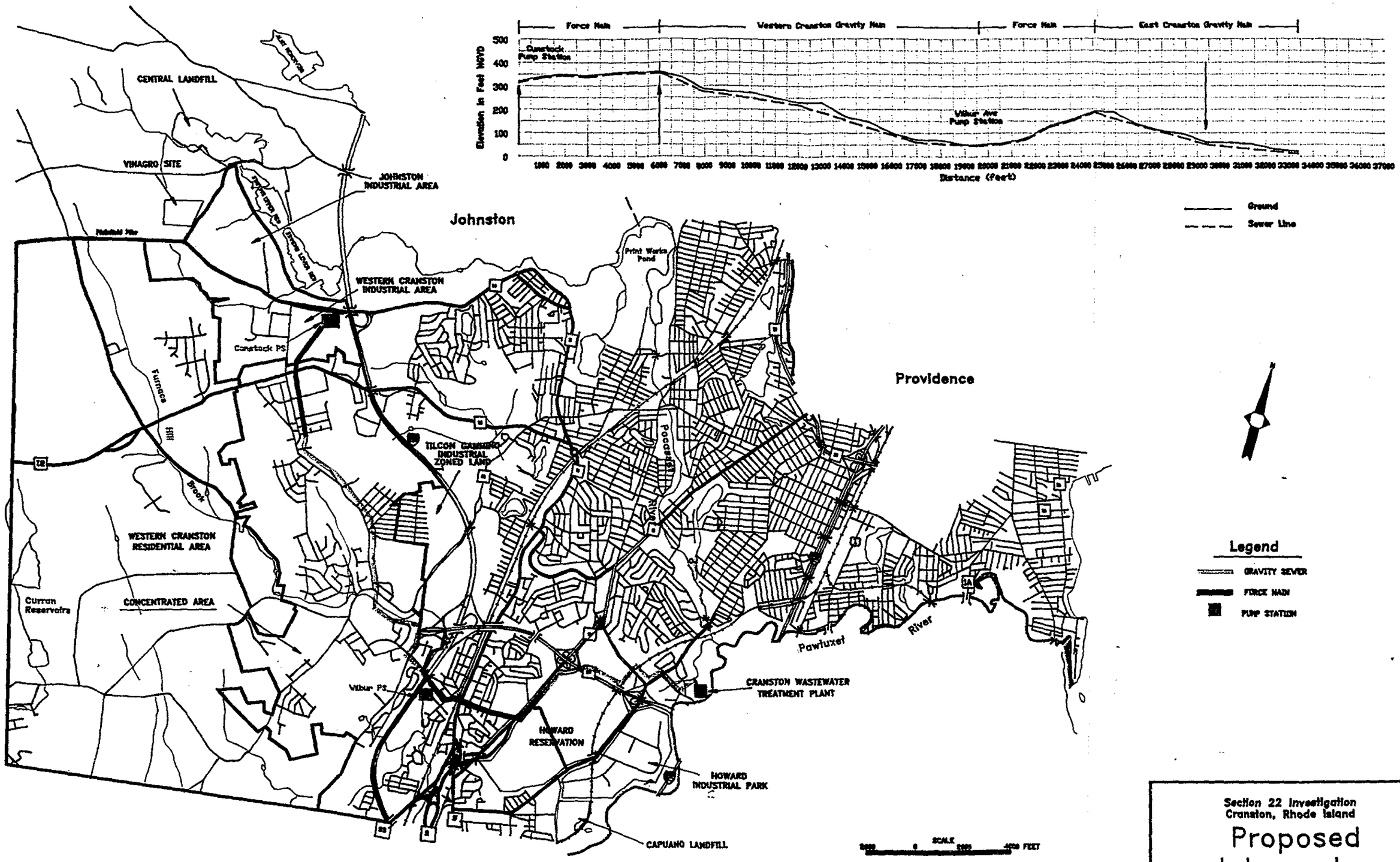
Package treatment facilities were initially considered for all study sites, however, preliminary evaluation of package treatment facility characteristics and study site design flows limited further evaluation of this option to western Cranston Industrial Area, Tilcon Gammino site and the Western Cranston Residential Concentrated Area of Development.

This plan involves discharge of treated wastewater to either a local surface water or the ground. Siting studies of surface water discharge facilities would include water quality modeling of the proposed receiving stream. Studies would be required to demonstrate that the new discharge would meet the RI DEM anti-degradation policy. Surface streams in this area are rated Class B, but streams may be attaining Class A water quality.

Staff from EPA and the RI DEM contacted regarding this issue indicated it would most likely be impossible to obtain a new surface water discharge permit in the western Cranston area due to regulatory constraints, and soils in this area are not suitable for groundwater discharge. The RI DEM also suggested that no new discharges can be permitted to the Pawtuxet River as the wasteload allocation for the stream has been established based on the existing and future needs of the current users.

SEWER INTERCEPTOR

This plan looks at building an interceptor from the northwestern part of the city to the Cranston wastewater treatment facility to convey wastewater flows from the study sites. (See Figure 7). Information of pipe and pump requirements for this plan are presented in the Hydraulics Report, Appendix C. The interceptor would be constructed using a combination force main and gravity main to convey wastewater flows from the study sites.



Section 22 Investigation
Cranston, Rhode Island

Proposed Interceptor

U.S. Army Corps of Engineers
New England Division

June 1991

Figure 7

Wastewater discharges from Central Landfill, Vinagro Site, Johnston Site, Western Cranston Industrial Park and adjacent industrial areas are assumed to flow to the pipeline system on Plainfield Pike, into the proposed Comstock pump station and through the interceptor to the WWTF. Wastewater discharges from the Western Cranston Residential Concentrated Area of Development and the Tilcon Gammino site would be routed through a sewer collection system to the proposed interceptor. Wastewater discharges from the Howard Industrial Park, Howard Reservation and Capuano site are assumed to flow to the Howard Pump station through a new force main to the interceptor.

The alignment of the interceptor provides new conveyance capacity for wastewater from a growth area of the City through an already densely developed area to the WWTF. Construction of a new conveyance system to service western Cranston would decrease the demand on the existing sewer system pipelines and provide some amount of redundancy in the area of eastern Cranston with existing sewers. This plan will also involve disruption during construction, but depending on the final alignment will probably involve digging up fewer streets in heavily developed areas than modify existing system plan.

Based on available existing information it is believed more practical to route flows from the Howard pump station through the existing pipelines as opposed to building a new force main from the pump station to connect with the interceptor. However, better wastewater flow data for this area and detailed hydraulic analysis of these pipes would be required to determine the actual cost effectiveness of connecting to the sewer interceptor.

Model Plan Discussion

The City suggested that it is not the hardware alone that makes a solution a "model" project, but the combination of elements including: the proposed technological hardware; the alignment of an interceptor from a newer and undeveloped area through older development to an existing treatment facility; the desire of the city to provide solutions for future or existing wastewater problems in an adjacent community as well as their own community; the required cooperation in planning future land use and local growth between the State and the City and the impact of these plans on future wastewater conveyance needs, the investigative component of the study requiring a broad look at defining existing pollution problems at study sites; the role of the Corps in coordination, evaluation and implementation of the solution.

The City of Cranston proposed that the interceptor design incorporate project elements such as energy efficient electric motors and variable frequency drives at the pump stations, the use of low friction plastic force mains, and the use of a continuous force main/ pressure sewer versus a force main/gravity sewer for the last 14,000 feet at the end of the interceptor.

Following is a summary of information obtained on the use of the suggested project design elements.

- Use of energy efficient electric motors, variable frequency drives and low friction plastic force mains is technically feasible and may provide operational cost savings.

- Use of a plastic force main pipeline is not standard for this type of interceptor, but may offer some advantages. These include fewer manholes, shallower excavations and a residual pressure head at the end of the pipeline which might allow bypassing screw pumps at the wastewater treatment facility. The City's engineer has suggested the pressure line may be easier to construct than a conventional gravity line in a developed area.

- Disadvantages are the need for clean-outs and potential maintenance problems. However, the City's engineer has suggested placing cleanouts in proximity to existing gravity sewer lines, and flushing cleanouts into the existing sewer. Also, construction of a force main through an existing sewered area precludes correcting deficiencies that may exist with the gravity sewer such as infiltration/inflow.

WASTEWATER MANAGEMENT PLAN

The Wastewater Management Plan (WMP) looks at four ways of managing future wastewater flows.

1) The Demand Management component of the WMP aims, through domestic water conservation, to reduce wastewater discharges into the sewerage system. Measures are proposed in the Western Cranston Residential Concentrated Area of Development served by the City of Cranston Water Division and in eastern Cranston served by the Providence Water Supply Board.

2) The Infiltration/Inflow component seeks to examine the possibility of reductions in wastewater flows in the City of Cranston's sewerage system by addressing inflow from illegal connections (roof leaders, private drains, storm sewers, etc.) and groundwater infiltration.

3) The Rezoning component addresses the possibility of decreasing future wastewater flows from the Western Cranston Residential Concentrated Area of Development and the Western Cranston Industrial area by limiting growth through zoning changes.

4) The Waste Water Management District component addresses implementation of a city operated septic system approval, inspection and maintenance program in western Cranston to protect groundwater.

The analysis for the Western Cranston Residential Concentrated Area of development is based on the two variations of population projections: the State of Rhode Island's Land Use 2010 Data and Building Permits Data. These are presented below in Table 17.

Table 17
City of Cranston, Rhode Island - Population Projections

Year	Total Population(1)	Western Cranston Residential Concentrated Area of Development(2)	
		Land Use 2010 Data	Building Permits Data
2010	79,703	8,286	9,413
2040	87,857	9,134	13,200

(1) Source: R.I. Division of Planning, LAND USE 2010, June 1989. Data provided to 2010 and extrapolated to 2040.
(2) Study area limited to south of Scituate Avenue, west of Phenix Avenue/Natick Avenue, east of Pipin Orchard Road and north of the Cranston Warwick Boundary as delineated on Figure 2.

Demand Management

Present Situation - Demand Management is basically a series of conservation measures to reduce wastewater flow by reducing the use of water which is subsequently discharged into the sewerage system. Three agencies provide potable water to the City of Cranston: the Providence Water Supply Board (Board) for the city east of Route 295; and the City of Cranston's Water Division for the portion of the city west of Route 295 except for a small part in the southwest which is served by the Kent County Water Authority. The primary source of water supply for the city is the Board's Scituate Reservoir. The Board retails water directly to eastern Cranston and wholesales water to both the city and the Kent County Water Authority. Available water supply data for the City of Cranston is presented in Table 18.

Judging by the volumes of water delivered to customers in Cranston, conservation efforts would theoretically be most effective if directed by the Providence Water Supply Board which supplies about 90 percent of the water to the City versus the City of Cranston which retails only about 8 percent. The Board installs and maintains the distribution system in eastern Cranston and bills customers directly. Thus the major responsibility for reducing water demand in Cranston rests with City of Providence agencies over which the City of Cranston does not exercise direct control.

Table 18
City of Cranston, Rhode Island
Estimated Water Use by Supplier
(Million gallons per day - mgd)

Fiscal Year	Providence Water Supply Board(1)(5)	City of Cranston(2)	Kent County Water Authority	Total(5)
1990	8.55	1.04		
1989	9.26	1.02		
1988	8.71	0.85		
1987(3)	6.36	0.60	0.16(4)	7.12
1986(3)	10.95	0.61		

(1) Source: Providence Water Supply Board for retail service area.
(2) Source: Providence Water Supply Board for water sold wholesale to the City of Cranston.
(3) Billing period is unknown.
(4) Water Supplied to 626 customers that are serviced by the Cranston Wastewater system. Source: Tutela Engineering Associates.
(5) Does not include Cranston Print Works which provides its own water supply (approximately 0.32 mgd in 1989), but discharges its wastewater into Cranston's Wastewater System.

Present water conservation measures have been modest. The Board, in cooperation with the Narragansett Bay Commission, which manages the City of Providence's wastewater system, has instituted conservation measures in the Board's retail service area (City of Providence and Eastern Cranston). These have included educational programs aimed at changing the behavior of water users whether through the schools, residential users or industries in the form of presentations, workshops and the distribution of conservation literature. The Board also has a program of leak detection. During the summers of 1989 and 1990, a Youth Conservation Program recruited young people to retrofit residences and elderly housing units with domestic water-saving devices (low pressure shower heads, toilet dams and faucet aerators). No information is available on the effectiveness of these programs in reducing water uses.

The Board has commissioned a water demand study, the results of which are scheduled to be released in late 1991 early 1992. The study would provide a computerized data base of all customers, in the service area. The data base would include land use, socioeconomic and water use data of all customers. Comprehensive profiles of each consumer would serve as a basis for establishing a water use management plan.

Conservation efforts in western Cranston also have been modest. Since the water distribution system is relatively new (about 20 years old), City officials have no reason to expect that these are major leaks in the system although there is an ongoing leak detection program for both the distribution system and residential plumbing. In addition, the City has a program for meter testing and replacement and an education component devoted primarily to mailings of conservation literature with water bills.

Future Wastewater Reduction - Estimates of future reductions in wastewater flows are based on a continuation of current trends in water demand management in the city of Cranston and additionally the implementation of concerted water conservation measures including a domestic device retrofit program. For the purpose of this analysis it is assumed that reductions in water use are equivalent to reductions in wastewater flows.

The wastewater flow reductions shown in the Table 19 are the difference between the per capita wastewater flow without the demand management program or 75 gallons per capita per day (gpcd) and the per capita flow with the demand management program. The peak flow reduction calculations are estimated based on the average reduction and peak factors developed for the wastewater flow projections from the TR-16 guidelines.

Based on the results of pilot projects in the Boston area, one half of the Cranston population is projected to be retrofitted with domestic water saving devices (low pressure shower heads, faucet aerators and toilet dams) by the year 2040. It is estimated that these measures will effect a reduction in water flow of 14 gpcd by the year 2040. Table 19 presents the projected wastewater flow reductions for both the Land Use 2010 Data and Building Permits Data projections.

The implementation of the Water Demand Management Component using Land Use 2010 Data indicates for the Western Cranston Residential Concentrated Area of Development average and peak wastewater flow reductions respectively in 2010 of 0.05 and 0.15 mgd and 0.14 and 0.42 mgd in 2040. Since the Building Permits Data projects higher population levels, the respective reductions in wastewater flow are higher. For the year 2010, the average and peak reductions are 0.09 and 0.27 mgd and for 2040 0.24 and 0.67 mgd. Therefore, in the year 2040 average wastewater flows are projected to be reduced within the range of 140,000 to 240,000 gallons per day depending on the population projection used. For the Western Cranston Residential Concentrated Area of Development these reductions would affect flows at the Sherman Pumping Station for the modifications to the existing wastewater system plan and at the Wilbur Pumping Station for the Sewer Interceptor plan.

Demand Management in Eastern Cranston would reduce average wastewater flows between 0.20 and approximately 0.50 mgd. These reductions would occur throughout the eastern Cranston area.

Infiltration/Inflow (I/I) Measures

Background - Wastewater flows can be reduced by controlling inflow into the wastewater system from illegal connections (roof leaders, private drains, storm sewers, etc.) and from groundwater infiltration due to breaks in wastewater collection system. A report prepared by Universal Engineering Corporation in 1976 entitled, "Wastewater Facility Plan - Cranston, Rhode Island" recommended that an infiltration/inflow program be performed in order to eliminate 1.9 mgd of infiltration during wet weather or 44 percent of the total infiltration that was estimated to exist in the Cranston wastewater system. In addition, measures were recommended to eliminate 1.6 mgd of inflow or an estimated 34 percent of the inflow that apparently existed in the system.

According to Cranston Department of Public Works officials, all of the infiltration/ inflow (I/I) problems identified in the report, that were cost effective to correct, were rectified during the late 1970's and early 1980's. A large part of the corrective action consisted of sealing manhole covers, particularly at low areas. In addition, the State of Rhode Island intervened three times during the 1980's in order to correct I/I problems at the Howard Reservation in eastern Cranston. Tutela Engineering Associates is currently initiating an I/I program for the City of Cranston beginning with metering. According to Tutela representatives, the sealing of additional manholes is a primary effort. They have no reason to believe that there are major I/I problems in Cranston that can be cost effectively corrected. Most of the illegal connections have been identified and corrected.

Table 19
Wastewater Management Plan (WMP)
Reductions in Wastewater Flow Forecasts
(in million gallons per day)

	2010		2040	
	Average	Peak	Average	Peak
1. DEMAND MANAGEMENT				
Western Cranston Residential Area				
Concentrated Area of Development				
Land Use 2010 Data	0.05	0.15	0.14	0.42
Building Permits Data	0.09	0.27	0.24	0.67
2. DEMAND MANAGEMENT				
Eastern Cranston (1)				
Land Use 2010 Data	0.20	0.60	0.53	1.60
Building Permits Data	0.20	0.60	0.52	1.56
3. INFLOW/INFILTRATION				
According to city of Cranston Officials, no serious I/I problem exists. Comparison of water use at the Howard Reservation with estimated wastewater flows indicates a possible I/I or metering problem.				
4. REZONING(2)				
Western Cranston Residential Area				
Concentrated Area of Development				
Land Use 2010 Data				
Rezone to A-80 (80,000 sq.ft. lots)	0.00	0.00	0.06	0.15
Rezone to S-1 (open space)	0.04	0.11	0.11	0.27
Building Permits Data				
Rezone to A-80 (80,000 sq.ft. lots)	0.08	0.21	0.36	0.90
Rezone to S-1 (open space)	0.13	0.32	0.41	1.01
5. REZONING(2)				
Western Cranston Industrial Area				
Rezone to A-80 (80,000 sq.ft. lots)	0.04	0.10	0.25	0.69
Rezone to S-1 (open space)	0.05	0.14	0.27	0.75

(1) Wastewater reductions for the entire eastern Cranston area serviced by the Providence Water Supply Board.
(2) Assumes all land area currently not developed could be reconfigured.

However, other information indicates that I/I may continue to be a problem at the Howard Reservation. A comparison of the water use at Howard and estimated wastewater flows indicates a possible infiltration/inflow problem or metering problem. Existing water use at Howard during 1989 and 1990 obtained from the Providence Water Supply Board shows an average daily water use of about 1.4 mgd while estimated existing average daily wastewater flows is about 1.9 mgd. Obtaining accurate metering data of water use and wastewater flow at Howard over the same time period should show whether there is an actual I/I problem.

Based on these discussions with Cranston officials, the Wastewater Flow Management Plan anticipates no significant reductions in wastewater flows due to the identification and correction of infiltration/inflow problems in Cranston, Rhode Island. However, confirmation of an I/I problem and its rectification at Howard would provide capacity in the existing wastewater conveyance system.

Rezoning

Rezoning addresses the possibility of decreasing future wastewater flows from the Western Cranston Residential Concentrated Area of Development and the Western Cranston Industrial Area by limiting growth through zoning changes. The Western Cranston Residential Concentrated Area of Development and the Western Cranston Industrial Area are contiguous areas that are on the frontier of current expansion in Cranston.

For the purposes of this reconnaissance level investigation the assumption has been made that all land area currently not developed could be reconfigured. This approach is a simplification of the zoning process that would be involved in carrying out such a plan but provides a first cut at the potential reduction in wastewater flows and allows for a discussion of the concept and an identification of the potential impacts. Further investigation of land configuration and ownership in this area would be needed if this plan were to be considered further. The Rezoning Plan would have an impact on the economy of the City and is probably not a politically or socially acceptable solution.

Western Cranston Residential Concentrated Area of Development - Rezoning of the existing Western Cranston Residential Concentrated Area of Development has been considered using two variants and assuming all land area currently not developed could be reconfigured: rezoning of undeveloped land to 80,000 square feet lots (A-80) and rezoning to open space (S-1). These variants have also been analyzed with the two population projections used elsewhere in this report. The Land Use 2010 data projects population to expand from an estimated 7,720 inhabitants in 1990 to 9,134 in the year 2040. The Building Permits Data projects an estimated population of 6,917 in 1990 to 13,200 in 2040.

Using the Land Use 2010 Data, the rezoning to 80,000 square foot lots would result in a loss of 2,747 lots and would therefore leave only 740 lots available for development to

year 2040. At the current rate of development, all available lots would be developed by year 2011. Average wastewater flows would show no significant decrease in year 2010. By year 2040, the average wastewater flow forecast would be reduced by 0.06 mgd or a peak of 0.15 mgd. Rezoning all of the land to open space would reduce average and peak flows forecasts in 2010 respectively by 0.04 and 0.11 mgd and by year 2040 by 0.11 and 0.27 mgd.

The Building Permits Data predict higher population growth and, therefore, higher wastewater flows than the Land Use 2010 Data. As a result, rezoning minimum 80,000 square feet lots and open space to prevent this growth causes greater reduction in wastewater flows. Rezoning to 80,000 square foot lots would reduce average and peak wastewater flows forecasts respectively in the year 2010 by 0.08 and 0.21 mgd and in 2040 mgd 0.36 and 0.90 mgd. Rezoning to open space would reduce average and peak flows forecasts respectively to 0.13 and 0.32 mgd in 2010 and 0.41 and 1.01 in the year 2040.

Western Cranston Industrial Area - This area includes 162 acres within the industrial park itself and 100 undeveloped acres in other industrially zoned lands along Plainfield Pike. The rezoning considers two variants and assumes that all land area currently not developed could be reconfigured. The first is rezoning the 262 undeveloped acres to 80,000 square foot residential lots, thereby, creating 88 lots at the industrial park and approximately 53 lots in the other industrial areas. For planning purposes, it has been assumed that 22 houses would be built per decade in the industrial park up to the 88 lots limit and slightly higher in the area along Plainfield Pike up to the 53 lot limit. The same mix of industries would be maintained in the park during the period. Wastewater flow rates are based on 75 gallons per capita per day. Under these assumptions reductions in average and peak wastewater flows in the year 2010 would be respectively 0.04 and 0.10 mgd and in 2040 0.25 and 0.69 mgd.

Rezoning the 262 acres to open space would bring about reductions in average and peak wastewater flows respectively of 0.05 and 0.14 mgd in 2010 and 0.27 and 0.75 mgd in the year 2040.

Wastewater Management Districts

The Waste Water Management District concept addresses implementation of a city operated septic system approval, inspection and maintenance program in western Cranston to protect groundwater.

Enabling legislation passed in the 1987 General Assembly Session allows Rhode Island municipalities to establish Wastewater Management Districts (WMD). The purpose of these districts is to eliminate and prevent the contamination of State waters caused by malfunctioning individual septic disposal systems (ISDS) through the implementation of inspection and maintenance programs. The adoption of an appropriate ordinance would allow Cranston to provide for passage onto private property for periodic, inspection and maintenance of ISDS systems; raise funds for operation of the WMD; establish local administrative and enforcement structures and establish a public education program. The

WMD could establish more stringent design criteria than the DEM's ISDS regulations. However, natural soil characteristics in western Cranston may limit the effectiveness of this solution to prevent groundwater contamination.

VII. COMPARISON OF COSTS

METHODOLOGY

Preliminary cost estimates for the proposed structural plans - modifications to the existing system, local wastewater treatment facility and sewer interceptor were developed. The costs of each plan at a particular study site were compared.

In order to develop preliminary cost estimates for comparison of structural plans, wastewater flows from study sites were projected. (See Section V). Next, based on these flow estimates structural alternatives were sized to accommodate the projected flow. See Hydraulics Report, Appendix C. Preliminary cost estimates for elements of the structural plans (pipes, pumps, treatment, etc.) were then calculated. These capital and annual operation and maintenance costs for a plan were then proportioned by individual site based on the location of the proposed connection and the amount of discharge from the site.

In addition to conveyance and treatment elements, an attempt was made to identify all costs for solving wastewater problems at each individual study site. These additional costs include groundwater pumping and pretreatment.

Capital cost estimates and operation and maintenance cost estimates for the modifications to the existing system plan, sewer interceptor plan and local treatment facility plan are based on EPA cost curve information, information from literature and recent bid estimates. The costs were then updated to 1991 dollars using the Engineering News Record (ENR) index.

Preliminary cost estimates for advanced treatment were taken from the Interim Facility Plan (March 1991) prepared by Tutela Engineering for the city of Cranston.

Unit costs for groundwater collection and pretreatment at the landfills were developed from a review of feasibility studies for other landfill sites.

Cost estimates for pretreatment at the industrial/commercial study sites were developed assuming twenty percent of the increased flow at the study sites might require pretreatment and were based on unit costs for the metal plating industry.

The cost comparisons for the structural plans are discussed in the following sections of the report and costs presented in Tables 20 to 27. Table 28 presents the summary of costs by site. The costs for the nonstructural plan, the Wastewater Management Plan are discussed after the cost comparison of the structural plans. The summary of costs by plan are shown in Table 29.

CENTRAL LANDFILL

The comparison of costs for Central Landfill is presented in Table 20. The design elements of the plans are discussed in Section VI and Appendix C. (See also Figures 2, 4, and 7).

Costs considered at the Central Landfill site include groundwater collection at the site, possible pretreatment costs, advanced treatment cost at the Cranston WWTF (wastewater treatment facility) and the site's portion of the individual plan costs.

At this level of analysis, modification of the existing system plan and the interceptor plan for the site appeared to cost about the same. The local treatment facility plan appears more expensive.

Removing the Howard and Capuano sites from the interceptor had very little impact on the cost at Central Landfill because these sites connect at the beginning of the interceptor and bear only a small portion of the total cost. Removing the Western Cranston Residential flow from the interceptor, however, would increase the cost at the Central Landfill site because this area shares a significant portion of the cost of the interceptor. The Western Cranston Industrial area also shares a significant portion of the modification of the existing system and sewer interceptor cost for this area.

VINAGRO SITE

The comparison of costs for the Vinagro site is presented in Table 21. The design elements of the plans are discussed in Section VI and Appendix C. (See also Figures 2, 4, and 7).

Costs considered at the site include groundwater collection, leachate collection, pretreatment, advanced treatment and the sites portion of the individual plan costs.

At this level of analysis all plans at the site appeared to cost about the same. This site has low flows relative to other study sites and benefits from the larger portion of the costs assigned to the other sites. The sewer interceptor plan would not be economically practical for this site without the sharing in the costs by the other study sites.

Table 20
Central Landfill
Proportional Cost of Plans (1)(2)

	Capital Cost($)	Annual O&M($)
Modifications to the Existing System		
Modify system	1,010,000	8,000
Groundwater collection	3,000,000	nd
Leachate collection	nd(3)	nd
Pretreatment	8,500,000	30,000
Advanced treatment	290,000	nd
Total	12,800,000	38,000
Local Treatment		
New Treatment facility	3,280,000	180,000
Groundwater collection	3,000,000	nd
Leachate collection	nd(4)	nd
Pretreatment	8,500,000	30,000
Total	14,780,000	210,000
Sewer Interceptor		
Interceptor	913,000	12,000
Groundwater collection	3,000,000	nd
Leachate collection	nd	nd
Pretreatment	8,500,000	30,000
Advanced treatment	290,000	nd
Total	12,703,000	42,000
Sewer Interceptor Without Howard & Capuano		
Interceptor	919,000	12,000
Groundwater collection	3,000,000	nd
Leachate collection	nd	nd
Pretreatment	8,500,000	30,000
Advanced treatment	290,000	nd
Total	12,709,000	42,000

(1) Costs are presented and calculated for comparative purposes only.
(2) Capital and O&M Costs are proportioned by flow and location of service connection.
(3) nd - not determined.
(4) Costs for leachate collection at Central Landfill were not estimated because SWMC is in the process of providing this system.

Table 21
Vinagro Site
Proportional Cost of Plans (1)(2)

	Capital Cost ($)	Annual O&M ($)
Modifications to the Existing System		
Modify system	72,000	minimal
Groundwater collection	430,000	nd(3)
Leachate collection	400,000	nd
Pretreatment	960,000	5,000
Advanced treatment	30,000	nd
Total	1,892,000	5,000
Local Treatment		
New Treatment facility	300,000	20,000
Groundwater collection	430,000	nd
Leachate collection	400,000	nd
Pretreatment	960,000	5,000
Total	2,090,000	25,000
Sewer Interceptor		
Interceptor	65,000	800
Groundwater collection	430,000	nd
Leachate collection	400,000	nd
Pretreatment	960,000	5,000
Advanced treatment	30,000	nd
Total	1,885,000	5,800
Sewer Interceptor Without Howard & Capuano		
Interceptor	65,000	800
Groundwater collection	430,000	nd
Leachate collection	400,000	nd
Pretreatment	960,000	5,000
Advanced treatment	30,000	nd
Total	1,885,000	5,800

(1) Costs are presented and calculated for comparative purposes only.
(2) Capital and O&M Costs are proportioned by flow and location of service connection.
(3) nd - not determined.

WESTERN CRANSTON INDUSTRIAL AREA

The comparison of costs for the Western Cranston Industrial area is presented in Table 22. The design elements of the plans are discussed in Section VI and Appendix C. (See also Figures 2, 4, and 7).

A local treatment facility appears to be the most expensive option with package treatment facilities at the site appearing the most economical. However, siting costs are not included and obtaining a discharge permit is most likely not practical.

Modification of the existing system plan and the sewer interceptor plan appear to cost about the same. Dropping Central Landfill and the Vinagro site from the sewer interceptor plan would increase the cost for the Western Cranston Industrial area as these sites share in the cost for the new pump station and force main to the Western Cranston Residential area gravity interceptor.

JOHNSTON SITE

The comparison of costs for the Johnston site is presented in Table 23. The design elements of the plans are discussed in Section VI and Appendix C. (See also Figures 2, 4, and 7).

Costs considered at the site include pretreatment and advanced treatment of new wastewater flows and the sites portion of the individual plan costs. Costs for collection sewers are required, but were not determined because of insufficient information on the eventual site layout.

As noted under the other sites, sharing of the cost for the interceptor or modifications to the existing system by the Johnston site slightly decreases the cost for the plan at the other sites. At this level of analysis with all sites sharing in the costs, the modifying the existing system plan cost and the sewer interceptor plan appear about the same.

Table 22
Western Cranston Industrial Area
Proportional Cost of Plans (1)(2)

	Capital Cost ($)	Annual O&M ($)
Modifications to the Existing System		
Modify system	3,102,000	25,000
Pretreatment	328,000	107,600
Advanced treatment	190,000	nd(3)
Total	3,620,000	132,600
Local Treatment		
New Treatment facility	4,670,000	250,000
Pretreatment	328,000	107,600
Total	4,998,000	357,600
Package Treatment Facilities		
Six package facilities	516,000	108,000
Pretreatment	328,000	107,600
Total	844,000	215,600
Sewer Interceptor		
Interceptor	2,806,000	36,000
Pretreatment	328,000	107,600
Advanced treatment	190,000	nd
Total	3,324,000	143,600
Sewer Interceptor Without Howard and Capuano		
Interceptor	2,824,000	36,000
Pretreatment	328,000	107,600
Advanced treatment	190,000	nd
Total	3,342,000	143,600

(1) Costs are presented and calculated for comparative purposes only.
(2) Capital and O&M Costs are proportioned by flow and location of service connection.
(3) nd - not determined.

Table 23
Johnston Site
Proportional Cost of Plans (1)(2)

	Capital Cost($)	Annual O&M($)
Modifications to the Existing System		
Modify system	1,155,000	9,000
Collection sewers	nd(3)	nd
Pretreatment	317,000	104,000
Advanced treatment	150,000	nd
Total	1,622,000	113,000
Local Treatment		
New Treatment facility	1,740,000	90,000
Collection sewers	nd	nd
Pretreatment	317,000	104,000
Total	2,057,000	194,000
Sewer Interceptor		
Interceptor	1,044,000	13,000
Collection sewers	nd	nd
Pretreatment	317,000	104,000
Advanced treatment	150,000	nd
Total	1,511,000	117,000
Sewer Interceptor Without Howard and Capuano		
Interceptor	1,051,000	13,500
Collection sewers	nd	nd
Pretreatment	317,000	104,000
Advanced treatment	150,000	nd
Total	1,518,000	117,500

(1) Costs are presented and calculated for comparative purposes only.
(2) Capital and O&M Costs are proportioned by flow and location of service connection.
(3) nd - not determined.

WESTERN CRANSTON RESIDENTIAL AREA

The comparison of costs for the Western Cranston Residential Concentrated Area of Development is discussed in Table 24. The design elements of the plans are presented in Section VI and Appendix C. (See also Figures 2, 4, and 7).

Costs considered include collection sewers and advanced treatment and the sites share of the individual plan costs. Again, the most expensive solution is the local wastewater treatment facility option. The least expensive solution are scattered package treatment facilities. However, these are most likely not feasible from an operational point of view.

The modification of existing system option and the sewer interceptor option cost about the same. Dropping the Howard and Capuano sites has minimal impact on the cost of the interceptor plan for this area.

TILCON GAMMINO INDUSTRIAL ZONED LAND

The comparison of costs for the Tilcon Gammino site is presented in Table 25. The design elements of the plans are presented in Section VI and Appendix C. (See also Figures 2, 4, and 7).

Cost considered included collection sewers, pretreatment and advanced treatment and the sites share of the individual plan costs. The most expensive plan is the local treatment facility option. The sewer interceptor plan for this site is more expensive than the modify system plan. The modification of the existing system at Tilcon Gammino site includes only a share in the cost to modify the Sherman pump station. The larger share of the costs for modifying the existing system are assigned to the Western Cranston Residential area. Without the share by Western Cranston of the interceptor costs the overall plan cost for this site would increase substantially.

Table 24
Western Cranston Residential Concentrated Area of Development
Proportional Cost of Plans (1)(2)

	Capital Cost($)	Annual O&M($)
Modifications to the Existing System		
Modify system	3,573,000	7,400
Collection sewers	5,940,000	13,500
Advanced treatment	760,000	nd(3)
Total (4)	10,273,000	20,900
Local Treatment		
New Treatment facility	8,700,000	470,000
Collection sewers	5,940,000	13,500
Total	14,640,000	483,500
Package Treatment Facilities		
Eight package facilities	946,000	198,000
Collection sewer	5,940,000	13,500
Total	6,886,000	211,500
Sewer Interceptor		
Interceptor	3,601,000	26,000
Collection sewers	5,940,000	13,500
Advanced treatment	760,000	nd
Total	10,301,000	39,500
Sewer Interceptor Without Howard and Capuano		
Interceptor	3,636,000	26,000
Collection sewers	5,940,000	13,500
Advanced treatment	760,000	nd
Total	10,336,000	39,500

(1) Costs are presented and calculated for comparative purposes only.
(2) Capital and O&M Costs are proportioned by flow and location of service connection.
(3) nd - not determined.
(4) Does not include costs for any additional pump stations that may be required in Western Cranston.

Table 25
Tilcon Gammino Industrial Site
Proportional Cost of Plans (1)(2)

	Capital Cost ($)	Annual O&M ($)
Modifications to the Existing System		
Modify system	14,000	minimal
Collection sewers	660,000	1,500
Pretreatment	51,000	16,800
Advanced treatment	30,000	nd(3)
Total	755,000	18,300
Local Treatment		
New Treatment facility	340,000	20,000
Collection sewers	660,000	1,500
Pretreatment	51,000	16,800
Total	1,051,000	38,300
Package Treatment Facilities		
One package facility	73,500	16,500
Collection sewer	660,000	1,500
Pretreatment	51,000	16,800
Total	784,500	34,800
Sewer Interceptor		
Interceptor	140,000	1,000
Collection sewers	660,000	1,500
Pretreatment	51,000	16,800
Advanced treatment	30,000	nd
Total	881,000	19,300
Sewer Interceptor		
Without Howard and Capuano		
Interceptor	141,000	1,000
Collection sewers	660,000	1,500
Pretreatment	51,000	16,800
Advanced treatment	30,000	nd
Total	882,000	19,300

(1) Costs are presented and calculated for comparative purposes only.
(2) Capital and O&M Costs are proportioned by flow and location of service connection.
(3) nd - not determined.

HOWARD RESERVATION AND INDUSTRIAL PARK

The comparison of costs for the Howard Reservation and Industrial Park is presented in Table 26. The design elements of the plans are discussed in Section VI and Appendix C. (See also Figures 2, 4, and 7).

Costs considered include pretreatment and advanced treatment, and a proportional share of the individual plan costs. The sewer interceptor plan includes a new force main from the Howard pump station to the interceptor. Modifications to the gravity lines feeding the Howard pump station and at the pump station are required for both the modification of existing system plan and the interceptor plan. The modification of the existing system plan is less expensive than the interceptor plan because of the sites proportional share in the cost of the interceptor and the new force main.

CAPUANO SITE

The comparison of costs for the Capuano site is presented in Table 27. The design elements of the plans are discussed in Section VI and Appendix C. (See also Figures 2, 4, and 7).

Costs considered include groundwater collection, pretreatment, advanced treatment, a new gravity line to the existing system and the sites proportional share of the individual plan costs. Because the estimated flows from this site are relatively small, the site shares only a small cost of the conveyance plans. Most of the costs at this site are related to the groundwater collection, pretreatment and new gravity main.

The sewer interceptor plan for this site appears only slightly more expensive than the modification of the existing system plan because the Howard Reservation and Howard Industrial Park is assigned most of the cost for the new force main from the Howard pump station and the proportional cost of the interceptor for this area. Without those sites the sewer interceptor plan does not make economical sense for the Capuano site.

Table 26
Howard Reservation and Industrial Park
Proportional Cost of Plans (1)(2)

	Capital Cost ($)	Annual O&M ($)
Modifications to the Existing System		
Modify system	1,585,000	2,200
Pretreatment	256,000	84,000
Advanced treatment	360,000	nd(3)
Total	2,201,000	86,200
Local Treatment		
New Treatment facility	13,600,000	800,000
Pretreatment	256,000	84,000
Mod. to existing system	1,585,000	2,200
Total	15,441,000	886,200
Sewer Interceptor		
Interceptor	662,000	1,600
New FM at Howard PS	207,000	300
Mod. to existing system	1,585,000	2,200
Pretreatment	256,000	84,000
Advanced treatment	360,000	nd
Total	2,977,000	87,800

(1) Costs are presented and calculated for comparative purposes only.
(2) Capital and O&M Costs are proportioned by flow and location of service connection.
(3) nd - not determined.

Table 27
Capuano Site
Proportional Cost of Plans (1)(2)

	Capital Cost ($)	Annual O&M ($)
Modifications to the Existing System		
Modify system	19,000	minimal
New gravity line	210,000	600
Groundwater collection	750,000	nd(3)
Pretreatment	1,700,000	7,000
Advanced treatment	40,000	nd
Total	2,719,000	7,600
Local Treatment		
New Treatment facility	310,000	20,000
New gravity line	210,000	600
Mod. to existing system	19,000	minimal
Groundwater collection	750,000	nd
Pretreatment	1,700,000	7,000
Total	2,989,000	27,600
Sewer Interceptor		
Interceptor	7,000	minimal
New gravity line	210,000	600
New FM at Howard PS	3,000	minimal
Mod. to existing system	19,000	minimal
Groundwater collection	750,000	nd
Pretreatment	1,700,000	7,000
Advanced treatment	40,000	nd
Total	2,729,000	7,600

(1) Costs are presented and calculated for comparative purposes only.
(2) Capital and O&M Costs are proportioned by flow and location of service connection.
(3) nd - not determined.

Table 28
Summary of Plan Costs by Site

	Capital Cost ($)	Annual O&M ($)
Central Landfill		
Modifications to the Existing System	12,800,000	38,000
Local Treatment, New Facility	14,780,000	210,000
Sewer Interceptor	12,703,000	42,000
Vinagro Site		
Modifications to the Existing System	1,892,000	5,000
Local Treatment, New Facility	2,090,000	25,000
Sewer Interceptor	1,885,000	5,800
Western Cranston Industrial Area		
Modifications to the Existing System	3,620,000	132,600
Local Treatment, New Facility	4,998,000	357,600
Package Treatment Plants	844,000	215,600
Sewer Interceptor	3,324,000	143,600
Johnston Site		
Modifications to the Existing System	1,622,000	113,000
Local Treatment, New Facility	2,057,000	194,000
Sewer Interceptor	1,511,000	117,000
Tilcon Gammino Site		
Modifications to the Existing System	755,000	18,300
Local Treatment, New Facility	1,051,000	38,300
Package Treatment Plant	784,500	34,800
Sewer Interceptor	881,000	19,300
Western Cranston Concentrated Residential Area		
Modifications to the Existing System	10,273,000	20,900
Local Treatment, New Facility	14,640,000	483,500
Package Treatment Plants	6,886,000	211,500
Sewer Interceptor	10,301,000	39,500
Howard Reservation and Industrial Park		
Modifications to the Existing System	2,201,000	86,200
Local Treatment, New Facility	15,441,000	886,200
Sewer Interceptor	2,977,000	87,800
Capuano Site		
Modifications to the Existing System	2,719,000	7,600
Local Treatment, New Facility	2,989,000	27,600
Sewer Interceptor	2,729,000	7,600

WASTEWATER MANAGEMENT PLAN

The Wastewater Management Plan considers four components: Demand Management, Infiltration/Inflow (I/I) Measures, Rezoning industrial and residential land and establishing a Wastewater Management District. However, additional costs would be incurred only with the Demand Management component and the Wastewater Management District component. According to officials of the City of Cranston, the more serious I/I problems that can be cost-effectively corrected, have been corrected. The Rezoning component would likely increase administrative measures on the part of the city, but it is assumed that the city of Cranston could undertake rezoning with its current level of resources.

The costs of the Water Demand Management components are based on data obtained from the Massachusetts Water Resources Authority (MWRA). According to the MWRA, the unit costs of retrofitting a service in 1990 was approximately $29.00. In addition, the unit costs of leak detection, meter replacement, educational programs, overhead, and inflation has been estimated at $31 for a total of $60. The annual cost of the Demand Management component is estimated at $26,000 per year based on retrofitting approximately 430 services per year.

The annual cost of operating a Watershed Management District in western Cranston concentrated residential area at total build out of this area is estimated at $600,000, assuming one full time sanitary engineer, one part time secretary, and pumping of one third of the septic tanks on an annual basis.

Table 29
Summary of Costs by Plan

	Capital Cost($)	Annual (O&M)
Modifications to the Existing Plan		
Central Landfill	12,800,000	38,000
Vinagro Site	1,892,000	5,000
Western Cranston Industrial Area	3,620,000	132,600
Johnston Site	1,622,000	113,000
Tilcon Gammino Site	755,000	18,300
Western Cranston Residential Area	10,273,000	20,900
Howard Reservation and Industrial Park	2,201,000	86,200
Capuano Site	2,719,000	76,000
Total	**35,882,000**	**490,000**
Local Treatment Plan New Facility Option		
Central Landfill	14,780,000	210,000
Vinagro Site	2,090,000	25,000
Western Cranston Industrial Area	4,998,000	357,600
Johnston Site	2,057,000	194,000
Tilcon Gammino Site	1,051,000	38,300
Western Cranston Residential Area	14,640,000	483,500
Howard Reservation and Industrial Park	15,441,000	886,200
Capuano Site	2,989,000	27,600
Total	**58,046,000**	**2,222,200**
Local Treatment Plan Package Treatment Facility Option		
Central Landfill	nc(1)	nc
Vinagro Site	nc	nc
Western Cranston Industrial Area	844,000	215,600
Johnston Site	nc	nc
Tilcon Gammino Site	784,500	34,800
Western Cranston Residential Area	6,886,000	211,500
Howard Reservation and Industrial Park	nc	nc
Capuano Site	nc	nc
Total (2)	**8,514,500**	**461,900**
Sewer Interceptor Plan		
Central Landfill	12,703,000	42,000
Vinagro Site	1,885,000	5,800
Western Cranston Industrial Area	3,324,000	143,600
Johnston Site	1,511,000	117,000
Tilcon Gammino Site	881,000	19,300
Western Cranston Residential Area	10,301,000	39,500
Howard Reservation and Industrial Park	2,977,000	87,800
Capuano Site	2,729,000	7,600
Total	**36,311,000**	**462,600**
Wastewater Management Plan	0	626,000

(1) nc - package treatment plants not considered for this site
(2) Does not represent solution for all sites.

VIII. SOCIOECONOMIC IMPACTS

INTRODUCTION

This section considers socioeconomic impacts at sites under consideration for each of the plans presented in Section IV. Socioeconomic resources expected to be affected by these plans are (1) land use, (2) population, (3) employment, (4) income, (5) sales, (6) housing, (7) schools, (8) tax revenues, and (9) public service costs.

METHODOLOGY

The effects on socioeconomic resources discussed are the direct effects or first round effects generated by an increase in employment in Cranston. As a portion of this income will be spent in Cranston, secondary impacts include further increases in sales, income, and employment. This income is in turn spent in the local economy resulting in more increases in employment, sales and income. The total effect of increased employment and wages is a sum of the direct effect and the cumulative indirect effect of additional spending rounds. It is beyond the scope of this study to determine the total effect of increased employment and wages, but the total increase in sales and income could be twice as large as the direct increase in wages. The total effect is referred to as a multiplier effect. This total effect should be investigated in future more detailed economic feasibility studies.

Employment growth rates are developed from local planning studies for the type of industry and commerce expected to locate in Cranston. Acreage available for development is then combined with industry averages for the number of employees per acre to determine expected future employment levels. These employment estimates are also used to determine projected wastewater flows from the study sites. (See Section V of this report.)

Growth in personal income is approximated by changes in wages. An annual wage is developed for the type of industry in which growth is expected to occur. Expected increases in population in western Cranston is based on current and past growth for that area. Projected school enrollment increases are based on population increases and the current ratio of school age children to the population. All the demand for housing units in the Western Cranston Residential area is assumed to be for owner occupied housing. The increased number of housing units in western Cranston depends upon the acreage available for residential development and the current and past population growth rates.

Based on their locations, the sites are divided into three groups for purposes of analysis. Plan impacts at sites within each group are closely interdependent requiring that these sites be studied as a unit. The sites furthest away and located northeast of the wastewater treatment facility are the Central landfill, Vinagro site and the Western Cranston Industrial area. South of this area is the Western Cranston Residential area and the Tilcon Gammino site. Although these two sites are close they are studied separately as plan impacts are not strongly interdependent. The final group is the Howard Reservation and Industrial Park and the Capuano Landfill which are located east and southeast of the

wastewater treatment facility.

STUDY AREA

In 1980 the city of Cranston had a population of 69,437 which ranked it the third largest city in Rhode Island. The Western Cranston area had a total population of 8,594. Cranston had 27,280 total housing units of which 17,667 were owner occupied and 8,437 were renter occupied. The Western Cranston area had an estimated 2,970 total units.

As of June 1990 Cranston had 2,123 firms with an employment of 22,843. These firms had an estimated annual payroll of $603,996,000. From 1980 to 1988 Cranston had 1,194,688 square feet of floor space for manufacturing constructed. Commercial construction in Cranston for the same period was 1,546,866 square feet.

Local government revenues in 1985 were $69,776,738 of which $44,327,981 were made available through a property tax. Local expenditures were $68,857,044 of which $33,640,607 was for public education. In the 1985-86 school year public school enrollment in Cranston was 9,285.

PLAN IMPACTS

Group I

Group I is comprised of the Central Landfill, Vinagro site and the Western Cranston Industrial area. The Central Landfill currently contains a materials recycling facility, scale houses, methane recovery building, a tree chipping area with composting facility, and a planned resource recovery facility. There is an area adjacent to the landfill that is zoned industrial and is available for future use. The Vinagro site consists of a hog farm, a closed landfill, a recycling facility and proposed transfer station. The Western Cranston Industrial area contains 352 acres of which 190 are developed and 162 are vacant. Currently there are about 27 companies in the park with several of these being distributorships. The site is near to and easily accessible to Interstate 295. It is estimated that these companies employ 1,955 workers earning approximately $46,422,000 annually.

Under the no action plan, potential future flow from Central Landfill would preclude further development of land near the Central Landfill and the Western Cranston Industrial area. With no action, land use would remain the same and the number of jobs and increase in income discussed in the following paragraph would not be achieved.

With the structural plans, which include modification of the existing system, providing local treatment facilities and building an interceptor, land use changes to industrial will be to their fullest extent. The impacts of modifications to the existing system, building a local wastewater treatment facility, and an interceptor are similar. With all three plans the number of acres devoted to industrial use would increase by 162 to 352 by the year 2040. Industrial growth would result in an anticipated direct increase of 1,667 jobs to 3,622 in the

same period and an increase of $39,584,000 in personal income to $86,006,000. A portion of the expanded work force is expected to live in Cranston, thereby, increasing the local population, the demand for housing, the school age population, and local revenue from property taxes.

A wastewater management plan (WMP) which includes rezoning the western Cranston Industrial undeveloped area to open space would limit growth similar to the no action plan. Even if the rezoning component were not included in the WMP, this plan alone is not likely to make available sufficient conveyance capacity in the existing system and development may be limited.

Group II

Group II contains the Western Cranston Residential area and the Tilcon Gammino Site. These sites are analyzed separately as unlike the other sites plan impacts are not interdependent.

For the Western Cranston Residential area the no action alternative and the wastewater management plan would limit future residential development. Land use would remain a combination of residential and open space. If current home owners cannot find a solution to their septic system problems, property values will decline thereby reducing the real income of these families.

Plans that call for modification of the sewer system, building a local wastewater treatment facility, and constructing an interceptor would provide for residential growth.

Population projections for the total Western Cranston Residential area range between 9,428 and 21,400 for this area by the year 2040. Based on the ratio of public school enrollment in 1985 to the city population for that year, school enrollment for the area is estimated to be between 1002 and 1415 for 1990. By the year 2040 school enrollment for this area is expected to range between 1182 and 2684, an increase of between 180 and 1269. With residential growth property tax revenues will rise, but so will public costs as the city provides services for more people.

The population increase in this area will have an indirect effect on sales, income, and employment. The increased number of people living in western Cranston will spend a portion of their income in Cranston. This will lead to further spending rounds as businesses and services will spend a portion of these receipts in Cranston and a portion of these receipts will be spent again in the city.

The Tilcon Gammino Industrial Land consists of approximately 170 acres of land containing a stone quarrying operation. The city estimates that this concern will be out of business in 10 to 15 years as the natural resource of the site will be exhausted by that time. The site is adjacent to Interstate 295 and will be zoned for light industrial or office use when the mining operation ceases.

As this site is currently without sewers the no action plan would preclude industrial development. Modifications to the sewer system, local wastewater treatment and the interceptor plan would allow for the maximum industrial development of this site. Industrial growth is assumed to be similar to that in Western Cranston Industrial area and industrial growth is assumed to begin in 2010. Thus approximately 30 acres will be converted to industrial use by the year 2040 with 140 acres remaining vacant. Employment is expected to 319 in 2040. Assuming the same mix of labor as in western Cranston, wages are expected to increase by $7,575,000 in 2040. Indirectly, sales, income and employment will again increase as some the initial increase in wages will be spent in Cranston. Population, school enrollment, and the demand for housing are expected to increase as some the increased employment will come from individuals living in Cranston. Property tax collections will again increase with an increase in owner occupied housing units.

Group III

Group III contains the Howard Reservation and Industrial Park and the Capuano Landfill.

The Howard Reservation is currently owned by the State and used as an institution for the aged, ill, addicted, mentally ill , homeless and handicapped. The current institutional population is 3450 in 1990 with employment of 3500. Institutional population is projected to reach a limit of 5550 in the year 2000 and remain constant throughout the remainder of the planning period. The number of employees is projected to increase to 6925 by 2040. The projected growth in employment, wages, population, school enrollment and housing units is projected to occur with all plans including the no action plan.

The Howard Industrial Park currently includes 3,300 employees on 155 acres. There are approximately 115 acres available for expansion. The no action plan would limit further industrial development. A wastewater flow management plan correcting inflow/infiltration problems might allow for growth. Modifications to the sewer system, local wastewater treatment facility and the interceptor plan would allow for the maximum industrial development of this site. Industrial growth is assumed to be similar to that in western Cranston. The entire 115 acres will be converted to industrial use by the year 2030. Employment is expected to increase from 3300 in 1990 to 5748 in 2030. Assuming the same mix of labor as in western Cranston, annual wages are expected to increase from $78,359,000 to $136,486,000, an increase of $58,127,000 in 2030. Indirectly, sales, income and employment will again increase as some of the initial increase in wages will be spent in Cranston. Population, school enrollment, and the demand for housing are expected to increase as some of the increased employment will come from individuals living in Cranston. Property tax collections will again increase with an increase in owner occupied housing units.

The Capuano Landfill consists of 47 acres located south of the Howard Industrial Development. The current land use is a solid waste transfer facility and closed landfill. Additional growth is not expected at the site.

IX. ENVIRONMENTAL IMPACTS

CENTRAL LANDFILL

No Action

The Central Landfill in Johnston will remain a potential contributor to an existing surface and groundwater contamination problem should surface runoff and leachate runoff remain uncontrolled. (See Water Quality Evaluation Report, Appendix B)

Modifications to the Existing Sewer System

Collection and pretreatment of leachate and increasing the capacity of the existing sewer system to handle future flows would prevent potential overflow contamination to water resources in the area. There would be short-term impacts during any construction activities in modifying the system, such as noise and dust emissions. Construction activities would occur mainly in heavily developed areas, therefore, it is unlikely that significant impacts would occur to wildlife species already tolerant of human interaction. However, should construction activities occur near wetlands or streams, appropriate sediment control systems should be installed to minimize siltation in these areas. Positive benefits to water quality would be realized from advanced treatment at Cranston's wastewater treatment facility where advanced treatment is required to meet Class C goals for the Pawtuxet River.

Local Wastewater Treatment Facility

There would be short-term impacts, such as noise and dust emissions, associated with the construction of a local wastewater treatment near the Plainfield Pike. It is unlikely that this work would have a significant impact on resident wildlife populations. An evaluation of the effects of discharge of treated wastewater to a local stream or groundwater would be required to support obtaining a discharge permit from the State of Rhode Island. Water quality benefits would be realized to adjacent surface and groundwater from collection and treatment of the Central Landfill and Vinagro Landfill leachate and industrial flows from the Western Cranston Industrial area.

Sewer Interceptor

Routing future flows to an interceptor would require construction of a new pumping station in the vicinity of Comstock Parkway. Minor environmental impacts would be expected due to existing high level of development in the area. Positive water quality benefits to adjacent surface and groundwater would be realized from collection and treatment of the landfill leachate and industrial and residential flows.

VINAGRO SITE

No Action

The Vinagro Landfill and Vinagro Farm (hog farm) in Johnston have been cited by the Rhode Island Department of Environmental Management for uncontrolled runoff that is contributing to a pollution problem in Cedar Swamp Brook. Under the No Action plan, this area will continue to negatively impact surface and groundwater in the area. (See Water Quality Evaluation Report, Appendix B.)

Modifications to Existing Sewer System

See impacts as listed under Central Landfill.

Wastewater Treatment Facility

See impacts as listed under Central Landfill.

Sewer Interceptor

See impacts as listed under Central Landfill.

WESTERN CRANSTON INDUSTRIAL AREA

No Action

The combined flows from future expansion in the Western Cranston Industrial area, leachate collection from the Central Landfill and sewerage from the residential development north of Scituate Avenue exceeds the capacity of the existing sewer lines and pumping stations. This could result in potential overflows to wetlands, streams or groundwater in the area. Future expansion of the Western Cranston Industrial area may impact land identified as Prime Farmland by the United States Department of Agriculture. The definition of Prime Farmland is "land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops and is also available for these uses" (USDA, 1985).

Modifications to Existing Sewer System

See impacts as listed under Central Landfill.

Local Wastewater Treatment Facility

See impacts as listed under Central Landfill.

Package Treatment Facility

Installation of a prefabricated package treatment facility (location unknown) for collection of local sewerage is not likely to result in any significant construction impacts. An evaluation of effects of discharge of treated wastewater to surface or groundwater would be required in support of obtaining a discharge permit from the State of Rhode Island. Water quality benefits would be realized to adjacent surface and groundwater from collection and treatment of the residential and industrial flows.

Sewer Interceptor

See impacts as listed under Central Landfill

Wastewater Management

The Demand Management and the Rezoning plan do not involve construction activities and therefore will have no significant construction impacts. Rezoning would benefit wildlife in the western Cranston area by limiting development thereby reducing habitat displacement.

JOHNSTON SITE

No Action

Under the No Action plan, future trends would continue towards rural development utilizing on-site septic systems. Industrial growth would be limited due to an industry preference to locate in areas where utilities are available. Limiting growth will benefit wildlife through habitat preservation and reduced construction disturbances.

Modifications to Existing Sewer System

Existing facilities in the area consist of mainly on-site septic systems, therefore, this area would require installation of sewer lines in addition to increasing the capacity of the existing sewer system to handle future flows. There would be short-term impacts during construction of sewer lines (mainly along roadways) and in modifying the system, such as noise and dust emissions. Construction activities occurring near wetlands or streams should have appropriate sediment control systems to minimize siltation. Benefits to water quality would be realized from advanced treatment at Cranston's wastewater treatment facility where advanced treatment is required to meet Class C goals for the Pawtuxet River. Growth related long-term impacts would negatively impact wildlife populations in the area. Future development may also impact lands identified as Prime Farmlands by the United States Department of Agriculture (USDA, 1985).

Wastewater Treatment Facility

See impacts under Central Landfill and growth related impacts discussed under modifications to existing sewer system.

Sewer Interceptor

Routing future flows to an interceptor would require installation of collection sewer lines and construction of a new pumping station at Comstock Parkway. There would be short-term impacts to wildlife during installation of sewer lines and construction activities, such as noise and dust emissions. See growth related impacts discussed under modifications to existing sewer system. Water quality benefits would be realized to adjacent surface and groundwater from collection and treatment of the industrial and residential flows.

WESTERN CRANSTON RESIDENTIAL AREA

No Action

Under the No Action plan, future trends would continue towards rural development utilizing on-site septic systems. The soils in this area have severe limitations for on-site septic systems. The City of Cranston is concerned that septic systems located in unsuitable areas may be increasing pollution to surface and ground waters from septic system failure. Should this site limitation serve to constrain development through strict permitting procedures, positive benefits to wildlife would be realized through habitat preservation and a reduction in human disturbance.

Modifications to Existing Sewer System

Existing facilities in the area consist of mainly on-site septic systems, therefore, this area would require installation of sewer lines in addition to increasing the capacity of the existing sewer system to handle future flows. There would be short-term impacts during construction of sewer lines (mainly along roadways) and in modifying the system, such as noise and dust emissions. Construction activities occurring near wetlands or streams should have appropriate sediment control systems to minimize siltation. Benefits to water quality would be realized from advanced treatment at Cranston's wastewater treatment facility where advanced treatment is required to meet Class C goals for the Pawtuxet River. Growth related long-term impacts would negatively impact wildlife populations in the area. Future development may also impact lands identified as Prime Farmlands by the United States Department of Agriculture (USDA, 1985).

Wastewater Treatment Facility

There would be short-term impacts, such as noise and dust emissions, associated with the construction of a local wastewater treatment and installation of sewer lines in western

Cranston. Sewer lines would most likely be located along roadways, therefore, it is unlikely that construction activities would have a significant impact on resident wildlife populations. See modifications to the existing sewer system for growth related impacts. An evaluation of the effects of discharge of treated wastewater to a local stream or groundwater would be required in support of obtaining a discharge permit from the State of Rhode Island. Water quality benefits would be realized to adjacent surface and groundwater from collection and treatment of the flows from the western Cranston residential area and Tilcon Gammino.

Package Treatment Facility

Installation of prefabricated package treatment facilities (locations unknown) for collection of local sewerage is not likely to result in any significant construction impacts. An evaluation of effects of discharge of treated wastewater to surface or groundwater would be required in support of obtaining a discharge permit from the State of Rhode Island. Water quality benefits would be realized to adjacent surface and groundwater from collection and treatment of the residential and industrial flows. See modifications to the existing system for growth related impacts.

Sewer Interceptor

Routing future flows to an interceptor would require installation of sewer lines in the western Cranston Residential area and Tilcon Gammino site. There would be short-term impacts to wildlife during installation of the sewer lines and interceptor. These impacts are not expected to be significant because construction activities would most likely be along roadways or in previously disturbed areas. See modifications to the existing system for growth related impacts. Water quality benefits would be realized to adjacent surface and groundwater from collection of residential and industrial flows.

Wastewater Management

The Domestic Device Retrofit Program and the Rezoning plan do not involve construction activities and therefore will have no significant construction impacts. Rezoning would benefit wildlife in the western Cranston area by limiting development thereby reducing habitat displacement.

TILCON GAMMINO INDUSTRIAL ZONED LAND

No Action

Under the No Action plan, the stone mining operation will be exhausted in approximately 15 years. Without sewer collection lines to support industrial growth in the area, industrial growth may be constrained. Limited growth would benefit wildlife through habitat preservation and reduced construction disturbances.

Modifications to Existing Sewer System

This area would require installation of sewer lines to support industrial growth. There would be short-term impacts during construction of sewer lines (mainly along roadways) and in modifying the system, such as noise and dust emissions. Construction activities occurring near wetlands or streams should have appropriate sediment control systems to minimize siltation. Benefits to water quality would be realized from advanced treatment at Cranston's wastewater treatment facility where advanced treatment is required to meet Class C goals for the Pawtuxet River.

Wastewater Treatment Facility

There would be short-term impacts, such as noise and dust emissions, associated with the construction of a local wastewater treatment facility and installation of sewer lines in western Cranston. Sewer lines would most likely be located along roadways, therefore, it is unlikely that construction activities would have a significant impact on resident wildlife populations. An evaluation of the effects of discharge of treated wastewater to a local stream or groundwater would be required in support of obtaining a discharge permit from the State of Rhode Island. Water quality benefits would be realized to adjacent surface and groundwater from collection and treatment of the flows from the western Cranston residential area and Tilcon Gammino.

Package Treatment Facility

See discussion under Western Cranston Industrial area.

Sewer Interceptor

Routing future flows to an interceptor would require installation of sewer lines in the Western Cranston Residential area and Tilcon Gammino site. There would be short-term impacts to wildlife during installation of the sewer lines and interceptor. These impacts are not expected to be significant because construction activities would most likely be along roadways or in previously disturbed areas. Water quality benefits would be realized to adjacent surface and groundwater from collection of residential and industrial flows.

HOWARD RESERVATION AND INDUSTRIAL PARK

No Action

This area is currently sewered or adjacent to existing sewer lines. No significant environmental impacts are expected under the No Action plan.

Modifications to Existing Sewer System

Increasing the capacity of the existing sewer system to handle future flows would prevent potential overflow contamination to water resources in the area. There would be short-term impacts during any construction activities in modifying the system, such as noise and dust emissions. Construction activities would occur mainly in heavily developed areas, therefore, it is unlikely that significant impacts would occur to wildlife species already tolerant of human interaction. However, should construction activities occur near wetlands or streams, appropriate sediment control systems should be installed to minimize siltation in these areas. Positive benefits to water quality would be realized from advanced treatment at Cranston's wastewater treatment facility where advanced treatment is required to meet Class C goals for the Pawtuxet River.

Wastewater Treatment Facility

There would be short-term impacts, such as noise and dust emissions, associated with the construction of a local wastewater treatment facility near the Pawtuxet River. It is unlikely that this work would have a significant impact on resident wildlife populations. An evaluation of the effects of discharge of treated wastewater to the discharge location would be required in support of obtaining a discharge permit from the State of Rhode Island. Water quality benefits would be realized to adjacent surface and groundwater from collection and treatment of flows from the Howard Industrial Park and Reservation.

Sewer Interceptor

Routing future flows to an interceptor would require construction and modification to the existing system. No significant impacts are expected due to existing high level of development in the area. Positive water quality benefits to adjacent surface and groundwater would be realized from collection and treatment of the wastewater flows.

CAPUANO LANDFILL

No Action

Under the No Action plan, the Capuano Landfill will remain a potential threat to surface and groundwater in the area. A study conducted by Ecology and the Environment, Inc. 1982 presented a hypothesis that a contamination plume was moving into the glacial outwash aquifer at the site and possibly into the Pawtuxet River. (See Water Quality Evaluation Report, Appendix B).

Modifications to Existing Sewer System

See discussion under Howard Reservation and Industrial Park.

Wastewater Treatment Facility

See discussion under Howard Reservation and Industrial Park.

Sewer Interceptor

See discussion under Howard Reservation and Industrial Park.

ENDANGERED SPECIES

No Federally listed or proposed, threatened or endangered species are known to occur in the project area, with the exception of occasional transient endangered bald eagles (Haliaeetus leucocephalus) or peregrine falcons (Falco peregrinus anatum) (USFWS, 1991). At this time, three populations of rare or ecologically significant natural communities occur in Cranston or Johnston south of Route 6 to Route 14 (RIDEM, 1991). The locations of these communities are beyond the proposed project boundaries. Therefore, it is unlikely that the proposed plans will have an effect on Rhode Island significant natural communities.

X. HISTORIC AND ARCHAEOLOGICAL IMPACTS

METHODOLOGY

Since this is a reconnaissance level study, this report is principally a review of existing literature available on the Cranston and Johnston areas, with particular attention to the specific sites under investigation. The various plans considered for each site were then evaluated for their potential direct and indirect impact on historic properties.

The Rhode Island Historical Preservation Commission (RIHPC) has prepared survey reports for the communities of Cranston and Johnston (1980 and 1976). These surveys provide a historic overview of each town and an inventory of "...buildings, sites, and open spaces of historical, architectural, or visual interest." (RIHPC 1980). In addition, the RIHPC has site files for all known historic and prehistoric archaeological sites within the project area. A history of Cranston, published on the occasion of the 150th anniversary of the town was also consulted.

HISTORIC OVERVIEW

The prehistoric period is usually divided into three time periods based on distinct environmental changes and cultural adaptations: Paleo-Indian Period (10,000 - 8,000 before present (B.P.)), Archaic Period (8,000 - 2,700 B.P.), Woodland Period (2,700 - 1524 A.D.), Contact Period (1524-1636).

Paleo-Indian Period

The Paleo-Indian period represents the earliest human presence in the northeast following the last glacier retreat. The environment at that time, probably supported a spruce and pine forest and large game animals such as caribou, mastodon and mammoth. The Amerindian population consisted of small groups of nomadic hunters who "...followed herds of mastodon and caribou into the bleak subarctic landscape of southeastern New England. Because Paleo-Indian populations were both small and mobile, little evidence of them remains." (RIHPC 1980). There are no known Paleo-Indian sites in Cranston.

Archaic Period

"Broadly defined, the Archaic Period marks a change in environment, adaptation and artifact styles. ...and is divided into four sub-periods corresponding to environmental and cultural changes." (RIHPC 1986). These sub-periods are Early Archaic (10,000 - 8,000 B.P.), Middle Archaic (8,000 - 6,000 B.P.), Late Archaic (6,000-3,700 B.P.) and Terminal Archaic (3,700 - 2,700 B.P.).

During the Archaic period, the climate grew warmer, herds of big-game animals disappeared and the environment became more diverse. The Amerindian groups increased

in population size and utilized a wider variety of plants and animals. This is reflected in the archaeological record, in the variety of Archaic Period sites. Archaic sites are found on small streams, adjacent to wetlands, on major rivers and lakes and along the coast and estuaries. Rock shelters and caves were also used as temporary camps. Western Cranston is rich in Archaic and Early Woodland sites. A major site exists along Furnace Hill Brook:

> "...this habitation area, ideally located on a knoll above the confluence of Meshanticut Brook, Furnace Hill Brook, and Church Brook, revealed many projectile points and other tools from the Late Archaic and Early Woodland periods with fragments of semifinished soapstone or steatite bowls from a nearby quarry. The Oaklawn Quarry, located less than a mile to the west, is one of the two known Rhode Island soapstone or steatite quarries from which Late Archaic peoples extracted this workable stone for fashioning bowls and other vessels." (RIHPC 1980)

The Furnace Hill Brook Historical and Archaeological District, which includes the Oaklawn Quarry, is listed on the National Register of Historic Places.

Woodland Period

The Woodland period is characterized by the presence of pottery in archaeological sites. The sites from this period can be divided into Early, Middle and Late Woodland periods. Plant domestication and horticulture were probably first introduced during this period. The period is identified by large habitation sites located near major rivers and small temporary camps situated on smaller rivers and streams. Sites are also found along the coast, particularly in estuarine areas. Examples of large habitation sites were probably present along the Pawtuxet River. However, small seasonal camps were probably also located along smaller streams such as Furnace Hill Brook. A rock shelter utilized during the Late Archaic and Woodland periods is found at Church Brook.

Contact Period

The Contact Period begins with Verrazano's exploration of Narragansett Bay and ends with the initial settlement of the area by Roger Williams in 1636.

> "At the time the first European settlers arrived, the Narragansett Indians lived in large, semi-permanent coastal villages surrounded by extensive fields which had been cleared for cultivation. The Narragansetts, members of the large Algonquin nation, were the most populous Indian tribe in southern New England. When the first white settlers arrived, it is said that there were at least six Indian villages in Cranston." (RIHPC 1980: 6)

One of these Indian villages, Pontiac, was reportedly located near the intersection of Hope and Pippin Orchard Roads.

European Settlement

The first European to settle in what is now Cranston was William Arnold, one of the original Providence proprietors. He and three other men, William Harris, William Carpenter and Zechariah Rhodes settled along the Pawtuxet River in 1638 (Clausen 1904: 5). This area became known as the Pawtuxet Purchase, under the control of Providence, and included all of what is now Cranston, Scituate, Foster and parts of Johnston and West Warwick (RIHPC 1980: 7). The population of the area slowly increased until 1676, when during King Philip's war, the settlers abandoned their homes and the Indians destroyed the entire settlement (Clausen 1904: 7). The settlers gradually returned and rebuilt their homesteads.

The residents of Cranston began to agitate for separation from Providence as early as 1660. However, they were not successful until 1754 when an act of incorporation was submitted and adopted (Clausen 1904: 13). The town was named after Thomas Cranston, Speaker of the House of Representatives at that time. The population after incorporation was 1,460.

Cranston was essentially an agricultural community throughout the 18th and early 19th centuries. "Western Cranston still contains a number of individual houses and entire farmsteads that evoke the quality of the landscape as it looked in the early years of the nineteenth century. ...These farms and others like them on Phenix Avenue, Hope Road, Pippin Orchard Road, and the Plainfield Pike consisted of acres of cultivated fields." (RIHPC 1980: 15). These include the Lippit Hill Historic District on Hope Road and the Potter-Remington House, both eligible for the National Register.

The town did, however, have several small industries during this time. A grist mill was established on Meshanticut Brook, a large saw mill was situated at Scituate Avenue and Pippin Orchard Road and a bog iron bed and furnace were established on Furnace Hill Brook. The furnace remained in use only during the late 17th century,1but the iron bed was worked until the 19th century. The iron ore from Cranston was transported to the Hope Furnace in Scituate during the Revolutionary War and used to manufacture cannonballs (RIHPC 1980: 12). The Cranston Furnace is included in the Furnace Hill Brook Historical and Archaeological District which is listed on the National Register of Historic Places.

There were four main sites of textile manufacture in Cranston by 1820: Fiskeville, Dugaway Hill, Pawtuxet and the Cranston Print Works. By the early 19th century Cranston had three woolen factories, seven cotton mills, a gin distillery, six grist mills and a fulling and wadding mill (Clausen 1904: 31).

The most influential manufacturers in Cranston between 1821 and 1873 were the Sprague family, who owned and operated the Cranston Print Works. The Spragues controlled a manufacturing dynasty that stretched from Maine to North Carolina. Their factory system produced cotton material as well as printing the calico design, a revolution-

ary innovation at the time. "The output of the Sprague mills was greater than that of all the other factories in the United States combined." (Clausen 1904: 38). A company town developed at the Print Works, with the mills, worker housing and a company store providing occupations and services for over 2,000 employees (RIHPC 1980: 20). The Print Works failed during the Depression of 1873. The collapse of the Sprague empire was the largest business failure in the nation's history and caused the failure of numerous banks which had extended credit and loans to the company (Clausen 1904: 40).

During the latter part of the 19th century, railroad, horsecar lines and later electric streetcars made travel between Providence and Cranston more convenient.

> "The increased and simplified communication between Providence and Cranston gradually changed the town's character from that of a rural farm community to an integral part of the emerging metropolitan area. ...The town's population jumped from 4,311 in 1850 to 13,349 in 1900. Cranston was also the site of the region's reservoir, pumping station, and penal institutions. The town provided numerous recreation facilities for the diversion of the Providence population and vast truck farms for their sustenance." (RIHPC 1980: 22).

Most of the area in this study is in Cranston. However, the Johnston Site and the Central Landfill are in the Town of Johnston. The Johnston Site has not been heavily developed, except for certain areas along the Plainfield Pike. The area is still considerably wooded and currently supports several farms.

The Central landfill is situated northwest of the Simmons Upper and Lower Reservoirs. These reservoirs were built in 1822 by James F. Simmons and a mill was established. A disastrous flood destroyed the mill in 1840, but it was rebuilt. Cotton cloth was manufactured here, beginning in 1854 and the community was known as Simmons Upper Village (RIHPC 1976: 6). Several mill houses were built to accommodate workers, most of which survive. However, stone foundations are all that remain of the mills. This former manufacturing village now known as Simmonsville, comprises the Simmonsville Historic District (RIHPC 1976: 14).

HISTORIC PROPERTIES

There are numerous historic properties within the area of western Cranston under investigation. Listed below, are those properties that the Rhode Island Historical Preservation Commission considers significant historic and archaeological sites. Those sites eligible for or listed on the National Register of Historic Places are noted. In addition, there are at least 83 known prehistoric sites in the area, of which varying amounts of information is known.

Furnace Hill Brook Archaeological District

The district includes the Oaklawn Soapstone Quarry, the Cranston Furnace and the Cranston Ore Beds and is listed on the National Register. This area has been used for

habitation and industry for at least the last 4,000 years.

Lippitt Hill Historic District

This district encompasses several farms in western Cranston, that were first established in the mid to late-18th century. Included in the district are the Lippitt Hill Farm (c.1790) and the William Lippitt Farm (c.1798). Both are still working farms owned by the descendants of William Lippitt. This district is eligible for the National Register of Historic Places.

Other historic western Cranston farms are: the Dr. Rowland Green Farmhouse (c. 1850), Hudson Farm (c. 1860) and Brayton Farm (c. 1840).

One of the oldest surviving schools in Cranston is the Lippitt Hill School (c. 1858), located on Hope Road. This school served the historic community of Lippitt Hill as well as Fiskeville to the south.

Hope Road from Pippin Orchard to Seven Mile Road

This road is one of the best preserved roads in Cranston. This section of Hope Road was used to link the Cranston ore-beds to the Hope Furnace in Scituate and was opened in 1767. The road "retains much of its 18th-century character, including its contour, narrow winding course, and dry-laid stone boundary walls." (RIHPC 1980: 69).

Ruins of Henry Jordan's Sawmill - This mill was established in 1823 at the intersection of Pippin Orchard Road and Scituate Avenue, and operated into the 1870s. The stone ruins of the mill are still present.

Nathan Westcott House, Joy Homestead, Sheldon House - These three historic houses are located on Scituate Avenue and were constructed between 1728 and 1778. All three structures are eligible for the National Register.

Potter-Remington Farmhouse - This farmhouse, located on Natick Avenue, was built by Caleb Potter in 1795 and sold to Benjamin Remington in 1804. Remington's son, Jonathan, acquired the house in 1812. Jonathan Remington was one of the wealthiest farmers in western Cranston during the first half of the 19th-century. The Potter-Remington Farmhouse is eligible for the National Register.

Oaklawn Village Historic District - Oaklawn was one of Cranston's first suburban, commuter villages. In 1872, Oaklawn had only eight houses and was known as Searle's Corner. However, in 1872, property was subdivided in this area and lots sold. The main advantage of the area was its proximity to the railroad into Providence. The district is made up of about 35 houses, most of which date to the late 19th-century. This district is National Register eligible.

The State Institutions at Howard - "Occupying the old Stukeley Westcott and William S. Howard Farms, the state institutions at Howard represent, in architecture and physical layout, the evolution of the state's role as agent of public welfare for its citizens." (RIHPC 1980: 70). The first institutional buildings were constructed in 1873 and several other large scale structures
were completed before the turn of the century. Between 1900-1918, six other large, red brick buildings were constructed, with 28 buildings erected by the WPA during the 1930s.

PLAN IMPACTS

This study is investigating various measures for dealing with wastewater flows at the following sites: Central Landfill, Vinagro Site, Western Cranston Industrial area, Johnston site, Western Cranston Residential area, Tilcon Gammino Industrial area, Howard Reservation and Howard Industrial Park and the Capuano Landfill. The impacts of the proposed plans No Action, Wastewater Management, Modifications to the Existing System, Local Wastewater Treatment and Sewer Interceptor are evaluated on a site by site basis. Material as presented for each general plan is not very detailed as this is a reconnaissance level investigation. Table 31 identifies the potential impacts the plans will have on historic properties.

If this project proceeds to a further stage of planning, then additional research on the history of the area and any historic properties within the project area, would have to be performed and if necessary an archaeological survey would have to be completed, prior to construction.

The sewer interceptor plan could have an indirect impact to historic properties by stimulating development and new construction in western Cranston. Construction of the interceptor could also have a direct effect on archaeological sites, depending on the project alignment. With the proposed plan, the sewer interceptor traverses the location of the Furnace Hill Brook Archaeological District and the Oaklawn Village Historic District.

Table 30
Impacts to Historic Properties

	NO ACTION CONDITION	WASTEWATER FLOW MANAGEMENT	MODIFICATIONS TO EXISTING SEWER SYSTEM	LOCAL WASTEWATER TREAT. PLAN	SEWER INTERCEPTOR PLAN
CENTRAL LANDFILL	NO FURTHER IMPACTS THAN CURRENTLY FROM EXPANSION OF LANDFILL	NOT APPLICABLE	COULD HAVE EFFECT IF MODIFICATIONS INVOLVE EARTHMOVING	COULD HAVE EFFECT ON UNIDENTIFIED SITES IN THE AREA	COULD HAVE EFFECT ON UNIDENTIFIED SITES IN THE AREA
JOHNSTON SITE	WOULD LIMIT DEVELOPMENT SO WOULD DEC. IMPACTS TO HISTORIC PROP.	LIMITING DEVELOPMENT WOULD DEC. IMPACTS TO HISTORIC PROP.	INC. DEV. AND CONSTRUCTION COULD IMPACT HISTORIC PROPERTIES	INC. DEV. AND CONSTRUCTION COULD IMPACT HISTORIC PROPERTIES	INC. DEV. AND CONSTRUCTION COULD IMPACT HISTORIC PROPERTIES
VINAGRO LANDFILL	NO FURTHER IMPACTS	NOT APPLICABLE	COULD HAVE EFFECT IF MODIFICATIONS INVOLVE EARTHMOVING	COULD HAVE EFFECT ON UNIDENTIFIED SITES IN THE AREA	COULD HAVE EFFECT ON UNIDENTIFIED SITES IN THE AREA
WESTERN CRANSTON INDUST. AREA	INC. DEVEL. COULD IMPACT UNIDENTIFIED HISTORIC PROPERTIES	INC. DEVEL. COULD IMPACT UNIDENTIFIED HISTORIC PROPERTIES	COULD HAVE EFFECT IF MODIFICATIONS INVOLVE EARTHMOVING	INC. DEV. AND CONSTRUCTION COULD IMPACT HISTORIC PROPERTIES	INC. DEV. AND CONSTRUCTION COULD IMPACT HISTORIC PROPERTIES
WESTERN CRANSTON RESIDEN. AREA	WOULD LIMIT DEVELOPMENT SO WOULD DEC. IMPACTS TO HISTORIC PROP.	LIMITING DEVELOPMENT WOULD DEC. IMPACTS TO HISTORIC PROP.	INC. DEV. AND CONSTRUCTION COULD IMPACT HISTORIC PROPERTIES	INC. DEV. AND CONSTRUCTION COULD IMPACT HISTORIC PROPERTIES	INC. DEV. AND CONSTRUCTION COULD IMPACT HISTORIC PROPERTIES

Table 30 continued
Impacts to Historic Properties

	NO ACTION CONDITION	WASTEWATER FLOW MANAGEMENT	MODIFICATIONS TO EXISTING SEWER SYSTEM	LOCAL WASTEWATER TREAT. PLAN	SEWER INTERCEPTOR PLAN
TILCON GAMMINO INDUST. ZONED LAND	NO FURTHER IMPACTS	NO IMPACTS	CONSTRUCTION COULD IMPACT HISTORIC PROPERTIES	CONSTRUCTION OF TREAT. PL. COULD IMPACT HISTORIC PROPERTIES	CONSTRUCTION OF INTERCEPTOR COULD IMPACT HISTORIC PROPERTIES
HOWARD RESERV. AND INDUS. PARK	NO IMPACTS	NO IMPACTS	MODIFICATIONS COULD IMPACT HISTORIC PROPERTIES	INC. DEV. AND CONSTRUCTION COULD IMPACT HISTORIC PROPERTIES	MODIFICATIONS COULD IMPACT HISTORIC PROPERTIES
CAPUANO LANDFILL	NO IMPACTS	NOT APPLICABLE	CONSTRUCTION COULD IMPACT HISTORIC PROPERTIES	CONSTRUCTION COULD IMPACT HISTORIC PROPERTIES	CONSTRUCTION COULD IMPACT HISTORIC PROPERTIES

NOTE: INC. DEV = INCREASED DEVELOPMENT
DEC = DECREASED

XI. FUTURE COURSE OF ACTION

COMPARISON OF PLANS

The following sections present a summary of the reconnaissance level review of the suitability of the formulated plans to address the grouping of interrelated environmental problems identified in the study. Also included is a listing of ongoing investigations which could impact on the findings of this report as well as a listing of future studies which should be conducted prior to final selection and implementation of a proposed project to address the wastewater conveyance problems.

The basic intent of this reconnaissance level review was to define the problems, formulate and evaluate plans to correct the problems and suggest a future course of action for the City to undertake to solve the problems. It was also envisioned that the Section 22 study would include preparation of preliminary time and costs estimates for the proposed project. Because of the uncertainty created by the various ongoing investigations, it is not feasible in this reconnaissance level study to select the proposed project or to produce realistic time and cost estimates for a proposed project. This effort can be pursued effectively during future planning and design efforts.

No Action

This plan would limit future growth in the Western Cranston Industrial area and would limit any future connections by the town of Johnston in this area. Projected wastewater flow from Central Landfill would be routed to the Cranston sewer system, but the existing sewer system capacity would be strained. The Western Cranston Industrial area would be without a plan to solve future septic system failure problems. The Tilcon Gammino area would probably not be developed because of the presence of ledge and lack of sewers. Some of the growth at the Howard Reservation and Industrial Park may be limited. Options for dealing with potential projected flows from the Vinagro site and the Capuano Landfill would be limited.

Under the No Action alternative, water quality may be compromised in the future due to wastewater treatment needs exceeding the conveyance capacity of the existing system. Many areas in western Cranston may continue utilizing on-site septic systems or remain without sewers. No action may benefit fish and wildlife resources through limited construction and development, however, degraded water quality from potential overflows or poorly sited septic systems may negatively impact fish and wildlife resources.

Modifications to the Existing System

The modifications plan looks at modifying the existing sewer system in Cranston to increase the conveyance capacity of the existing system to handle projected flows from the study sites.

Water quality benefits could be realized through planning and implementation of modifications to the existing system which meet the future needs of Central Landfill, Cranston and Johnston and managed and operated in compliance with established water quality standards. Collection and treatment of landfill leachate or groundwater may serve to protect groundwater resources in the area.

Economic benefits would be realized by the City and the State through the construction of sewer systems to presently unsewered areas. These benefits would result from the development of industrial opportunities in presently constrained areas and from the residential growth in the western portion of the city.

Potential plan impacts include disruption from construction in heavily developed areas, possible impacts on historic properties and the potential for environmental impacts during construction. Appropriate siltation control measures would be required in areas of wetlands or streams to minimize impacts.

The modifications to the existing system plan appears feasible for all study sites, however, it may not be the most implementable, cost effective solution. This plan seems most practical for the Howard Reservation and Industrial Park flows which are assumed to be routed to the Howard Pump station and through the existing force main to the existing system pipelines to the treatment facility. Based on the economic analysis performed in this investigation, there does not appear to be a clear advantage between modifying the existing system and the construction of a sewer interceptor. Further analysis of elements of the modifications to the existing system plan in combination with and versus elements of the sewer interceptor plan is needed.

Local Wastewater Treatment

This study investigated the possibility of constructing local treatment facilities to process the projected wastewater flows from the study sites and discharge them to a receiving water. Two options were evaluated: construction of new local wastewater treatment facilities near the study sites; and the use of package treatment facilities.

Cost comparison of the new local treatment option with the modifications to the existing system plan and the sewer interceptor plan indicated this plan to be the most expensive of the proposed plans.

This plan involves permitting and discharge of treated wastewater to either a local surface water body or into the ground. Siting studies of surface water discharge facilities would include water quality modeling of the proposed receiving stream. Studies would be required to demonstrate that the new discharge would meet the RI DEM anti-degradation policy.

Staff from EPA and RI DEM contacted regarding this issue indicated it would most likely be impossible to obtain a new surface water discharge permit in the western Cranston area and soils in this area are not suitable for groundwater discharge. The Rhode Island DEM also suggested that no new discharges can be permitted to the Pawtuxet River as the wasteload allocation for the stream has been established based on the existing and future needs of the current users. This plan therefore is less feasible for solving the projected wastewater flow problems at the residential and industrial sites.

Sewer Interceptor

The potential construction of a sewer interceptor through the western portion of the City was also investigated. The interceptor system would include a combination of force mains and gravity lines to convey wastewater flows from the study sites to the existing treatment facility.

With implementation of this plan, growth at the study sites would not be constrained by wastewater conveyance and the option of routing potential projected wastewater flows from landfill sites to the modified system would be available. The construction of a sewer interceptor would result in economic growth opportunities for the City and the State through the increased opportunity for industrial expansion and from increased residential development.

Water quality benefits could be realized through planning and implementation of a sewer interceptor system which meets the future needs of the Central Landfill, Cranston and Johnston and is managed and operated in compliance with established water quality standards. Collection and treatment of landfill leachate and/or contaminated groundwater may serve to protect groundwater resources in the area. Short term impacts to wildlife resources can be expected with construction activities.

The sewer interceptor plan could have an indirect impact to historic properties by stimulating development and new construction in western Cranston. Construction of the interceptor could also have a direct effect on archaeological sites, depending on the project alignment. With the proposed plan, the sewer interceptor traverses the location of the Furnace Hill Brook Archaeological District and the Oaklawn Village Historic District.

This plan to increase the conveyance capacity of the Cranston sewer system to carry projected wastewater flows from the study sites appears feasible for all study sites, but may not be the most implementable, cost effective solution at all sites. The Howard Reservation and the Capuano landfill appear to offer a stand alone option. Future flows generated at these areas could be routed to the wastewater treatment facility utilizing the existing sewer system with required modifications.

Wastewater Management Plan

This Section 22 investigation evaluated various wastewater management activities to reduce the future flows to the Cranston wastewater system. These measures would need to be implemented in conjunction with structural alternatives in order to provide sufficient conveyance capacity for the projected wastewater flows. These measures included a demand management component, possibly decreasing infiltration/inflows (I/I) to the system, rezoning in western Cranston and consideration of establishing a Wastewater Management District in the western Cranston area to handle the potential septic system problems.

Implementation of the water demand management component to decrease water use and thus wastewater flow appears to be feasible. The costs for the program are modest. However, there may be some problems with program implementation because most of the water supply system in eastern Cranston is operated by other political entities in the City of Providence (the Providence Water Supply Board and the Narragansett Bay Commission) and implementation of the program would involve coordination with agencies beyond the direct control of the city of Cranston.

The city's engineer is currently conducting an I/I investigation. Current information indicated that inflow/infiltration in the city is not a problem except possibly at the Howard Reservation. If there is a problem at the Howard Facility and it can be cost effectively corrected, costs for modifying the existing system in this area to carry future flows would decrease.

Rezoning areas of potential growth in western Cranston would limit residential, commercial and industrial growth and may not be practical because of ownership rights and land configurations.

Establishing a city operated Wastewater Management District (WMD) in Western Cranston to implement approval, inspection and maintenance of individual subsurface disposal systems is proposed to prevent groundwater contamination. The decision to pursue this option would require additional administrative responsibilities for the city. This action would require the Cranston City Council to adopt an ordinance creating a Wastewater Management District. In addition natural soil characteristics in this area may limit the effectiveness of this solution to prevent groundwater contamination.

Opportunities to reduce wastewater flows through demand management and reducing inflow and infiltration should be pursued by the City regardless of what specific options are selected to increase the conveyance capacity of the system.

Future planning studies conducted by the city should address the need for and suitability of establishing a Wastewater Management District in western Cranston to prevent groundwater contamination.

ONGOING INVESTIGATIONS

The following ongoing investigations are being conducted by EPA and the City of Cranston. The results of these investigations could impact on the conclusions presented in this study.

1. The EPA is conducting a Superfund RI/FS investigation at the Central Landfill and until the record of decision is reached on this case the quantity of future discharges from this site remain uncertain. The other two landfills sites are currently awaiting listing site investigations by EPA under the Superfund program to determine qualification and rank on the national priority list. Until these studies are undertaken the quantity of any future discharges to the treatment facility remain uncertain.

2. The city of Cranston is currently conducting a Wastewater Treatment Facilities Plan which is scheduled for completion in April of 1992. Information contained in the Facilities Plan may impact plans developed in this study to convey wastewater to the City's wastewater treatment facility

3. Cranston and Johnston are also in the process of developing a comprehensive land use plan and results of these studies will impact assumptions made in this report concerning future land use.

ADDITIONAL STUDIES

The Section 22 study looked at a broad range of plans to solve a grouping on interrelated environmental problems. The plans that initially appear feasible are Modifications to the Existing System, Construction of a Sewer Interceptor through Western Cranston and implementation of components of the Wastewater Management Plan. The next step is to determine which combination of plan elements provide the most cost effective solution. In order to take the next step the following additional studies should be undertaken:

1. Detailed study of existing and projected wastewater flows at the study sites and in the portions of the affected sewer system. May require detailed city wide population and economic growth projections.

2. Water quality characterization studies of potential wastewater discharges from landfills and industrial sites to determine compliance with the City's local limits on pollutant discharge to the municipal sewer system.

3. Formulation of specific project alternatives from the described plans.

4. Evaluation of specific project alternatives including preliminary design, hydraulics, cost estimates, environmental assessments and socioeconomic assessments.

5. Layout design and costs of lateral sewer lines and branch interceptors in Western Cranston Residential area and other areas the are not currently sewered, but which may connect to a new interceptor or to the modified existing system.

6. Selection of a proposed project based on a consideration of project costs, environmental impacts, regional benefits and public acceptance.

7. Engineering design of the proposed project at sufficient detail to go to plans and specifications.

8. A complete environmental assessment (EA) of the proposed project including, but not limited to impacts on fish and wildlife, wetlands, water quality, historic and archaeological sites, local economy, recreational resources. The results of the EA will either be a finding of no significant impact or of the need to do an larger Environmental Impact Study.

9. Identification of required Federal, State and local permits for the proposed project and the initiation of the application process. Each project sponsor should be responsible for identifying and initiating the process with their own agencies.

IDENTIFICATION OF FEDERAL STATE AND LOCAL PERMIT REQUIREMENTS

The following is a summary of Federal, State and local regulations that may apply to any future actions. Appendix A provides additional information on Rhode Island environmental regulations.

CLEAN WATER ACT

The goal of the Clean Water Act of 1977, as amended, is to restore and maintain the Nation's waters. The Section 404(b)(1) guidelines under Section 404 of the Clean Water Act regulates the placement of dredge and fill material in waters of the United States. A permit from the Army Corps of Engineers would be required should installation of sewers/sewer interceptor or construction activities impact wetlands or streams. The Freshwater Wetlands Act, R.I. General Laws, Section 2-1-18 through 2-1-27 has permitting authority over anyone proposing to affect a freshwater wetland or its regulated perimeter. See Permit Appendix page A.1 - Freshwater Wetlands for detailed filing information.

The regulatory authority for several of the functional elements of the Clean Water Act has become the responsibility of the State of Rhode Island. The water discharge permitting authority (Sections 402 of the Clean Water Act) was delegated to the State of Rhode Island in a memorandum of Agreement between the U.S. Environmental Protection Agency (EPA) and the Rhode Island Department of Environmental Management (RI DEM) on September 1984. Rhode Island General Law 46-12, 42-17.1 and 42-35 regulates issuance, compliance and enforcement of all water discharge permits issued in Rhode Island; however, EPA retains oversite responsibility for assuring that draft permits comply with both Federal and State Water Quality regulations (USEPA, 1991). See page A.5 of Appendix A - Rhode Island Pollutant Discharge Elimination System (RIPDES) Permit for detailed filing information.

Sections 301, 302, 306 and 307 of the Clean Water Act requires State Water Quality Certification that the discharge will not violate water quality standards. Pursuant to the Rhode Island General Laws Chapter 46-12, 42-17.1, and 42-35, permitting authority is maintained through the Rhode Island Division of Water Resources. See page A.7 of Appendix A - Certification of Water Quality Standards for detailed filing information.

The State of Rhode Island, Division of Water Resources (Rhode Island General Laws, Chapters 46-12, 42 -17.1, and 42-35) requires an Order of Approval for installation or modification of a wastewater treatment system. See page A.8 of Appendix A - Order Of Approval To Construct, Install, Or Modify Any System Or Means of Wastewater Treatment for detailed Filing information.

RESOURCE CONSERVATION RECOVERY ACT

Section 204(b) and 405 of the Clean Water Act and Subtitle C and D of the Resource Conservation Recovery Act of 1976 and Rhode Island General Laws, Chapter 44-11-11.1 involves pretreatment requirements for industrial users prior to discharge of wastewater into a municipal sewer system. The National Pretreatment Program established under the Clean Water Act, controls toxic pollutant discharge into sewer systems which may interfere with, pass through or upset the treatment process. See page A.9 of Appendix A - Approval of Wastewater Pretreatment System for detailed filing information. In some instances, the same pollutants are also defined as hazardous and are therefore, regulated under the Resource Conservation Recovery Act. In addition, potentially toxic wastewater from the landfills and industrially zoned property may require modifications to Cranston's permit to comply with Implementation of Interim Sludge Requirement (Section 405(d) of the Clean Water Act) Agreement between RIDEM and EPA dated June 18, 1990 (USEPA, 1991).

The State of Rhode Island Division of Air and Hazardous Materials issues all State and Federal permits with regards to enforcement and compliance actions pursuant to the Resource Conservation Recovery Act. Rhode Island General Laws, Section 23-19.1 requires permitting for transport and disposal of products which may exhibit the characteristics of hazardous waste such as the by-products of industrial pretreatment and wastewater facility sludge. Both industrial users and municipalities which operate publicly owned

treatment facilities may be regulated parties (USEPA,1985). The State of Rhode Island periodically reports to EPA on
programs including notification of enforcement/compliance actions taken. See page A.10 of Appendix A - Hazardous Waste Permits for detailed filing information.

CRANSTON'S SEWER USE ORDINANCE

The City of Cranston also has regulatory authority over discharges into the wastewater collection and treatment system. The City of Cranston Sewer Use Ordinance "provides a means for determining wastewater volume, constituents and characteristics, the setting of charges and fees, and the issuance of permits to certain users." In addition, this ordinance includes regulations concerning the installation and maintenance of septic systems and sewer system design standards. A permit is also required by the Rhode Island Division of Groundwater and Freshwater Wetlands for installation of an Individual Sewage Disposal System (ISDS) pursuant to Rhode Island General Laws, Section 42-17.1 (l), (m), (r) and (s) (RI DEM, 1989).

CERCLA

The Comprehensive Environmental Response, Compensation and Liability Act of 1980 (Superfund),as amended, and Rhode Island General Laws, Section 23-19.1 address the clean-up of hazardous waste releases which threaten the public or environment. A portion of the Central Landfill in Johnston is listed on EPA's National Priority list. A Remedial Investigation/ Feasibility Study (RI/FS) is underway for the site with recommendations expected in 1992. See page A.12 of Appendix A - Hazardous Waste Site Assessment and Remediation Program for detailed information on the Superfund process. The EPA has completed Preliminary Assessments for the Capuano and Vinagro Landfills with Hazard Ranking to be completed at a future date (unknown).

SAFE DRINKING WATER ACT

Pursuant to Section 1428 of the Safe Drinking Water Act of 1974, as amended, the State of Rhode Island developed and submitted a Wellhead Protection Program to EPA. The program was approved in February 1990. The protection of groundwater in Rhode Island from activities proposed within wellhead protection areas may be accomplished through the use of zoning restrictions or stringent permitting requirements. See page A.15 of Appendix A - Wellhead Protection Program for detailed information.

The Safe Drinking Water Act also addresses the use of underground injection wells. Should proposed wastewater treatment facilities utilize underground injection wells, the State of Rhode Island requires (Rhode Island General Laws, Chapters 42-17.1 and 46-12) an Order of Approval be issued (with periodic approve by the EPA) prior to disposal of sewage in Class V Underground Injection Wells under the Rhode Island Underground Injection Control Regulations. See page A.16 of Appendix A - Order Of

Approval To Operate, Construct, Alter, Or Repair Injection Wells And Subsurface Disposal Systems For Non-Domestic Waste for detailed filing information.

NEPA

The National Environmental Policy Act (NEPA) of 1969 requires an interdisciplinary approach to planning and decision making for Federal actions which may significantly affect the human environment. More detailed analysis and planning by the Army Corps of Engineers of wastewater treatment systems for the City of Cranston may require the preparation of an Environmental Impact Statement (EIS). The NEPA process requires coordination with Federal, State and local agencies with jurisdiction in the project. For example, potential impacts to farmlands as a result of proposed project impacts would require coordination with the United States Department of Agriculture, Soil Conservation Service pursuant to Executive Memorandum (1) Council on Environmental Quality Memorandum, August 11, 1980, Analysis of Impacts on Prime or Unique Agricultural Land in Implementing NEPA.

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XII. CONCLUSIONS

The purpose of this Section 22 investigation is to perform a reconnaissance level review of a grouping of interrelated environmental problems faced by the City of Cranston and the neighboring communities. The conclusions are based on the preliminary analysis of plans to solve the identified wastewater conveyance problems and on coordination efforts with appropriate Federal, State and local agencies and entities. Further study is recommended to completely evaluate the engineering feasibility of these plans, determine which combination of plan elements provide the most cost effective solution and determine the environmental, socioeconomic, and water quality benefits and impacts. The reader should also be aware that the results of ongoing investigations by EPA, the State of Rhode Island and the City of Cranston may directly impact on the findings presented here.

If no action is taken by the City of Cranston, the expansion of industrial and commercial opportunities would be constrained by the limitations of the conveyance capacity of the existing sewer system. Residential development in the western portion of the City would be constrained and existing development would continue to experience problems due to the construction of septic systems in unsuitable soil conditions. The City would continue to meet its contractual obligation to take 400,000 gpd from the Central Landfill, however, the city would be limited in using its existing sewer system to address future water quality problems at the landfills.

Several alternative plans to the no action plan were formulated to address future wastewater conveyance problems faced by the City. These included modifications to the existing system, the construction of new local wastewater treatment facilities, the construction of a sewer interceptor through the western portion of the City, and the implementation of wastewater management practices.

The City has recommended the construction of a sewer interceptor through the western portion of the city using project elements including energy efficient electric motors and variable frequency drives at the pump stations, the use of low friction plastic force mains, and the use of a continuous force main/pressure sewer versus a force main/gravity sewer over approximately 14,000 feet at the end of the interceptor.

The City has also recommended using an approach of integrated evaluation and planning to develop and implement a suitable solution to to the complex and interrelated environmental problems.

The following is a summary of reconnaissance level study findings.

- The construction of local treatment facilities to address industrial or residential development does not appear feasible due to the restrictive discharge requirements.

- Future industrial and institutional flows from the Howard Facilities should be routed to the wastewater treatment facility utilizing the existing sewer system with required modifications. Additional studies would be required to better define the existing system capacities and determine possible system deficiencies.

- The remaining wastewater flows could be conveyed to the existing treatment facility through modifications to the existing sewer system or by constructing a sewer interceptor through the western portion of the City. The analysis performed for this study could not identify a clear advantage of constructing one alternative versus the other. Further detailed analysis is recommended.

- The use of project elements in sewer interceptor design such as energy efficient motors, variable frequency drives and low friction plastic force mains and pressure sewer segments is technically feasible and may provide construction and operation cost savings.

- Opportunities to address wastewater flow through demand management and reducing inflow and infiltration should be pursued by the City regardless of what specific options are selected to increase the conveyance capacity of the system.

- Future planning studies conducted by the City should address the need for and suitability of establishing a Wastewater Management District in Western Cranston to prevent groundwater contamination.

- The City should continue to pursue an approach of integrated evaluation and planning to develop and implement a suitable solution for the grouping of interrelated environmental problems. Such an approach will be valuable to governmental agencies at all levels.

In summary, this study addressed and developed a broad array of solutions for a grouping of interrelated environmental problems. The specific plans that initially appear feasible in the Cranston area as ways to address the wastewater conveyance problems are modifications to the existing sewer system, construction of a sewer interceptor and implementation of components of a wastewater management program. The next step is to conduct a detailed study using an integrated evaluation and planning approach to determine which combination of plan elements is most effective from a cost and environmental impact standpoint.

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APPENDIX A

RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
GUIDE TO ENVIRONMENTAL PERMITS AND APPROVALS

A. PRELIMINARY DETERMINATION APPLICATION
B. FORMAL APPLICATION TO ALTER A WETLAND

Legislative Authority
Freshwater Wetlands Act, R.I. General Laws, Sections 2-1-18 through 2-1-27.

Lead Agency
DEM Division of Groundwater and Freshwater Wetlands.

The U.S. Army Corps of Engineers has jurisdiction over freshwater wetlands under Section 404 of the Clean Water Act. Application for a State wetland permit does not relieve the applicant from applying to the Army Corps of Engineers. It is also important to note that the wetland jurisdictional boundaries of DEM and the Army Corps of Engineers may differ.

Purpose
Prevent loss of floodplains and reduction of the ability of a wetland to moderate damaging effects of flood flows. Protect water quality and ability of wetlands to recharge groundwater aquifer, provide wildlife habitat, recreational value, and other unique characteristics of any wetland as identified in the Rules and Regulations Governing the Enforcement of the Freshwater Wetlands Act.

Who Must Apply
Anyone proposing to alter a freshwater wetland must first obtain a permit from the DEM Division of Groundwater and Freshwater Wetlands. Approval is required whenever there is a possibility that a proposal might affect a freshwater wetland or its regulated perimeter. To determine if a permit will be required, a preliminary determination application should be submitted.

Approval Procedure

A. PRELIMINARY DETERMINATION APPLICATION ($30 fee)

1. Applicant submits a Preliminary Determination Application to determine whether the project area is a wetland or if the proposed project will require formal permit approval based upon the proposed site alterations submitted. For wetland determination only, a site plan depicting the flagged wetland edge (delineated by the applicant) must be shown. Verification of boundaries by DEM staff will be provided after review of plans and site inspection.

2. Review of proposed site alterations in a Preliminary Determination Application requires wetland edge flagging to be located in the field, as well as the limits of proposed building features and construction activities. A brief description and purpose of the project must be provided along with detailed site plans showing wetland edges, perimeter wetlands (ie: riverbanks, or that area of land within 50 feet of the edge of any marsh, swamp, bog or pond), and proposed alterations. Refer to the checklist of site plan requirements for design details needed for specific construction projects. Engineering requirements to be submitted for proposed changes involving drainage/runoff characteristics, water quality, and floodplain effects must be prepared by a registered professional engineer.

3. DEM notifies the applicant of its findings, including: deficiencies in the application; the type of wetland present; the Wetlands Act does not apply; the proposed project is an insignificant alteration; or the project represents a significant alteration to one or more values provided by the freshwater wetland present. Conditional approvals for insignificant alterations may be granted under the Preliminary Determination Application process, and will include identification of specific provisions required to ensure protection of the wetland, depending upon individual circumstances. A determination that the proposal represents a significant alteration will require a formal permit to alter the wetland. This permit is required prior to commencing any work within the wetland or adjacent perimeter wetland such as riverbank, or that area within 50 feet of any marsh, swamp, bog, or pond.

4. DEM forwards notification of applicability decision to the appropriate cities and towns.

B. FORMAL APPLICATION TO ALTER A WETLAND ($150 fee Single Family Residence; $500 Non-Single Family Residence)

1. Applicant submits Formal Application to Alter a Wetland with the site plans showing existing wetlands and regulated perimeters, property owners within 200 feet (of the propose alteration), proof of property ownership, proposed alterations, temporary and permanent erosion controls, description/purpose of project and any other informaion required for review as specified by DEM. Wetland delineations and all proposed project features (limits of clearing, retention basins, septic systems, roadways, etc.) must be clearly marked in the field, prior to submission of the application. Site plan requirements for specific construction projects must be addressed as outlined in the general application requirements. Engineering requirements for drainage/runoff characteristics, floodplain effects, and water quality, must be prepared by a registered professional engineer.

2. DEM reviews applications and conducts site inspections. Where there exists substantial question concerning impacts to water quality, the Division of Groundwater and Freshwater Wetlands may request a water quality certification from the Division of Water Resources.

3. When DEM considers the application complete for notice purposes, DEM issues notice of the proposed alteration to:
   a) Abutting landowners;
   b) City/Town representatives where the project is located; and,
   c) Other interested persons and agencies.

4. A 45-day review period is allowed, during which time the local government has the authority to deny the permit. Appeal from such a denial may be made to the Superior Court.

5. DEM makes a decision to issue or deny the permit within six weeks following the close of the 45-day review period if no substantive objection is received.

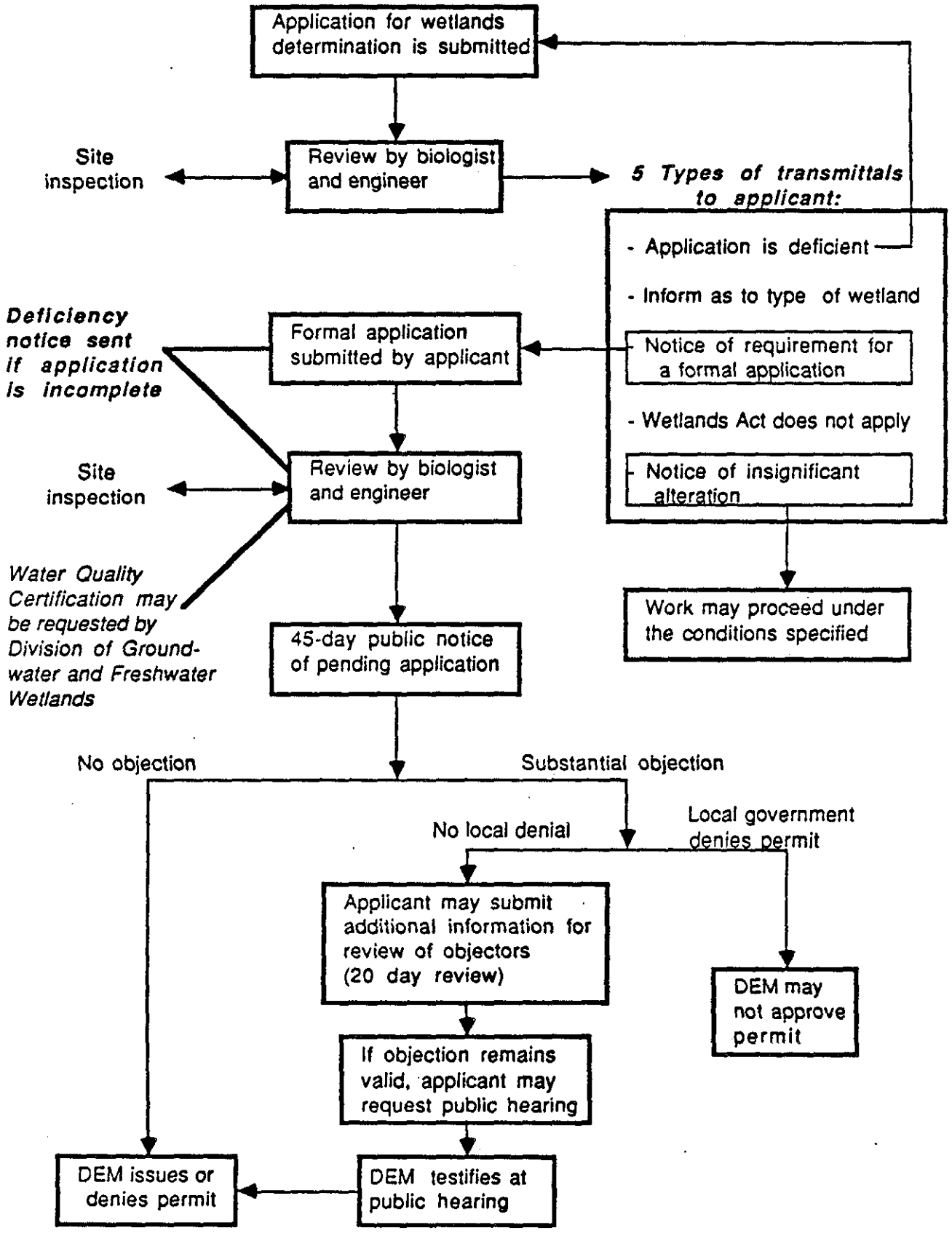
   The applicant may request a public hearing when one of the following circumstances apply:
   a) Substantive objection (not local permit denial) is received;
   b) Applicant is aggrieved by a provision of the permit approval; or,
   c) DEM denies application.

6. DEM hearing officer makes decision to approve or deny the permit within six weeks of the close of the hearing.

Estimated Time For Approval
Thirty (30) days for a preliminary wetlands determination. Approximately 4-6 months for formal wetlands permit approval from the date a complete application is received. Longer if a public hearing is held.

The need for a formal wetlands permit can be eliminated entirely by planning development around wetlands. If some alteration cannot be avoided, the applicant should consult with qualified experts (wildlife biologists, ecologists, hydrologists, etc.) to keep wetlands disturbance to an absolute minimum. Since the major cause of delay in permit processing is insufficient information, considerable time can be saved by submitting a complete application the first time.

WETLANDS DETERMINATION AND PERMIT PROCEDURE



RHODE ISLAND POLLUTANT DISCHARGE ELIMINATION SYSTEM (RIPDES) PERMIT

Legislative Authority
Rhode Island General Laws, Chapters 46-12, 42-17.1, and 42-35; Federal Clean Water Act, Sections 402, 403, 316 (a) and (b).

Lead Agency
DEM has primary permitting and enforcement authority over discharge of pollutants to waters under the RIPDES program, delegated to the State by EPA. Applications are forwarded to EPA for review and concurrence with DEM's findings, prior to issuance of permits.

DEM Division of Groundwater and Freshwater Wetlands and Division of Fish and Wildlife are also involved in the review of Section 316 (a) and (b) approvals affecting the State's water.

Purpose
To restore, preserve, and enhance the quality of the surface water; and to protect the state's waters from discharge of pollutants so that the waters will be available for all beneficial uses and thus protect the public health, welfare, and environment.

The discharge program regulates the types and quantity of waste material discharged directly to state waters to ensure compliance with all applicable effluent limitations and water quality standards. Section 316 (a) and (b) approvals address impacts of thermal water discharges and best available intake structure design and location to minimize impact to aquatic resources. A RIPDES permit is issued for the discharge. The Division of Groundwater and Freshwater Wetlands reviews the intake structure. A wetlands permit, water quality certificate, or order of approval may be necessary for water withdrawals.

Variances may be issued to allow modifications of standards under certain economic or unconventional circumstances, or when it is demonstrated that environmental quality will be maintained.

Who Must Apply
Anyone who discharges wastewater or proposes to discharge pollutants directly into the State waters must obtain a RIPDES permit from DEM. Permits must be renewed at least once every five years. Although no stormwater permits are presently being issued, application forms for RIPDES stormwater permits are being accepted. EPA extended the deadline for receipt of application for existing discharges to February 4, 1990.

Information Required
Application Form 1 must be submitted to DEM for all proposed discharges into State waters. Additional data to be provided include identity and amount of pollutants discharged, a description of the nature of the activity generating wastes, a diagram showing waste streams, toxics used or manufactured, outfall location, location map, and any other descriptive information required by DEM. Based upon the nature of the wastewater discharge identified on Form 1, other appropriate permit application forms (Forms 2C, 2D, 2E, etc.) must be completed as noted on Form 1.

Additional engineering data/documentation may be required if DEM indicates that the Antigredation Policy (Section 17 of the Water Quality Regulations for Water Pollution Control) applies to the discharge.

Approval Procedure

After coordination and review by EPA, and the public, DEM issues permits for wastewater discharges specifying effluent limitations, monitoring, and reporting requirements. A water quality monitoring program is stipulated for the duration of the permit dependent upon the nature of the discharge. No permits are currently being issued for RIPDES stormwater applications until the EPA has resolved the mechanism by which this portion of the program can be administered.

Legislative Authority
Rhode Island General Laws Chapters 46-12, 42-17.1, and 42-35.

Lead Agency
DEM Division of Water Resources.

Water quality certification may be required for approval of, and prior to issuance of permits involving the U.S. Army Corps of Engineers Section 404 program, DEM freshwater wetlands, FERC hydroelectric facilities, and CRMC coastal permits. DEM issues a similar statement of water quality compliance as part of the RIPDES permit approval process in certain cases.

Purpose
Water quality standards provide a system by which the waters of the State are classified by uses so as to protect the public health and welfare, enhance the quality, and provide for optimum utilization of waters. Physical, chemical, and biological water quality criteria are the minimum water quality parameters necessary to support these uses. Water Quality Standards consist of these water use classifications and water quality criteria. High quality waters (certain A, SA, B and SB waters) receive the strictest requirements to minimize, or in some cases, completely eliminate impacts on water quality under the Antidegradation Policy (Section 17 of the WQ regulations).

Who Must Apply
DEM reviews all projects that may affect water quality in order to ensure that proposed activities will not degrade water quality or preclude attainment of water quality standards. If the project will not affect attainment of water quality standards, DEM Division of Water Resources issues a water quality certificate. The water quality review process is initiated as a result of a requirement on a specific permit submitted to another agency or division, and then forwarded to the Division of Water Resources. Therefore, the applicant does not formally apply to the Division of Water Resources, but must provide any data required by DEM to complete the review process.

Approval Procedure
1. Application for Section 404 permit, freshwater wetlands permit, coastal permit, or discharge permit is made to the appropriate permitting agency.

2. A request for water quality certification is forwarded to the Division of Water Resources by the permitting agency, along with a copy of the application or appropriate data.

3. The Division of Water Resources reviews the application and makes findings regarding water quality. DEM may confer with the applicant and the permitting agency; and may require further technical documentation.

4. DEM issues its findings to the permitting agency and if necessary, testifies at the public hearing.

   In the event that water quality standards cannot be certified, the Water Quality Regulations for Water Pollution Control provide for the following remedies, each requiring public hearing:

   a) The decision may be appealed by the applicant.

ORDER OF APPROVAL TO CONSTRUCT, INSTALL, OR MODIFY ANY SYSTEM OR MEANS OF WASTEWATER TREATMENT

Legislative Authority
Rhode Island General Laws, Chapters 46-12, 42-17.1, and 42-35.

Lead Agency
DEM Division of Water Resources.

Purpose
To preserve and enhance the quality of the State's waters and to protect waters from discharge of sewage, hazardous and other waste. The order of approval for wastewater treatment systems is required to ensure that the resulting discharges will meet restrictions established in the RIPDES permit in order to attain water quality standards.

Who Must Apply
Anyone proposing to construct, install, add to, or modify any system or means of wastewater treatment, including the extension of lateral sewers to an existing sewer system. The order of approval is generally required for major industrial and publicly owned treatment works. Issuance of the order of approval does not relieve the discharger of the responsibility to obtain a RIPDES permit and State certification that the discharge will not violate water quality standards.

Approval Procedure
1. Application for order of approval is made to DEM. If the proposed activity will require a new or revised discharge permit, applications should be made concurrently.

2. DEM evaluates the proposed system and makes a decision to approve or deny the application. DEM may approve the system design with modifications. Findings are also made regarding water quality and/or certification.

3. Denials may be appealed to public hearing. The applicant shall have the burden of showing that the proposed project can be constructed and operated without violating water quality criterion of receiving or downstream waters.

Estimated Time for Approval
Depending on the complexity of the project, a minimum of one month is required for order of approval, but longer for major municipal facilities.

APPROVAL OF WASTEWATER PRETREATMENT SYSTEM

Legislative Authority
Rhode Island General Laws, Chapter 44-11-11.1.

Lead Agency
DEM Division of Water Resources.

Purpose
To provide a mechanism whereby owners of pretreatment systems installed pursuant to municipal sewer use ordinances can obtain DEM approval for providing minimum standards for wastewater entering the municipal sewer system. The approval of such pretreatment systems by the Director of the DEM allows the owner to qualify for State tax advantages provided for installation of water pollution control facilities and materials.

Who Must Apply
This is a non-mandatory certificate of approval provided to owners implementing pretreatment systems installed pursuant to municipal sewer use ordinances, which function to remove contaminants and pollutants from, or alter the chemical properties of wastewater, such that they may comply with sewer use ordinance restrictions.

Information Required
Any person seeking "Approval for State Tax Advantages" for their pretreatment system shall submit the following requirements to the Division of Water Resources:

1. A brief, complete description of the pretreatment system for which approval is sought. This description must include a narrative of its operation, process and instrumentation diagram, and any other schematics, shop drawings and material specifications necessary to enable the Division to determine the nature of the pretreatment system and its methods of operation. All drawings must be stamped and signed by a Registered Professional Engineer.

2. A description of the manner in which the pretreatment system operates including the levels and types of containment removals for which it was designed.

3. A list of supplies acquired for incorporation into; or used and consumed in the operation of a pretreatment facility only, and verified by the design specifications for the facility.

4. An analysis of both the wastewater influent to the pretreatment system, and wastewater effluent from the pretreatment system.

5. Identification of the sewer use ordinance effluent restriction pursuant to which the pretreatment system was installed.

6. A copy of the permit with local limits from the municipality or other entity whose sewage treatment works receives the effluent from the applicant's pretreatment system.

7. A certificate of approval and operability from the municipality or other entity whose sewage treatment works receives the effluent from the applicant's pretreatment system.

Approval Procedure
Approval shall be issued by the Director provided all required information has been submitted in an acceptable form and a site inspection has been conducted by DEM to confirm the installation and operation of the pretreatment system.

Legislative Authority
Rhode Island General Laws, Section 23-19.1; Resource, Conservation, and Recovery Act (RCRA), and the 1984 Hazardous and Solid Waste Amendments (HSWA).

Lead Agency
Division of Air and Hazardous Materials issues all State and Federal permits, and reports perodically to EPA on programs including notification of enforcement/compliance actions taken. DEM Division of Groundwater and Freshwater Wetlands may comment concerning groundwater resources and freshwater wetlands.

Purpose
To protect the environment, public health, and safety from the effects of improper, inadequate, or unsound management of hazardous waste; through regulations over storage, transportation, treatment, and disposal. Recovery and recycling of such waste is also encouraged.

Who Must Apply
Any person who generates hazardous waste must comply with the Rules and Regulations for Generators of Hazardous Waste. Anyone who handles hazardous waste must complete a manifest provided by the Division, as required by the Manifesting Rules and Regulations.

A hazardous waste is defined as a waste or combination of wastes of a solid, liquid, contained gaseous, or semisolid form which because of its quantity, concentration, or physical, chemical or infectious characteristics may cause or significantly contribute to an increase in mortality or serious irreversible, or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment. It should be noted that Rhode Island has defined hazardous waste to be regulated in its Rules and Regulations for Hazardous Waste Generation, Transportation, Treatment, Storage and Disposal that are in addition to those defined under federal criteria.

Approval Procedure and Information Required

A. Transporter Permits
Transporters of hazardous waste must obtain a permit before waste is transported. An application is filed with the Division which includes: A description of emergency procedures, a description of training, a certificate of liability insurance, and the application fee of $25.00 per vehicle. Vehicles to be permitted must be inspected by Division personnel. Some of the specific requirements the inspector looks for are: registration, emergency equipment, condition of vehicle, name and permit number on vehicles. Permits for hazardous waste transporters shall be issued for a period not to exceed one year.

B. Permits for Treatment, Storage, and Disposal Facilities
1. The applicant must submit an application ($100.00 fee) with all the information required by the appropriate regulations. This includes: site plans, abutters within 500 feet of the facility's perimeter, waste descriptions, groundwater monitoring plans, 100 year floodplain design, waste analysis plan, security procedures, inspection schedule, contingency plans, training program, closure plan, container and tank storage systems, financial assurance for closure costs, and liability insurance. Hazardous waste management facility permits are reviewed at least every five years and inspections are conducted as warranted.

2. The application is reviewed by the Division. Additional information, or corrections to the information submitted may be required to make the application comply with the appropriate regulations.

3. A public hearing on the application is held. A hearing officer must decide whether to issue or deny the permit after hearing from the applicant, the Division, and members of the public.

Estimated Time For Approval

Review and approval of permits to transport hazardous waste takes approximately two weeks. Permit approval for treatment, storage, and disposal facilities will take a minimum of six months to process.

Legislative Authority
Rhode Island General Laws, Section 23-19.1; Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA); Superfund Amendments Reauthorization Act of 1986 (SARA).

Lead Agency
DEM Division of Air and Hazardous Material and the U.S. Environmental Protection Agency coordinate review activities and determine responsibilities. DEM Division of Groundwater and Freshwater Wetlands may also provide technical assistance in assessing the site conditions.

Purpose
CERCLA established funding to address clean-up of hazardous waste releases occurring on land where public health, welfare, or the environment is threatened. Superfund money addresses the clean-up of the worst abandoned or inactive waste sites which are determined through the preliminary site assessment and review by the State, and ultimately ranking on the National Priorties List (NPL).* RCRA addresses compliance at existing facilities (see Hazardous Waste Permits).

Review Process
After site discovery, EPA or the State conducts a Preliminary Assessment to evaluate if emergency clean-up actions are needed, or whether additional investigation is required to evaluate the site. If no further action is warranted, the site remains on the Superfund inventory for future reference and the State may initiate its own clean-up actions. If the Preliminary Assessment shows further study is necessary, the next step is a site inspection. Based upon the information gathered during the site inspection, a hazard ranking is conducted. If the site scores above the proposed cutoff, it is placed on the NPL. Under CERCLA, EPA and the State share responsibility to provide clean-up costs (State pays a minimum contribution of 10 percent) where there are no responsible parties, or an agreement cannot be reached with a potentially responsible party. The federal government will later sue the responsible party to recover clean-up costs.

For sites listed on the NPL, further study determines the nature and extent of contamination in the remedial investigation stage. After the public has had an opportunity to comment on the analysis, the most effective long-term clean-up remedy is determined. Citizens living near Superfund sites may apply for technical assistance grants to assist in their interpretation of the technical information and understanding of the site and proposed activities.

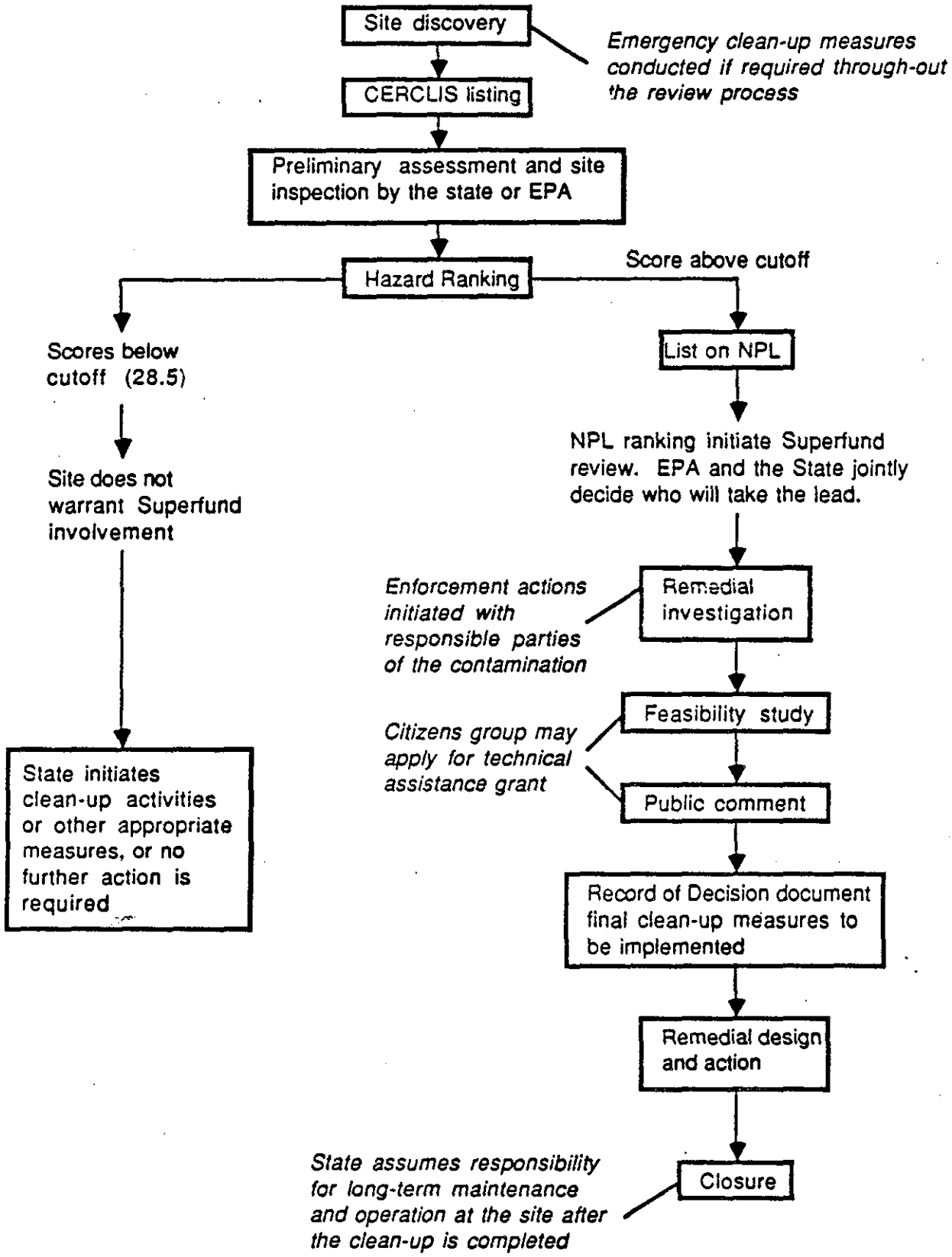
Remedial actions implemented must use permanent solutions to address the contamination which may include such measures as incinerating contaminated soil, depositing contaminated materials in an approved landfill, or pumping and treating contaminated groundwater to clean up an aquifer. To promote the development of new technologies for treating hazardous waste, SARA also established the Superfund Innovative Technologies Program whereby EPA solicits

* National Priorities List - Sites warranting Superfund money are placed on the NPL after having been rated by the Hazard Ranking System, receiving a score of at least 28.5. Sites are evaluated according to the type, quantity, toxicity of waste, proximity to and number of people potentially exposed by various exposure pathways; and the extent, importance, and susceptibility of underlying groundwater supplies to contamination.

proposals from developers of technologies that destroy, immobilize, or reduce the volume of hazardous waste. Upon completion of the Superfund action, the State assumes responsibility for the maintenance and operation of the site to ensure the effectiveness of the clean-up remedy.

In addition, the State will implement enforcement actions whenever hazardous waste sites are discovered. Discovery of sites occurs on a regular basis through a variety of mechanisms. This may include emergency response to chemical spills, investigation of complaints lodged with the Division of Air and Hazardous Materials, and routine review for industrial compliance of facilities regulated under Rhode Island General Laws 23-19.1 for the generation, transportation, treatment, and storage of hazardous waste. The State will attempt to identify responsible parties and recover clean-up costs.

SUPERFUND PROCESS



Legislative Authority
Safe Drinking Water Act (SDWA) of 1974, amended 1986.

Lead Agency
DEM Division of Groundwater and Freshwater Wetlands. A Rhode Island Wellhead Protection Program was approved in February 1990 by EPA.

Purpose
Major legislative authority for protecting drinking water sources was initiated with the SDWA of 1974. Amendments to the act in 1986 provided further protection by requiring the establishment of additional drinking water standards, as well as protection of underground sources of drinking water from the underground disposal of fluids. Also included in the the SDWA are two major groundwater protection programs; the wellhead protection program to protect areas around public drinking water wells, and the sole source aquifer (SSA) demonstration program to protect unique underground water supplies.

Specifically, this portion of the program will deal with issues concerning the protection of groundwater supplies in efforts to minimize contamination of water resources utilized or with the potential use for human consumption. The designated wellhead protection area will include the surface and subsurface areas surrounding a water well or wellfield suitable for public water supply, that may be susceptible to contamination. A standardized classification system will be utilized to develop a coordinated and comprehensive approach to groundwater protection. State and local governments may develop more stringent criteria than the Federal government, delineate high priority areas, and control sources of contamination that are not Federally regulated.

Approval Procedure and Information Required
The State's Wellhead Protection Program submitted to EPA establishes the guidance criteria to be utilized in conjunction with various cities and towns to protect water supply areas. The protection of groundwater may be accomplished through the use of zoning restrictions, or by more stringent requirements needed on other permits (ie: underground storage tanks, injection wells, ISDS, RIPDES, etc.) where activities are proposed in wellhead protection areas, including prohibition of certain activities. Major water supplies will be required to submit contingency plans addressing responses to be taken in the event of well or wellfield contamination.

ORDER OF APPROVAL TO OPERATE, CONSTRUCT, ALTER, OR REPAIR INJECTION WELLS AND SUBSURFACE DISPOSAL SYSTEMS FOR NON-DOMESTIC WASTE

Legislative Authority
Rhode Island General Laws, Chapters 42-17.1 and 46-12.

Lead Agency
Division of Groundwater and Freshwater Wetlands issues the Order of Approval and reports periodically to EPA.

Purpose
To preserve the quality of the groundwaters of the State by assuring the proper location, design, construction, maintenance, and operation of injection wells and other subsurface waste disposal systems.

Who Must Apply
Any person proposing or causing to be installed, constructed, altered, or repaired, any subsurface disposal system used to dispose of non-hazardous waste of a non-domestic nature. The rules apply to Class V injection wells, subsurface disposal systems of a non-domestic nature, and multiple dwelling, community, or regional systems for the injection of domestic wastes. These rules do not apply to injection wells or subsurface disposal systems used to dispose of individual or single family residential domestic waste except under specified conditions. Lagoons also fall within the jurisdiction of the UIC regulations.

Information Required
General information required on permit applications include the name and address of the facility and owner/operator, type of ownership, nature of the business, site location, well locations (discharge wells/disposal areas and drinking water wells), type of well and discharge constituents, and type of approval desired. Additional information requirements will vary depending on the injection well type, existing status, effluent characteristics and Rhode Island groundwater classification. Attachments may include design calculations, wastewater sample analysis, cross-section, well construction details, and geologic and hydrologic conditions. Other operating data, injection procedures, testing and monitoring programs, contingency plans, and construction procedures or plugging and abandonment plans, may be required attachments to the application.

A preapplication meeting to inspect the site may be required in some cases to assess the specific information to be incorporated into the submission to the Department.

Approval Procedure
An order of approval shall be obtained by providing DEM with plans, specifications, sample analysis for priority pollutants, and other information required to establish affirmative evidence that the facility will be in compliance with applicable rules and regulations.

Note: The State prohibits Class I - IV wells, as described by EPA; only Class V wells are allowed. EPA is in the process of considering additional controls for Class V wells to prevent contamination of underground sources of drinking water.

b) The applicant may request a modification of water quality standards, allowing for downgrading of specified low quality waters to the water quality standard actually being attained. Refer to the Water Quality Regulations for further detail.

c) An application for variance from the standards and limitations established in the Water Quality Regulations for Water Pollution Control may be requested, excluding waters that have a use classification of, or meet water quality criteria for Class A or SA water; and where it can be demonstrated that overall water quality goals and objectives can be maintained.*

Estimated Time for Approval

Approximately one month for water quality certification not requiring public hearing; and up to six months or longer for complex proposals, and projects involving high quality waters.

* In all applicable cases, the applicant must comply with Section 17 of the Rhode Island Water Quality Regulations for Water Pollution Control, concerning antidegradation and upgrading of water quality standards.

APPENDIX B

WATER QUALITY EVALUATION

SECTION 22 STUDY
CITY OF CRANSTON, RHODE ISLAND
WATER QUALITY EVALUATION

JUNE 1991

HYDRAULICS AND WATER QUALITY BRANCH
WATER CONTROL DIVISION
ENGINEERING DIRECTORATE

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

SECTION 22 STUDY
CITY OF CRANSTON, RHODE ISLAND
WATER QUALITY EVALUATION

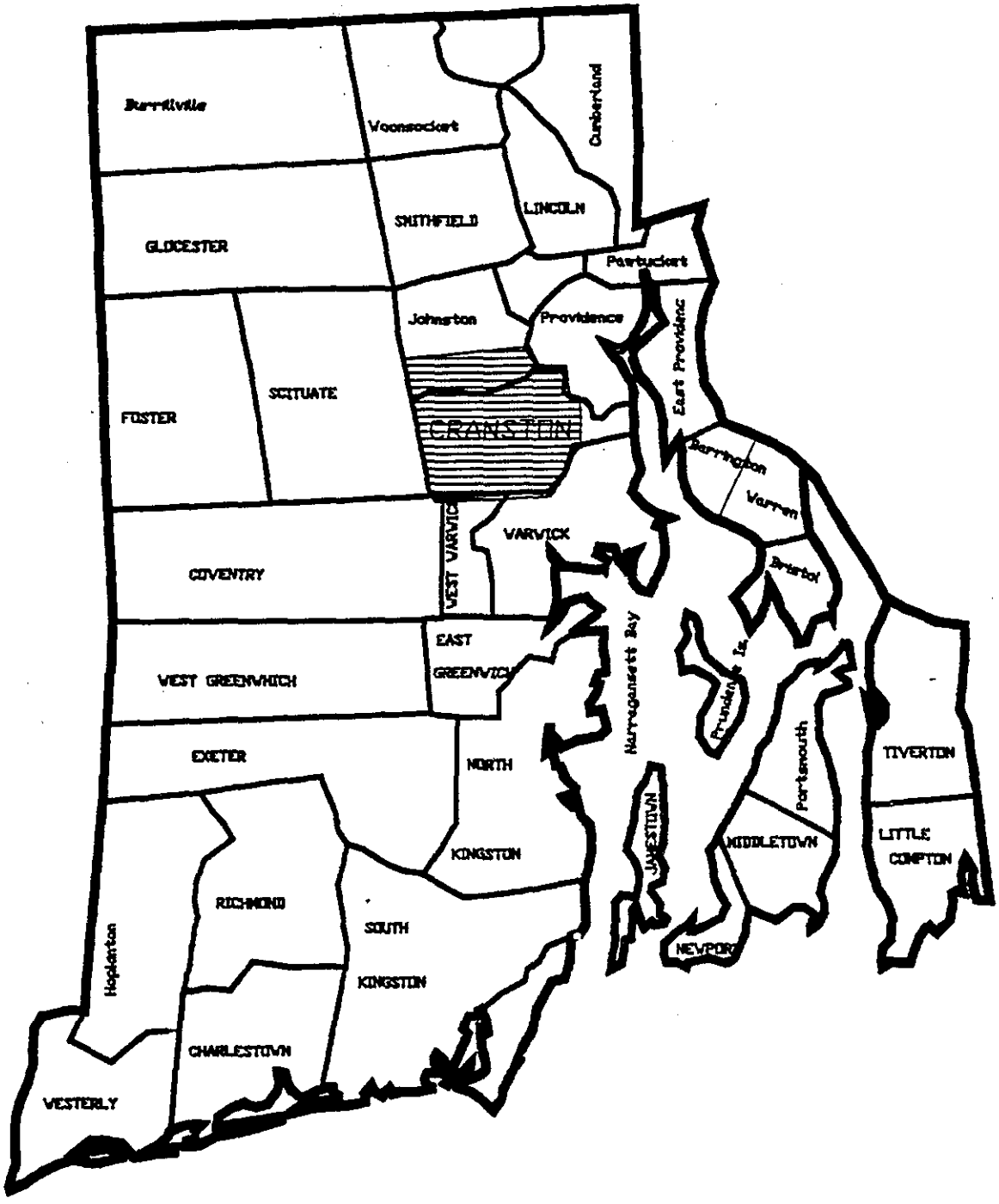
1. INTRODUCTION

a. Background. In 1990, the City of Cranston, through its Congressional delegation approached the Assistant Secretary of the Army for Civil Works requesting the Corps of Engineers conduct a reconnaissance study to address several environmental problems by connecting multiple sources of pollution with the Cranston RI sewer system. He made available a reconnaissance level study through the Section 22, "Planning Assistance to the States" program (PL 93-251, as amended). The State of Rhode Island Department of Administration requested by letter date 6 August 1990, that the New England Division undertake the Section 22 study.

b. Study Area. Cranston is a medium-sized city immediately south of Providence, Rhode Island on the western side of Narragansett Bay. It borders Warwick on the south, Scituate on the west, and Johnston on the northwest. The study area includes land in the communities of Cranston and Johnston. Figure 1 shows the study area.

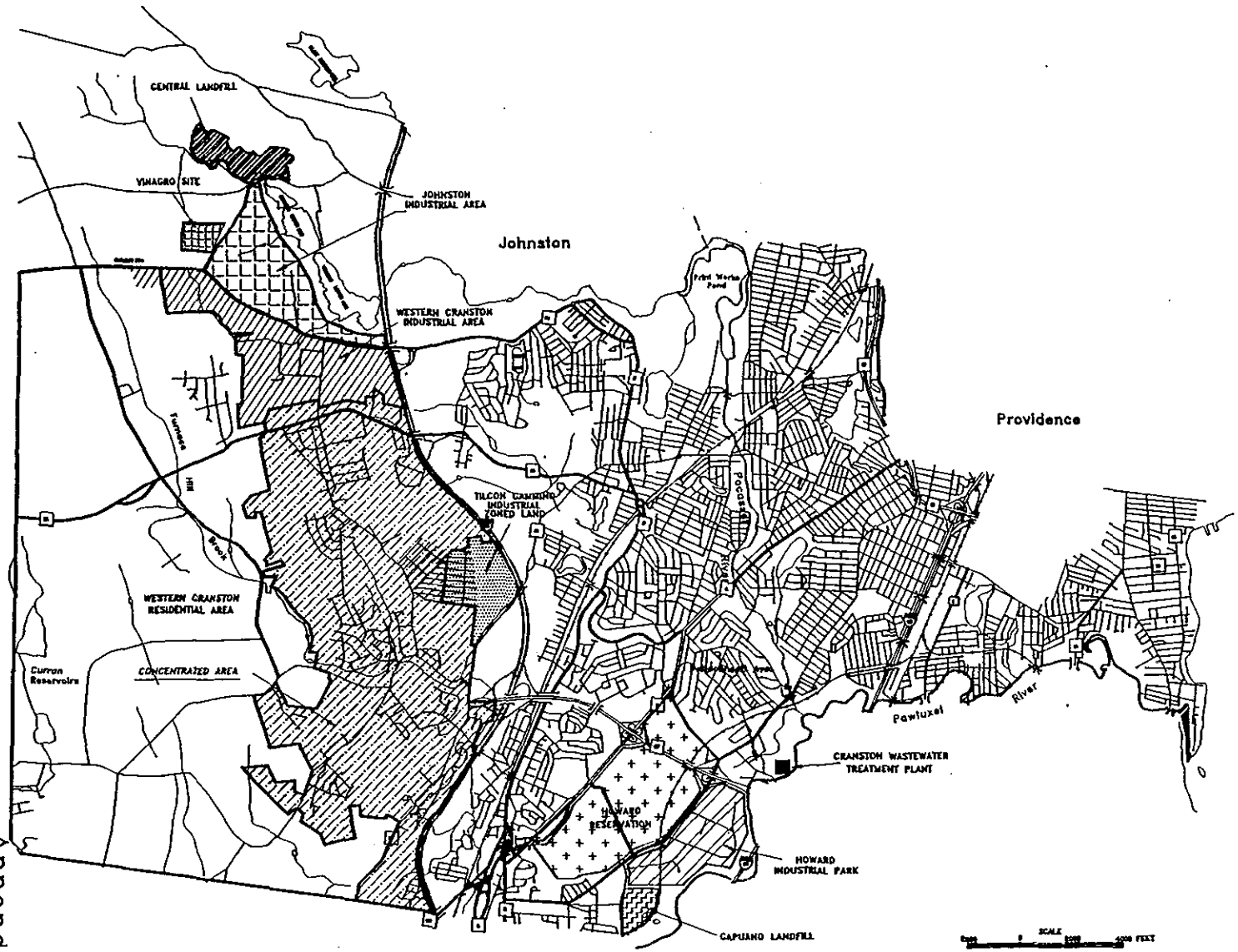
c. Pawtuxet River. The entire study area is within the Pawtuxet River watershed. This river forms at the confluence of the North Branch, which originates in outflow from Scituate Reservoir, and the South Branch, which begins at the Flat River Reservoir outlet. The two branches join in West Warwick, and the main stem flows east along the border of Cranston and Warwick to Pawtuxet Cove adjacent to the Providence River in the northern end of Narragansett Bay. The Pawtuxet River has a total drainage area of 230 square miles, and the North and South Branches have respective drainage areas of 106 and 73 square miles.

d. Wastewater Problems. The "Environmental Threats" described by Cranston in their discussions with the Corps are from landfills, unsewered residential areas, and future industrial sites (see figure 2). Central Landfill along with the smaller Vinagro and Capuano sites are suspected of causing ground and surface water pollution. Leachate and runoff control and collection systems are being developed, but here is a need for a means to get leachate and wastewater from landfill operations to the Cranston Wastewater Treatment Plant (WWTP) without overloading existing sewer systems. Cranston has also expressed concerns that leachate from Central Landfill, if not collected and transported to the WWTP could pollute Scituate Reservoir, main water supply for Providence and over sixty percent of Rhode Island's



Section 22, Cranston , Rhode Island
Wastewater Investigation
Study Area

Appendix B
Figure 1



Legend

Section 22 Investigation
Cranston, Rhode Island

STUDY SITES

U.S. Army Corps of Engineers
New England Division

June

Appendix B
Figure 2

population. A number of residential areas in western Cranston are unsewered and depend on individual septic tanks and leaching fields for disposal of wastewater. However, soils in these areas have poor drainage and many individual systems are failing and polluting local streams. Finally, there are a number of areas suitable for commercial or industrial development but with no sewers or inadequate systems to handle increased flows. As much of the Cranston sewer system is in heavily-developed areas, it would be extremely disruptive and expensive to dig up streets and replace existing pipes with larger ones. Consequently, Cranston believes that the best solution to these problems is to build a new sewer interceptor to collect these various flows and convey them to the Cranston WWTP.

e. Hydraulics and Water Quality Branch Involvement. Long Range Planning Branch requested assistance from Hydraulics and Water Quality Branch to (1) describe existing surface water and groundwater quality, and (2) perform a hydraulic analyses of existing and proposed sewer systems. This report covers water quality evaluations. Hydraulic analyses are included in a separate report.

2. WATER QUALITY GENERAL

a. General. No data were collected by the Corps for this study; however, based on available data and past reports it is clear that the Pawtuxet River is possibly the most polluted in Rhode Island. The entire length of the main stem and most of the North and South Branches are designated class C. Such waters are neither fishable nor swimmable but are suitable for boating, fish habitat, and some other uses. The main stem of the Pawtuxet River does not consistently meet class C water quality standards. Dissolved oxygen is the primary concern. Effects of toxic substances including ammonia and heavy metals are secondary and unresolved concerns. Heavy metals and ammonia have been measured at or estimated to occur at levels that exceed U.S. Environmental Protection Agency (EPA) criteria to protect aquatic life. However, no studies have ever confirmed that harm is actually occurring. Additionally, some of the metals such as copper, lead and silver occur extensively throughout the watershed in ground and surface water at levels exceeding EPA chronic criteria. This indicates that chronic criteria values for these metals in the Pawtuxet River need to be reevaluated. Fecal coliform bacteria are elevated in the Pawtuxet River, as well as other parts of the watershed, but are not high enough to violate standards or limit uses of the water. Elevated levels of color, sodium, chloride, phosphorus, and nitrate have been observed, but not in concentrations which would limit uses of the water.

b. Pollution Sources. Water quality in the Pawtuxet River basin is primarily degraded by urban drainages and

three wastewater treatment plants (WWTP): Cranston, Warwick, and West Warwick. The Cranston WWTP is the principal concern because of the size of its discharge. All three WWTPs have secondary treatment and are scheduled to be upgraded to tertiary treatment. Wasteload allocation studies have shown that advanced treatment is required to meet minimum class C goals for the Pawtuxet River. There are also two industrial point source discharges - Hoechst Celanese Corporation and Original Bradford Soap Works, both located on the North Branch. However, the effects of their flows are comparatively minor.

c. Tributaries. Tributaries to the Pawtuxet River are generally designated class B or better. An exception is the Pocasset River which is rated class C from Print Works Pond to the Pawtuxet River.

d. Groundwater. Groundwater throughout the watershed is generally clean or has trace levels of organic contaminants. An exception to this is groundwater taken from immediately within or downstream from the Central Landfill; these samples have higher concentrations of organic contaminants and metals. Such organic contaminants as are found in groundwater in the watershed are typically substances such as tricholorethylene, which is used as a degreasing compound in septic tanks, and methyl tertiary butyl ether, an anti-knock compound in gasoline. Consequently, many, if not most, of the contaminants found in wells originate in sources other than landfill leachate.

3. SURFACE WATER QUALITY

a. Water Quality Classification. Water quality classifications of Rhode Island waters are set by the Department of Environmental Management (RIDEM), Division of Water Resources. Such classifications and their accompanying standards serve the dual purposes of establishing water quality goals for specific water bodies and providing the basis for required levels of treatment for discharges.

(1) North Branch, Pawtuxet River. Scituate Reservoir and the North Branch of the Pawtuxet River to one-half mile downstream from the reservoir and all tributaries up to that point are rated class A by RIDEM. From one-half mile below the Scituate Reservoir to Fiskeville Dam, the North Branch of the Pawtuxet River is designated class B. From Fiskeville Dam to the confluence with the South Branch, the North Branch is rated class C.

(2) South Branch, Pawtuxet River. Big River and its tributaries to Harkney Hill Road and Flat River Reservoir are rated class A. Flat River Reservoir and its tributaries, and the South Branch of the Pawtuxet River to South Main Street Highway Bridge are rated class B. From South Main

Street to the confluence with the North Branch, the South Branch of the Pawtuxet River is designated class C.

(3) Main Stem, Pawtuxet River. The entire length of the main stem of the Pawtuxet River is designated class C and a warm water fishery. However, its present water quality condition is less than class C.

(4) Tributaries. Most tributaries to the main stem of the Pawtuxet River are rated class B including Simmons Upper and Lower Reservoirs and Simmons Brook to Print Works Pond. Exceptions include the Pocasset River from the discharge of Print Works Pond to the Pawtuxet River, Mashapaug Pond, and all ponds in Roger Williams Park and Mashapaug Brook which are designated class C.

b. Water Quality Conditions. Those parts of the Pawtuxet River watershed that are rated class A or B generally meet the standards assigned to their classification. However, these waters are threatened by the effects of continued development in their watersheds. An exception is Spectacle Pond which is designated class B but whose present condition is class C.

(1) North Branch, Pawtuxet River. In the four mile class C section of the North Branch from Fiskeville Dam to the confluence with the South Branch, designated uses are not supported due to levels of heavy metals including copper and cadmium, and organic contaminants including napthalene and fluoranthene. Additionally, levels of total and fecal coliform bacteria are elevated, though not high enough to interfere with designated uses of class C waters. There are no significant point sources discharges on this section of the river, and water quality problems are due to urban runoff and effects of river sediments.

(2) South Branch, Pawtuxet River. Based upon criteria established to support water quality uses, the South Branch from South Main Street Bridge to the confluence with the North Branch does not support designated uses. Elevated levels of heavy metals and organics from point and nonpoint sources are causes of this water quality degradation. Data indicate exceedances of criteria for lead, napthalene, fluoranthene, copper, cadmium, and silver. Additionally, elevated levels of chloride, color, total and fecal coliforms and total phosphorus have been recorded, but are not impairing class C uses. American Hoechst, a manufacturer of pharmaceuticals, is the only significant point source discharge to this reach.

(3) Main Stem, Pawtuxet River. The main stem of Pawtuxet River is, and historically has been, one of the most polluted rivers in Rhode Island. Sources of pollution include industrial and municipal discharges, urban storm

water runoff, and, to a lesser degree, agricultural runoff and effects from failed or overloaded septic systems.

Water quality in the entire length of the main stem of the Pawtuxet River is considered by RIDEM to be not in support of designated uses. Heavy metals including cadmium, copper, lead, mercury, and silver, petroleum hydrocarbons, ammonia, and low dissolved oxygen are causes of noncompliance. Additionally, elevated levels of color, sodium, chloride, phosphorus, nitrate and coliform bacteria have been observed, but not in concentrations exceeding class C criteria. Sources of pollutants in the main stem include Warwick, West Warwick and Cranston WWTPs; agricultural runoff, urban and highway runoff, and river sediments. Of the various water quality problems afflicting this stretch of river, low dissolved oxygen and elevated ammonia levels seem to be of most concern because of their effects on fish habitat. Some of the metals, especially lead and silver, are found so extensively throughout the watershed in groundwater as well as surface water at levels that exceed criteria that they appear to be geological background levels.

(4) Tributaries - Pocasset River. The Pocasset River and its tributaries upstream from Print Works Pond are designated class B. From Print Works Pond to the Pawtuxet River it is rated class C. Upper and Lower Simmons Reservoirs, which receive leachate and runoff from the Central and Vinagro Landfills, and Simmons Brook from Lower Simmons Reservoir to Print Works Pond are designated class B. Although conditions in these waters are not considered to meet class B criteria, fishable/swimmable conditions are considered attainable according to RIDEM in their 1990 report to Congress. Sampling by Goldberg-Zoino & Associates in August 1989 showed extremely high levels of fecal coliform bacteria in Cedar Pond Brook, after it passed the landfill, and even higher levels at the entrance to Upper Simmons Reservoir. This may explain the Solid Waste Management Corporation's (operators of the Central Landfill) actions in buying and closing all homes on Simmons Reservoir. At Print Works Pond class B conditions are not supported and fishable/swimmable conditions are not considered attainable by RIDEM. There are no significant point source discharges to Print Works Pond. The principal problems at Print Works Pond are due to urban runoff and contaminated sediments. Contaminants from landfills, carried in by Simmons Brook, apparently have only minor effects on Print Works Pond.

(5) Tributaries - Meshanticut Brook. Meshanticut Brook, and by implication its tributaries, are rated class B, but there is little other information on the condition of Furnace Hill Brook. A groundwater map for the area shows Furnace Hill Brook watershed as being entirely glacial till, where it isn't exposed bedrock. Glacial till has very low permeability making it of poor quality for wells or septic

tanks. Consequently, if the area relies excessively on septic tanks it could cause pollution of surface waters including Furnace Hill Brook.

4. GROUNDWATER QUALITY

a. General. Groundwater throughout the watershed is generally clean or has trace levels of organic contaminants. An exception to this is groundwater taken from immediately within or downstream from the Central Landfill, these samples have higher concentrations of organic contaminants and metals. Highest levels of contamination were found in shallow wells directly within the landfill. Such organic contaminants as are found in groundwater in the watershed are typically substances such as tricholorethylene (TCE) which was at one time extensively used as a degreasing compound in septic tanks, and methyl tertiary butyl ether which is an anti-knock compound in gasoline. Consequently, many, if not most, of the contaminants found in wells originated in sources other than landfill leachate.

b. Private Wells. About 30 percent of the private wells analyzed found volatile organic compounds (VOCs), but these were rarely at levels above trace amounts. Some wells upgradient from Central Landfill were contaminated with VOCs. Therefore, the landfill could not be the only source of groundwater contamination. Other likely sources include gasoline spills and degreasing agents used in septic tanks and by dry-cleaners.

5. SCITUATE RESERVOIR CONTAMINATION

a. Background. The City of Cranston has indicated to the Corps that they are concerned that leachate from Central Landfill might be moving towards aquifers associated with Scituate Reservoir. Because this is the public water supply source for over sixty percent of the State's population, the City proposed that even a remote possibility of contamination should be taken extremely seriously.

b. Corps Investigations. To determine if existing data indicate Central Landfill leachate is a threat to Scituate Reservoir, the Corps met with the Rhode Island Solid Waste Management Corporation (SWMC), Providence Water Supply Board, and Rhode Island Department of Health Private Well Surveillance Program, and Rhode Island Department of Environmental Management Groundwater Section; and talked with and received a letter from the USGS. Based on available data, there is no reason to suspect that leachate from the Central Landfill poses a threat to Scituate Reservoir. Both surface water and shallow groundwater divides separate the landfill from the reservoir, and studies indicate that water in bedrock fractures also flows away from the reservoir.

c. Surface Water Divide. The approximate eastern surface water divide for Scituate Reservoir runs from Sickkibunkiaut Hill, to Bishops Heights, to Pine Hill, to the bluffs overlooking Duck Pond from the East, to Peck Hill, along Hill Road and Pippin Orchard Road, up to Horn Hill, and on to Bald Hill (see figure 3). From Pine Hill to Pippin Hill Road, this is also the western watershed divide for the Central Landfill. The northern watershed boundary for the landfill runs from Round Rocks to Pine Hill, and the southern boundary runs from Simmons Upper Reservoir to Pippin Hill Road.

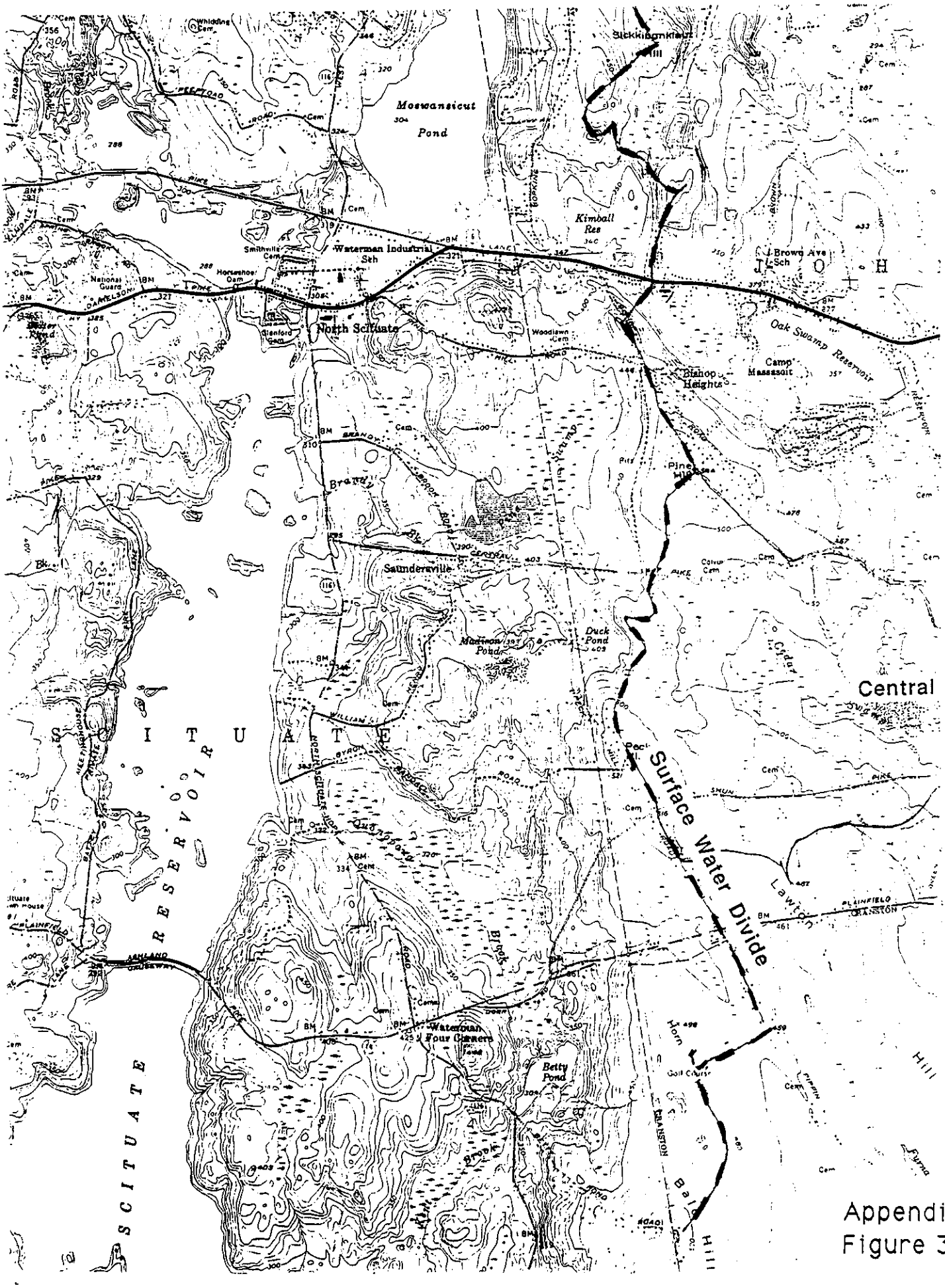
d. Groundwater Divide. The eastern shallow groundwater divide for Scituate Reservoir follows the surface water divide fairly closely. This is not unexpected because it is extremely rare for a groundwater divide to vary significantly from a surface water divide. For example, in designating watershed limits for the protection of sole-source aquifers, the EPA has always used surface water divides.

e. Groundwater Data. Goldberg-Zoino & Associates Inc. (GZA), under contract to SWMC, has collected shallow groundwater data at the landfill (GZA 1986, 1989, 1990). Although the wells they monitor do not extend to the western groundwater divide, they have collected enough data to show that groundwater on the west of the landfill is moving east and away from Scituate Reservoir. For example, a groundwater contour plan for the landfill prepared by GZA (December 1989) depicting groundwater flow in the overburden and shallow rock beneath the landfill shows groundwater flow to be towards Upper Simmons Reservoir except for a northern portion of the landfill where groundwater is moving towards Almy Reservoir.

f. Geophysical Data. Geophysical data confirm the presence of a zone of fractured bedrock extending 350 to 450 feet beneath the Central Landfill. This raises the possibility that leachate could travel along a bedrock fracture to Scituate Reservoir. The longest fracture, lineament No. 1, extends from Almy Reservoir to Scituate Reservoir. An investigation of this fracture found that local topography and groundwater elevations created a groundwater divide separating landfill and reservoir.

g. Deep Bedrock Fractures. The final possibility for leachate to travel from the landfill to Scituate Reservoir is by an uncharted deep bedrock fracture. This fracture would have to be open beneath the landfill and Scituate Reservoir, but sealed to the higher groundwater in between, in effect acting as an underground pipe. If this connection did not act as a pipe but was open to groundwater between the landfill and the reservoir, the intermediate high groundwater would act as a barrier to flow. Furthermore, this deep bedrock fracture would have to be sealed at its ends, for if it extended beyond either Scituate Reservoir or the Central

Scituate Reservoir and Surface Water Divide



Appendix B
Figure 3

Landfill to areas of lower groundwater it could act as a drain on the reservoir rather than a conduit into it. Finally, the connection would have to carry enough flow to bring sufficient quantities of leachate to Scituate to overcome its enormous dilution capacity. For example, pesticides, PCBs, heavy metals, and VOCs are introduced to Scituate Reservoir (and all other reservoirs) through atmospheric precipitation. Unless the connection to the Central Landfill were large enough to carry adequate leachate to significantly increase existing contaminant concentrations in the reservoir, it would not be detectable. The probability that such a connection exists is too small to warrant further consideration.

h. Conclusions. In summary, although no data was collected by the Corps, all available data indicate that landfill leachate is moving away from Scituate Reservoir. The possibility that a deep bedrock connection has the potential to pollute Scituate Reservoir with Central Landfill leachate is too slight to warrant further consideration.

6. LANDFILLS

a. Introduction. There are 3 landfills in the study area that are of particular concern. These are the Central, Vinagro, and Capuano landfills. Concerns about these landfills include that they are and will continue to cause significant pollution unless leachate and contaminated groundwater are collected and treated. Unlike the future residential and industrial expansion which may not occur, the landfills are unquestionably there. The proposed sewer interceptor is envisioned by the City of Cranston as the best way to convey contaminated water from the landfills to the Cranston WWTP. Because of the concerns about these landfills, their effects on surface and groundwater quality are described in detail in the following paragraphs.

b. Central Landfill.

(1) Introduction. The Central Landfill, also known as the Johnston Landfill, is located in Johnston, Rhode Island, 1 mile north of the Cranston border, and across the Shun Pike from Simmons Upper Reservoir. Operated by the Solid Waste Management Corporation, the Central Landfill receives 80 percent of the state's solid waste.

(2) Water Quality Classification. Cedar Swamp Brook flows through the Central Landfill Site into Upper and Lower Simmons Reservoirs, Simmons Brook, Print Works Pond, the Pocasset River, and finally the main stem of the Pawtuxet River. From Cedar Swamp Brook to the discharge from Print Works Pond these waters are designated class B by the Rhode Island Department of Environmental Management. From Print

Works Pond to the Pawtuxet River, these waters are designated class C.

(3) Surface Water Quality. Limited data are available on water quality in Cedar Swamp Brook upstream from the Central Landfill; however, the relatively undeveloped nature of the watershed indicates class B fishable and swimmable conditions are probably met. Sampling data for Cedar Swamp Brook below the landfill shows small increases in metals levels including aluminum, zinc, nickel, and lead; large increases in turbidity and suspended solids, and an enormous increase in fecal coliform bacteria. Cedar Swamp Brook does not meet class B water quality conditions after receiving runoff and groundwater leachate from the Central Landfill. However, class B conditions are considered possible after the landfill is capped and runoff and leachate from the landfill are controlled. When the landfill is properly capped, it is expected that conditions in Cedar Swamp Brook will meet class B conditions except possibly during rainstorms when elevated levels of turbidity and suspended solids may occur in runoff from the Central Landfill Site.

(4) Groundwater Quality. Groundwater monitoring data indicate Central Landfill has an adverse impact on water quality in the vicinity of the landfill. However, the full vertical and lateral extent of contamination has not yet been defined. The most severe contamination has been observed in relatively shallow wells located within the landfill proper. Deeper wells have not yet been installed in areas exhibiting highest levels of contamination.

Groundwater taken from immediately within or downstream from Central Landfill has higher concentrations of a variety of contaminants including chloride, nitrate, sulfate, dissolved metals, and volatile and semivolatile organic compounds. However, only VOCs regularly show up in significantly elevated concentrations. Metals levels in monitoring wells during a February 1986 sampling, for example, were found only in concentrations below drinking water criteria (GZA October 1986).

Upgradient wells have shown VOC levels generally below 10 ppb although up to 100 ppb (mostly TCE) have been observed. In wells within and immediately downgradient of the landfill, VOC concentrations from more than 100 to more than 1,000 ppb have been observed. These have been primarily chlorobenzenes, toluene, and total xylenes. Highest concentration of VOCs was in two wells downgradient of the former hazardous waste disposal area. During a May 1986 sampling, 94,000 ppb of chlorobenzene were measured in one of these wells (GZA October 1986). By comparison, drinking water criteria for chlorobenzenes are 5 to 600 ppb depending on the specific compound.

b. Vinagro Landfill.

(1) Introduction. The Vinagro Landfill is located in Johnston on Green Hill Avenue between the Plainfield Pike and Central Landfill. Past activities at this site have included farming of over 3,000 pigs at a time, disposal and burning of construction debris and other solid waste. Currently the site is used for stockpiling of construction and demolition debris and awaiting a permit to operate a recycling center. There also remains a stockpile of pig waste which is planned to be disposed of by onsite composting.

The Vinagro site has been cited by RIDEM for pollution of Cedar Swamp Brook through uncontrolled surface runoff. In addition, the Vinagro site is currently on EPA's Comprehensive Environmental Compensation and Liability Act list as a potentially contaminated hazardous waste site. RIDEM is working with EPA to investigate this site further.

(2) Water Quality Classification. Drainage from the Vinagro Site flows by way of an unnamed brook into Upper Simmons Reservoir, through Lower Simmons Reservoir, into Simmons Brook, Print Works Pond, the Pocasset River, and finally the main stem of the Pawtuxet River. The unnamed brook is too small to receive an individual water quality classification by the RIDEM. In the absence of an individual classification, the waters can assumed to be designated class B with a goal of being fishable and swimmable. From the Simmons Reservoirs to the discharge from Print Works Pond, the waters are designated class B. From Print Works Pond to the Pawtuxet River, the waters are designated class C.

(3) Surface Water Quality. The pig farm and landfill have been cited by RIDEM for pollution of Cedar Swamp Brook through uncontrolled surface runoff. However, limited data are available on water quality in the unnamed brook upstream or downstream from the Vinagro Site. The relatively undeveloped nature of the watershed indicates class B conditions are probably met upstream from the site. However, it is likely that this brook is negatively impacted by the site, particularly during storms.

Based on the history of usage at this site, and data available from other landfills, it is likely that the Vinagro Site causes high levels of sedimentation, turbidity, and coliform bacteria in the unnamed brook during rainstorms. There are also likely increases in metals and VOCs due to runoff from the site. These effects likely extend through Cedar Swamp Brook into Upper Simmons Reservoir, but are masked by the effects of the Central Landfill Site on that body of water.

The owner is under court order to cap the landfill. Additionally he must design a leachate collection system to either treat the leachate, or discharge in into the Green Hill Road sewer line. When this is completed, it is expected that conditions in the unnamed brook will meet class B conditions except possibly during rainstorms when elevated levels of turbidity and suspended solids may runoff from the Vinagro Site.

(4) Groundwater Quality. There is little groundwater data available for the Vinagro Site. However, based on what is known about groundwater in the Pawtuxet watershed in general and monitoring results at other landfills, predictions can be made.

Groundwater upgradient from the Vinagro site is probably clean or has trace levels of organic contaminants. It is likely that groundwater beneath and downgradient from the Vinagro site is contaminated with nitrate from the pig wastes; dissolved metals from the demolition debris - including lead and copper; and VOCs - possibly including TCE.

c. Capuano Landfill.

(1) Introduction. The Capuano Landfill, also known as the Pontiac Avenue Landfill, is located just north of the intersection of the Pawtuxet River and the Cranston-West Warwick border, between Pontiac Avenue and the Conrail railroad tracks. It is a closed, capped landfill with an operating transfer station.

The Capuano Landfill site appears to be contaminating ground and surface water with organic compounds and heavy metals. Areas of heaviest contamination are along the east and northeast sides. Vegetative stress has been observed on the Pawtuxet River floodplain downgradient of the landfill. Contaminated ground and surface waters appear to be flowing towards the Pawtuxet River.

(2) Water Quality Classification. Drainage from the landfill flows across a marsh and directly into the main stem of the Pawtuxet River. This wetland is too small to receive an individual water quality classification. In the absence of an individual classification, the waters can assumed to be designated class B with a goal of being fishable and swimmable. From the confluence of the North and South Branches to Pawtuxet Cove, the main stem of the Pawtuxet River is designated class C by the Rhode Island Department of Environmental Management.

(3) Surface Water Quality. The landfill forms a steep mound which rises sharply above surrounding land. Consequently, runoff originating above the landfill is diverted around it, and direct precipitation produces the

only runoff from the landfill. The presence of a wetland at the base of the landfill means that the groundwater table is high and leachate can affect surface water in the immediate vicinity.

Vegetative stress has been observed on the Pawtuxet River floodplain downgradient of the landfill. Aerial photographs taken in 1980 by the Region I, EPA indicate that stress is localized along surface water drainage paths and edges of two ponds nearest the eastern side of the landfill.

Samples of surface water above and below the landfill show increases in total dissolved solids, sulfates, chlorides, Kjeldahl nitrogen, and iron downgradient from the landfill. Other tests including coliform and chlorides have shown a marked increase in concentration along the face and downstream of the landfill. Dissolved oxygen and pH measurements are slightly lower than levels observed upstream. It is likely, based on the solvents and heavy metals disposed at this site in the past, that organic compounds and heavy metals are contaminating surface water; iron, sulfates, chlorides, and Kjeldahl nitrogen would not be causing the reported vegetative stress. However, because of inconsistencies in analyses of surface water samples, specific information on the amount of organic chemical and heavy metal contamination originating in the landfill is not available.

(4) Groundwater Quality. Studies indicate that a plume of groundwater, contaminated by numerous organic and inorganic compounds not detected in background wells, is moving horizontally and vertically away from the landfill. Heaviest contamination is currently at two wells along the down-gradient east and northeast sides of the landfill. The distance this plume has traveled is not known. From types of soil and glacial materials present downgradient of the site, it is possible the plume has reached and is discharging into the Pawtuxet River.

Analyses have found many organic compounds at elevated levels in groundwater at the site. Compounds detected at 100 ppb or more in at least one sampling include acetone, benzene, chlorobenzene, ethyl benzene, methylene chloride, TCE, PCE, tetrahydrofuran, toluene, and xylene. Metals including lead, mercury, barium, and iron are found at elevated levels in wells downgradient from the landfill. Arsenic was found at an extremely high concentration (10,500 ppb) during one sampling round in a downgradient well.

7. SUMMARY

This report described water quality in the Pawtuxet River and its tributaries based on a review of available data and past reports. Surface and groundwater quality were

examined with emphasis on the effects of landfills. The potential for leachate from the Central Landfill to contaminate Scituate Reservoir was also scrutinized.

The Pawtuxet River is possibly the most polluted in Rhode Island. The entire length of the main stem and most of the North and South Branches are designated class C. Such waters are neither fishable nor swimmable but are suitable for boating, fish habitat, and some other uses. The main stem of the Pawtuxet River does not consistently meet class C water quality standards. Dissolved oxygen is the primary concern. Effects of toxic substances including ammonia and heavy metals are secondary and unresolved concerns. Heavy metals and ammonia have been measured at or estimated to occur at levels that exceed EPA criteria to protect aquatic life. However, no studies have ever confirmed that harm is actually occurring. Additionally, some of the metals such as copper, lead and silver occur extensively throughout the watershed in ground and surface water at levels exceeding EPA chronic criteria. This indicates that chronic criteria values for these metals in the Pawtuxet River need to be reevaluated. Fecal coliform bacteria are elevated in the Pawtuxet River, as well as other parts of the watershed, but are not high enough to violate standards or limit uses of the water. Elevated levels of color, sodium, chloride, phosphorus, and nitrate have been observed, but not in concentrations which would limit uses of the water.

Water quality in the Pawtuxet River basin is primarily degraded by urban drainages and three wastewater treatment plants (WWTP): Cranston, Warwick, and West Warwick. The Cranston WWTP is the principal concern because of the size of its discharge. All three WWTPs have secondary treatment and are scheduled to be upgraded to tertiary treatment. Wasteload allocation studies have shown that advanced treatment is required to meet minimum class C goals for the Pawtuxet River. There are also two industrial point source discharges - Hoechst Celanese Corporation and Original Bradford Soap Works, both located on the North Branch. However, the effects of their flows are comparatively minor.

Tributaries to the Pawtuxet River are generally designated class B or better. An exception is the Pocasset River which is rated class C from Print Works Pond to the Pawtuxet River.

Groundwater throughout the watershed is generally clean or has trace levels of organic contaminants. An exception to this is groundwater taken from immediately within or downstream from the Central Landfill, these samples have higher concentrations of organic contaminants and metals. Highest levels of contamination were found in shallow wells directly within the landfill. Such organic contaminants as are found in groundwater in the watershed are typically

substances such as tricholorethylene (TCE) which was at one time extensively used as a degreasing compound in septic tanks, and methyl tertiary butyl ether which is an anti-knock compound in gasoline. Consequently, many, if not most, of the contaminants found in wells originated in sources other than landfill leachate.

Although no data was collected by the Corps, all available data indicate Central Landfill leachate is moving away from Scituate Reservoir. The possibility that a deep bedrock connection has the potential to pollute Scituate Reservoir with Central Landfill leachate is too slight to warrant further consideration.

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APPENDIX C

HYDRAULICS APPENDIX

SECTION 22 STUDY
CITY OF CRANSTON, RHODE ISLAND
HYDRAULIC ANALYSES OF SEWERS

JUNE 1991

HYDRAULICS AND WATER QUALITY BRANCH
WATER CONTROL DIVISION
ENGINEERING DIRECTORATE

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

SECTION 22 STUDY
CITY OF CRANSTON, RHODE ISLAND
HYDRAULIC ANALYSES OF SEWERS

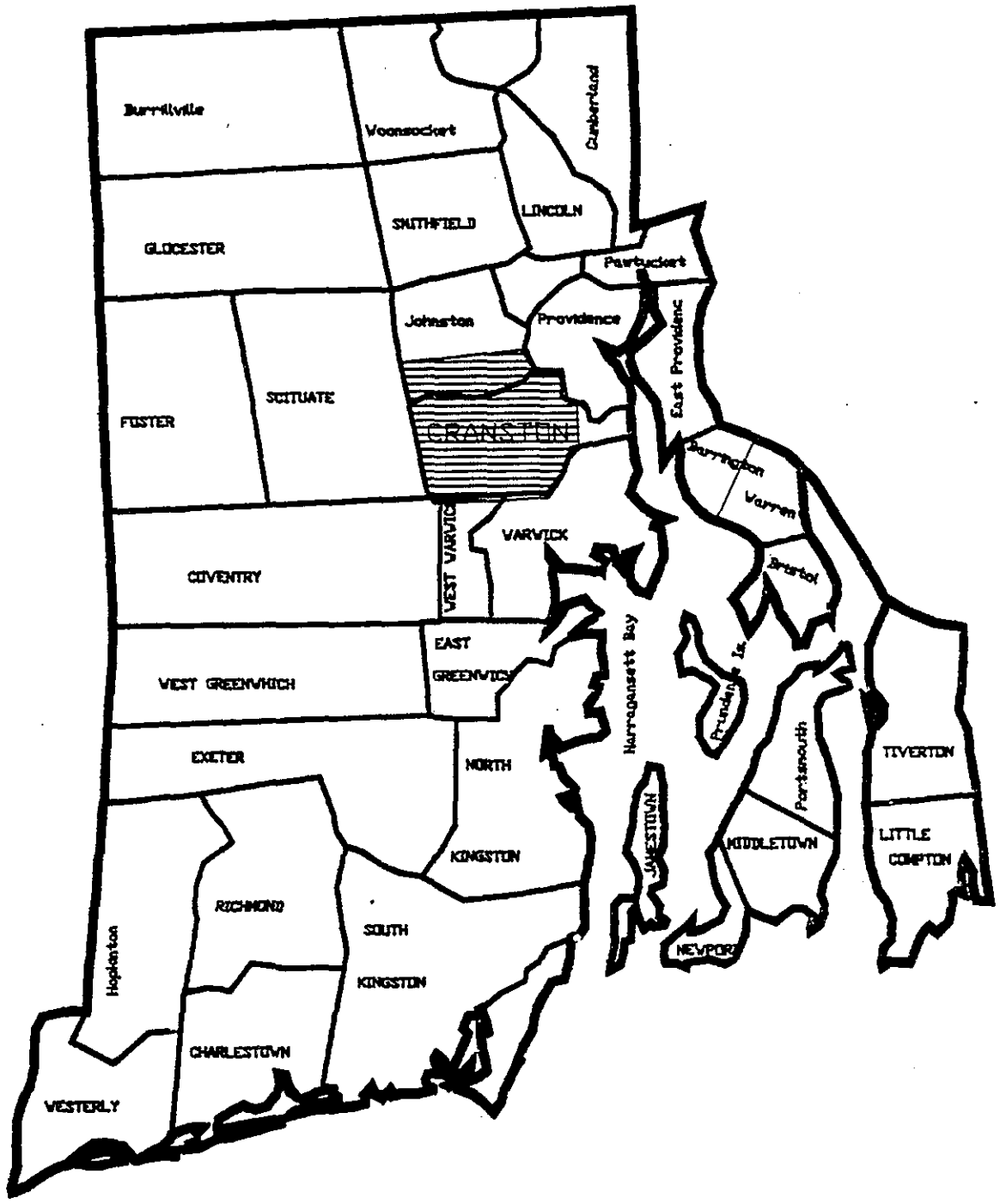
1. INTRODUCTION

a. Background. In 1990, the City of Cranston, through its Congressional delegation approached the Assistant Secretary of the Army for Civil Works requesting the Corps of Engineers conduct a reconnaissance study to address several environmental problems by connecting multiple sources of pollution with the Cranston RI sewer system. He made available a reconnaissance level study through the Section 22, "Planning Assistance to the States" program (PL 93-251, as amended). The State of Rhode Island Department of Administration requested by letter date 6 August 1990, that the New England Division undertake the Section 22 study.

b. Study Area. Cranston is a medium-sized city immediately south of Providence, Rhode Island on the western side of Narragansett Bay. It borders Warwick on the south, Scituate on the west, and Johnston on the northwest. The study area includes land in the communities of Cranston and Johnston. Figure 1 shows the study area.

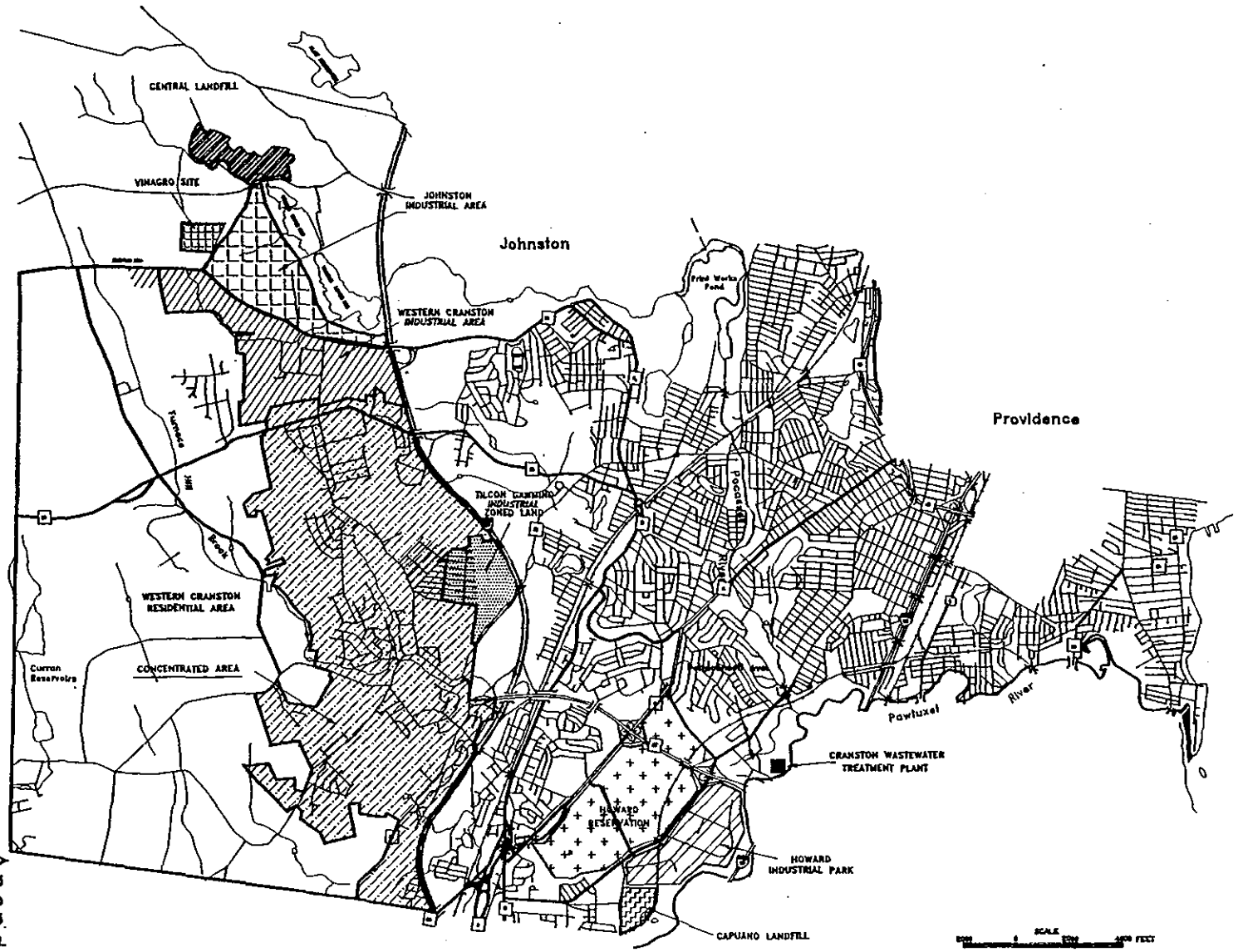
c. Pawtuxet River. The entire study area is within the Pawtuxet River watershed. This river forms at the confluence of the North Branch, which originates in outflow from Scituate Reservoir, and the South Branch, which begins at the Flat River Reservoir outlet. The two branches join in West Warwick, and the main stem flows east along the border of Cranston and Warwick to Pawtuxet Cove adjacent to the Providence River in the northern end of Narragansett Bay. The Pawtuxet River has a total drainage area of 230 square miles, and the North and South Branches have respective drainage areas of 106 and 73 square miles.

d. Wastewater Problems. The "Environmental Threats" described by Cranston in their discussions with the Corps are from landfills, unsewered residential areas, and future industrial sites (see figure 2). Central Landfill along with the smaller Vinagro and Capuano sites are suspected of causing ground and surface water pollution. Leachate and runoff control and collection systems are being developed, but there is a need for a means to get leachate and wastewater from landfill operations to the Cranston Wastewater Treatment Plant (WWTP) without overloading existing sewer systems. Cranston has also expressed concerns that leachate and contaminated groundwater from Central Landfill, if not collected and transported to the WWTP could pollute Scituate Reservoir, main water supply for Providence



Section 22, Cranston , Rhode Island
Wastewater Investigation
Study Area

Appendix C
Figure 1



Legend

Section 22 Investigation
Cranston, Rhode Island

STUDY SITES

U.S. Army Corps of Engineers
New England Division

June

Apendix C
Figure 2

and over sixty percent of Rhode Island's population. A number of residential areas in western Cranston are unsewered and depend on individual septic tanks and leaching fields for disposal of wastewater. However, soils in these areas are rated as having severe limitations for septic systems by the Soil Conservation Service. Finally, there are a number of areas suitable for commercial or industrial development but with no sewers or inadequate systems to handle increased flows. As much of the Cranston sewer system is in heavily-developed areas, it would be disruptive and expensive to dig up streets and replace existing pipes with larger ones. Consequently, Cranston believes that the best solution to these problems is to build a new sewer interceptor to collect these various flows and convey them to the Cranston WWTP.

e. Hydraulics and Water Quality Branch Involvement. Assistance requested by Long Range Planning Branch (LRPB) of Hydraulics and Water Quality Branch was of two types: (1) a description of existing surface water and groundwater quality, and (2) a hydraulic analyses of existing and proposed sewer systems. This report contains results of the hydraulics analyses; results of water quality analyses are included in a separate report.

2. SUMMARY

a. Alternatives. LRPB is examining several plans for dealing with the environmental threats identified by the City of Cranston. Actions being considered fall into 5 general categories: (A) take no action, (B) expand existing sewer capacity, (C) construct local wastewater treatment plants, (D) build a new sewer interceptor, and (E) develop a wastewater management plan. When estimating flows for the design year 2040, there were areas where the amount of future development was particularly uncertain. These were the western Cranston residential area and industrial development areas along the Plainfield Pike. Therefore, when examining wastewater conveyance systems, 2 conditions were considered: one with expected flows from moderate development in all areas, and a second condition with expected flows from moderate development in most areas but higher development in the western Cranston residential area and additional development along the Plainfield Pike.

Alternatives examined in this report are

(1) Upgrade the present system to carry the estimated year-2040 flows (see Plate No. 1).

(2) Upgrade the present system to carry the same flows as in alternative 1 plus flows from additional development in the Plainfield Pike industrial areas and in the western Cranston residential area (see Plate No. 2).

(3) Build a combination force-main and gravity interceptor from the northwestern part of the city to the Cranston wastewater treatment plant (WWTP). This interceptor would collect flows from Central Landfill, Vinagro Site, Western Cranston Industrial, Tilcon-Gammino Site, Western Cranston Concentrated Residential Area, the Howard Facility and Industrial Park, and Capuano Site (see Plate No. 3).

(4) Build the same interceptor to collect the same flows as in alternative 1 plus flows from additional development in the Plainfield Pike industrial areas and in the western Cranston residential area (see Plate No. 4).

(5) Build a combination gravity and force-main interceptor, from the northwestern part of the city to the Cranston WWTP, using a greater length of force-main than in alternatives 3 and 4. This interceptor would carry flows from Central Landfill, Vinagro Site, Western Cranston Industrial area, the Tilcon-Gammino Site and the Western Cranston Residential Area (see Plate No. 5). Existing sewers would be upgraded to carry flows from the Howard Facility and Industrial Park, and Capuano Site.

(6) Build the same interceptor to collect the same flows as in alternative 5 plus flows from additional development in the Plainfield Pike industrial areas and western Cranston residential area (see Plate No. 6). Again, existing sewers would be upgraded to carry flows from the Howard Facility and Industrial Park and Capuano Site.

b. HWQB Evaluations. LRPB requested Hydraulics and Water Quality Branch (HWQB) review the capacities of the pumps and pipes involved in these alternatives.

(1) Sewer Pipes. For alternatives involving upgrading the existing system, HWQB evaluated the capacity of existing pipes and, if they were inadequate to handle the year 2040 flows, computed the minimum replacement pipe size.

(2) Pump Stations. Pump stations were evaluated for their ability to pass the peak year 2040 flows with the largest pump out of commission. If the pump station's capacity was found inadequate, HWQB computed the capacity and horsepower required.

(3) Interceptors. The interceptors were evaluated for their ability to carry year 2040 peak flows while meeting proper criteria. Additionally, the horsepower, required to pump peak flows through force-main sections of the interceptor, was computed.

(4) Flows. Flows from different areas were generally estimated by LRPB. However, HWQB estimated groundwater pumping flows from the landfills, and existing

flows from residential areas for which LRPB had no estimates.

c. Findings.

(1) Sewer Lines. Many sections of sewer lines are inadequate to carry the estimated year 2040 flows. Table 1 summarizes the lengths of pipe that would have to be upgraded for each of the alternatives.

(2) Pump Stations. Capacities of the Welsh, Plainfield Circle, Randall Street, Pontiac Avenue, Sherman Avenue, and Howard Pump Stations were examined. Certain pump stations will need to be upgraded to handle year-2040 flows. This would require installing additional or larger pumps. The remaining stations examined had at least adequate capacity to handle estimated flows for the year 2040. Tables 1 and 2 summarize upgrading necessary for pump stations under the different alternatives examined.

(3) Interceptors. LRPB presented HWQB with proposed designs for new sewer interceptors. Results of HWQB's calculations showed that these designs would carry the planned flows and meet good design criteria.

3. YEAR 2040 FLOWS

a. Study Sites. HWQB primarily used year 2040 wastewater flows provided by LRPB. These flows were estimated from existing flows provided by Tutela Engineering and estimates of the development that would occur in the Johnston Industrial Park, West Cranston Industrial Site, Tilcon-Gammino Site, Western Cranston Residential Area, and the Howard Reservation and Industrial Park. Table 3 contains a summary of flows provided by LRPB.

b. Landfills. Wastewater flows from the 3 landfills in the study (Central, Vinagro, and Capuano) will be generated by onsite processes, leachate collection, and groundwater pumping. Some data are available on wastewater from existing processes and leachate generation. However, no estimates are available for the amount of groundwater pumping that will occur, because neither the extent of groundwater contamination nor the rate of groundwater movement are known. Consequently, it was necessary for HWQB to estimate these flows.

In projecting future groundwater pumping flows from the landfills in the Cranston study, HWQB assumed the required pumping would be that necessary to keep the contaminated plume from moving off-site. This would be equal to groundwater movement under the site. Assuming that minimum streamflow is related to groundwater movement, an estimate of 0.001 cfs per acre of groundwater flow was made. This was derived from USGS Geological Survey Professional Paper

TABLE 1

SUMMARY OF SEWER AND PUMP STATION CONSTRUCTION REQUIREMENTS

Alternative	Comstock Pump Sta.	Welsh Pump Sta.	Plainfield Circle Pump Sta.	Randall Circle Pump Sta.	Pontiac Avenue Pump Sta.	Sherman Pump Sta.	Wilbur Pump Sta.	Howard Pump Sta.	Total New Pipe Including Interceptor (ft)
1	NC	Pipe: NN Pump: 1300	Pipe: 4130 Pump: RES	Pipe: 3012 Pump: RES	Pipe: 3497 Pump: RES	Pipe: NN Pump: RES	NC	Pipe: 4056 Pump: RES	14,700
2	NC	Pipe: NN Pump: 1890	Pipe: 4130 Pump: 2390	Pipe: 3053 Pump: 2890	Pipe: 5288 Pump: RES	Pipe: NN Pump: RES	NC	Pipe: 4056 Pump: RES	16,500
3	Pipe: INT Pump: 1300	Replaced by Comstock	Pipe: NNE Pump: NN	Pipe: NN Pump: NN	Pipe: NNE Pump: RES	Pipe: NN Pump: NN	Pipe: INT Pump: 3000	Pipe: 4056 Pump: RES	37,500
4	Pipe: INT Pump: 1890	Replaced by Comstock	Pipe: NNE Pump: NN	Pipe: NN Pump: NN	Pipe: NNE Pump: RES	Pipe: NN Pump: NN	Pipe: INT Pump: 4060	Pipe: 4056 Pump: RES	37,500
5	Pipe: INT Pump: 1300	Replaced by Comstock	Pipe: NNE Pump: NN	Pipe: NN Pump: NN	Pipe: NNE Pump: RES	Pipe: NN Pump: NN	Pipe: INT Pump: 3000	Pipe: 4056 Pump: RES	37,500
6	Pipe: INT Pump: 1890	Replaced by Comstock	Pipe: NNE Pump: NN	Pipe: NN Pump: NN	Pipe: NNE Pump: RES	Pipe: NN Pump: NN	Pipe: INT Pump: 4060	Pipe: 4056 Pump: RES	37,500

NC - Comstock and Wilbur Stations will not be constructed under alternatives 1 or 2.
NN - New sewer construction or additional pump station capacity is not needed.
NNE - Pipes can handle expected flows, but some sections would exceed design depths.
RES - Present station has adequate capacity, but only with all pumps running. Upgrading would be needed to provide reserve capacity for pump failures.
INT - Pump station feeds new interceptor.

Notes:
1. Piping information pertains to lines feeding into the station.
2. Pipe lengths equal total length of pipe in feet to be constructed or upgraded base on design capacity (i.e. Pipe: 4130).
3. Pump flows equal required upgraded station capacity in GPM (i.e. Pump: 1300).

TABLE 2

SUMMARY OF FLOWS AND PUMP STATION CAPACITIES

Station	Force Main Diameter (inches)	Force Main Length (feet)	Year-2040 Peak Flow (gpm)	Manning's "n"	Existing Station Hf (feet)	Existing Station Capacity (gpm)	Existing Station Power (Hp)	Upgraded Condition Hf (feet)	Upgraded Condition Total Head (feet)	Upgraded Condition Capacity (gpm)	Upgraded Condition Power (Hp)
ALTERNATIVE 1											
Welsh	8	1,100	1,300	0.013	37.4	1,000	30	63.2	91.8	1,300	36
Comstock	Not Constructed.										
Plainfield	10	800	1,800	0.013	33.1	2,000	30	26.8	51.8	(1,800)	(28)
Randall	14	350	2,300	0.013	3.6	2,440	50	3.2	29.3	(2,300)	(20)
Pontiac	2*24	2,500	19,100	0.013	29.9	22,200	222*	22.1	50.1	19,100	290
Sherman	24	3,000	3,160	0.013	7.6	5,100	27*	2.9	37.9	3,160	36
Wilbur	Not Constructed.										
Howard	14	2,200	3,730	0.013	60.5	4,000	80*	52.6	82.6	3,730	93
ALTERNATIVE 2											
Welsh	8	1,100	1,890	0.013	37.4	1,000	30	134	162	1,890	93
Comstock	Not Constructed.										
Plainfield	10	800	2,390	0.013	33.1	2,000	30	47.3	72.3	2,390	52
Randall	14	350	2,890	0.013	3.6	2,440	50	5	31.1	(2,300)	(27)
Pontiac	2*24	2,500	19,700	0.013	29.9	22,200	222*	23.5	51.5	19,700	307
Sherman	24	3,000	3,670	0.013	7.6	5,100	27*	3.9	38.9	3,670	43
Wilbur	Not Constructed.										
Howard	14	2,200	3,730	0.013	60.5	4,000	80*	52.6	82.6	3,730	93
ALTERNATIVE 3											
Welsh	Replaced by Comstock										
Comstock	10	6,000	1,300	0.013	No Existing Station			105	171	1,300	67
Plainfield	10	800	500	0.013	33.1	2,000	30	2.1	27.1	(500)	(4)
Randall	14	350	1,000	0.013	3.6	2,440	50	0.6	26.7	(1,000)	(8)
Pontiac	2*24	2,500	17,800	0.013	29.9	22,200	222*	19.2	47.2	17,800	255
Sherman	24	3,000	1,500	0.013	7.6	5,100	27*	0.7	35.7	(1,500)	(16)
Wilbur	15	5,000	2,957	0.013	No Existing Station			52	217	2,957	194
Howard	14	2,200	3,730	0.013	60.5	4,000	80*	52.6	82.6	3,730	93

TABLE 2 (Cont.)

SUMMARY OF FLOWS AND PUMP STATION CAPACITIES

Station	Force Main Diameter (inches)	Force Main Length (feet)	Year-2040 Peak Flow (gpm)	Manning's "n"	Existing Station Hf (feet)	Existing Station Capacity (gpm)	Existing Station Power (Hp)	Upgraded Condition Hf (feet)	Upgraded Condition Total Head (feet)	Upgraded Condition Capacity (gpm)	Upgraded Condition Power (Hp)
ALTERNATIVE 4											
Welsh		Replaced by Comstock									
Comstock	12	6,000	1,890	0.013	No Existing Station			83.8	150	1,890	86
Plainfield	10	800	500	0.013	33.1	2,000	30	2.1	27.1	(500)	(4)
Randall	14	350	1,000	0.013	3.6	2,440	50	0.6	26.7	(1,000)	(8)
Pontiac	2*24	2,500	17,800	0.013	29.9	22,200	222*	19.2	47.2	17,800	255
Sherman	24	3,000	1,500	0.013	7.6	5,100	27*	0.7	35.7	(1,500)	(16)
Wilbur	18	5,000	4,060	0.013	No Existing Station			37.1	202	4,060	249
Howard	14	2,200	3,730	0.013	60.5	4,000	80*	52.6	82.6	3,730	93
ALTERNATIVE 5											
Welsh		Replaced by Comstock									
Comstock	10	6,000	1,300	0.013	No Existing Station			105	171	1,300	67
Plainfield	10	800	500	0.013	33.1	2,000	30	2.1	27.1	(500)	(4)
Randall	14	350	1,000	0.013	3.6	2,440	50	0.6	26.7	(1,000)	(8)
Pontiac	2*24	2,500	17,800	0.013	29.9	22,200	222*	19.2	47.2	17,800	255
Sherman	24	3,000	1,500	0.013	7.6	5,100	27*	0.7	35.7	(1,500)	(16)
Wilbur	18	13,800	2,957	0.009	No Existing Station			9.4	174	2,957	156
Howard	14	2,200	3,730	0.013	60.5	4,000	80*	52.6	82.6	3,730	93
ALTERNATIVE 6											
Welsh		Replaced by Comstock									
Comstock	12	6,000	1,890	0.013	No Existing Station			83.8	150	1,890	86
Plainfield	10	800	500	0.013	33.1	2,000	30	2.1	27.1	(500)	(4)
Randall	14	350	1,000	0.013	3.6	2,440	50	0.6	26.7	(1,000)	(8)
Pontiac	2*24	2,500	17,800	0.013	29.9	22,200	222*	19.2	47.2	17,800	255
Sherman	24	3,000	1,500	0.013	7.6	5,100	27*	0.7	35.7	(1,500)	(16)
Wilbur	18	13,800	4,060	0.009	No Existing Station			17.8	183	4,060	225
Howard	14	2,200	3,730	0.013	60.5	4,000	80*	52.6	82.6	3,730	93

Notes:
Hf = Friction head.
*Hp of existing pumps estimated due to lack of data.
Numbers in parenthesis indicate existing station capacity exceeds upgraded condition requirements.
As recommended in TR-16, efficiency of pumps assumed at 83 percent.
As recommended in TR-16, 25 ft added to head loss to account for suction losses from wet well.

TABLE 3

SUMMARY OF YEAR-2040 WASTEWATER FLOWS
PROVIDED BY LRPB

Study Site	Alternatives 1, 3, 5 Ave GPD	Alternatives 1, 3, 5 Peak GPM	Alternatives 2, 4, 6 Ave GPD	Alternatives 2, 4, 6 Peak GPM
CENTRAL LANDFILL				
Sanitary and Ops.	3,200	6	3,200	6
Gas Recovery	1,500	1	1,500	1
Leachate Collectn	77,000	53	77,000	53
Prop. Res. Rec. Fac.	15,000	10	15,000	10
Groundwater Pump.	230,000	160	230,000	160
Future Ind. Flow	73,300	127	73,300	127
Total	400,000	357	400,000	357
VINAGRO SITE				
Sanitary and Ops.	800	1	800	1
Leachate Collectn	700	0	700	0
Groundwater Pump.	35,000	24	35,000	24
Total	36,500	25	36,500	25
WESTERN CRANSTON INDUSTRIAL AREAS				
Wastewater Flow	478,000	923	478,000	923
Total	478,000	923	478,000	923
TILCON-GAMINO				
Wastewater Flow	42,000	81	42,000	81
Total	42,000	81	42,000	81
WESTERN CRANSTON CONCENTRATED RESIDENTIAL AREA				
Wastewater Flow	760,000	1,576	1,060,000	2,086
Total	760,000	1,576	1,060,000	2,086
HOWARD FACILITY AND INDUSTRIAL PARK				
How. Fac. Flow	2,170,000	3,014	2,170,000	3,014
Ind. Park Flow	490,000	681	490,000	681
Total	2,660,000	3,695	2,660,000	3,695
CAPUANO SITE				
Sanitary and Ops.	1,000	2	1,000	2
Groundwater Pump.	60,000	42	60,000	42
Total	61,000	44	61,000	44
PLAINFIELD PIKE INDUSTRIAL AREAS				
Wastewater Flow	0	0	303,000	590
Total	0	0	303,000	590

"Drainage Density and Streamflow" which measured the average minimum monthly streamflow in 15 small eastern drainage areas. Contributory areas for the landfills and resulting flows are as follows:

Site	Area (acres)	Flow (gpd)
Central Landfill	350	230,000
Vinagro	54	35,000
Capuano	88	60,000
Total	492	325,000

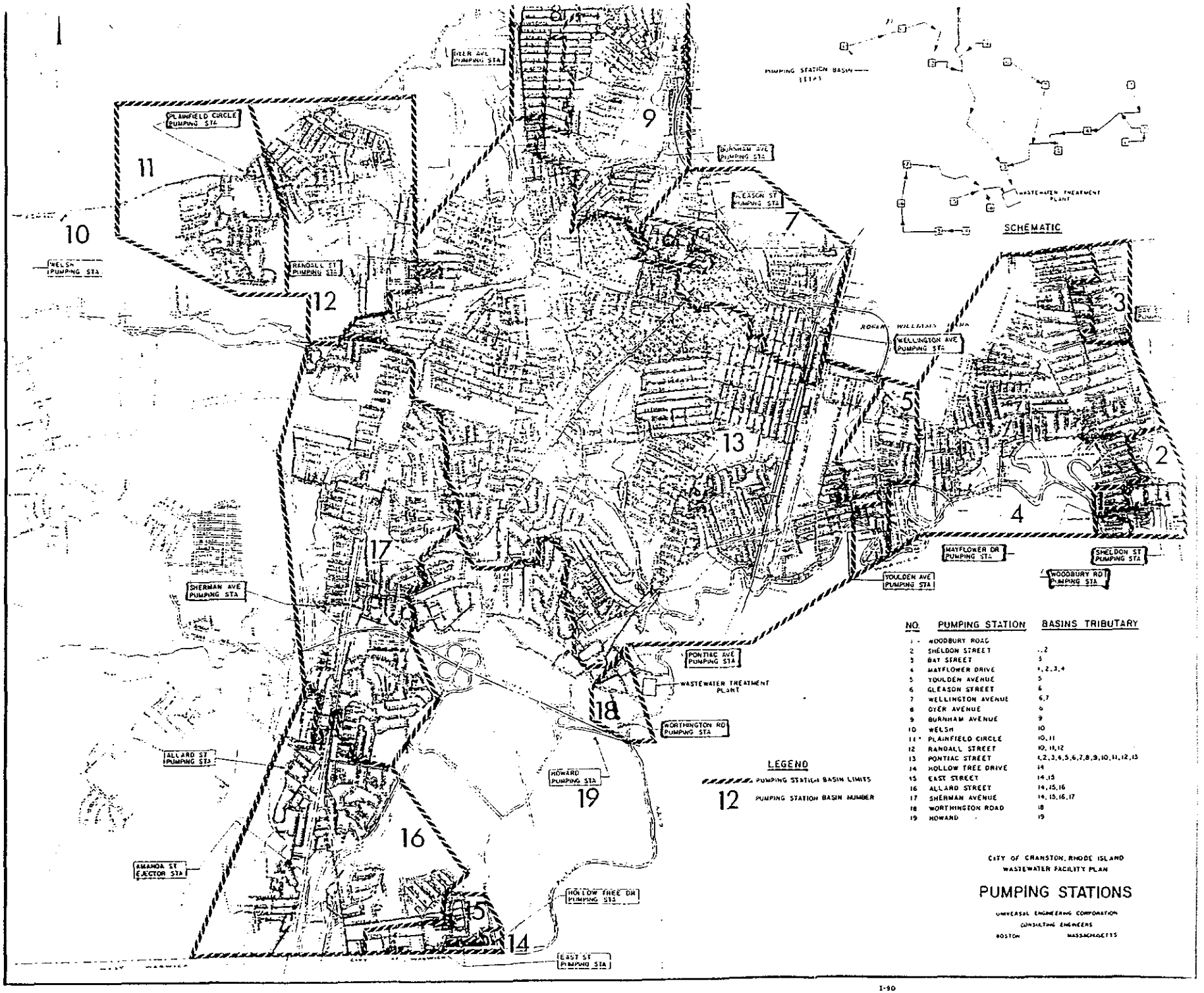
c. Residential Areas in Eastern Cranston.

(1) General. The Cranston sewer system includes a web of interconnecting pump stations (see figure 3). In order to evaluate the adequacy of the existing sewer lines, it is necessary to estimate all flows in the year 2040. Many of the residential areas are developed and, for the purposes of this study, future flows are assumed to be the same as present flows. However, information on existing flows was not always available. In particular, flows from basins 1 though 7 and 13 in figure 3 were not available although the peak flow at the Pontiac Avenue pump station was. In order to estimate the flows through the existing main sewer from the Randall Street to Pontiac Avenue pump stations, it was necessary to estimate flows from these residential areas.

(2) Procedures. These areas are highly developed and HWQB assumed that they will not have significant growth in the future. Using census tract and building permit information received from the city of Cranston (Attachment A) wastewater flow rates were estimated assuming 2.5 people per unit, and average flows of 75 gallons per capita day. These numbers were taken from TR-16, "Guides for the Design of Wastewater Treatment Works." Peak flows were estimated using ratios of peak to average flows contained in TR-16. Resulting estimated peak flows are contained in table A-1 in Attachment A. The resulting total peak flows at the Pontiac Avenue pump station were less than the total recorded peak flows. This difference was assumed due to infiltration and underestimates of usage. Consequently, the flows were increased by the ratio of the total flow recorded at Pontiac Avenue to the total computed flow. The results are summarized in table A-1 Attachment A.

4. SEWER CAPACITY ANALYSES

a. Sources. In analyzing the capacities of the existing sewer lines, HWQB relied primarily on data provided



Appendix C
Figure 3

by Tutela Engineering Associates, the consultant to the City of Cranston. Additional data were collected by LRPB.

b. Criteria. Criteria for sewer lines were taken from TR-16 and the City of Cranston. TR-16 criteria included a minimum velocity for full pipe flow of 2 fps, and a maximum flow not greater than 12 fps under any flow conditions. City of Cranston criteria included that pipes 21 inches diameter and smaller should not flow more than 0.6 full, and pipes larger than 21 inches should be more than 0.7 full. Force mains should have minimum velocity of 2 fps at design average flow conditions and a maximum velocity not greater than 10 fps.

c. Results. Capacities of sewers and force mains were computed using a spreadsheet analysis. A summary showing the length of pipe and which pump stations need upgrading for each alternative is presented in table 1. A detailed discussion of the individual alternatives is presented in the following paragraphs.

5. ALTERNATIVE 1

a. General. Alternative 1 involves upgrading the present system to accommodate growth projected to the year-2040. Plate 1 and table 4 summarize flows under this alternative. HWQB analyzed the ability of the existing system to carry these flows. For this analysis, the sewer system was divided into areas contributory to pump stations as shown on figure 3. Table 1 summarizes the lengths of pipe that would have to be replaced, and required pump station improvements. A total of 14,700 feet of pipe would have to be replaced with larger pipe, and the Welsh pump station would have to be upgraded by adding pumps or replacing existing pumps with larger ones.

b. WELSH PUMP STATION.

(1) Summary. Capacities of the main sewer lines bringing flow to the Welsh pump station are more than adequate to carry the projected flows for the year 2040. However, the pumping station does not have adequate capacity to pump the year-2040 flows. Maximum pump station capacity is 1,000 gpm with both pumps running, while peak flow is 1,300 gpm.

(2) Existing Peak Flow. According to Tutela Engineering Associates., the present peak hourly flow at the Welsh pump station is estimated at 500 gpm.

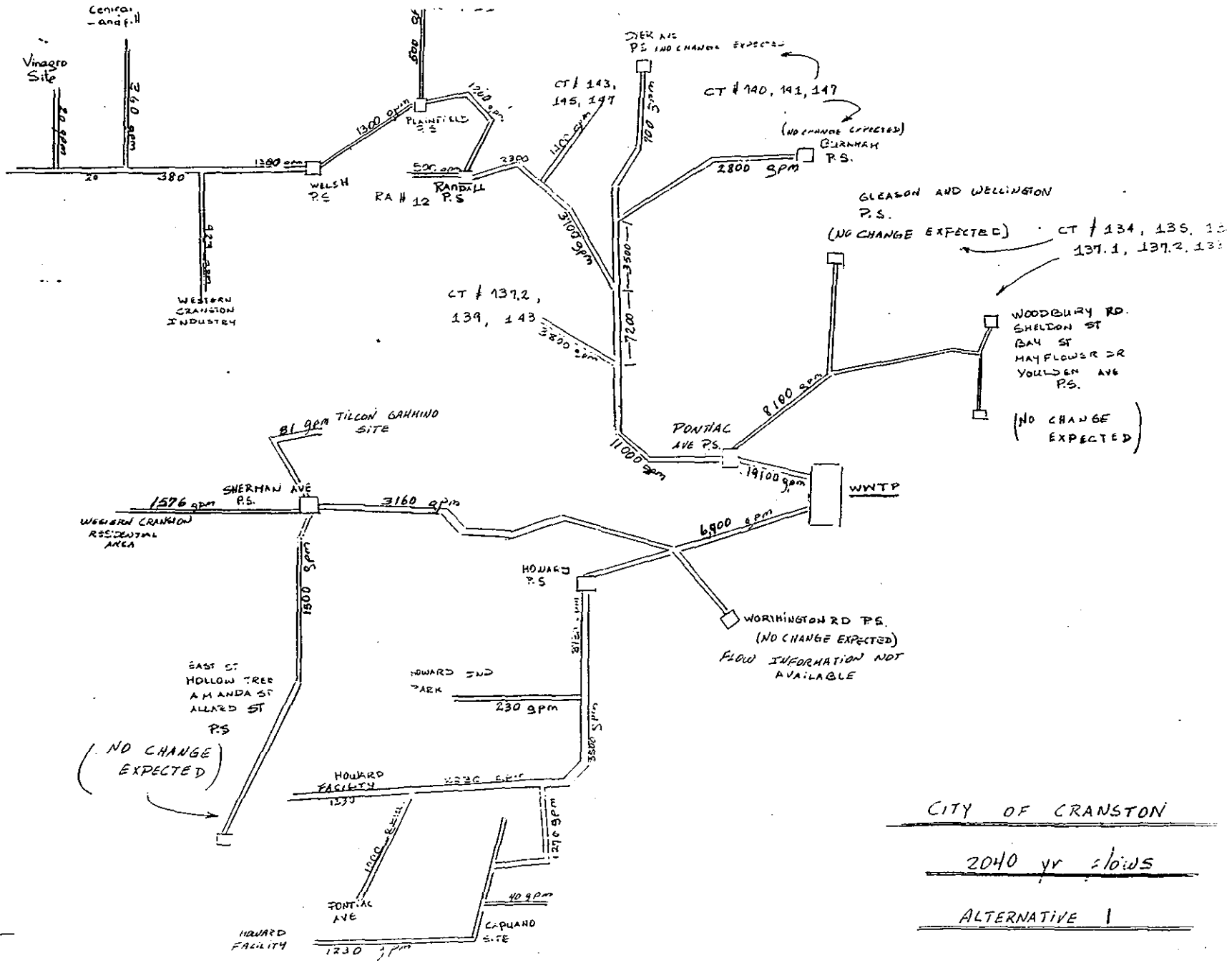
(3) Year 2040 Peak Flow. NED estimates peak flows of 360 gpm from the Central Landfill, 920 gpm from the Western Cranston Industrial Area and 20 gpm from Vinagro Site. The total estimate year-2040 peak flow at the pump station is 1,300 gpm.

(4) Sewer Capacity. Design capacity of the Green Hill Avenue sewer line, which carries the Central Landfill's projected 360 gpm flow is 1,100 gpm. From the intersection of Green Hill Avenue and the Plainfield Pike to the Welsh pump station, the design capacity is 1,940 gpm.

(5) Pump Station Capacity. Welsh pump station has 2 pumps in parallel rated at 500 gpm at 52 feet of total head. Total station capacity is 1,000 gpm. This is less than the estimated year-2040 flow of 1,300 gpm.

c. PLAINFIELD CIRCLE PUMP STATION

(1) Summary. Capacities of the main sewer lines bringing flow to the Plainfield Circle pump station are inadequate to carry projected peak flows for the year 2040. In order to carry the projected flow of 1,800 gpm, 3,249 feet of 8 inch pipe would have to be replaced with 12 inch pipe, and 881 feet of 12 inch pipe would have to be replaced with



Appendix C
Plate 1

Not to scale

CITY OF CRANSTON

2040 yr flows

ALTERNATIVE 1

TABLE 4

SUMMARY OF FLOWS FOR DIFFERENT ALTERNATIVES

AREA	Alt. 1 Flow (gpm)	Alt. 2 Flow (gpm)
SEGMENT # 1		
Vinagro	20	20
Central Landfill	360	360
W. Cranston Ind.	923	923
Addit. Dev Plainfld Pike		590
Total to Welsh P.S.	1300	1890
Res. Area # 11	500	500
Total to Plainfld P.S.	1800	2390
Res. Area # 12	500	500
Total to Randall P.S.	2390	2890
Census T # 143,145,147	1400	1400
Dyer & Burnham P.S.	3500	3500
Census T # 137.2,139,143	3800	3800
Total from PS # 1 - 7	8100	8100
Total to Pontiac P.S.	19100	19700
Segment # 1 flows into WWTP		
SEGMENT # 2		
Total from East, Hollow Amanda, and Allard P.S.	1500	1500
West Cranston Residential	1576	2086
Tilcon Gammino Site	81	81
Total to Sherman P.S.	3160	3670
Howard Facility	2460	2460
Pontiac Ave	1000	1000
Capuano Site	40	40
Howard Ind. Park	230	230
Total to Howard P.S.	3730	3730
Total Sherman & Howard P.S. into WWTP	6900	7400
Segment # 2 flows into WWTP		

AREA	Alt. 3 Flow (gpm)	Alt. 4 Flow (gpm)
SEGMENT # 1		
Res. Area # 11	500	500
Total to Plainfld P.S.	500	500
Res. Area # 12	500	500
Total to Randall P.S.	1000	1000
Census T # 143,145,147	1400	1400
Dyer & Burnham P.S.	3500	3500
Census T # 137.2,139,143	3800	3800
Total from PS # 1 - 7	8100	8100
Total to Pontiac P.S.	17800	17800
Segment # 1 flows into WWTP		
SEGMENT # 2		
Vinagro	20	20
Central Landfill	360	360
W. Cranston Ind.	923	923
Addit. Dev Plainfld Pike		590
Total to Comstock P.S.	1300	1890
Tilcon Gammino Site	81	81
West Cranston Residential	1576	2086
Total to Wilbur P.S.	2960	4060
Howard Facility	2460	2460
Pontiac Ave	1000	1000
Capuano Site	40	40
Howard Ind. Park	230	230
Total to Howard P.S.	3730	3730
Total from Wilbur & Howard P.S. into WWTP	6690	7790
Segment # 2 flows into WWTP		
SEGMENT # 3		
Total from East, Hollow Amanda, and Allard P.S.	1500	1500
Total to Sherman P.S.	1500	1500
Segment # 3 flows into WWTP		

AREA	Alt. 5 Flow (gpm)	Alt. 6 Flow (gpm)
SEGMENT # 1		
Res. Area # 11	500	50[illegible]
Total to Plainfld P.S.	500	50[illegible]
Res. Area # 12	500	50[illegible]
Total to Randall P.S.	1000	1000
Census T # 143,145,147	1400	140[illegible]
Dyer & Burnham P.S.	3500	3500
Census T # 137.2,139,143	3800	3800
Total from PS # 1 - 7	8100	8100
Total to Pontiac P.S.	17800	17800
Segment # 1 flows into WWTP		
SEGMENT # 2		
Vinagro	20	2[illegible]
Central Landfill	360	35[illegible]
W. Cranston Ind.	923	92[illegible]
Addit. Dev Plainfld Pike		59[illegible]
Total to Comstock P.S.	1300	1890
Tilcon Gammino Site	81	8[illegible]
West Cranston Residential	1576	2086
Total to Wilbur P.S.	2960	4060
Segment # 2 flows into WWTP		
SEGMENT # 3		
Total from East, Hollow Amanda, and Allard P.S.	1500	150[illegible]
Total to Sherman P.S.	1500	150[illegible]
Howard Facility	2460	2460
Pontiac Ave	1000	10[illegible]
Capuano Site	40	4[illegible]
Howard Ind. Park	230	23[illegible]
Total to Howard P.S.	3730	[illegible]
Total from Sherman & Howard P.S. into WWTP	5230	5230
Segment # 3 flows into WWTP		

18 inch pipe. Pumping capacity at Plainfield Circle pump station is adequate to handle projected peak flows.

(2) Existing Peak Flow. According to Tutela Engineering Associates, the present peak hourly flow at the Plainfield pump station is estimated at 1,000 gpm. This is greater than the existing sewer capacity of 700 gpm. Either the estimated peak hourly flows are high, or pressure flow is occurring in the pipes and flow is backing up in the manholes. Such a condition is hazardous because it could lead to sewage overflows at manhole covers.

(3) Year 2040 Peak Flow. NED estimates peak flows at Plainfield Circle pump station of 1,800 gpm by the year 2040. This includes 1,300 gpm from the Welsh pump station and 500 gpm from residential area "11" (see figure 3).

(4) Sewer Capacity. Design capacity of sewer lines feeding the Plainfield station is 480 gpm.

(5) Pump Station Capacity. The Plainfield Circle pump station has 2 pumps in parallel rated at 1,000 gpm at 31 feet of total head. Total station capacity is 2,000 gpm. This is greater than the projected peak flow of 1,800 gpm.

d. RANDALL CIRCLE PUMP STATION.

(1) Summary. Capacities of the main sewer lines bringing flow to the Randall pump station are inadequate to carry projected peak flows for the year 2040. In order to obtain sufficient flow capacity, 3,013 feet of pipe would have to be replaced with larger pipe. Capacity of the Randall Street pump station is adequate for projected peak flows.

(2) Existing Peak Flow. Tutela Engineering Associates estimate the present peak hourly flow at the Randall Street pump station as 1,500 gpm.

(3) Year 2040 Peak Flow. NED estimates peak flows of 2,300 gpm at the Randall Street pump station by the year 2040. This includes 1,800 gpm from the Plainfield Circle station and 500 gpm from residential area "12" (see figure 3).

(4) Sewer Capacity. Design capacity of the sewer lines between the Plainfield and Randall pump station is 840 gpm.

(5) Pump Station Capacity. The Randall Street pump station has 2 pumps in parallel rated at 1,220 gpm at 42 feet of head. Total station capacity is 2,440 gpm. This is greater than the estimated year 2040 peak flow of 2,300 gpm.

e. PONTIAC AVENUE PUMP STATION:

(1) Summary. Capacities of the main sewer lines bringing flow to the Pontiac Avenue pump station are inadequate to carry projected peak flows for the year 2040. In order to obtain sufficient capacity, 2,163 feet of 18-inch pipe, 1,473 feet of 24-inch pipe, and 1,652 feet of 39-inch pipe would have to be replaced with larger diameter pipe. Pump station capacity is adequate to handle expected future flows.

(2) Existing Peak Flow. According to Tutela Engineering Associates, the present peak hourly flow at the Pontiac pump station is estimated at 18,300 gpm.

(3) Year 2040 Peak Flow. NED estimates peak flows of 19,100 gpm by the year 2040. This includes 2,300 gpm from the Welsh pump station, 1,400 gpm from census tract 147, 700 gpm from Dyer Ave pump station, 2,800 gpm from Burnham Avenue pump station, 3,800 from census tracts 143, 139, 137.02, and 138; and a total of 8,100 gpm from the Gleason Street, Wellington Avenue, Woodbury Road, Sheldon Street, Bay Street, Mayflower Street, and Youlden Avenue pumping stations.

(4) Sewer Capacity. Design capacity of sewer lines feeding the Pontiac Avenue Station is inadequate to carry year-2040 flows, and 3,497 feet of pipe would have to be upgraded.

(5) Pump Station Capacity. The Pontiac Avenue pump station has 2 pumps rated at 5,550 gpm and 3 pumps rated at 3,700 gpm. Total station capacity is 22,200 gpm. This is greater than the estimated peak flow of 19,100 gpm by the year 2040. However, additional capacity would be needed to pump projected peak flows with one pump out for maintenance.

f. SHERMAN AVENUE PUMP STATION

(1) Summary. Capacities of main sewer lines bringing flow to the Sherman Avenue Station are more than adequate to carry the projected flows for the year 2040. In addition, the pumping station has adequate capacity to pump the year 2040 flows. Maximum pump station capacity is 5,000 gpm with both pumps running, while projected peak flow is 3,160 gpm. However, it may be necessary to upgrade the pump station to have the ability to pass peak flows with one pump out for maintenance.

(2) Existing Peak Flow. Estimated current peak flow at the Sherman Avenue pump station is 1,500 gpm.

(3) Year 2040 Peak Flow. NED estimates peak flows of 1,500 gpm from the areas currently tied into the Sherman Avenue pump station (including 400 gpm of infiltration),

1,580 gpm from the Western Cranston, and 80 gpm from the Tilcon-Gammino Site. This gives an estimated total peak flow of 3,160 gpm at the pump station by the year 2040.

(4) Sewer Capacity. Design capacity of sewer lines feeding the Sherman station and the Cranston WWTP is 5,960 gpm. This is greater than the year 2040 peak flow of 3,160 gpm.

(5) Pump Station Capacity. The Sherman Avenue pump station has 4 pumps (2 series of 2) rated at 2,550 gpm each at 62 ft. Total station capacity is 5,100 gpm. This is greater than the projected peak flow of 3,160 gpm. However, it may be necessary to upgrade the pump station to have the ability to pass peak flows with one pump out for maintenance.

g. HOWARD PUMP STATION

(1) Summary. Capacities of the main sewer lines bringing flow to the Howard Avenue pump station are inadequate to carry projected peak flows for the year 2040. In order to obtain sufficient capacity, 4,056 feet of pipe replaced with larger diameter pipe. The existing pumps are able to handle expected future flows only when all are operating. Additional pumping capacity is required to pass peak flows with one pump down for maintenance.

(2) Existing Peak Flow. NED estimates the existing peak flow at 3,000 gpm.

(3) Year 2040 Peak Flow. NED estimates peak flows of 3,500 gpm by the year 2040 from the Howard Facility and 230 gpm from the Industrial Park for a total of 3,730 gpm at the pump station.

(4) Sewer Capacity. Design capacity of sewer lines feeding the Howard pump station is 640 gpm.

(5) Pump Station Capacity. The Howard pump station has 4 pumps in parallel rated at 1,000 gpm giving a total station capacity of 4,000 gpm. This is greater than the expected peak flow of 3,730 gpm. However, this station would need to be upgraded to pass the peak flow with one pump down for maintenance.

6. ALTERNATIVE 2

a. General. Alternative 2 involves upgrading the present system to accommodate growth projected to the year-2040; it differs from alternative 1 in that it includes higher flows. These extra flows come from higher development in the western Cranston residential area and along Plainfield Pike. Plate 2 and table 4 summarize flows under this alternative. HWQB analyzed the ability of the existing system to carry these flows. For this analysis, the sewer system was divided into areas contributory to pump stations as shown on figure 3. Table 1 summarizes the lengths of pipe that would have to be replaced, and required pump station improvements. A total of 16,500 feet of pipe would have to be replaced with larger pipe, and the Welsh, Plainfield Circle, and Randall Street pump stations would have to be upgraded by adding pumps or replacing existing pumps with larger ones.

b. WELSH PUMP STATION.

(1) Summary. Capacities of the main sewer lines bringing flow to the Welsh pump station are more than adequate to carry the projected flows for the year 2040. However, the pumping station does not have adequate capacity to pump the year-2040 flows. Maximum pump station capacity is 1,000 gpm with both pumps running, while peak flow is 1,890 gpm

(2) Existing Peak Flow. According to Tutela Engineering Associates., the present peak hourly flow at the Welsh pump station is estimated at 500 gpm.

(3) Year 2040 Peak Flow. NED estimates peak flows of 360 gpm from the Central Landfill, 920 gpm from the Western Cranston Industrial Area, 20 gpm from Vinagro Site, and 590 gpm from additional industrial development along Plainfield Pike. The total estimate year-2040 peak flow at the pump station is 1,890 gpm.

(4) Sewer Capacity. Design capacity of the Green Hill Avenue sewer line, which carries the Central Landfill's projected 360 gpm flow is 1,100 gpm. From the intersection of Green Hill Avenue and the Plainfield Pike to the Welsh pump station, the design capacity is 1,940 gpm.

(5) Pump Station Capacity. Welsh pump station has 2 pumps in parallel rated at 500 gpm at 52 feet of total head. Total station capacity is 1,000 gpm. This is less than the projected year-2040 peak flow of 1,890 gpm.

c. PLAINFIELD CIRCLE PUMP STATION

(1) Summary. Capacities of main sewer lines bringing flow to the Plainfield Circle pump station are inadequate to carry projected peak flows for the year 2040. In order to carry the projected flow of 2,390 gpm, 3,249 feet of 8 inch pipe would have to be replaced with 12 inch pipe, and 881 feet of 12 inch pipe would have to be replaced with 18 inch pipe. Pumping capacity at Plainfield Circle pump station is inadequate to handle projected peak flows.

(2) Existing Peak Flow. According to Tutela Engineering Associates, the present peak hourly flow at the Plainfield pump station is estimated at 1,000 gpm. This is greater than the existing sewer capacity of 700 gpm. Either Tutela's estimates are high, or pressure flow is occurring in the pipes and flow is backing up in the manholes. Such a condition is hazardous because it could lead to sewage overflows at manhole covers.

(3) Year 2040 Peak Flow. NED estimates peak flows at Plainfield Circle pump station of 2,390 gpm by the year 2040. This includes 1,890 gpm from the Welsh pump station and 500 gpm from residential area 11.

(4) Sewer Capacity. Design capacity of sewer lines feeding the Plainfield station is 480 gpm.

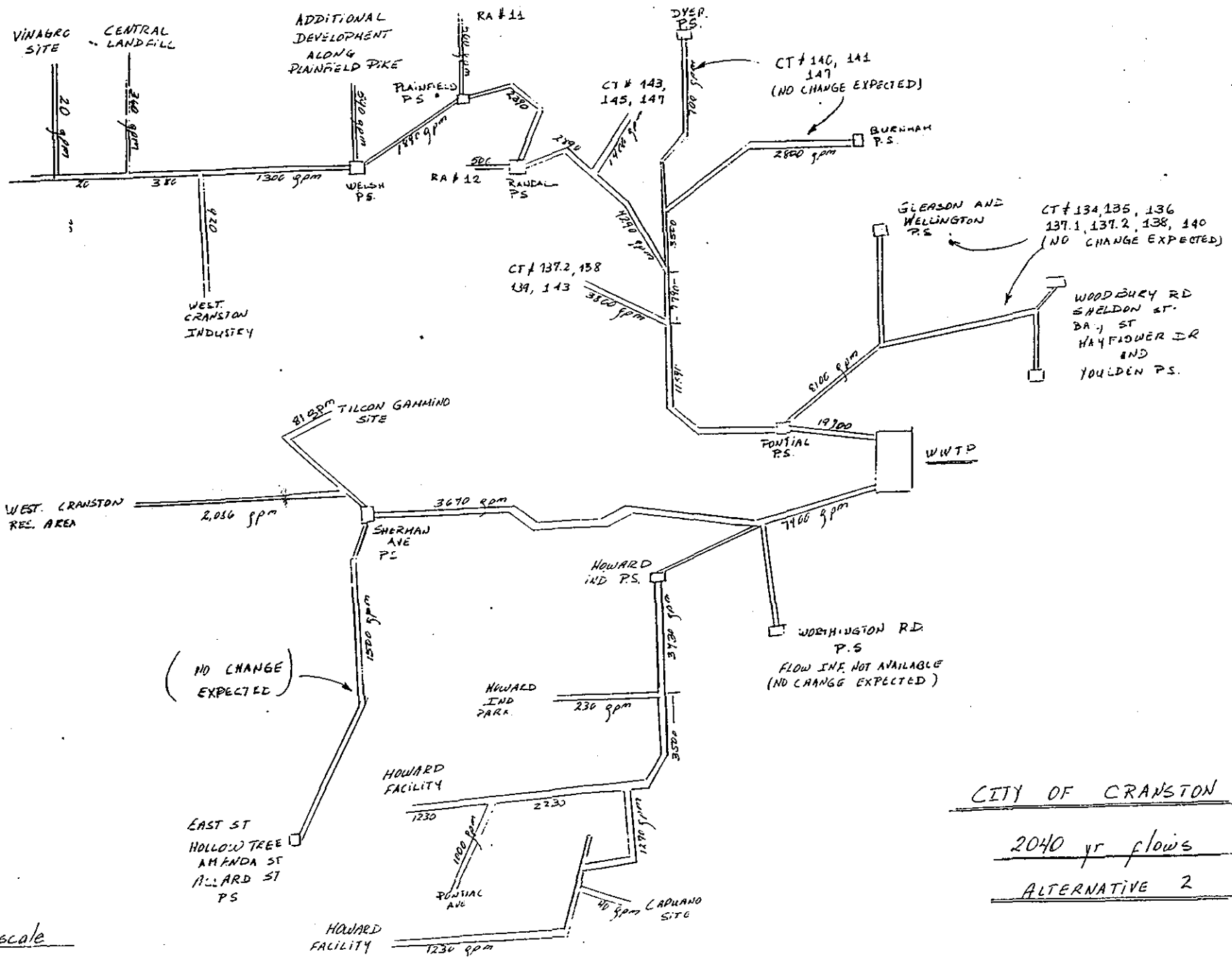
(5) Pump Station Capacity. The Plainfield Circle pump station has 2 pumps in parallel rated at 1,000 gpm at 31 feet of total head. Total station capacity is 2,000 gpm. This is less than the projected peak flow of 2,390 gpm.

d. RANDALL CIRCLE PUMP STATION.

(1) Summary. Capacities of the main sewer lines bringing flow to the Randall pump station are inadequate to carry projected peak flows for the year 2040. In order to obtain sufficient flow capacity, 3,053 feet of pipe would have to be replaced with larger pipe. Capacity of the Randall Street pump station is inadequate for projected peak flows.

(2) Existing Peak Flow. Tutela Engineering Associates estimate the present peak hourly flow at the Randall Street pump station as 1,500 gpm.

(3) Year 2040 Peak Flow. NED estimates peak flows of 2,890 gpm at the Randall Street pump station by the year 2040. This includes 2,390 gpm from the Plainfield Circle station and 500 gpm from residential area 12.



CITY OF CRANSTON

2040 yr flows

ALTERNATIVE 2

Not to scale

Appendix C
Plate 2

(4) Sewer Capacity. Design capacity of the sewer lines between the Plainfield and Randall pump station is 840 gpm.

(5) Pump Station Capacity. The Randall Street pump station has 2 pumps in parallel rated at 1,220 gpm at 42 feet of head. Total station capacity is 2,440 gpm. This is less than the estimated year 2040 peak flow of 2,890 gpm.

e. PONTIAC AVENUE PUMP STATION:

(1) Summary. Capacities of the main sewer lines bringing flow to the Pontiac Avenue pump station are inadequate to carry projected peak flows for the year 2040. In order to obtain sufficient capacity, 2,163 feet of 18-inch pipe, 1,473 feet of 24-inch pipe, and 1,652 feet of 39-inch pipe would have to be replaced with larger diameter pipe. Pump station capacity is adequate to handle expected future flows.

(2) Existing Peak Flow. According to Tutela Engineering Associates, the present peak hourly flow at the Pontiac pump station is estimated at 18,300 gpm.

(3) Year 2040 Peak Flow. NED estimates peak flows of 19,700 gpm by the year 2040. This includes 2,890 gpm from the Randall Circle pump station, 1,400 gpm from census tract 147, 700 gpm from Dyer Ave pump station, 2,800 gpm from Burnham Avenue pump station, 3,800 from census tracts 143, 139, 137.02, and 138; and a total of 8,100 gpm from the Gleason Street, Wellington Avenue, Woodbury Road, Sheldon Street, Bay Street, Mayflower Street, and Youlden Avenue pumping stations.

(4) Sewer Capacity. Design capacity of sewer lines feeding the Pontiac Avenue Station is inadequate to carry year-2040 flows, and 5,288 feet of pipe would have to be upgraded.

(5) Pump Station Capacity. The Pontiac Avenue pump station has 2 pumps rated at 5,550 gpm and 3 pumps rated at 3,700 gpm. Total station capacity is 22,200 gpm. This is greater than the estimated peak flow of 19,100 gpm by the year 2040. However, additional capacity would be needed to pump projected peak flows with one pump out for maintenance.

f. SHERMAN AVENUE PUMP STATION

(1) Summary. Capacities of main sewer lines bringing flow to the Sherman Avenue Station are more than adequate to carry the projected flows for the year 2040. In addition, the pumping station has adequate capacity to pump the year 2040 flows. Maximum pump station capacity is 5,000 gpm with both pumps running, while projected peak flow

is 3,160 gpm. However, it may be necessary to upgrade the pump station to have the ability to pass peak flows with one pump out for maintenance.

(2) Existing Peak Flow. Estimated current peak flow at the Sherman Avenue pump station is 1,500 gpm.

(3) Year 2040 Peak Flow. NED estimates peak flows of 1,500 gpm from the areas currently tied into the Sherman Avenue pump station (including 400 gpm of infiltration), 2,086 gpm from the Western Cranston, and 80 gpm from the Tilcon-Gammino Site. This gives an estimated total peak flow of 3,670 gpm at the pump station by the year 2040.

(4) Sewer Capacity. Design capacity of sewer lines feeding the Sherman station and the Cranston WWTP is 5,960 gpm. This is greater than the year 2040 peak flow of 3,670 gpm.

(5) Pump Station Capacity. The Sherman Avenue pump station has 4 pumps (2 series of 2) rated at 2,550 gpm each at 62 ft. Total station capacity is 5,100 gpm. This is greater than the projected peak flow of 3,160 gpm. However, it may be necessary to upgrade the pump station to have the ability to pass peak flows with one pump out for maintenance.

g. HOWARD PUMP STATION. For the Howard pump station and the sewer lines feeding it, flows, pipe sizes, and pumping are the same in alternative 2 as alternative 1.

(1) Summary. Capacities of the main sewer lines bringing flow to the Howard Avenue pump station are inadequate to carry projected peak flows for the year 2040. In order to obtain sufficient capacity, 4,056 feet of pipe replaced with larger diameter pipe. The existing pumps are able to handle expected future flows only when all are operating. Additional pumping capacity is required to pass peak flows with one pump down for maintenance.

(2) Existing Peak Flow. NED estimates the existing peak flow at 3,000 gpm.

(3) Year 2040 Peak Flow. NED estimates peak flows of 3,500 gpm by the year 2040 from the Howard Facility and 230 gpm from the Industrial Park for a total of 3,730 gpm at the pump station.

(4) Sewer Capacity. Design capacity of sewer lines feeding the Howard pump station is 640 gpm.

(5) Pump Station Capacity. The Howard pump station has 4 pumps in parallel rated at 1,000 gpm giving a total station capacity of 4,000 gpm. This is greater than the expected peak flow of 3,730 gpm. However, this station

would need to be upgraded to pass the peak flow with one pump down for maintenance.

7. ALTERNATIVE 3

a. General. Alternative 3 involves construction of a new sewer interceptor for western Cranston. This interceptor will collect flows from the Vinagro Site, Central Landfill, Western Cranston Industrial area, Tilcon-Gammino Site, Western Cranston Residential area, and Howard pump station.

The interceptor design has 6 elements: (1) a new pump station, (Comstock pump station); (2) a 10 inch diameter, 6,000 foot long force main (Force Main No. 1); (3) a 13,600 foot long gravity main (Gravity Main No. 1); (4) a new pump station (Wilbur pump station); (5) a 15 inch diameter, 5,000 foot long force main (Force Main No. 2); and (6) an 8,800 foot long gravity main (Gravity Main No. 2). Plate 3 shows the layout of the proposed interceptor.

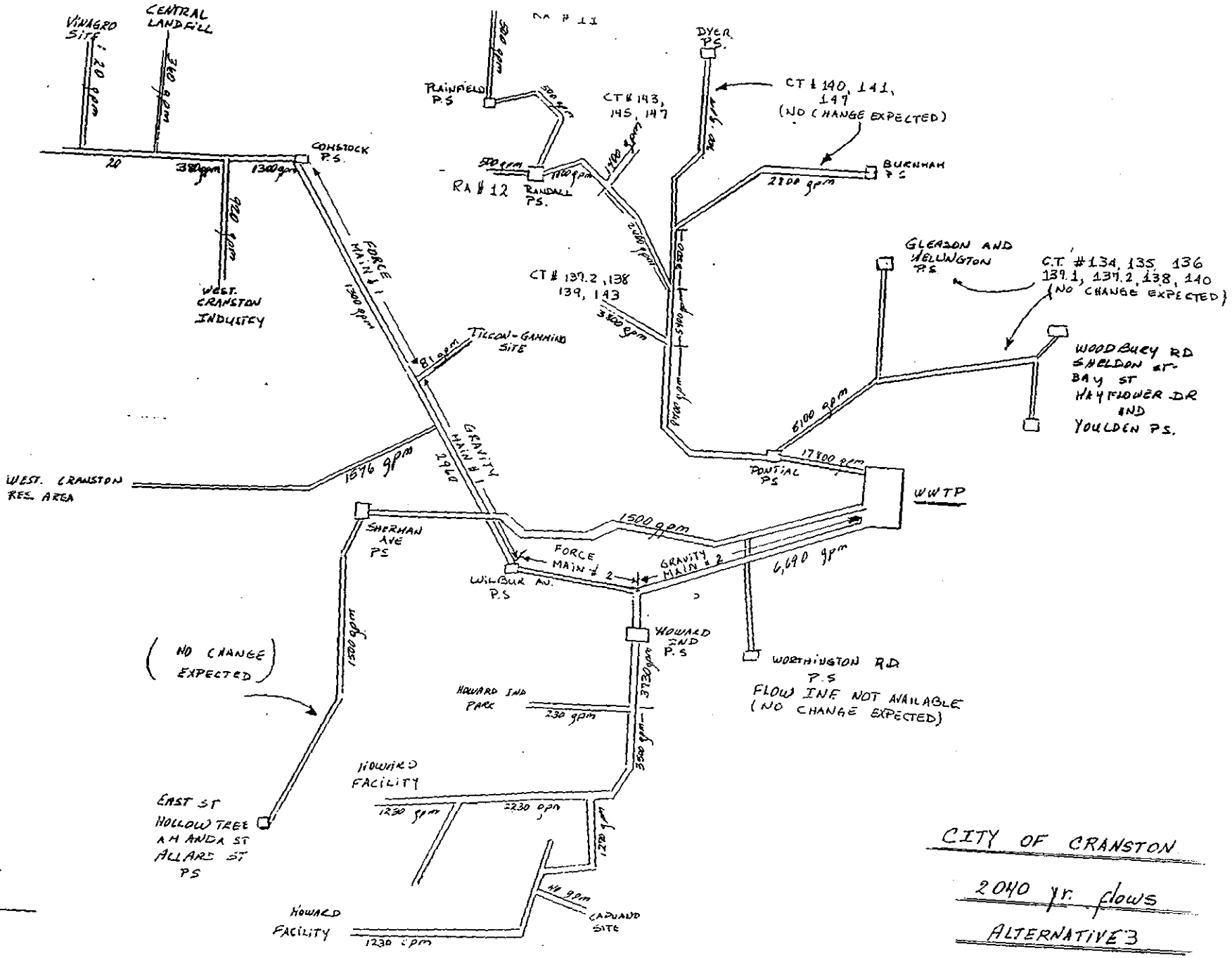
With the construction of this interceptor, the Welsh pump station will be eliminated and flows into the Plainfield pump station reduced to 500 gpm. Total peak flows projected for the year 2040 into Pontiac pump station will be reduced from 19,100 to 17,800 gpm. Flows from the study sites will not flow into the portion of the existing system from Plainfield to Pontiac pump stations or the Sherman pump station. The existing pipes from Plainfield to Pontiac pump stations are able to carry the projected flows, although sections of these pipes will flow at a greater depth than specified in design criteria. For these reasons, under alternative 3 the existing sewer lines from Plainfield pump station to Pontiac pump station are assumed not to be upgraded to meet design criteria.

Table 5 contains a summary of design analysis for the interceptor. Table 1 contains a summary of pipes and pump stations needing upgrading under alternative 3.

b. COMSTOCK AVENUE PUMP STATION. This new pump station will be the start of the new interceptor. Its location is shown on plate 3. It will receive flows from the Vinagro Site, Central Landfill, and Western Cranston Industrial area.

(1) Year-2040 Peak Flow. NED estimates total peak flows to the Comstock pump station from the Vinagro Site, Central Landfill, and Western Cranston Industrial area at 1,300 gpm.

(2) Sewer Capacity. Existing sewer pipes are adequate to carry projected flows to the Comstock Station. Design capacity of the Green Hill Avenue sewer line, which carries the Central Landfill's projected 360 gpm flow, is 1,100 gpm. From the intersection of Green Hill Avenue and the Plainfield Pike to the new Comstock pump station the minimum design capacity sewer segment carries 1,940 gpm.



Appendix C
Plate 3

Not to scale

CITY OF CRANSTON

2040 yr. flows

ALTERNATIVE 3

TABLE 5
SUMMARY OF INTERCEPTOR DESIGN ANALYSIS
ALTERNATIVE 3

FORCE MAINS

Station	Q (cfs)	Q (gpm)	dia (in)	A (ft^2)	V (fps)	L (ft)	hL (ft)	Elev Chge (ft)	Total Head (ft)	Power (hp)
use n = 0.013										
F M No 1										
using Q peak	2.90	1300	10	0.55	5.31	6000	104	41	171	77
using Q ave	1.38	618	10	0.55	2.53	6000				
F M No 2										
using Q peak	6.59	2960	15	1.23	5.37	5000	52	140	217	194
using Q ave	3.47	1556	15	1.23	2.82	5000				

GRAVITY MAINS

Station	Q (cfs)	Q (gpm)	dia (in)	A (ft^2)	V (fps)	L (ft)	S (ft/ft)	Elev Chge (ft)	Design Flow (gpm)	Design Veloc (fps)
use n = 0.013										
GRAV 1.1	6.59	2960	15	1.23	5.38	2000	0.038	10.86	3770	5.78
GRAV 1.2	6.59	2960	18	1.77	3.73	4000	0.014	6.58	3720	4.01
GRAV 1.3	6.59	2960	15	1.23	5.38	5000	0.032	10.03	3490	5.78
GRAV 1.4	6.59	2960	21	2.40	2.74	2600	0.008	4.92	4190	2.95
GRAV 2.1	6.59	2960	18	1.77	3.73	4800	0.027	9.23	5220	4.01
GRAV 2.2	14.91	6690	30	4.91	3.04	4000	0.008	5.12	14060	3.46

Notes.
Q = Flow.
dia = Pipe diameter.
A = Pipe cross-sectional area.
V = Velocity of flow.
L = Length of interceptor section.
hL = Hydraulic head loss.
S = Slope of interceptor section.

(3) Pump Station Capacity. Required capacity for Comstock pump station is 1,300 gpm at a total head of 171 feet. Using the recommended 83 percent efficiency in TR-16, a 67 Hp motor would be required.

c. WILBUR AVENUE PUMP STATION. The second new pump station required under alternative 3 would be constructed at Wilbur Avenue as shown on plate 3.

(1) Year 2040 Peak Flows. NED estimates peak flows at the Wilbur Avenue pump station of 2,957 gpm. These include 1,300 gpm from the Comstock pump station, 81 gpm from the Tilcon-Gammino Site, and 1,576 gpm from the Western Cranston Residential Area.

(2) Sewer Capacity. The sewer lines feeding Wilbur Avenue pump station are Force Main No. 1, and Gravity Main No. 1. Force Main No. 1 is 6,000 feet of 10-inch diameter pipe. Gravity Main No. 1 is made up of 4 segments: (1) 2,000 feet of 15-inch diameter pipe, (2) 4,000 feet of 18-inch pipe, (3) 5,000 feet of 15-inch pipe, and (4) 2,600 feet of 21-inch pipe.

(3) Pump Station Capacity. In order to handle projected year-2040 peak flows, the Wilbur Avenue pump station will require pumping capacity of 3,000 gpm at 217 feet of total head. This will require at least a 194 Hp motor.

d. WASTEWATER TREATMENT PLANT. The final segments of the new interceptor will run from the Wilbur pump station to the Cranston Wastewater Treatment Plant. These segments consist of Force Main No. 2 and Gravity Main No. 2.

(1) Force Main No. 2. Force main No. 2 consists of 5,000 feet of 15-inch diameter pipe.

(2) Gravity Main No. 2. Gravity main No. 2 consists of 4,800 feet of 18-inch pipe followed by 4,000 feet of 30-inch pipe.

e. PLAINFIELD CIRCLE PUMP STATION

(1) Summary. Construction of the interceptor reduces flows to the Plainfield Circle pump station with the result that capacities pumps are adequate to handle projected year-2040 flows, and only 80 feet pipe would have to be upgraded to meet design criteria; however, the existing pipes have the capacity to carry these flows.

(2) Year 2040 Peak Flow. NED estimates peak flows at Plainfield Circle pump station of 500 gpm by the year 2040.

(3) Sewer Capacity. Design capacity of sewer lines feeding the Plainfield station is 480 gpm. To handle projected flows of 500 gpm, 80 feet of 12-inch pipe would have to be replaced with 15-inch to meet design criteria.

(4) Pump Station Capacity. The Plainfield Circle pump station has 2 pumps in parallel rated at 1,000 gpm at 31 feet of total head. Total station capacity is 2,000 gpm. This is greater than the projected peak flow of 500 gpm.

f. RANDALL CIRCLE PUMP STATION.

(1) Summary. With construction of the interceptor, peak year-2040 flows to the Randall Circle pump station would be reduced to 1,000 gpm. Existing pumps and capacities of main sewer lines bringing flow to the Randall pump station are adequate to carry these flows.

(2) Year 2040 Peak Flow. NED estimates peak flows of 1,000 gpm at the Randall Street pump station. This includes 500 gpm from the Plainfield Circle station and 500 gpm from residential area 12.

(3) Pump Station Capacity. The Randall Street pump station has 2 pumps in parallel rated at 1,220 gpm at 42 feet of head. Total station capacity is 2,440 gpm. This is greater than the estimated year 2040 peak flow of 1,000 gpm.

g. PONTIAC AVENUE PUMP STATION:

(1) Summary. Construction of the interceptor reduces flows to the Pontiac Avenue pump station with the effect that only 2,124 feet of pipe need to be upgraded to meet design criteria; however, the existing pipes have the capacity to carry these flows. Capacities of existing pumps remain adequate but lack reserve capacity.

(2) Year 2040 Peak Flow. NED estimates peak flows of 17,800 gpm by the year 2040.

(3) Sewer Capacity. Design capacity of sewer lines feeding the Pontiac Avenue Station is inadequate to carry year-2040 flows, and 2,124 feet of pipe would have to be upgraded.

(4) Pump Station Capacity. The Pontiac Avenue pump station has 2 pumps rated at 5,550 gpm and 3 pumps rated at 3,700 gpm. Total station capacity is 22,200 gpm. This is greater than the projected peak flow of 17,800 gpm. However, additional capacity would be needed to pump projected flows with one pump out for maintenance.

h. SHERMAN AVENUE PUMP STATION.

(1) Summary. Construction of the interceptor reduces flows to the Sherman Avenue pump station by diverting discharges from Tilcon-Gammino and Western Cranston residential area. Capacities of main sewer lines bringing flow to the station are more than adequate to carry the projected flows for the year 2040. The pumping station has adequate capacity to pump the year 2040 flows but is lacking reserve capacity.

(2) Year 2040 Peak Flow. NED estimates peak flows of 1,500 gpm from the areas currently tied into the Sherman Avenue pump station.

(3) Sewer Capacity. Design capacity of sewer lines feeding the Sherman station and the Cranston WWTP is 5,960 gpm. This is greater than the projected 1,500 gpm.

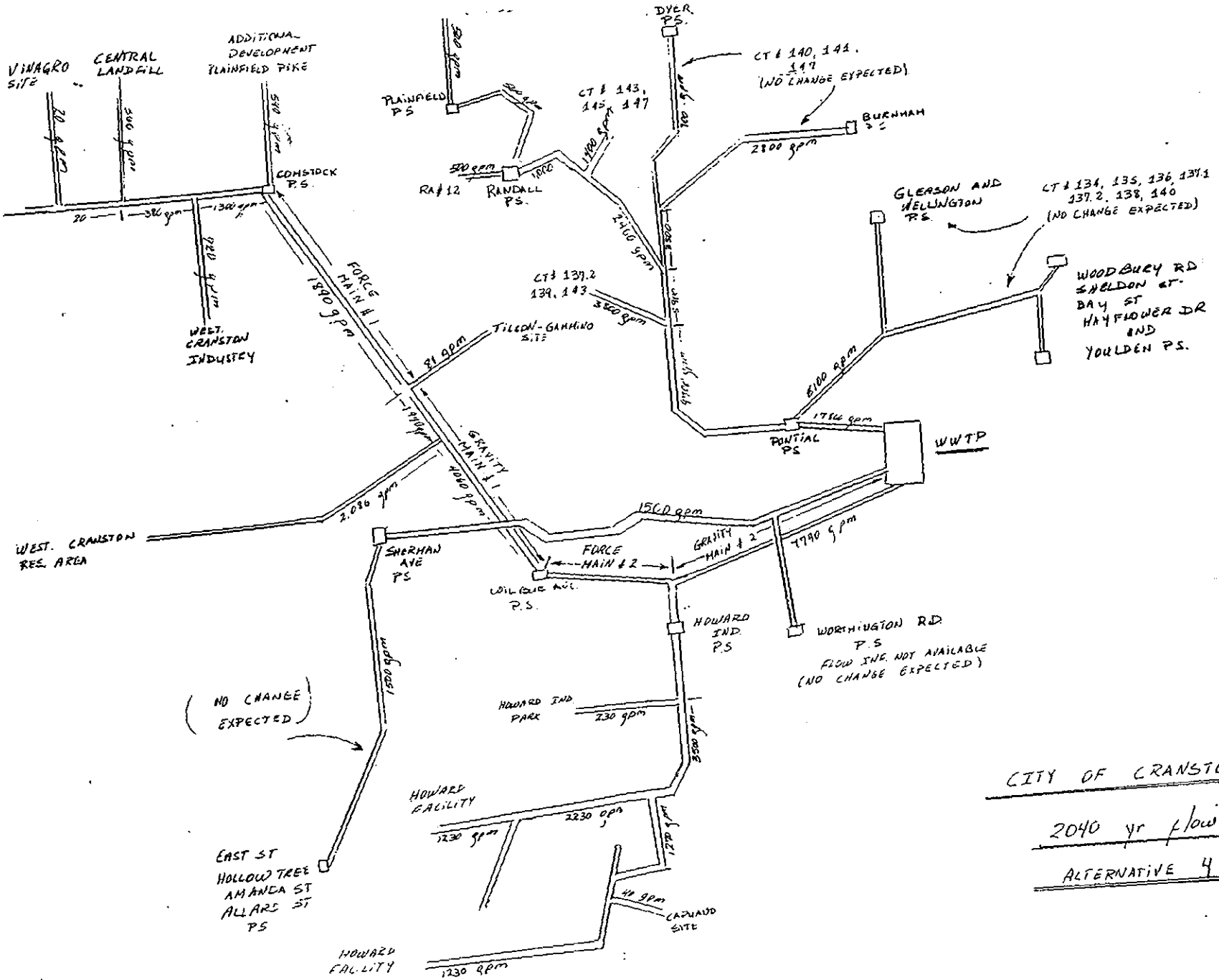
(4) Pump Station Capacity. The Sherman Avenue pump station has 4 pumps (2 series of 2) rated at 2,550 gpm each at 62 ft. Total station capacity is 5,100 gpm. This is greater than the projected peak flow of 1,500 gpm.

i. HOWARD PUMP STATION. Construction of the interceptor does not affect flows into the Howard pump station. Projected peak year-2040 flow into the station is 3,730 gpm and 4,056 feet of pipe would have to be upgraded to handle it. The Howard pump station has 4 pumps in parallel rated at 1,000 gpm giving a total station capacity of 4,000 gpm. Although this is greater than the expected peak flow of 3,730 gpm, this station would need to be upgraded to pass the peak flow with one pump down for maintenance.

8. ALTERNATIVE 4

a. General. Alternative 4 involves construction of the same interceptor as in alternative 3; however, it carries higher flows due to assumed heavier development in the Plainfield Pike industrial area and the western Cranston residential area. The interceptor will collect the flows from Vinagro Site, Central Landfill, Western Cranston Industrial area, additional development at Plainfield Pike, Tilcon Gammino Site, Western Cranston Residential area and Howard Industrial Park area. Plate 4 summarizes the layout and flows under this alternative.

The interceptor design for alternative 4 the same as for alternative 3. The design has 6 elements: (1) a new pump station, (Comstock pump station); (2) a 12 inch diameter, 6,000 foot long force main (Force Main No. 1); (3) a 13,600 foot long gravity main (Gravity Main No. 1); (4) a new pump station (Wilbur pump station); (5) an 18 inch diameter, 5,000



CITY OF CRANSTON

2040 yr flows

ALTERNATIVE 4

Appendix C
Plate 4

Not to scale

TABLE 6
SUMMARY OF INTERCEPTOR DESIGN ANALYSIS
ALTERNATIVE 4

FORCE MAINS

Station	Q (cfs)	Q (gpm)	dia (in)	A (ft^2)	V (fps)	L (ft)	hL (ft)	Elev Chge (ft)	Total Head (ft)	Power (hp)
use n = 0.013										
FM No 1										
using Q peak	4.21	1890	12	0.79	5.36	6000	83	41	150	100
using Q ave	2.10	944	12	0.79	2.68	6000				
F M No 2										
using Q peak	9.05	4060	18	1.77	5.12	5000	37	140	202	280
using Q ave	5.02	2255	18	1.77	2.84	5000				

GRAVITY MAINS

Station	Q (cfs)	Q (gpm)	dia (in)	A (ft^2)	V (fps)	L (ft)	S (ft/ft)	Elev Chge (ft)	Design Flow (gpm)	Design Veloc (fps)
use n = 0.013										
GRAV 1.1	9.05	4060	18	1.77	5.12	2000	0.038	10.86	6140	5.51
GRAV 1.2	9.05	4060	21	2.40	3.76	4000	0.014	6.58	5610	4.04
GRAV 1.3	9.05	4060	18	1.77	5.12	5000	0.032	10.03	5670	5.51
GRAV 1.4	9.05	4060	21	2.40	3.76	2600	0.008	4.92	4190	4.04
GRAV 2.1	9.05	4060	18	1.77	5.12	4800	0.027	9.23	5220	5.51
GRAV 2.2	17.36	7790	30	4.91	3.54	4000	0.008	5.12	14060	4.03

foot long force main (Force Main No. 2); and (6) an 8,800 foot long gravity main (Gravity Main No. 2).

With the construction of this interceptor, the Welsh pump station will be eliminated and flows into the Plainfield pump station reduced to 500 gpm. Total peak flows projected for the year 2040 into Pontiac pump station will be reduced from 19,100 to 17,800 gpm. Flows from the study sites will not flow into the portion of the existing system from Plainfield to Pontiac pump stations or the Sherman pump station. The existing pipes from Plainfield to Pontiac pump stations are able to carry the projected flows, although sections of these pipes will flow at a greater depth than specified in design criteria. For these reasons, under alternative 4 the existing sewer lines from Plainfield pump station to Pontiac pump station are assumed not to be upgraded to meet design criteria.

Table 6 contains a summary of design analysis for the interceptor. Table 1 contains a summary of pipes and pump stations needing upgrading under alternative 4.

b. COMSTOCK AVENUE PUMP STATION. Construction of the proposed interceptor will require the construction of a new pump station near Comstock Avenue. This station would be at the same location as in alternative 3.

(1) Year 2040 Peak Flow. NED estimates the Vinagro Site, Central Landfill, Western Cranston Industry and an additional Development at Plainfield Pike will have a peak flow of 1,890 gpm by the year 2040.

(2) Sewer Capacity. Design capacity of the Green Hill Avenue sewer line, which carries the Central Landfill's projected 360 gpm flow, is 1,100 gpm. From the intersection of Green Hill Avenue and the Plainfield Pike to the new Comstock pump station the minimum capacity sewer segment carries 1,940 gpm. This is adequate to carry the projected flows of 1,300 gpm along this segment.

(3) Pump Station Capacity. Required pumping capacity for the new Comstock pump station is 1,900 gpm at a total head of 150 feet. This will require at least 86 Hp from the motors.

c. WILBUR AVENUE PUMP STATION. The proposed interceptor will require construction of a new pump station at Wilbur Avenue.

(1) Year 2040 Peak Flows. NED estimates peak flows at the Wilbur Avenue pump station of 4,060 gpm. This includes 1,890 gpm from the Comstock pump station, 81 gpm from the Tilcon-Gammino Site and 2,086 gpm from the Western Cranston Residential Area.

(2) Sewer Capacity. The sewer lines feeding Wilbur Avenue pump station are Force Main No. 1, and Gravity Main No. 1.

Using a 12-inch pipe in Force Main No. 1 meets design requirements set by TR-16 and the City of Cranston.

For Gravity Main No. 1, using sequentially 2,000 feet of 18-inch pipe, 4,000 feet of 21-inch pipe, 5,000 feet of 18-inch pipe, and 2,600 feet of 21-inch pipe will meet all design criteria.

(3) Pump Station Capacity. The new Wilbur Avenue pump station will be built to handle the projected peak flow. Required pumping capacity for Wilbur pump station is 4,100 gpm at 202 feet of total head which will require at least 249 Hp.

d. WASTEWATER TREATMENT PLANT. The final segments of the new interceptor will run from the Wilbur pump station to the Cranston Wastewater Treatment Plant. These segments consist of Force Main No. 2 and Gravity Main No. 2.

(1) Force Main No. 2. Force main No. 2 consists of 5,000 feet of 18-inch diameter pipe. The extra flows require a larger pipe than the 15-inch used in alternative 3.

(2) Gravity Main No. 2. Gravity main No. 2 consists of 4,800 feet of 18-inch pipe followed by 4,000 feet of 30-inch pipe.

e. PLAINFIELD CIRCLE PUMP STATION

(1) Summary. Construction of the interceptor reduces flows to the Plainfield Circle pump station with the result that capacities pumps are adequate to handle projected year-2040 flows, and only 80 feet pipe would have to be upgraded to meet design criteria; however, existing pipes have the capacity to carry these flows.

(2) Year 2040 Peak Flow. NED estimates peak flows at Plainfield Circle pump station of 500 gpm by the year 2040.

(3) Sewer Capacity. Design capacity of sewer lines feeding the Plainfield station is 480 gpm. To handle projected flows of 500 gpm, and meet design criteria, 80 feet of 12-inch pipe would have to be replaced with 15-inch.

(4) Pump Station Capacity. The Plainfield Circle pump station has 2 pumps in parallel rated at 1,000 gpm at 31 feet of total head. Total station capacity is 2,000 gpm. This is greater than the projected peak flow of 500 gpm.

f. RANDALL CIRCLE PUMP STATION.

(1) Summary. With construction of the interceptor, peak year-2040 flows to the Randall Circle pump station would be reduced to 1,000 gpm. Existing pumps and capacities of main sewer lines bringing flow to the Randall pump station are adequate to carry these flows.

(2) Year 2040 Peak Flow. NED estimates peak flows of 1,000 gpm at the Randall Street pump station. This includes 500 gpm from the Plainfield Circle station and 500 gpm from residential area 12.

(3) Pump Station Capacity. The Randall Street pump station has 2 pumps in parallel rated at 1,220 gpm at 42 feet of head. Total station capacity is 2,440 gpm. This is greater than the estimated year 2040 peak flow of 1,000 gpm.

g. PONTIAC AVENUE PUMP STATION:

(1) Summary. Construction of the interceptor reduces flows to the Pontiac Avenue pump station with the effect that only 2,124 feet of pipe need to be upgraded to meet design criteria; however, existing pipes have the capacity to carry these flows. Capacities of existing pumps remain adequate but lack reserve capacity.

(2) Year 2040 Peak Flow. NED estimates peak flows of 17,800 gpm by the year 2040.

(3) Sewer Capacity. Design capacity of sewer lines feeding the Pontiac Avenue Station is inadequate to carry year-2040 flows, and 2,124 feet of pipe would have to be upgraded.

(4) Pump Station Capacity. The Pontiac Avenue pump station has 2 pumps rated at 5,550 gpm and 3 pumps rated at 3,700 gpm. Total station capacity is 22,200 gpm. This is greater than the projected peak flow of 17,800 gpm. However, additional capacity would be needed to pump projected flows with one pump out for maintenance.

h. SHERMAN AVENUE PUMP STATION.

(1) Summary. Construction of the interceptor reduces flows to the Sherman Avenue pump station by diverting discharges from Tilcon-Gammino and Western Cranston residential area. Capacities of main sewer lines bringing flow to the station are more than adequate to carry the projected flows for the year 2040. The pumping station has adequate capacity to pump the year 2040 flows but is lacking reserve capacity.

(2) Year 2040 Peak Flow. NED estimates peak flows of 1,500 gpm from the areas currently tied into the Sherman Avenue pump station.

(3) Sewer Capacity. Design capacity of sewer lines feeding the Sherman station and the Cranston WWTP is 5,960 gpm. This is greater than the projected 1,500 gpm.

(4) Pump Station Capacity. The Sherman Avenue pump station has 4 pumps (2 series of 2) rated at 2,550 gpm each at 62 ft. Total station capacity is 5,100 gpm. This is greater than the projected peak flow of 1,500 gpm.

i. HOWARD PUMP STATION. Construction of the interceptor does not affect flows into the Howard pump station. Projected peak year-2040 flow into the station is 3,730 gpm and 4,056 feet of pipe would have to be upgraded to handle it. The Howard pump station has 4 pumps in parallel rated at 1,000 gpm giving a total station capacity of 4,000 gpm. Although this is greater than the expected peak flow of 3,730 gpm, this station would need to be upgraded to pass the peak flow with one pump down for maintenance.

8. ALTERNATIVE 5

a. General. Alternative 5 involves construction of a sewer interceptor from the western part of the city to the Cranston WWTP. It differs from alternative 3 in that the final segments from the Wilbur pump station to the Cranston WWTP will be a continuous force main rather than a segment of force main followed by a gravity sewer. Also, this continuous force main will be constructed from plastic pipe with a low friction factor to reduce pumping requirements. Flows are the same as in alternatives 2 and 6. The interceptor will collect flows from the Vinagro Site, Central Landfill, Western Cranston Industrial area, Tilcon Gammino Site, and Western Cranston Residential area, but not from the Howard pump station.

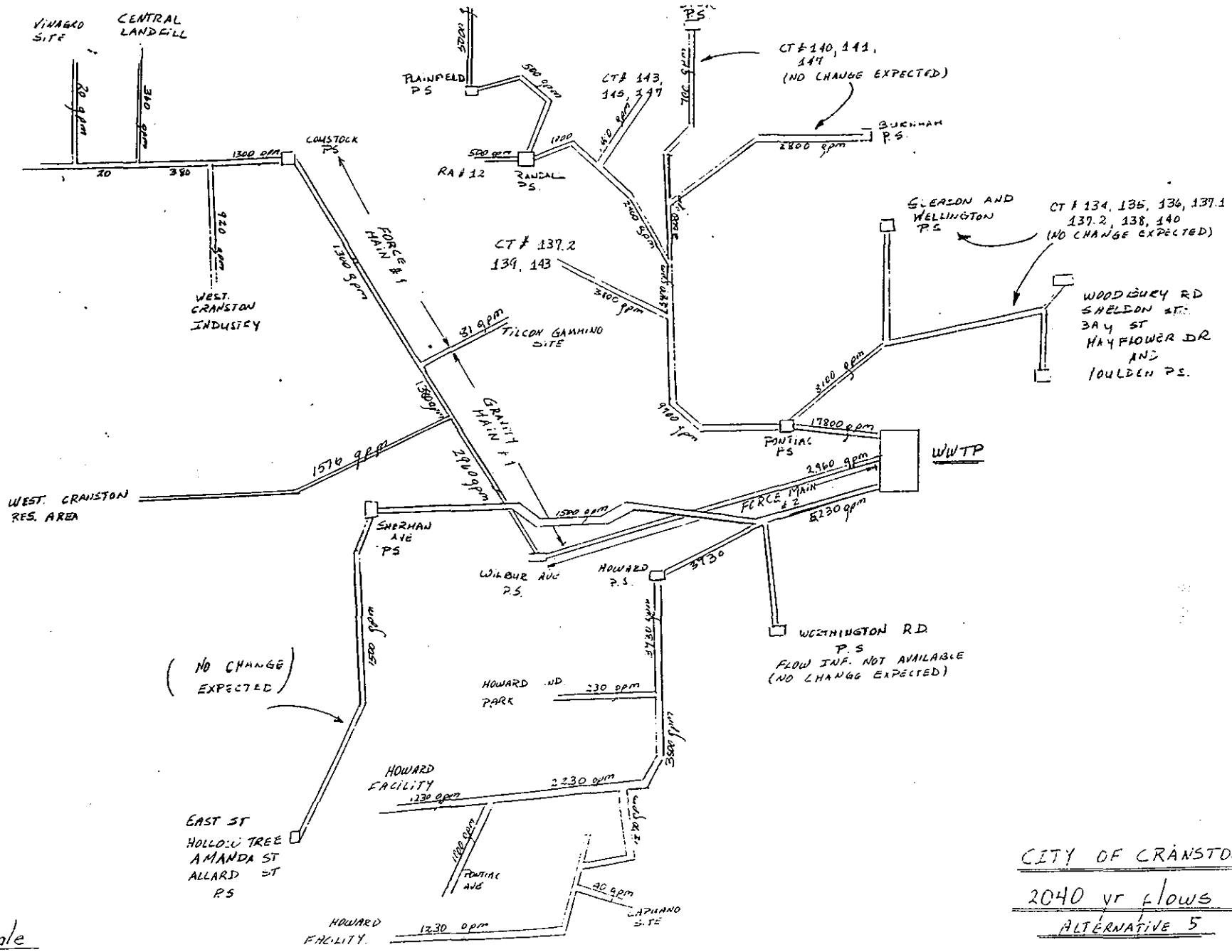
The interceptor design has 5 elements: (1) a new pump station, (Comstock pump station); (2) a 12 inch diameter, 6,000 foot long force main (Force Main No. 1); (3) a 13,600 foot long gravity main (Gravity Main No. 1); (4) a new pump station (Wilbur pump station); and (5) an 18 inch diameter, 13,800 foot long force main (Force Main No. 2).

Construction of this interceptor would eliminate need for the Welsh pump station, and flows into the Plainfield pump station would be reduced to 500 gpm. Total peak flows into the Pontiac Avenue pump station would be reduced from 19,100 to 17,800 gpm. Flows from the study sites will not flow into the portion of the existing system from Plainfield to Pontiac pump stations or the Sherman pump station. The existing pipes from Plainfield to Pontiac pump stations are able to carry the projected flows, although sections of these pipes will flow at a greater depth than specified in design criteria. For these reasons, under alternative 5 the existing sewer lines from Plainfield pump station to Pontiac pump station are assumed not to be upgraded to meet design criteria.

Table 7 contains a summary of design analysis for the interceptor. Table 1 contains a summary of pipes and pump stations needing upgrading under alternative 5.

b. COMSTOCK AVENUE PUMP STATION. The proposed interceptor would require construction of a new pump station near Comstock Avenue. This station would be the same as in alternative 3, and peak flows, and sewer capacities would also be the same as in alternative 3.

(1) Year-2040 Peak Flow. NED estimates total peak flows to the Comstock pump station from the Vinagro Site, Central Landfill, and Western Cranston Industrial area at 1,300 gpm.



Not to scale

Appendix C
Plate 5

CITY OF CRANSTON

2040 yr flows

ALTERNATIVE 5

(2) Sewer Capacity. Existing sewer pipes are adequate to carry projected flows to the Comstock Station. Design capacity of the Green Hill Avenue sewer line, which carries the Central Landfill's projected 360 gpm flow, is 1,100 gpm. From the intersection of Green Hill Avenue and the Plainfield Pike to the new Comstock pump station the minimum design capacity sewer segment carries 1,940 gpm.

(3) Pump Station Capacity. Required capacity for Comstock pump station is 1,300 gpm at a total head of 171 feet. Using the recommended 83 percent efficiency in TR-16, a 67 Hp motor would be required.

c. WILBUR AVENUE PUMP STATION. The proposed interceptor would require a new pump station on Wilbur Avenue at the same location as in alternatives 3 and 4. However, due to use of low-friction plastic pipe, a smaller station can be used.

(1) Year 2040 Peak Flows. NED estimates peak flows at the Wilbur Avenue pump station of 2,957 gpm. This includes 1,300 gpm from the Comstock pump station, 81 gpm from the Tilcon Gammino Site and 1,576 gpm from the Western Cranston Residential Area.

(2) Sewer Capacity. The sewer lines feeding Wilbur Avenue pump station are Force Main No. 1, and Gravity Main No. 1. Force Main No. 1 is 6,000 feet of 10-inch diameter pipe. Gravity Main No. 1 is made up of 4 segments: (1) 2,000 feet of 15-inch diameter pipe, (2) 4,000 feet of 18-inch pipe, (3) 5,000 feet of 15-inch pipe, and (4) 2,600 feet of 21-inch pipe.

(3) Pump Station Capacity. In order to handle projected year-2040 peak flows, the Wilbur Avenue pump station will require pumping capacity of 3,000 gpm at 191 feet of total head. This will require at least a 171 Hp motor.

d. FORCE MAIN FROM WILBUR AVENUE STATION TO WWTP. The force main (Force Main No. 2 on plate 5) from the Wilbur Avenue pump station to the Cranston WWTP consists of 13,800 feet of 18-inch diameter plastic pipe. The Manning's "n" value for this pipe is estimated at 0.009 from manufacturer's literature (Contech Construction Products, Inc. A2-101, Edition 2, 7/90).

e. PLAINFIELD CIRCLE PUMP STATION

(1) Summary. Construction of the interceptor reduces flows to the Plainfield Circle pump station with the result that capacities pumps are adequate to handle projected year-2040 flows, and only 80 feet pipe would have to be upgraded to meet design criteria.

TABLE 7
SUMMARY OF INTERCEPTOR DESIGN ANALYSIS
ALTERNATIVE 5

FORCE MAINS

Station	Q (cfs)	Q (gpm)	dia (in)	A (ft^2)	V (fps)	L (ft)	hL (ft)	Elev Chge (ft)	Head Req (ft)	Power (hp)
use n = 0.013										
F M No 1										
using Q peak	2.90	1300	10	0.55	5.31	6000	104	41	171	77
using Q ave	1.38	618	10	0.55	2.53					
use n = 0.009										
F M No 2										
using Q peak	6.59	2960	18	1.77	3.73	13800	26	140	174	156
using Q ave	3.66	1643	18	1.77	2.07					

GRAVITY MAINS

Station	Q (cfs)	Q (gpm)	dia (in)	A (ft^2)	V (fps)	L (ft)	S (ft/ft)	Elev Chge (ft)	Design Flow (gpm)	Design Veloc (fps)
use n = 0.013										
GRAV 1.1	6.59	2960	15	1.23	5.38	2000	0.038	10.86	3770	5.78
GRAV 1.2	6.59	2960	18	1.77	3.73	4000	0.014	6.58	3720	4.01
GRAV 1.3	6.59	2960	15	1.23	5.38	5000	0.032	10.03	3490	5.78
GRAV 1.4	6.59	2960	21	2.40	2.74	2600	0.008	4.92	4190	2.95

(2) Year 2040 Peak Flow. NED estimates peak flows at Plainfield Circle pump station of 500 gpm by the year 2040.

(3) Sewer Capacity. Design capacity of sewer lines feeding the Plainfield station is 480 gpm. To handle projected flows of 500 gpm, and meet design criteria, 80 feet of 12-inch pipe would have to be replaced with 15-inch.

(4) Pump Station Capacity. The Plainfield Circle pump station has 2 pumps in parallel rated at 1,000 gpm at 31 feet of total head. Total station capacity is 2,000 gpm. This is greater than the projected peak flow of 500 gpm.

f. RANDALL CIRCLE PUMP STATION.

(1) Summary. With construction of the interceptor, peak year-2040 flows to the Randall Circle pump station would be reduced to 1,000 gpm. Existing pumps and capacities of main sewer lines bringing flow to the Randall pump station are adequate to carry these flows.

(2) Year 2040 Peak Flow. NED estimates peak flows of 1,000 gpm at the Randall Street pump station. This includes 500 gpm from the Plainfield Circle station and 500 gpm from residential area 12.

(3) Pump Station Capacity. The Randall Street pump station has 2 pumps in parallel rated at 1,220 gpm at 42 feet of head. Total station capacity is 2,440 gpm. This is greater than the estimated year 2040 peak flow of 1,000 gpm.

g. PONTIAC AVENUE PUMP STATION:

(1) Summary. Construction of the interceptor reduces flows to the Pontiac Avenue pump station with the effect that only 2,124 feet of pipe need to be upgraded to meet design criteria; however, existing pipes have the capacity to carry these flows. Capacities of existing pumps remain adequate but lack reserve capacity.

(2) Year 2040 Peak Flow. NED estimates peak flows of 17,800 gpm by the year 2040.

(3) Sewer Capacity. Design capacity of sewer lines feeding the Pontiac Avenue Station is inadequate to carry year-2040 flows, and 2,124 feet of pipe would have to be upgraded.

(4) Pump Station Capacity. The Pontiac Avenue pump station has 2 pumps rated at 5,550 gpm and 3 pumps rated at 3,700 gpm. Total station capacity is 22,200 gpm. This is greater than the projected peak flow of 17,800 gpm. However,

additional capacity would be needed to pump projected flows with one pump out for maintenance.

h. SHERMAN AVENUE PUMP STATION.

(1) Summary. Construction of the interceptor reduces flows to the Sherman Avenue pump station by diverting discharges from Tilcon-Gammino and Western Cranston residential area. Capacities of main sewer lines bringing flow to the station are more than adequate to carry the projected flows for the year 2040. The pumping station has adequate capacity to pump the year 2040 flows but is lacking reserve capacity.

(2) Year 2040 Peak Flow. NED estimates peak flows of 1,500 gpm from the areas currently tied into the Sherman Avenue pump station.

(3) Sewer Capacity. Design capacity of sewer lines feeding the Sherman station and the Cranston WWTP is 5,960 gpm. This is greater than the projected 1,500 gpm.

(4) Pump Station Capacity. The Sherman Avenue pump station has 4 pumps (2 series of 2) rated at 2,550 gpm each at 62 ft. Total station capacity is 5,100 gpm. This is greater than the projected peak flow of 1,500 gpm.

i. HOWARD PUMP STATION. Construction of the interceptor does not affect flows into the Howard pump station. Projected peak year-2040 flow into the station is 3,730 gpm and 4,056 feet of pipe would have to be upgraded to handle it. The Howard pump station has 4 pumps in parallel rated at 1,000 gpm giving a total station capacity of 4,000 gpm. Although this is greater than the expected peak flow of 3,730 gpm, this station would need to be upgraded to pass the peak flow with one pump down for maintenance.

9. ALTERNATIVE 6

a. General. Alternative 6 is similar to alternative 5 but involves higher flows due to assumed heavier development in the Plainfield Pike industrial areas and Western Cranston residential areas. This alternative includes construction of a force-main interceptor from the western part of the city to the Cranston WWTP. The interceptor will collect the flows from Vinagro Site, Central Landfill, Western Cranston Industrial area, Tilcon-Gammino Site, and Western Cranston Residential area. Plate 6 summarizes the layout and flows under this alternative.

The interceptor design has 5 elements: (1) a new pump station, (Comstock pump station); (2) a 12 inch diameter, 6,000 foot long force main (Force Main No. 1); (3) a 13,600 foot long gravity main (Gravity Main No. 1); (4) a new pump station (Wilbur pump station); and (5) an 18 inch diameter, 13,800 foot long force main (Force Main No. 2).

With the construction of this interceptor, need for the Welsh pump station will be eliminated and flows into the Plainfield pump station reduced to 500 gpm. Total peak flows projected for the year 2040 into Pontiac Avenue pump station will be reduced from 19,100 to 17,800 gpm. Flows from the study sites will not flow into the portion of the existing system from Plainfield to Pontiac pump stations or the Sherman pump station. The existing pipes from Plainfield to Pontiac pump stations are able to carry the projected flows, although sections of these pipes will flow at a greater depth than specified in design criteria. For these reasons, under alternative 6 the existing sewer lines from Plainfield pump station to Pontiac pump station are assumed not to be upgraded to meet design criteria.

Table 8 contains a summary of design analysis for the interceptor. Table 1 contains a summary of pipes and pump stations needing upgrading under alternative 6.

b. COMSTOCK AVENUE PUMP STATION. Construction of the proposed interceptor will require the construction of a new pump station near Comstock Avenue. This station will be the same as and receive flows as in alternative 4.

(1) Year 2040 Peak Flow. NED estimates the Vinagro Site, Central Landfill, Western Cranston Industry and an additional Development at Plainfield Pike will have a peak flow of 1,890 gpm by the year 2040.

(2) Sewer Capacity. Design capacity of the Green Hill Avenue sewer line, which carries the Central Landfill's projected 360 gpm flow, is 1,100 gpm. From the intersection of Green Hill Avenue and the Plainfield Pike to the new Comstock pump station the minimum capacity sewer segment

carries 1,940 gpm. This is adequate to carry the projected flows of 1,300 gpm along this segment.

(3) Pump Station Capacity. Required pumping capacity for the new Comstock pump station is 1,900 gpm at a total head of 150 feet. This will require at least 86 Hp from the motors.

c. WILBUR AVENUE PUMP STATION. The proposed interceptor will require construction of a new pump station at Wilbur Avenue. This station will handle the same flows as in alternative 5; however, because of the low friction plastic pipe in the force main, smaller horsepower motors will be needed.

(1) Year 2040 Peak Flows. NED estimates peak flows at the Wilbur Avenue pump station of 4,060 gpm. This includes 1,890 gpm from the Comstock pump station, 81 gpm from the Tilcon-Gammino Site and 2,086 gpm from the Western Cranston Residential Area.

(2) Sewer Capacity. The sewer lines feeding Wilbur Avenue pump station are Force Main No. 1, and Gravity Main No. 1.

Using a 12-inch pipe in Force Main No. 1 meets design requirements set by TR-16 and the City of Cranston.

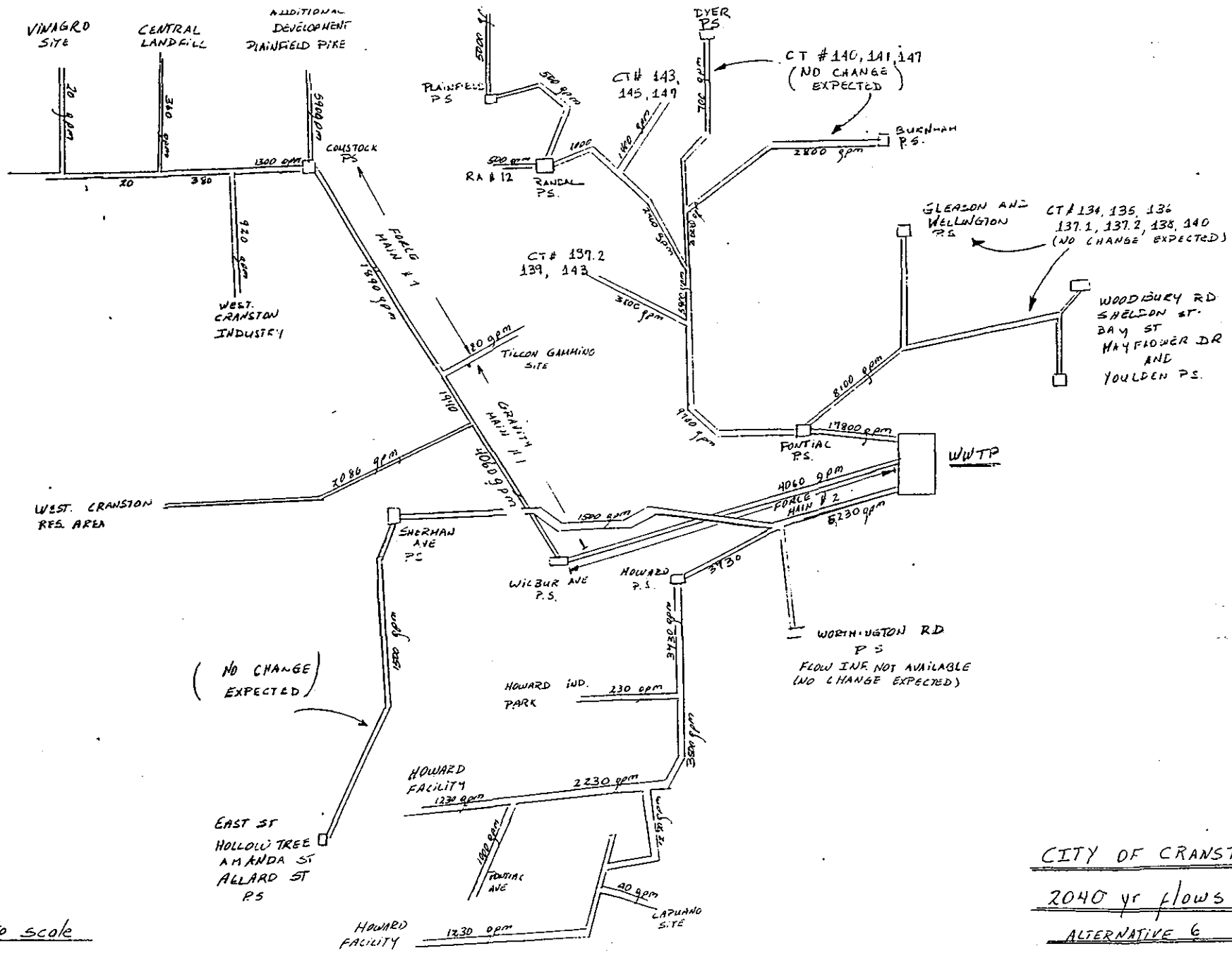
For Gravity Main No. 1, using sequentially 2,000 feet of 18-inch pipe, 4,000 feet of 21-inch pipe, 5,000 feet of 18-inch pipe, and 2,600 feet of 21-inch pipe will meet all design criteria.

(3) Pump Station Capacity. The new Wilbur Avenue pump station will be built to handle the projected peak flow. Required pumping capacity for Wilbur pump station is 4,100 gpm at 183 feet of total head which will require at least 225 Hp.

d. WASTEWATER TREATMENT PLANT. The final segment of the new interceptor will be a 13,800 foot long 18-inch plastic force main (Force Main No. 2) from the Wilbur pump station to the Cranston Wastewater Treatment Plant.

e. PLAINFIELD CIRCLE PUMP STATION

(1) Summary. Construction of the interceptor reduces flows to the Plainfield Circle pump station with the result that capacities pumps are adequate to handle projected year-2040 flows, and only 80 feet pipe would have to be upgraded to meet design criteria; however, existing pipes have the capacity to carry these flows.



Not to scale

Appendix C
Plate 6

CITY OF CRANSTON

2040 yr flows

ALTERNATIVE 6

TABLE 8
SUMMARY OF INTERCEPTOR DESIGN ANALYSIS
ALTERNATIVE 6

FORCE MAINS

Pumping Station	Q (cfs)	Q (gpm)	dia (in)	A (ft^2)	V (fps)	L (ft)	hL (ft)	Elev Chge (ft)	Head Req (ft)	Power (hp)
use n= 0.013										
F M No 1										
Using Q peak	4.21	1890	12	0.79	5.36	6000	83	41	150	100
using Q ave	2.10	944	12	0.79	2.68	6000	21			
use n = 0.009										
F M No 2										
using Q peak	9.05	4060	18	1.77	5.12	13800	49	140	189	225
using Q ave	5.30	2379	18	1.77	3.00	13800	17	183		

GRAVITY MAINS

Station	Q (cfs)	Q (gpm)	dia (in)	A (ft^2)	V (fps)	L (ft)	S (ft/ft)	Elev Chge (ft)	Design Flow (gpm)	Design Veloc (fps)
use n = 0.013										
GRAV 1.1	9.05	4060	18	1.77	5.12	2000	0.038	11	6140	5.51
GRAV 1.2	9.05	4060	21	2.40	3.76	4000	0.014	7	5610	4.04
GRAV 1.3	9.05	4060	18	1.77	5.12	5000	0.032	10	5670	5.51
GRAV 1.4	9.05	4060	21	2.40	3.76	2600	0.008	5	4190	4.04

(2) Year 2040 Peak Flow. NED estimates peak flows at Plainfield Circle pump station of 500 gpm by the year 2040.

(3) Sewer Capacity. Design capacity of sewer lines feeding the Plainfield station is 480 gpm. To handle projected flows of 500 gpm, 80 feet of 12-inch pipe would have to be replaced with 15-inch.

(4) Pump Station Capacity. The Plainfield Circle pump station has 2 pumps in parallel rated at 1,000 gpm at 31 feet of total head. Total station capacity is 2,000 gpm. This is greater than the projected peak flow of 500 gpm.

f. RANDALL CIRCLE PUMP STATION.

(1) Summary. With construction of the interceptor, peak year-2040 flows to the Randall Circle pump station would be reduced to 1,000 gpm. Existing pumps and capacities of main sewer lines bringing flow to the Randall pump station are adequate to carry these flows.

(2) Year 2040 Peak Flow. NED estimates peak flows of 1,000 gpm at the Randall Street pump station. This includes 500 gpm from the Plainfield Circle station and 500 gpm from residential area 12.

(3) Pump Station Capacity. The Randall Street pump station has 2 pumps in parallel rated at 1,220 gpm at 42 feet of head. Total station capacity is 2,440 gpm. This is greater than the estimated year 2040 peak flow of 1,000 gpm.

g. PONTIAC AVENUE PUMP STATION:

(1) Summary. Construction of the interceptor reduces flows to the Pontiac Avenue pump station with the effect that only 2,124 feet of pipe need to be upgraded to meet design criteria; however, existing pipes have the capacity to carry these flows. Capacities of existing pumps remain adequate but lack reserve capacity.

(2) Year 2040 Peak Flow. NED estimates peak flows of 17,800 gpm by the year 2040.

(3) Sewer Capacity. Design capacity of sewer lines feeding the Pontiac Avenue Station is inadequate to carry year-2040 flows, and 2,124 feet of pipe would have to be upgraded.

(4) Pump Station Capacity. The Pontiac Avenue pump station has 2 pumps rated at 5,550 gpm and 3 pumps rated at 3,700 gpm. Total station capacity is 22,200 gpm. This is greater than the projected peak flow of 17,800 gpm. However,

additional capacity would be needed to pump projected flows with one pump out for maintenance.

h. SHERMAN AVENUE PUMP STATION.

(1) Summary. Construction of the interceptor reduces flows to the Sherman Avenue pump station by diverting discharges from Tilcon-Gammino and Western Cranston residential area. Capacities of main sewer lines bringing flow to the station are more than adequate to carry the projected flows for the year 2040. The pumping station has adequate capacity to pump the year 2040 flows but is lacking reserve capacity.

(2) Year 2040 Peak Flow. NED estimates peak flows of 1,500 gpm from the areas currently tied into the Sherman Avenue pump station.

(3) Sewer Capacity. Design capacity of sewer lines feeding the Sherman station and the Cranston WWTP is 5,960 gpm. This is greater than the projected 1,500 gpm.

(4) Pump Station Capacity. The Sherman Avenue pump station has 4 pumps (2 series of 2) rated at 2,550 gpm each at 62 ft. Total station capacity is 5,100 gpm. This is greater than the projected peak flow of 1,500 gpm.

i. HOWARD PUMP STATION. Construction of the interceptor does not affect flows into the Howard pump station. Projected peak year-2040 flow into the station is 3,730 gpm and 4,056 feet of pipe would have to be upgraded to handle it. The Howard pump station has 4 pumps in parallel rated at 1,000 gpm giving a total station capacity of 4,000 gpm. Although this is greater than the expected peak flow of 3,730 gpm, this station would need to be upgraded to pass the peak flow with one pump down for maintenance.

Attachment A to Appendix C

Projected year-2040 peak flows for areas contributory to sewer lines between the Randall Street and Pontiac Avenue pump stations were computed as described below.

For the purposes of this study, and because the areas are heavily developed, it was assumed that year-2040 flows would be similar to present flows. Flows were estimated based census tract and building permit data obtained from the City of Cranston.

The area was subdivided into 4 areas as shown in Figure A-1. Area 1 included flows entering the main sewer lines along Randall Street and Park Avenue. Area 2 included flows from the Dyer Avenue and Burnham Avenue pump stations. Area 3 included areas between Park Avenue and the Pontiac Avenue pump station (exclusive of Area 4). Area 4 included flows from the Gleason, Wellington, Woodbury, Sheldon, Bay, Mayflower, and Youlden pump stations.

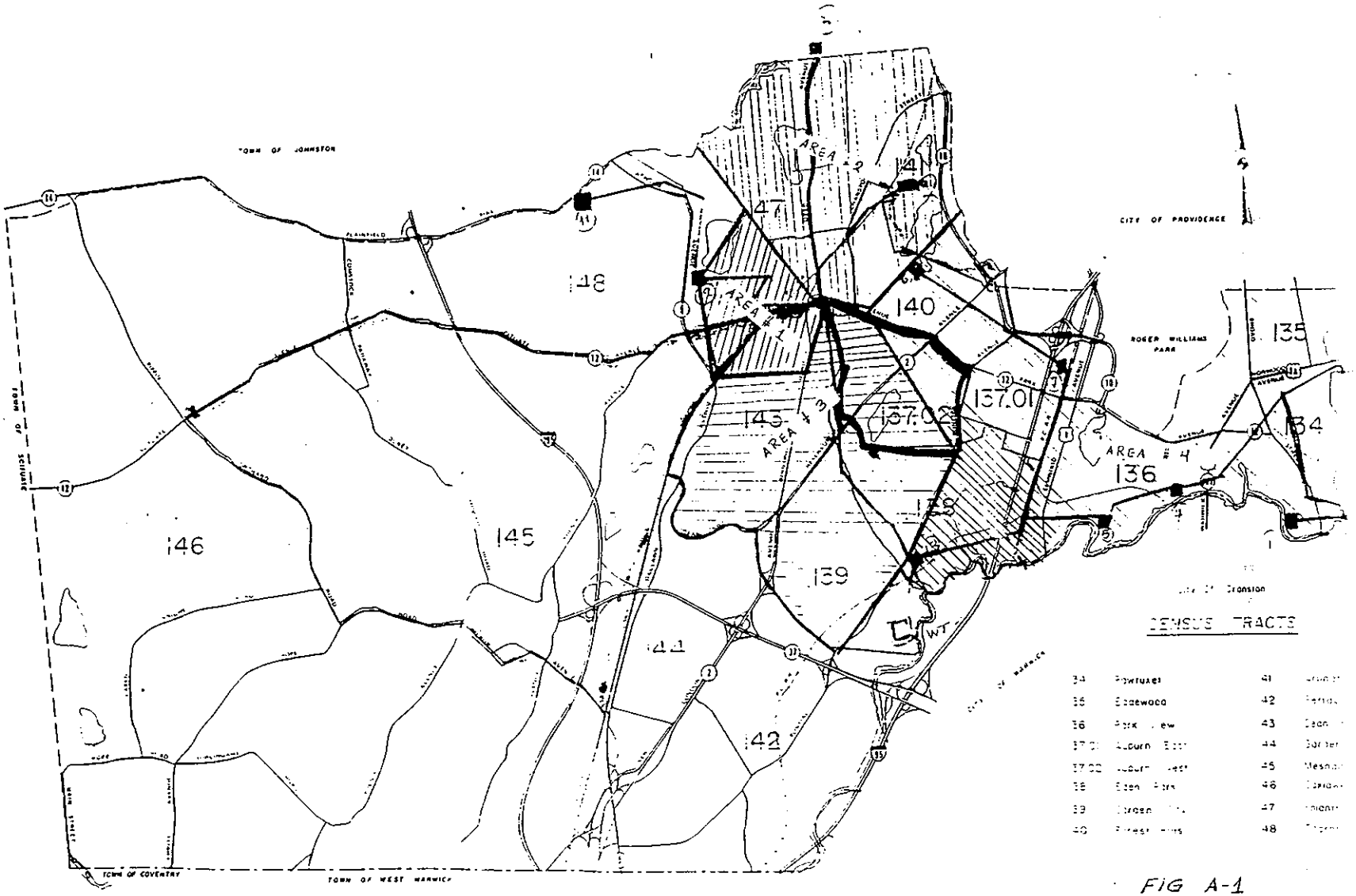
Each tract area, or a percentage of it, was allocated to the closest sewer line and the pump station that sewer flowed into. Figure A-1 shows the limits of areas 1 through 4.

Wastewater flow rates were estimated assuming 2.5 people per unit, and average flows of 75 gallons per capita day. Ratios of peak to average flows varied depending on the size of the population, and were taken from table 1 in TR-16, "Guides for the Design of Wastewater Treatment Works."

Total flows from these 4 areas and Randall Street pump station were less than the reported present peak flow of 18,300 gpm at the Pontiac Avenue pump station. This difference was assumed due to infiltration and underestimates of usage. Flows from areas 1 through 4 were adjusted upward by a factor of 1.8 to give the final estimate.

This adjustment factor was computed as follows: reported peak flow at Pontiac Ave. PS minus reported peak flow at Randall St. PS (18,300 - 507 = 17,793 rounded to 17,500 gpm), divided by computed peak flow at Pontiac Ave. PS minus reported peak minus reported peak flow at Randall St. PS (9,878 - 507 = 9,371 rounded to 9,500 gpm). Adjustment factor = 17,500/9,500 = 1.8.

Table A-1 summarizes flow estimates from these areas.



Attachment A
Figure A-1

TABLE A-1
MAX. PEAK FLOW FROM CENSUS TRACT INFORMATION
EAST CRANSTON

GUIDELINES:
POPULATION = 2.5 PEOPLE/UNIT
AVERAGE FLOW = 75 GPD/CAPITA
Q ave/Q max ratio taken from "TR-16", Table 1"

TRACT No	PERCENTAGE OF TRACT USED	TOT UNITS	POP	Q ave (gpm)	Q max (gpm)	Q max (cfs)	Qmax * 1.5 (gpm)
Area # 1: Flows after Randall St PS (PS # 12) on Randall St. and Park Ave.							
143	30% Pop.	642	1604.2	83.55	257.37	0.60	
145	5% Pop.	100	250.0	13.02	45.57	0.10	
147	35% Pop.	1080	2699.4	140.59	506.13	1.13	
			TOTAL	237.17	819.08	1.83	1400.00
Area # 2: Flows from Dyer Ave PS and Burnham Ave PS (PS # 8 and 9)							
140	20%	488	1221.0	63.59	241.66	0.54	
141	100%	2019	5047.5	262.89	854.39	1.90	
147	65%	2005	5013.1	261.10	848.58	1.89	
			TOTAL	587.58	1944.63	4.33	3500.00
Area # 3: Flows after Park Ave. into the Pontiac Ave PS (PS # 13)							
137.2	68%	850	2125.0	110.68	398.44	0.89	
138	45%	958	2395.1	124.75	436.61	0.97	
139	100%	1387	3467.5	180.60	632.10	1.41	
143	70%	1497	3743.3	194.96	623.88	1.39	
			TOTAL	610.98	2091.02	4.66	3800.00

TABLE A-1 (Cont.)

TRACT No	PERCENTAGE OF TRACT USED	TOT UNITS	POP	Q ave (gpm)	Q max (gpm)	Q max (cfs)	Qmax * 1.3 (gpm)
Area # 4: Flows from Gleason, Wellington, Woodbury, Sheldon, Bay, Mayflower and Youlden P.S. (PS # 1 to 7)							
134	100%	1877	4692.5	244.40	794.30	1.77	
135	100%	2124	5310.0	276.56	885.00	1.97	
136	100%	1203	3007.5	156.64	548.24	1.22	
137.1	100%	1757	4392.5	228.78	743.52	1.66	
137.2	32%	400	1000.0	52.08	197.92	0.44	
138	55%	1171	2927.4	152.47	533.64	1.19	
140	80%	1954	4884.0	254.38	814.00	1.81	
			TOTAL	1365.31	4516.62	10.06	8100.00
Flow at pumping station No. 12					507.00		2300.00
				Area 1	2091.02		
				Area 2	1944.53		
				Area 3	4516.62		
				Area 4	819.08		
Year 2040 peak flow at PS # 13:					9878.35	(GPM)	13100.00 (GPM)

APPENDIX D

CORRESPONDENCE

CLAUDINE SCHNEIDER
2ND DISTRICT, RHODE ISLAND

1512 LONGWORTH BUILDING
WASHINGTON, D.C. 20515
(202) 225-2735

95 SOCKANOSSET CR. #303
CRANSTON, RHODE ISLAND 02920
(401) 528-5220

CONGRESSIONAL COMPETITIVENESS CAUCUS
CO CHAIR

NORTHEAST MIDWEST CONGRESSIONAL COALITION
TREASURER

Congress of the United States

HOUSE OF REPRESENTATIVES
WASHINGTON, D.C. 20515

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NATURAL RESOURCES & ENVIRONMENT
(RANKING MINORITY MEMBER)
SCIENCE, RESEARCH & TECHNOLOGY

MERCHANT MARINE AND FISHERIES
OVERSIGHT & INVESTIGATIONS
(RANKING MINORITY MEMBER)
FISHERIES & WILDLIFE

AGING
HEALTH & LONG TERM CARE

July 25, 1990

The Honorable Robert W. Page
Assistant Secretary of the Army (Civil Works)
Pentagon
Washington, D.C. 20310

Dear Mr. Page:

I am writing to request your support for a project of great importance to the state of Rhode Island. The project offers an outstanding opportunity to address several environmental problems by connecting multiple sources of pollution with a wastewater facility in Cranston that has excess treatment capacity.

One of the most valuable uses of such a connector system would be to collect leachate and wastewater from nearby landfills, including a Superfund site at the Central Landfill. In addition, it would relieve the dependence on septic tanks in western Cranston, and assist compliance with a water pollution control consent agreement.

Cranston is NOT seeking federal funding to construct the sewer connectors. This will be paid for through local bonds. Cranston IS seeking federal support for a reconnaissance study, feasibility report, and design demonstration to show the project will work.

First, I would like to request that the Army Corps of Engineers perform a reconnaissance study of the Cranston project as soon as possible. Completion of this study would help the project get underway and pave the way for further work.

Second, I would like to request that the Corps support my efforts to include authorizing language for a feasibility report and design demonstration to be included in H.R. 5314, the Water Resources Development Act. I believe that only $1 million would be needed for the Army Corps of Engineers to complete the feasibility report and $5 million for the design demonstration.

The Corps has proven expertise in the Superfund and wastewater treatment fields which could be put to good use on behalf of this very meritorious project. Therefore, I respectfully request that the Corps make every effort on behalf of assisting this project.

Thank you for your consideration of this request. I have enclosed documents relating to the project for your review. If you have any other questions, please feel free to give a call to me or my staff person, Wesley Warren.

Sincerely,

Claudine Schneider

Claudine Schneider, M.C.

THIS STATIONERY PRINTED ON PAPER MADE OF RECYCLED FIBERS

CITY OF CRANSTON POLICY STATEMENT

WESTERN CRANSTON SEWER PROJECT

The City of Cranston is a growing, dynamic community of approximately 75,000 people. The building climate in the past several years has been extremely active; the majority of this activity has taken place west of Rt. 295 in areas of Cranston not currently serviced by municipal sewers.

The City vigorously supports the concept of an extension of sewer services into Western Cranston. We view this innovative project as an integral means of addressing local and regional environmental concerns, as well as providing the infrastructure capability for continued economic growth and sensitive residential development.

The successful implementation of this policy will provide Cranston with a blueprint for growth and development, balanced with respect for the environment. It represents nothing less than a vision from our community into the 21st century.

The specific elements of this comprehensive program are highlighted below:

Use of innovative technology, including pumping stations with energy efficient motors and variable frequency drives that can save 25-50% of normal power consumption costs. The proposed crosstown force main and pressure sewer will result in substantial capital cost savings. The use of durable PVC pipe will entail further energy savings because of its very low friction.

- <u>Environmental Protection</u> - <u>Western Cranston Groundwater</u>
  Installation of sewers in Western Cranston will drastically reduce the increasing problem of groundwater contamination resulting from faulty septic systems.
- <u>Central Landfill</u>
  The construction of a new Western Cranston line will bring the advanced secondary treatment capabilities of the Cranston Wastewater Treatment Plant to within one mile of the State of Rhode Island Central Landfill in Johnston, R.I. A proposed waste to energy facility is currently seeking a sewer connection for wastewater. Of even greater potential concern is the issue of possible ground water contamination from the

landfill infiltrating into the watershed of the Scituate Reservoir (although further testing is required to determine the extent of the problem). With proper pretreatment, leachate from the landfill could be safely treated at the Cranston Wastewater Treatment Plant.

In both issues, a Western Cranston sewer project can benefit the entire region by facilitating proper disposal of waste as well as providing for the protection of the public water supply of the Providence Metropolitan Area. No other treatment plant in the area offers the same capabilities.

- Economic Development

  Construction of a Western Cranston sewer line will enable the continuation of tax base expansion through economic development. Specifically it will provide sewer capabilities for full development of an additional 200 acres of the Western Cranston Industrial Area, an additional 100 acres in Phase III of the Howard Industrial Park and the 45 acre Training School site. Long range, the sewer line will also provide for future development of the 150 acre Tilcon-Cammino site along Rt. 295.

- City Planning - Western Cranston

  A project of this magnitude will serve as a catalyst for resolution of critical issue of residential development and open space. Plans for a sewer extension into Western Cranston will be accompanied with policies and methods for preserving open space, avoiding suburban sprawl, and maintaining the rural character of Western Cranston for the enjoyment of this and future generations. These policies will include the encouragement of cluster development as well as the acquisition of farm and open space development rights.

TUTELA ENGINEERING ASSOCIATES
P. O. BOX 28066
PROVIDENCE, RHODE ISLAND 02908
TEL. (401) 861-6880

DOMENIC V. TUTELA, P.E., PRESIDENT

March 23, 1990

Representative Claudine Schneider
30 Rolfe St.
Cranston, RI 02910

Re: Demonstration Grant-Innovative Technology
Wastewater Pumping/Transportation System

Dear Representative Schneider:

I am writing as engineering consultant to the City of Cranston to outline the technical aspects and economics of wastewater pumping and transportation techniques proposed for the western Cranston area of the City. The western Cranston sewer project includes an interceptor sewer to collect flows in western Cranston and the Central Landfill (leachate). This sewer includes about 20,000 LF of 18" & 24' diameter gravity sewer to the proposed Wilbur Avenue Pumping station adjacent to interstate Route 295. The western Cranston wastewater will then be pumped through a 24" forcemain/pressure sewer system about 14,000 feet to the Cranston Wastewater Treatment Plant. This wastewater transportation system will allow for the Rhode Island Solid Waste Management Landfill leachate discharge to be permanently connected to the Cranston wastewater treatment plant and will also allow for the connection of homes and industry in western Cranston. Western Cranston wastewater needs are currently served by Individual Sewage Disposal Systems (septic systems). All of these systems discharge to the shallow soils which are very dense and not suitable for this type of sewage disposal system. It is feared that groundwater is being contaminated by these systems. This project will provide the necessary artery to relieve this problem. In addition the Cranston Wastewater Treatment Plant was completed in 1985. This facility was designed to treat an average daily wastewater flow of 23 MGD by the year 2000. The plant currently treats about 12 MGD vs. the 16 MGD anticipated by 1990. The reasons for this shortfall include the closing of the Ciba-Geigy Chemical Plant in the early 1980's (-1.5 MGD), an aggressive industrial pretreatment program has reduced industrial flows through water conservation (-0.5 MGD), reductions in Infiltration/Inflow (-1.0 MGD) and the failure to provide an interceptor/transportation sewer to serve western Cranston (-1.5 MGD). In addition, western Cranston needs public facilities such as schools, which require sewage disposal facilities for large quantities of wastewater. As previously mentioned, the subsurface soils are not suitable for the use of septic systems.

The portion of the project beginning at and including the Wilbur Avenue Pumping Station and the 24" force main and pressure sewer are the subject of this letter. The design of the pumping station will include "energy efficient electric motors" which are capable of saving 10% of the power used by conventional motors and will also include the use of variable frequency drives.

The practical use of variable frequency drives as a method for controlling the operating speed of centrifugal pumps is fairly new. This solid state technology was developed about twenty years ago. The advantages to this type of drive are ease of operation and maintenance, reliability and competitive pricing. The VFD drive also has the advantage of a much greater turn down range than variable speed drives currently in use in the wastewater industry.

Using a hypothetical single pump example where static lift is zero and the flow range is between 30% and 50% of design; the savings using a VFD system would be about 85% over a conventional system. Of course this is an extreme case. Under design conditions normally encountered; we would expect between 25% and 50% power savings.

The reasons it is possible to run a pump system at less than design capacity are two fold. The first is that pump systems are designed for peak flow conditions so that the pumping facility will not be flooded during this period. This means the pump may be sized several times larger than what is required to meet average flow conditions. Using normal design practice, a pumping station designed for an average daily flow of 1.0 MGD may be designed for a peak flow of 3.0 MGD. This pumping station would normally require pumping at about 33% of the pump capacity. Enormous power savings can be realized by using variable frequency drives in this instance. The second factor affecting actual flow versus design pump capacity is the common and necessary factor of allowing for some growth in the pumping station service area. The Wilbur Avenue Pumping Sation would be designed to accomodate full development of the western Cranston area. The initial pump installations would have a capacity of ten to twenty years predicted population growth and interceptor extensions with provisions for additional pump installation as flow increases. The use of variable frequency drives will result in considerable power savings at the Wilbur Avenue Pumping Station from its start up and through its entire operating life.

The use of low friction plastic (PVC) pipe is another major contributor to reduced power costs. PVC pipe has a very low coefficient of friction, C=150 (Hazen-Williams) versus C=140 for cement lined ductile iron pipe. The friction savings is about 13% which may translate to about 10% in additional power savings at maximum pumping rate.

The use of a force main/pressure sewer system versus a force main/gravity sewer system will reduce construction costs of the gravity portion of the system by 20%-40%. Where possible, the pressure sewer pipeline may follow the contour of the ground using air release valves and gravity cleanout connections as necessary. Conventional design dictates a gravity sewer be used when the topography allows. This requires the construction of the pipeline at hydraulically calculated grades on an even slope between manholes spaced every 300-500 feet. Gravity sewer construction is convenient where frequent connections for interception of house connections and street sewers is required. It is not necessary when the purpose of the sewer is primarily for transmission of wastewater. The cost of

construction of gravity sewers is much higher than force main/pressure sewer construction. This higher cost is usually associated with deeper construction and the requirement for constant vertical drop. The advantage of the pressure sewer is that it can go up and down below the hydraulic grade line provided adequate safeguards are installed. These safeguards include combination air valves to allow air to enter and leave the system, and the use of cleanouts and discharges to adjacent wastewater collection systems.

The several innovations described herein need demonstration in a large scale system such as is proposed. The power savings through the use of "energy efficient" electric motors and variable frequency pump motor drives in combination with PVC pipe can only be assessed after full scale demonstration in a large pumping facility. The Wilbur Avenue Pumping Station will be designed for an average daily flow of 8.4 MGD and a peak flow of 17 MGD. Should this design approach prove to be as successful as anticipated, it will have wide application for new pumping stations designs and retrofitting of existing facilities. The energy savings would substantially reduce operations costs as well as have the added benefit of reducing the demand on electric operating resources.

The use of a "pressure sewer" versus a "conventional gravity" system needs large scale demonstration over an extended period of time to prove that the technology is as functional as the conventional gravity design. Also to be demonstrated is the substantial savings in construction to be realized by this type of construction. This type of design could have wide spread application in systems throughout the country. It is especially useful when remote areas of communities must have their wastewater transported through populated areas in order to connect to existing wastewater treatment facilities. Pressure sewer construction is not only less costly, but is also less destructive than conventional types of design.

The information provided herein is not the result of a full scale study but is our professional opinion of the approaches and innovative techniques that should be used to provide sewers to the western area of the City of Cranston. We feel the innovative wastewater transportation approaches deserve the attention of EPA and other federal agencies. The risks of success are nowhere as great as the

benefits to be derived from using these new approaches. If you need any additional information, please do not hesitate to call.

Very truly yours,

TUTELA ENGINEERING ASSOCIATES

Domenic V. Tutela, P.E.
President

encl.

cc: Mayor Traficante
E. Palazzo
R. Azar
J.W. Harsch

DVT/mat

#I110
108-19

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, DC 20310-0103

REPLY TO
ATTENTION OF

1 AUG 1990

Honorable Claudine Schneider
House of Representatives
Washington, D. C. 20515

Dear Congresswoman Schneider:

Thank you for your letter of July 25, 1990, regarding the potential to address environmental problems by connecting multiple sources of pollution with a wastewater facility in Cranston.

I am pleased to inform you that, through its Planning Assistance to States Program (Section 22, Public Law 93-251), additional Fiscal Year 1990 funds can be made available to the Army Corps of Engineers New England Division so that the Corps can cooperate with the State of Rhode Island to begin development of plans for a connector system for Cranston. Specifically, a reconnaissance level study will be initiated in accord with established Section 22 procedures, upon written request from the State of Rhode Island to the New England Division indicating the State's support for this work.

With regard to our position on authorization of a feasibility study and design demonstration, we are unable to support this effort since it lies outside our priority missions of navigation and flood control. The demands for these mission areas exceed our present budgetary resources.

Sincerely,

Robert W. Page
Assistant Secretary of the Army
(Civil Works)

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Administration
DIVISION OF PLANNING
One Capitol Hill
Providence, RI 02908-5870

August 6, 1990

Mr. Joseph Ignazio, Chief
Planning Division
Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

Dear Joe:

On June 26 I wrote to you recommending that studies be undertaken through the Planning Assistance and Flood Plain Management Service Programs. I have subsequently become aware of another opportunity to utilize the Planning Assistance (Section 22) Program as part of an ongoing effort by the City of Cranston and State of Rhode Island, to accomplish essential planning for the Western Cranston Interceptor Sewer.

The proposed interceptor would address several critical water quality issues in an area that is either unsewered, or where existing sewers are being used to capacity. It would serve the Solid Waste Management Corporation's Central Landfill (in the Town of Johnston), two major industrial sites, a growing residential area, the complex of State health care, custodial, and correctional institutions at the Howard Reservation, and a landfill that, although closed, is apparently leaching pollution. Initial studies by the City of Cranston have led to a technically innovative proposal that addresses serious threats to ground and surface water quality and makes use of existing uncommitted capacity in the Cranston Wastewater Treatment Facility. Some information on this proposal has been provided to Mr. Paul Pronovost of your staff.

The unique aspects of this proposal have led to its very serious consideration for federal funding in legislation providing for the conservation and development of water and related resources, currently before Congress. Consequently, it is logical to initiate more detailed planning for this important project. Section 22 appears to be an effective and timely way to do this. Consequently, I request that you initiate this work and give it priority for available federal fiscal year 1990 funds.

Yours very truly,

Daniel W. Varin
Associate Director

DWV:cac
FAX: (617) 647-8080
pc: [redacted]
Mr. Edward Symanski, RIDEM
Mr. Steven DeToy, Cranston Community Development
J. William Harsch, Esq., Coffey & Martinelli [FAX: (331-8450)]

D.9

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, DC 20310-0103

REPLY TO
ATTENTION OF

Honorable Claudine Schneider
House of Representatives
Washington, D. C. 20515

Dear Congresswoman Schneider:

As a follow-on to my letter of August 1, 1990, I am pleased to inform you of the progress we have made on your request.

The New England Division of the Army Corps of Engineers has received the formal request from the State of Rhode Island for a reconnaissance study under the Corps Planning Assistance to States (Section 22) Program of a connector system between several pollution sources and the wastewater facility in Cranston, Rhode Island.

We are making available $150,000 to the New England Division to cover the cost of this study, which should be completed next fiscal year at full Federal expense. Highlights of the study include the identification of: alternative designs, including preliminary engineering and cost estimates, economic evaluations, environmental assessments, real estate requirements, and significant long and short term construction effects; applicable Federal, State, and local requirements and permits; suggested field testing; and the tasks involved in preparing final design and cost estimates. The study would also include the preparation of preliminary time and cost estimates for the entire project, including the development of a logic network and critical path analysis for doing the work.

Sincerely,

Robert W. Page
Assistant Secretary of the Army
(Civil Works)

cf: CRC
CECW-Z
SACW (file, read, sign)
SD/ccg/20Aug90
TR/A:/Schneider

114 S

February 21, 1991

Planning Directorate
Basin Management Division

Mr. Edward Burke, Chairman
Providence Water Supply Board
552 Academy Ave.
Providence, RI.

Dear Mr. Burke,

The U.S. Army Corps of Engineers, New England Division is conducting a Section 22 "Planning Assistance to the States" investigation of wastewater and related problems identified by the City of Cranston. The study was requested by the city of Cranston and the Rhode Island Division of Planning. The purpose of the study is to define the problems at study sites, formulate and evaluate plans to correct the problems, and suggest a future course of action. The study is based entirely on existing information.

One of the study sites is the Central Landfill in Johnston. The City identified the problem of a possible water quality threat to Scituate Reservoir posed by leachate from the Central landfill. We have collected information on this issue from staff at the Providence Water Supply Board, U.S.Geological Survey, Solid Waste Management Corporation, and Rhode Island Department of Environmental Management. When we met with Mr. Hans Bergi and Mr. Christopher Modisette of your staff in November 1990 they provided a copy of the CH2M Hill report entitled "Evaluation of Central Landfill and its Potential Impacts on the Scituate Reservoir" dated October 1988.

All available data gathered from these agencies indicates: 1) landfill leachate is moving away from Scituate Reservoir and: 2) the possibility of a deep bedrock connection existing that would contaminate Scituate Reservoir is extremely remote and too small to consider further as an environmental problem in our study. However, the city of Cranston has indicated that even a remote possibility is something that must be viewed with great seriousness.

In order to fully address this sensitive issue we would appreciate a policy statement from the Providence Water Supply Board regarding your views on the threat of contamination to Scituate Reservoir by leachate from the Central landfill. We would appreciate a reply as soon as possible.

If you have any questions regarding our investigation, please contact Ms. Barbara Blumeris of my staff at (617) 647-8737.

Joseph L. Ignazio
Director of Planning

cf:
BMD file,114S
B. Blumeris, 114S (RIMEMOSII, pwsbltr)

March 4, 1991

Planning Directorate
Basin Management Division

Mr. Domenic Tutela
Tutela Engineering Associates
11 Middlesex Ave.
P.O. Box 817
Wilmington, MA 01887

Dear Mr. Tutela:

I am writing to you regarding the Corps of Engineers' Section 22 investigation of wastewater and related problems in Cranston, Rhode Island. In conversations between members of my staff, city officials, and yourself, we have requested information on the City's existing sewer system required as part of our investigation. We still require the following information.

- Existing peak flows or peak factor at Welsh, Plainfield, Randall, Pontiac, and Howard pump stations (PS).

- Information on the length, diameter, slopes of gravity mains, and force mains that carry the wastewater flow from Greenhill Ave. via Welsh PS via Plainfield PS via Randall PS via Pontiac PS to the wastewater treatment plant.

- Information on the length, diameter, slope of gravity mains, and force mains that carry the wastewater flow the Howard Facility and the Howard Industrial Park to the wastewater treatment plant.

- Copy of the report "Cranston Sewer System Impact Analysis, April 1988 average daily flow" prepared by Tutela Associates.

- Any future flow projections you may have calculated for the study sites.

In addition, to assess a possible connection of the western Cranston area to the Sherman Ave. pump station we require:

- Existing average day and peak flows or peak factor at the Sherman Avenue PS, number of pumps at this station and rated capacity. Information on the length, diameter, slope of gravity mains, and force mains that carry the wastewater flow this pump station to the wastewater treatment plant.

In our initial discussions with the Cranston officials, it was suggested that a sewer interceptor using innovated and alternative approaches was a means of alleviating many of the wastewater problems faced by the city. This approach was also suggested in your letter to Representative Claudine Schneider dated 23 March 1990. Since this unique approach was presented by your firm, we would appreciate your assistance in providing us with any design or cost information you may have on the innovative alternative aspects of the sewer interceptor. The items mentioned in the letter are the use of energy efficient electric motors, variable frequency drives, the use of low friction plastic pipe, and the use of a force main/pressure sewer. These items appear to be recommended for the portion of the interceptor from the Wilbur Avenue pump station to the wastewater treatment plant. We would also be interested in obtaining any information you may have on the application of this technology in other sewer systems and on the cost savings of this technology versus standard technology.

In order to achieve our end of June completion schedule for this Section 22 investigation, we need to receive this information from you by 12 March 1990. If you have any questions concerning this request, please contact Mrs. Barbara Blumeris of my staff at (617) 647-8737. Thank-you in advance for your cooperation.

Sincerely,

Joseph L. Ignazio
Director of Planning

Copy Furnished:

Mr. Raymond Azar
Cranston City Hall
269 Park Avenue
Cranston, RI 02910

cf:
B. Blumeris (114S,rimemosII, tutltr2)
BMD file, 114S

March 4, 1991

Planning Directorate
Basin Management Division

Ms. Virginia deLima
United States Geological Survey
Water Resources Division
Pastore Federal Building, USPO
Providence, RI 02903

Dear Ms. deLima:

The U.S. Army Corps of Engineers, New England Division is conducting a Section 22 "Planning Assistance to the States Study" of wastewater collection problems identified by the City of Cranston. The study was requested by the City of Cranston and the Rhode Island Division of Planning. This study is defining the wastewater problems at study sites, formulating and evaluating plans to fix the problems, and suggesting a future course of action. The study is based on existing information.

One of the study sites is the Central Landfill in Johnston. The City identified the leachate from the site and groundwater contamination at the site as a possible water quality threat to Scituate Reservoir.

We have collected information relative to this issue from your office, "USGS Quadrangle Maps Groundwater Resources" and from a letter signed by Mr. Herbert Johnston to the Governor dated 12 October 1983; from staff at the Providence Water Supply Board, CH2M Hill report entitled "Evaluation of Central Landfill and its Potential Impacts on the Scituate Reservoir" dated October 1988, from staff at the the Rhode Island Solid Waste Management Corporation, Goldberg Zonio Associates, groundwater monitoring reports; and and from staff at the Rhode Island Department of Environmental Management an inter-office memo on groundwater concerns at the Central Landfill. We have also contacted Dr. Reinhard Frohlich of the University of Rhode Island who has done fracture analysis of the area.

In addition, Ms. Barbara Blumeris of my staff talked with Mr. Herbert Johnson of your office on 6 November 1990 regarding the direction of groundwater flow at the Central Landfill and the possibility of a hydraulic connection between Scituate and the Central Landfill. He said that in 1983 he had sent a letter to the Governor which stated that surface and groundwater in the vicinity of the landfill does not flow into the drainage system of the Scituate Reservoir. He noted in the phone conversation that there was the possibility of fractured bedrock under the landfill.

Ms. Blumeris also spoke with you concerning this issue. In your phone conversation you suggested possible installation of wells near the surface and groundwater divide between the two watersheds to verify the divide and further study of the deep bedrock fracturing, and modeling of the leachate plume at the landfill. In discussing the issue of investigating deep bedrock fracturing you noted that fractured bedrock modeling is highly speculative and that even with additional studies there was no way to prove absolutely that a connection does not exist. However you did note that even if a connection existed that dilution and the overburden between bedrock and Scituate Reservoir would limit the risk of contamination. You also suggested that interception and collection of the leachate plume at the landfill would eliminate the source of the problem.

Report and available data gathered to date appears to indicate: 1) groundwater flow from Central Landfill is towards Simmons Reservoir and Almy Reservoir and; 2) the possibility of a deep bedrock connection existing that would carry contaminants to Scituate Reservoir is extremely remote. However, the City of Cranston has indicated that even a remote possibility is something that must be viewed with great seriousness.

We would like to obtain from USGS a written statement updating Mr. Herbert Johnston's letter of 1983 regarding the threat of contamination to Scituate Reservoir by contaminated groundwater from the Central landfill. We would appreciate a reply as soon as possible.

If you have any questions regarding our study please contact Ms. Barbara Blumeris of my staff at (617) 647-8737.

Sincerely,

Joseph L. Ignazio
Director of Planning

cf:
B. Blumeris (114S,rimemosII, usgsltr)
BMD file, 114S

United States Department of the Interior

GEOLOGICAL SURVEY

Water Resources Division
237 J.O. Pastore Federal Bldg.
Providence, Rhode Island 02903-1720

TAKE PRIDE IN AMERICA

March 6, 1991

Mr. Joseph L. Ignazio
Director of Planning
U.S. Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

Dear Mr. Ignazio:

Your letter of March 4, 1991 concerning the threat of contamination to the Scituate reservoir from the Central Landfill requested a letter from this office updating previous comments on the ground-water flow in the area. The U.S. Geological Survey has not done any further studies in the area since the work that you cite; thus the analyses presented in the October 12, 1983 letter to then Governor Garrahy still apply.

In my telephone conversation with Barbara Blumeris I mentioned that investigation of the bedrock might provide additional information on the direction of flow in the rock near the Central Landfill. Of paricular inportance would be information on head in multilevel wells drilled on the lineament in the area. If the head gradients in the rock are upward, the ground water is probably discharging within the drainage basin which includes the Central Landfill. If the gradients are downward, data from another set of multilevel wells along the lineament would be needed to determine if the flow is towards the Scituate Reservoir. These data on the head in the bedrock may be available from some of the recent studies that you mention in your letter.

Sincerely yours,

Virginia de Lima

Virginia de Lima
Acting Office Chief

#212

United States Department of the Interior

GEOLOGICAL SURVEY
224 J.O. Pastore Federal Building
Providence, Rhode Island 02903

October 12, 1983

Honorable J. Joseph Garrahy
Governor of Rhode Island
State House
Providence, Rhode Island 02903

Dear Governor Garrahy:

This is a reply to your letter of September 29, 1983, in which you ask if either ground water or surface water from the Central State Landfill in the town of Johnston might find its way into the Scituate Reservoir system. The answer to your question is no. Water from the vicinity of the landfill does not flow into the drainage system of the Scituate Reservoir. The following information is provided in support of my answer.

Mr. Ronald T. DelFino, Director of Engineering Operations for the Solid Waste Management Corporation, recently sent me a map, entitled "Map of Lands of Rhode Island Solid Waste Management Corp., Town of Johnston, County of Providence, Rhode Island". It was prepared by Weiler Associates, Land Surveyors. The map bears a preparation date of September 24, 1982, and several revision dates, the most recent of which is March 15, 1983. Mr. DelFino advised me by telephone that the Central State Landfill is delineated on this map by a line labeled "limit of licensed landfill".

Mr. DelFino could not provide a topographic map that showed the location of the landfill with respect to drainage basin boundaries. I therefore used the map that he sent to determine the location of the landfill on the Ground-Water Map of the North Scituate Quadrangle , which has a topographic base. This map report was prepared by the USGS from data collected chiefly in 1958 , and was published in 1960 as ground-water map number 12 by the Rhode Island Water Resources Coordinating Board. Two copies of the report are enclosed.

On an office copy of the ground-water map, I have drawn drainage boundaries and the boundaries of the landfill. From this information, it is evident that both surface water and ground water in the vicinity of the Central State Landfill drain to streams that are tributary to the Pocasset River, which empties into the Pawtuxet River in the city of Cranston. The Scituate Reservoir is in the basin drained by the North Branch of the Pawtuxet River, which empties into the main stem of the Pawtuxet River in West Warwick. Neither ground water nor surface water flows from one basin to the other.

more....

The direction of flow of both ground water and surface water can be determined from information contained on the ground-water map. Lines of equal land-surface altitude are shown in brown. Surface water flows perpendicular to these lines, from high altitude to low altitude, in the direction of the steepest slope.

Lines of equal water-table altitude are shown in red in areas mapped as outwash (green areas). Red numbers adjacent to black circles on the map indicate the altitude of the water table at selected wells. Although no water-table contours are shown in areas mapped as till (white areas), this could be done. Contours on the water-table surface would be almost parallel to land-surface contours, but would average about 10 feet less. (The text on the map says that the average depth to water in till is 10 feet). This means that the slope of the water table is about the same as that of land surface. Because ground water also flows from high to low altitude in the direction of the steepest water-table gradient, ground water flows in same general direction as surface water.

The water table fluctuates seasonally and from year to year. This will cause changes in the velocity of ground-water flow but will not change the direction of flow. Alterations of the surface drainage system and topography in the vicinity of the landfill have caused local changes in the direction of surface flow and possibly ground water flow as well. None of these changes, however, could cause water to flow from the landfill into the Scituate Reservoir drainage system.

I hope the information in this letter is sufficient to dispel any concern that water flowing either on or beneath land surface from the Central State Landfill in any way constitutes a threat to the quality of water in the Scituate Reservoir. It does not. If you, Mayor Ralph aRusso , or any of your constituents have additional questions about this issue, I will be happy to answer them.

Sincerely yours,

Herbert E. Johnston
Chief, Rhode Island Office

Enclosures

cc: Director, Solid Waste Management Corp., Providence, RI
Chief, New England District, WRD, USGS, Boston, MA

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
400 RALPH PILL MARKETPLACE
22 BRIDGE STREET
CONCORD, NEW HAMPSHIRE 03301-4901

Mr. Joseph Ignazio, Chief
Planning Directorate
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254

March 8, 1991

ATTN: Impact Analysis Division

Dear Mr. Ignazio:

This responds to your letter dated February 25, 1991 for information on the presence of Federally listed and proposed, endangered or threatened species in accordance with the preparation of a reconnaissance level investigation of wastewater pollution solutions in Cranston and Johnston, Rhode Island.

Based on information currently available to us, no Federally listed or proposed, threatened and endangered species under the jurisdiction of the U.S. Fish and Wildlife Service are known to occur in the project area, with the exception of occasional, transient endangered bald eagles (*Haliaeetus leucocephalus*) or peregrine falcons (*Falco peregrinus anatum*).

However, we suggest that you contact Rick Enser of the Rhode Island Natural Heritage Program, 83 Park Street, Providence, Rhode Island 02903, at 401-277-2776, for information on state listed species that may be present.

This response relates only to endangered species under our jurisdiction. It does not address other legislation or our responsibilities under the Fish and Wildlife Coordination Act.

A list of Federally designated endangered and threatened species in Rhode Island is inclosed for your information. Thank you for your cooperation and please contact Michael Amaral of this office at 603-225-1411 if we can be of further assistance regarding endangered species.

Sincerely yours,

Gordon E. Beckett

Gordon E. Beckett
Supervisor
New England Field Offices

Inclosure

IN RHODE ISLAND

Common Name	Scientific Name	Status	Distribution
FISHES:			
Sturgeon, shortnose*	Acipenser brevirostrum	E	Atlantic coastal waters
REPTILES:			
Turtle, green*	Chelonia mydas	T	Oceanic straggler in southern New England
Turtle, hawksbill*	Eretmochelys imbricata	E	Oceanic straggler in southern New England
Turtle, leatherback*	Dermochelys coriacea	E	Oceanic summer resident
Turtle, loggerhead*	Caretta caretta	T	Oceanic summer resident
Turtle, Atlantic ridley*	Lepidochelys kempii	E	Oceanic summer resident
BIRDS:			
Eagle, bald	Haliaeetus leucocephalus	E	Entire state
Falcon, American peregrine	Falco peregrinus anatum	E	Entire state-reestablishment to former breeding range in progress
Falcon, Arctic peregrine	Falco peregrinus tundrius	E	Entire state migratory-no nesting
Plover, Piping	Charadrius melodus	T	Atlantic coast
Roseate Tern	Sterna dougallii dougallii	E	Atlantic coast
MAMMALS:			
Cougar, eastern	Felis concolor couguar	E	Entire state-may be extinct
Whale, blue*	Balaenoptera musculus	E	Oceanic
Whale, finback*	Balaenoptera physalus	E	Oceanic
Whale, humpback*	Megaptera novaeangliae	E	Oceanic
Whale, right*	Eubalaena spp. (all species)	E	Oceanic
Whale, sei*	Balaenoptera borealis	E	Oceanic
Whale, sperm*	Physeter catodon	E	Oceanic
MOLLUSKS:			
NONE			
INSECTS:			
Beetle, American burying	Nicrophorus americanus	E	Washington
Beetle, northeastern beach tiger	Cicindela dorsalis dorsalis	T	Washington, probably extirpated
Beetle, Puritan tiger	Cicindela puritana	T	Extirpated
PLANTS:			
Small Whorled Pogonia	Isotria medeoloides	E	Providence, Kent Counties
Gerardia, Sandplain	Agalinus acuta	E	Washington

* Except for sea turtle nesting habitat, principal responsibility for these species is vested with the National Marine Fisheries Service

Rev. 11-13-90

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Environmental Management
DIVISION OF PLANNING AND DEVELOPMENT
83 Park Street
Providence, R.I. 02903 - 1037
(401) 277-2776

March 22, 1991

Joseph Ignazio
Director of Planning
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Rd.
Waltham, MA 02254-9149

RE: Wastewater Investigation
Cranston, RI

Dear Mr. Ignazio,

Thank you for contacting the Rhode Island Natural Heritage Program for information regarding rare species and ecologically significant natural communities in Cranston and in Johnston (south of Route 6 to Route 14).

At this time, we are aware of three populations of rare species in this area. These occurrences and their general locations are listed below:

1. Actea rubra (Red Baneberry) a species of Special Interest, occurs near the Windsor School, near the intersection of Rts. 6 and RI 195 in Johnston.

2. Agalinis tenuifolia (Slender Gerardia), a State Threatened species, occurs along a right-of-way near Fiskeville, in Cranston.

3. Corallorhiza trifida (Early Coralroot), a Species of Special Interest, occurs near Clarke Brook south of Curran Lower Reservoir in Cranston.

Please feel free to contact me if more information is required. As our inventory is ongoing, more information on this area may become available in the future.

Sincerely,

Joanne Michaud

Joanne Michaud
Data Manager/Environmental Planner
Natural Heritage Program

JM/jm

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Environmental Management
DIVISION OF FISH AND WILDLIFE
Field Headquarters
Box 218
West Kingston, R.I. 02892
Tel. (401) 789-0281
(401) 277-1267

March 28, 1991

Mr. Joseph L. Ignazio
Department of the Army
New England Division,
Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

Dear Mr.Ignazio:

I am writing in response to your letter requesting information regarding fishery resources in the Cranston and Johnston, Rhode Island areas.

Unfortunately, we do not have very much information regarding the fishery resources of that area, particularly for the streams you listed. We do, however, have some information for most of the ponds that appear in your list. You will find them listed in the enclosed publication.

Please feel free to contact me if you have any further questions.

Sincerely,

William J. Lapin

William J. Lapin
Supervising Biologist
(freshwater fisheries)

WJL:clb

Enc.

May 30, 1991

Planning Directorate
Basin Management Division

Mr. Gerald Potamis, P.E., Chief
Wastewater Management Section, RI-NH-VT
USEPA
JFK Federal Building
Boston, Mass 02203
MAILCODE WMN368

Dear Mr. Potamis:

The Corps of Engineers, New England Division is completing a Section 22, "Planning Assistance to States" investigation of wastewater flow problems in the City of Cranston, Rhode Island. One of the alternatives being investigated is the construction of a sewer interceptor through the western portion of the city to collect wastewater flows from several problem areas and convey them to the city's existing treatment facility. This alternative was originally proposed by the the city's engineer, Tutela Associates, as a potential "innovative and alternative" solution to the City's wastewater problems.

The "innovative and alternative" elements of the project including; the use of energy efficient electric motors and variable frequency drives at the pump stations; use of low friction plastic force mains; and the use of a force main/pressure sewer versus a force main/gravity sewer over approximately 14,000 feet at the end of the interceptor.

As part of our Section 22 investigation we have attempted to evaluate the technical feasibility of this proposal and address whether this approach is in fact "innovative and alternative". The following is a summary of our conclusions;

- The use of energy efficient electric motors, variable frequency drives and low friction plastic force mains is technically feasible and may provide significant cost savings, however, it does not appear to be innovative or alternative and does not warrant special demonstration.

- The use of a force main/pressure sewer is not standard for this type of interceptor.

We have attempted to determine, at a planning level of detail, whether the use of a force main/pressure sewer is advisable over the conventional force main/gravity sewer. Advantages to the pressure sewer include fewer manholes, shallower excavation and residual pressure head at the end of the pipeline which may allow bypassing the screw pumps at the wastewater treatment plant. Disadvantages are the need for clean-outs and potential maintenance problems. Advantages to the gravity line for this end of the interceptor is the presence of a steep down grade from the end of the force main to the waste water treatment plant. Further analysis of the two options would be recommended for any future feasibility study for the City of Cranston.

We would appreciate the EPA's opinion of the "innovative and alternative" features proposed by the City of Cranston and your review of the conclusions summarized in this letter. The primary areas of concern regarding these "innovative and alternative" elements are: 1) are these technologies currently innovative and alternative; 2) will implementation of these technologies result in a cost saving; and 3) is there a need to demonstrate these technologies. We request that your written response by 14 June 1991 to incorporate into our report scheduled for completion by the end of June.

Your office should be aware that Legislation was passed in the Water Resource Development Act of 1990 authorizing the Secretary of the Corps of Engineers, in consultation with the Administrator of the Environmental Protection Agency, to conduct a feasibility study of wastewater transportation options to the Cranston, Rhode Island wastewater treatment facility and to conduct a technology demonstration of the connector system. Funding for this project has not been appropriated.

I would like to thank you for your prompt cooperation in this important matter. If you have any questions or require any further information, please contact Mr. John Kennelly or Ms. Barbara Blumeris of my staff. They can be reached at (617) 647-8505 and 647-8737, respectively.

Sincerely,

Joseph L. Ignazio
Director of Planning

cf:
BMD files, 114S
B. Blumeris, 114S (cranepa)
✓ LRPB, 114S

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203-2211

June 28, 1991

Joseph Ignazio, Chief
Planning Directorate
US Army Corps Engineers
New England Division Bldg 114
Waltham, MA 02254-9149

Re: Draft Report Section 22 Planning Study for Cranston, Rhode Island

Dear Mr Ignazio:

In your letter of May 30, 1991 it was requested that the Environmental Protection Agency review the innovative and alternative features proposed by the City of Cranston and your review of the conclusion summarized in that letter.

Based upon the information presented we have concluded the following. The technologies are neither innovative or alternative. Insufficient information was presented to determine if the proposed project would result in cost savings or if there is a need to demonstrate the proposed technologies. As explained to Ms. Blumeris and Mr. Kennelly before any formal determination could be reached additional detailed information would be needed comparing alternatives, capital costs and operating costs. In short a Facilities Plan to include a cost effective analysis is required. In addition the proposed technologies need to be reviewed in accordance with the guidelines set forth in EPA's Innovative and Alternative Technology Assessment Manual (430/9-78-009).

We agree with the conclusions reached in your letter of May 30, 1991.

If you have additional questions or concerns please contact me at 617/565-3575.

Sincerely yours,

Gerald C. Potamis, P.E., Chief
Wastewater Management Section (WMN)

APPENDIX E

COMMENTS ON DRAFT REPORT

Post-it™ brand fax transmittal memo 7671 | # of pages ▸ 2

To Barbara	From Steve DeToy
Co.	Co. City Hall - Cranston
Dept.	Phone # 401-5380
Fax # 617-147-8080	Fax # 401-2602

IVE CHAMBER

RHODE ISLAND

MICHAEL A. TRAFICANTE
MAYOR

September 27, 1991

Mr. Paul Pronovost
Deputy Director of Planning
Planning Directorate
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

RE: **Section 22 Study/Cranston, Rhode Island**

Dear Paul:

You have asked for the city's comments on the draft of the Corps of Engineers' Section 22 study report. As a general matter, although I and the citizens of Cranston very much appreciate the hard work which went into the report and its obvious high quality, I am disappointed by the narrowness of the most critical conclusion from the point of view of the City. In this regard, I refer you to a copy of my January 29th letter of comment to you (copy enclosed for your reference) which discusses these fundamental policy issues.

As you can see, the city's view has not changed. Without belaboring the point, the city continues to feel very strongly that your agency is missing the fundamental point that the innovative and model nature of what is under discussion is broader than "**hardware**" - broader than certain specific elements of the proposed sewer line - broader still than the proposed system (interceptor project) as a whole. It is, instead, the concept of:

1. addressing in a unified way a series of substantial and interrelated environmental problems

2. applying to those problems the combined expertise of the local unit of government, regional and state agencies, and appropriate federal agencies, and

3. utilizing the unquestioned expertise and capabilities of your agency to provide the technical/engineering resources necessary to arrive at a sound and valuable solution to these problems.

While this approach has been the objective in many other situations, I am sure you will agree that a segmented approach which typifies this nation's handling of complex and interrelated environmental problems has been our actual experience in virtually every instance.

The vast majority of the work contained in your draft report fits this objective well. It

TO: Mr. Paul Pronovost

really falls short in only this one narrow respect, but I think you will agree with me that this aspect of your report is of fundamental importance. Attached herewith is a memorandum which focuses specifically on proposed changes in your report, which changes would bring it into line with my views (and I believe the views of many others in the public sector who are currently confronted with serious environmental/ remediation problems). You will also receive under separate cover the views of the city's consulting engineer, Tutela Engineering Associates, on certain aspects of the draft report.

In closing let me reiterate my very sincere appreciation for the dedicated and high quality work which you and your associates have performed regarding this city's most pressing environmental problems. You have assembled, reviewed and analyzed a tremendous amount of relevant data and have provided an invaluable point of reference and basis for further work. The questions which I am raising are ones with which your agency and many others have struggled with for years. They are very difficult I admit, but by the same token they are **very** important. Accordingly, I know that you will give these comments every consideration and want to thank you in advance for this. If you feel that any of the points covered in this letter or its attachments require further explanation, I will be glad to go over them with you.

With warm regards.

Sincerely,

Michael A. Traficante
Mayor

MAT/ama

cc: Senator John Chafee
Mr. John Grzebian

Comments of the City of Cranston on Section 22 Study
Cranston, Rhode Island Wastewater Investigation (Draft) Report

The following are specific comments on certain points contained or referred to in the captioned study by the U. S. Army Corps of Engineers:

1. Page iii (and Page 1). The final two bullets are, in the City's view inappropriately narrow. The demonstration/model aspect of the project in which we are currently engaged is far broader than these specific elements (although these elements do add to the demonstration/model value of the project). In a sense, the language in the concluding paragraph, "In summary, this study looked at a broad array of plans to solve current and future wastewater flow problems from the study sites." is itself an unduly narrow description. The project is intended to analyze, address and develop solutions for a grouping of significant and interrelated environmental problems (with the common element, in this case, of ground and surface water contamination). As is noted on page 1 (paragraph 3) of the introductory section of the report, Congress has already spoken on the demonstration question--the Agency is, in effect, instructed to "construct a demonstration project of a regional connector system.". Out of deference to the Congress, as well as perhaps a slightly broader sense of the definition of the project in which we are involved than is currently reflected in certain elements of the draft report, it is suggested that the appropriate sections of this report be rewritten. The final two bullets and the summary paragraph for page iii could be rewritten as shown in Attachment A.

2. Page 12. The comments which have been made previously by the City regarding the acceptable level of threat to the Scituate Reservoir are simply noted again, especially in regard to the information reported in this draft on the existence of a possible bed-rock fracture connection(s) spanning the two watersheds in question (See especially first full paragraph lines 7 - end.).

3. Pages 39, 40 and 94. The language contained in the Innovative/Alternative Discussion on pages 39 and 40 is not, we feel, consistent with the City's position on the demonstration/model aspect of the proposed project. The City submits that the focus of the Corps is too narrow and could be broadened by making several adjustments in these sections.

   Although paragraph 7 on page 39 does state why the City "suggested" that the interceptor be considered a model project, this paragraph is presented almost as an afterthought in the report. The comments set forth in this paragraph are substantive and, the City feels, most important; we suggest that they be used as an introduction to the Innovative/Alternative Discussion section (which we suggest might be re-titled the "Model Project Discussion") to establish the proper tone and framework for such a discussion. Given the framework and tone which would be established by this introductory paragraph, the City recommends changing the wording of the first sentence of paragraph 2

from "innovative and alternative" to "state-of-the-art" features. In addition, the Corps may not need to comment that "attempts were made to obtain information on the current use of this technology to determine whether this approach is in fact innovative and alternative;" (page 39, paragraph 3); the City has already noted that these elements alone are not what make this solution a "model" project, but "the combination of elements..." (page 39, paragraph 7).

The City also suggests that the Corps rewrite paragraph 4, page 39 without the final sentence which refers to the Interceptor technology and reads, "however, it does not appear to be innovative or alternative and does not warrant special demonstration." Attachment B is a summary of the City's desired modifications of the Innovative/Alternative Discussion on page 39 and the Conclusions on page 94 with Attachments C and D being rewritten pages 39 and 94 respectively.

4. Page 84 Comparison of Plans, especially paragraph 2. While it is admittedly difficult to hit a moving target, and another round of assessment and planning is perhaps an appealing way out of this dilemma, it can also be argued that part of the "demonstration" in this particular case is to do exactly that. At some point in time it is necessary to reach a conclusion and commence action. The Congress has, in effect, determined that such a point in time has been reached in regard to the Cranston demonstration project (see Section 117 of the Water Resources Development Act of 1990). Accordingly, it is suggested that this section be rewritten as shown in Attachment E.

5. Pages 93 & 94 Conclusions. There are several points in this section which raise the issues discussed above in this memorandum. Redrafting has been suggested above (especially in points 1 & 3 and Attachment D) which is also, obviously, applicable to the final two paragraphs of this section, including the two bullets on specific project elements. Certain changes along these lines are also suggested regarding paragraph 1 as rewritten in Attachment F.

ATTACHMENT A

Page iii Rewrite of Final Two Bullets and Summary Paragraph

- That use of advanced construction techniques, and such project elements as energy efficient electric motors, variable frequency drives and low friction plastic force mains and pressure sewer segments is technically feasible and may provide significant cost savings.

- That the approach of integrated evaluation and planning to develop and implement a suitable solution to complex and interrelated environmental problems will be valuable to governmental agencies at all levels.

In summary, this study looked at a broad array of plans to solve current and future interrelated environmental problems involving specific and actual sites. This is the logical first step in the process which responds to the Congressional directive contained in Section 117 of the Water Resources Development Act of 1990. The specific plans that initially appear feasible in the Cranston-area case as ways to address the problems which have been under study are modifications to the existing sewer system, construction of a sewer interceptor and implementation of a demand management program. The next step is to determine which combination of plan elements is the most effective from a cost and environmental impact standpoint.

ATTACHMENT B

Summary of Changes to Pages 39, 40 and 94

Page 39/40:

1. Change title to "Model Plan Discussion".
2. Use paragraph 7, which continues onto page 40, as the introductory paragraph to this section.
3. Change wording of first sentence of paragraph 2 from (innovative and alternative) to (state-of-the-art) features.
4. Eliminate from paragraph 3 the first sentence which reads, "As a part of this investigation, attempts were made to obtain information on the current use of this technology to determine whether this approach is in fact 'innovative and alternative'".
5. Retain the first part of Section (a.), but remove the part of the sentence that reads: "however, it does not appear to be innovative or alternative and does not warrant special demonstration".
6. Retain Section (b.) in full.
7. Retain paragraph 6 in full.

Page 94:

1. Change the wording of the first sentence of paragraph 3 from ("innovative and alternative") to (state-of-the-art) technology. And remove the words ("innovative and alternative") from the second sentence of paragraph 3.
2. Eliminate the first sentence of paragraph 4 which reads: "This Section 22 investigation attempted to obtain information on the current use of this technology to determine whether this approach is in fact 'innovative and alternative'".
4. Rewrite paragraphs 5 and 6 to same as final two bullets on page iii.
5. Rewrite concluding paragraph to same as summary paragraph on page iii.

ATTACHMENT C

Rewritten Page 39

Model Plan Discussion

The city suggested that it is not the hardware alone that makes a solution a "model" project, but the combination of elements including: the proposed technological hardware; the alignment of an interceptor from a newer and undeveloped area through older development to an existing treatment plant; the desire of the city to provide solutions for future or existing wastewater problems in an adjacent community as well as their own community; the required cooperation in planning future land use and local growth between the State and the city and the impact of these plans on future wastewater conveyance needs, the investigative component of the study requiring a broad look at defining existing pollution problems at study sites; the role of the Corps in coordination, evaluation and implementation of the solution.

The City of Cranston proposed that the interceptor be constructed using state-of-the-art features. These features include the use of energy efficient electric motors and variable frequency drives at the pump stations, the use of low friction plastic force mains, and the use of a continuous force main/pressure sewer versus a force main/gravity sewer for the last 14,000 feet at the end of the interceptor.

Following is a summary of study findings:

a. Use of energy efficient electric motors, variable frequency drives and low friction plastic force mains is technically feasible and may provide significant cost savings.

b. Use of a plastic force main pipeline is not standard for this type of interceptor, but may offer some advantages. These include fewer manholes, shallower excavations and a residual pressure head at the end of the pipeline which might allow bypassing screw pumps at the wastewater treatment plant. The City's engineer has suggested the pressure line may be easier to construct than a conventional gravity line in a developed area.

Disadvantages are the need for clean-outs and potential maintenance problems. However, the City's engineer has suggested placing cleanouts in proximity to existing gravity sewer lines, and flushing cleanouts into the existing sewer. Also, construction of a force main through an existing sewered area precludes correcting deficiencies that may exist with the gravity sewer such as infiltration/inflow.

versus the other. Further detailed analysis is recommended for each of the plans including the potential incorporation of individual elements from each of the plans.

- The implementation of a Demand Management Program should be pursued by the City independently, or as part of a structural solution, to reduce the overall demand on the system. The feasibility of a Wastewater Management District should be investigated further.

One of the alternatives recommended by the city is the construction of a sewer interceptor through the western portion of the city using state-of-the-art technology. The elements of the project include the use of energy efficient electric motors and variable frequency drives at the pump stations, the use of low friction plastic force mains, and the use of a continuous force main/pressure sewer versus a force main/gravity sewer over approximately 14,000 feet at the end of the interceptor.

Following is a summary of study findings:

- That use of advanced construction techniques, and such project elements as energy efficient electric motors, variable frequency drives and low friction plastic force mains and pressure sewer segments is technically feasible and may provide significant cost savings.

- That the approach of integrated evaluation and planning to develop and implement a suitable solution to complex and interrelated environmental problems will be valuable to governmental agencies at all levels.

In summary, this study looked at a broad array of plans to solve current and future interrelated environmental problems involving specific and actual sites. This is the logical first step in the process which responds to the Congressional directive contained in Section 117 of the Water Resources Development Act of 1990. The specific plans that initially appear feasible in the Cranston-area case as ways to address the problems which have been under study are modifications to the existing sewer system, construction of a sewer interceptor and implementation of a demand management program. The next step is to determine which combination of plan elements is the most effective from a cost and environmental impact standpoint.

ATTACHMENT E

Rewritten COMPARISON OF PLANS on Page 84

COMPARISON OF PLANS

The following section discusses the feasibility of each plan to address the wastewater conveyance problems identified in this report. This section also includes a listing of ongoing investigations which could impact on the findings of this report and on any action steps which may be taken in the near future. These must be kept in mind as the planning and implementation process goes forward. Also contained in this section is a listing of possible future studies which may be conducted in the course of selection and implementation of a selected plan.

The basic intent of this investigation is to develop a cost estimate and completion schedule to conduct future studies, prepare plans and specifications, obtain required permits, and construct the selected project. Because of the uncertainty created by the various ongoing investigations, it is important to consider this factor in producing realistic time and cost estimates. This effort can be pursued effectively so long as this uncertainty factor is kept in mind during future planning and design efforts.

ATTACHMENT F

Rewritten Paragraph 1, Page 93

The purpose of this Section 22 investigation is to perform a reconnaissance level investigation of a group of interrelated environmental issues (chiefly in the areas of ground and surface water contamination) which are confronted by the City of Cranston and the neighboring area and which affect or have the capacity to affect a large percentage of the citizens of the State of Rhode Island as the first step in a Congressionally mandated demonstration project. In particular, the report presents and analyzes various wastewater conveyance problems and opportunities which represent potential solutions to these problems. The conclusions drawn from this report and presented here are based on the preliminary analysis performed as part of this investigation and on coordination efforts with appropriate Federal, State and local agencies and entities. Further study is recommended to more completely evaluate the engineering feasibility of these plans, evaluate the cost effectiveness of the alternatives and determine the environmental, socioeconomic, and water quality benefits and impacts as the next stage of the demonstration process. The reader should also be aware that the results of ongoing investigations by EPA, the State of Rhode Island and the City of Cranston may directly impact on the project design as it develops from this point forward.

EXECUTIVE CHAMBER

CITY OF CRANSTON RHODE ISLAND

MICHAEL A. TRAFICANTE
MAYOR

January 29, 1991

Mr. John Kennelly
Chief Long Range Planning Branch
Planning Directorate
424 Trapelo Road
Waltham, MA 02254-9149

Dear Mr. Kennelly:

I am writing at this time in response to your request for comments relative to the draft report of the Corps' Section 22 study dated December 1990.

Before I state our specific comments on the draft study, I want the New England Division to be aware that under separate cover, in the near future, I will be addressing the overall scope and direction of this study as well as the issue of this study in relation to existing congressional actions.

Our comments and suggestions are as follows:

Page 1, Introduction: Last sentence should read, "The Pawtuxet River flows south to east along the easterly border of Cranston and empties into (the) Pawtuxet Cove adjacent to The Providence River."

Page 3, second paragraph, first sentence should read, the main stem of the Pawtuxet River does not consistently meet Class C water quality standards.

Page 3, third paragraph should include the fact that there are four not three waste water treatment plants on the Pawtuxet. Also, the topic of nonpoint pollution problems deserves much greater attention in this section on water quality. Save the Bay has done extensive work in this regard and I strongly urge you to incorporate their findings into this section.

Page 4, seventh paragraph, last sentence should include after .... city's industrial pre-treatment program and reduction of stormwater infiltration and inflow.

Page 5, Table 2. The footnote (1) also applies to the Pontiac Avenue and Howard pumping stations.

Page 6, second paragraph - The City has asked the Town of Johnston for zoning information relevant to this section.

Page 8, last paragraph should read ... The Welsh Pumping Station is currently receiving an average daily flow of approximately 300 gpm and experiences an estimated peak flow of 500 gpm. The pumping station has two 500 gpm pumps and is felt to be approaching its capacity with the rapid development of the adjacent industrial area and other unsewered areas in addition to the connection from the Central Landfill. Concerns for the capacities of the sewer lines prior to the Welsh Pumping Station are discussed in the "Western Cranston Industrial Area" section of this report.

Page 9, third paragraph, second sentence, Cedar Brook.

Page 10, citation from CHZM Hill Consultants as prepared for the Providence Water Supply Board clearly attempts to fit a square peg into a round hole. As this report confesses, "... the rates and directions of groundwater movement can only be inferred from the data currently available..." Their "inconclusive" conclusion is not substantiated and appears to be aimed at appeasing their clients inherent self-interests.

It would be contrary to public interest to dismiss the possibility, however small, of contamination of the state's primary source of drinking water. It is bad public policy to do anything other than to adopt the most cautious of approaches to any degree of risk that may be associated with the potential of contamination of this vital health resource.

Page 10, last paragraph; This statement is scientifically unsubstantiated, speculative and very presumptuous for a report of this nature. The City of Cranston is not prepared to accept this supposition. This paragraph should not be included in this study.

Page 11, first paragraph under "Problem Discussion", we would re-write as follows: The City of Cranston is concerned that the future development of the existing industrial park and adjacent areas zoned for industrial use may be limited by the capacity of the existing sewer lines and pumping stations. The existing lines and pump stations are incapable of receiving wastewater flow from the industrial areas, the Central Landfill, and areas presently not serviced on Plainfield Pike in western Cranston and Johnston. The City realizes that current planning by the towns for their comprehensive plans may result in a compatible industrial/commercial base

in Johnston, along Plainfield Pike, which could possibly increase the wastewater flow to this system. A system of parallel sewer lines of varying sizes runs by gravity to the Welsh Pumping Station from just past the former Brown Dairy Site on Plainfield Pike. The potential capacity problems of these sewer lines, as well as sewer lines and pumping stations further along the transmission route, should be evaluated.

Page 12, sixth paragraph should read: The western Cranston soils are derived from glacial till and are relatively impermeable.

Page 14, fourth paragraph, last sentence is highly speculative and should carry some disclaimer if it is to remain in the report. The ISDS has total responsibility for these systems and this information clearly attempts to absolve the department of its responsibility.

Page 15, Problem Discussion, first sentence should read, the city expects the stone mining site to be exhausted within fifteen years...

Page 15, last paragraph, third sentence should read, The City of Cranston would like to see this area developed as an office park or another high value and suitable use compatible to adjacent land uses.

Page 18, Problem Discussion, first sentence should read, The city is concerned that future leachate collection from this site might negatively impact the existing wastewater collection system in this area, and may require pre-treatment.

I appreciate this opportunity to provide our comments on this draft report and look forward to continuing to work with your towards the completion of this study.

Sincerely,

Michael A. Traficante
Mayor

MAT:tsp

xc: The Honorable John H. Chafee
Steven Shimberg
John Grezebian
Domenic Tutella
J. William W. Harsch. Esq.
Heather Wessely

EXECUTIVE CHAMBER

CITY OF CRANSTON RHODE ISLAND

MICHAEL A. TRAFICANTE
MAYOR

January 29, 1991

Mr. Paul Pronovost
Deputy Director of Planning
Planning Directorate
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

Re: Section 22 Study/Cranston, Rhode Island

Dear Mr. Pronovost:

This letter is in addition to the specific and more technically oriented comments on the preliminary draft of the captioned study which the City has provided separately. Beyond those areas of comment, there are several broader and more fundamental matters which we feel should again be raised in connection with the completion of the study.

From the City's perspective, one of the chief reasons for the Congressional referral of this entire set of complex and interrelated problems to the Corps of Engineers was the feeling that the engineering sophistication possessed by that agency represented a unique asset in evaluating and responding to the present situation. While we fully appreciate and understand that the components of the overall problem may, to some extent, need to be addressed separately, the critical ingredient for your agency is to maintain an overview of the interrelated environmental problems and issues that are present. As we have repeatedly stressed, and as the history of this situation clearly confirms, various attempts to deal with one or more individual elements of this overall problem have been unsuccessful precisely because of the lack of a sense of "context" and of a perception of the relationship of one specific issue to a number of others. The consequence of addressing the interrelated problems to which this particular study is directed in a unilateral manner can only be inefficiency and lost opportunity at best. At worst, measures designed to address one problem may actually aggravate other related problems.

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The multi-source/multi-media approach of the new Clean Air Act is, to our understanding, precisely what is intended in regard to the contamination issues which are the subject of your study. Thus it would appear that the Corps is in a position to help "break new ground" in an instant study which is consistent with the most current environmental legislation and to utilize in a concrete way the best current thinking on the subject of contamination remediation.

As has been repeatedly stated, this appears to be a situation for which the Corps of Engineers is ideally suited because of the depth of its engineering capabilities. We feel it is correct to view this undertaking as a "model" effort for your Agency. There is no question that this project, if carried out in a manner consistent with the expectation of the Congress and the affected public entities and citizens, is a departure from established practice. Obviously, because it is a departure it requires certain adjustments in approach and management to make certain that it does not fall back into old grooves but breaks the intended new ground. The results of this work will be of substantial value to all who are involved as long as it is carried out with this type of "policy level" approach.

One other "policy level" question has arisen in the course of our review of the draft study which we wanted to cover in the current letter. It appears to us that this provides a good example, at a more precise level, of the pitfalls which exist for your Agency in carrying out the intentions of the current study. Specifically, the study, in what is admittedly a very early stage, and in a manner which appears unintended, appears to reflect the view that the potential contamination of the Scituate Reservoir, because it is considered to be a relatively small probability by those professionals who have reviewed the situation to date, is something which can be treated as relatively unimportant. The critical point, in this regard, is that even a seemingly remote possibility of the contamination of the major water supply for the State of Rhode Island is something that must be viewed with great seriousness. There is, further, some reason for skepticism of the engineering conclusions which have been drawn to date because of the mandates under which that work was performed and the natural inclinations of the "customers" of the reports and studies. This is precisely why an agency with the unchallenged independence and sophistication of the Corps of Engineers can make a valuable contribution to this situation. It is admittedly difficult to reflect (especially in an early stage analysis such as the one which is currently under discussion) certain qualitative distinctions and it is probably likely that the above point has not been lost on the representatives of the Agency who are conducting the work. Nevertheless, this does stand as an important illustration of the fundamental point that levels of acceptable environmental risk will inevitably vary greatly among various elements of an interrelated set of environmental issues. Once again, it is the sophistication and breadth of Corps of Engineers' resources which makes it the logical Agency with which to address these questions. A very small possibility of environmental risk to a resource such as the Scituate Reservoir is much less acceptable than the risk, for example, involved in the potential malfunction of a pump or control valve involved in waste water transportation or treatment.

One final point may bear repetition in light of the preceding comments. The work which the Corps of Engineers is performing regarding the interrelated set of Rhode Island contamination problems currently under study represents not only a model for the Agency; it is also a potential model for states, municipalities and Federal agencies in terms of the common occurrence of similar situations, especially in the northeastern United States. Specifically, areas of relatively mature development, many of which are served by systems designed and built many years ago, are experiencing or will experience comparable problems. We agree that by "comparable" this does not necessarily mean that the same set of problems as those with which we are dealing in the current case confronts each area. What it does mean, however, is that agencies, municipalities and citizen groups are coming to a recognition that environmental problems are often extremely complex and involve a combination of sophisticated evaluation, engineering and response which has not hitherto been available. In addition to the other functions which the Corps is performing in carrying out this work, which we believe has substantial substantive value, we believe that the "model" element of the work will be widely applicable to others. This value will, of course, be enhanced if the work receives suitable attention and publicity. We certainly look forward to participating in the sharing of the results of this work with others.

We are, as we have often stated in the past, most appreciative of the talent and attention which have been devoted to this analysis and the future applications of this work. We look forward to working with the Corps in the successful conclusion of this phase of the process of developing a solution to the issues currently under review.

Sincerely,

Michael A. Traficante
Mayor

MAT:tsp

xc: The Honorable John Chafee
Steven Shimberg
John Grzebian
J. William W. Harsch
Heather Wessely
Domenic Tutella

TEL 351-1760

RALPH R. ARUSSO
MAYOR

TOWN OF JOHNSTON

JOHNSTON SANITARY DISTRICT

1385 HARTFORD AVENUE

JOHNSTON, RHODE ISLAND 02919

July 12, 1991

Mr. Raymond J. Azar
Director of Public Works
City of Cranston
City Hall
Cranston, R.I. 02910

Dear Mr. Azar;

Per our telephone conversation of July 11, 1991, please consider this letter as a formal request for a meeting with your office and represenatives of the Town of Johnston.

My purpose for this meeting is to discuss the draft entitled "Wastewater Investigation" issued by the U.S. Army Corps of Engineers.

Primarily, we are concerned that in as much as the U.S. Army Corps of Engineers proposes the upgrading of the sewer system along Plainfield Pike, it would then enhance our current planning by the Town of Johnston under its' comprehensive planning effort for a more compatible industrial/commercial base along Plainfield Pike.

We will be glad to meet with you at your office at any time you may find convenient.

Sincerely;

Vincent Iannazzi

Vincent Iannazzi
Sewer Commissioner

vi/

cc: Mayor Ralph R. aRusso
Col. Philip R. Harris
Barbara Blumeris

ETA

TUTELA ENGINEERING ASSOCIATES
P. O. BOX 28066
PROVIDENCE, RHODE ISLAND 02908
TEL. (401) 861-5990

DOMENIC V. TUTELA, P.E., PRESIDENT

September 19, 1991

Mr. Joseph Ignazio, Director
Planning Directorate
Army Corps of Engineers
Building 114 South
424 Trapelo Road
Waltham, MA 02254-9149

Re: Section 22 Study - Cranston, RI

Dear Mr. Ignazio:

We have received your Section 22 Study for the City of Cranston, RI Wastewater Investigation (draft) dated June, 1991 and have had an opportunity to review the document. The report was prepared in response to a request made by the Rhode Island Department of Administration, to determine the feasibility of a Western Cranston Sewer Interceptor. The sewer interceptor will service the residential and industrial areas of Western Cranston. The sewer will also service the Central Landfill, Vinagro Site and an adjacent industrial zoned area, all located in Johnston, RI which are environmental concerns to the City of Cranston. The study addresses the sewer interceptor project as well as its alternatives which could treat the wastewater from the areas of concern. We found the report reflected the data presented and discussed at the periodic status and information meetings held between the Corps and the City.

We understand the report was based on existing information and the purpose was to provide a reconnaissance level review of wastewater management and conveyance problems in the study area. In light of that, we wish to outline our comments regarding the report and its conclusions.

1. We concur that an alternative which includes new treatment facilities at the various sites would not be feasible due to restrictive discharge requirements set by RIDEM and EPA, lack of adequate receiving waters and the excessive costs. It should be noted that pretreatment most probably will be required to some degree at the landfills and industrial sites prior to discharging to the Cranston wastewater collection system.

2. We concur that the flows from the Howard Industrial Park, Capuano Landfill and the State Institutions should continue to be conveyed through the existing collection system to the treatment facilities. These study areas were presented to the Corps by the City in describing the total environmental concerns of the City. It was not anticipated these study areas be serviced by the sewer interceptor.

3. We concur that the wastewater flows from the western portion of the City can be conveyed to the Water Control Facility by means of either a new sewer

interceptor or by the existing collection system, with significant modifications. A detailed evaluation comparing the impacts of these two scenarios is required. It is our preliminary opinion that the sewer interceptor is more advantageous because its construction would provide an effective means of wastewater transport with a minimum impact to the environment and at a lower cost than the upgrading of the City's existing sewers and pumping station.

4. We concur that a water demand management program would be beneficial to Cranston and Rhode Island, but disagree that such an option can be considered as a solution to the problems of handling and disposal of wastewater from the given areas. A management program is capable of reducing wastewater volumes, but is not considered a reliable alternative.

5. Properly administered waste management districts can achieve beneficial results. The responsibility of policing the reliability of individual subsurface disposal systems (ISDS) currently lies at the State level. We disagree with your proposal to implement a local waste management program in lieu of a municipal sewer system in Western Cranston. Western Cranston residential development is located in areas that contain excessively steep slopes, high groundwater, poor soils and other conditions ill-suited for subsurface disposal. We recommend that the waste management program remain at the State level. We further recommend State officials monitor the frequency at given locations serviced by septage haulers as a means of determining the efficiency of the ISDS systems within the region.

6. We agree that energy efficient electric motors, variable frequency drive motors, low friction plastic force mains and pressure sewers can offer significant cost savings and should be evaluated for use in place of the more conventional systems.

7. The residential area of Western Cranston wastewater flow was determined using 75 gpcd (gallons per capita per day) based on existing water use, a literature review, and infiltration and inflow (I/I) estimates. We would like to bring to your attention that the Cranston Facility Plan (1976) determined the residential rate to be 100 gpcd (I/I not included) and a 1982 document prepared by WPCF (Manual of Practice - No. FD-5) and ASCE (Manuals and Reports on Engineering Practice - No. 60) entitled Gravity Sanitary Sewer Design and Construction specifically indicates the sewer design basis for Cranston, RI to be 150 gpcd (with nominal allowance for I/I). A flow rate of 119 gpd per inmate at the State Institutions was used in design of the new correctional facility, which is also greater than the 75 gpcd used for residential flows. We believe these flow rates referenced are significantly higher than the flow rate used in the report and therefore warrant a reevaluation of the report flow estimates.

8. The area of study in the report known as Western Cranston Residential is defined as the area south of Scituate Ave.; west of Phenix Ave./Natick Ave.; east of Pippin Orchard Rd.; and north of Cranston/Warwick Boundary. This is the area the City noted as a concern due to ISDS failures but is not the only portion of Western Cranston projected for municipal sewer service. The previous facility plan (1976) shows an area of service extending beyond the above described area, and in a May 16, 1991 letter from our office to your division, we provided a sketch showing the preliminary service area being considered in the current facility plan, which also extends beyond the area noted in the report. We do not feel the study reflects the impacts of the entire service area in Western Cranston and, therefore, it should be reevaluated.

We appreciate this opportunity to comment on your study report and felt your division expeditiously produced a worthwhile planning document. Our review was conducted from the perspective of the City of Cranston. We would be very interested in the comments made by other concerned parties. If you have any questions regarding our comments, do not hesitate to contact the undersigned.

Very truly yours,

TUTELA ENGINEERING ASSOCIATES

Domenic V. Tutela, P.E.
President

cc: Mayor Traficante
E. Palazzo
R. Azar
S. DeToy
K. Flynn
B. Harsch

DVT/TJK/ch

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203-2211

July 29, 1991

Philip R. Harris
Colonel, Corps of Engineers
Division Engineer
424 Traplelo Rd.
Waltham, Massachusetts 02254-9149

Re: Section 22, Cranston, RI
Draft Report - Wastewater Investigation

Dear Col. Harris:

I have reviewed the above referenced report and wish to congratulate you and your staff for an excellent job. The Draft report presents a comprehensive overview of the many and complex issues associated with various wastewater pollution problems identified by the city of Cranston. Our comment letters of February 20, 1991 and June 28, 1991 from Mr. Kevin McSweeney and myself to Mr. Joseph Ignazio are still valid and will need to be addressed by the City before any final decision is made regarding the various alternatives.

I suggest that the first conclusion identified on Page ii be revised. The Clean Water Act does not authorize temporary discharge permits under the National Pollutant Discharge Elimination System.

In addition I would like to point out that the State of Rhode Island is also responsible for implementing the Industrial Pretreatment Program, Construction Grants Program and the State Revolving Fund Program under the Clean Water Act.

Sincerely yours

Gerald C. Potamis, P.E., Chief
Wastewater Management Section

AUG 02 1991

ER

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203-2211

February 20, 1991

Mr. Joseph Ignazio, Chief
Planning Directorate.
U.S. Army Corps of Engineers
New England Division - BLDG. 114
424 Trapelo Road
Waltham, MA 02254-9149

Re: Comments on U.S. Army Corps of Engineers Draft Report, Section 22 Planning Study of Cranston, Rhode Island

Dear Mr. Ignazio:

Pertinent comments of subject report by this Agency's Wastewater Management Division are compiled below by section and staff person.

Comments by Frederick B. Gay of Wastewater Management Section, Mail Code WMN-368, Tel. No. (617) 565-3503:

The water discharge permitting authority/responsibility for facilities located in Rhode Island was delegated to the State of Rhode Island in September 1984 through a Memorandum of Agreement between U.S. Environmental Protection Agency (EPA) and Rhode Island Department of environmental Management (RIDEM). Through this memorandum RIDEM is responsible for issuance, compliance and enforcement of all water discharge permits issued in Rhode Island; however, EPA retains oversite responsibility for assuring that draft permits comply with both Federal and State Water Quality requirements.

From a permitting perspective, this report lacks a detailed wastewater characterization of each proposed discharge to Cranston's sewer system. Characterization should be done according to chemical content, concentration, discharge volume as well as variability with respect to time for each item mentioned. This information is needed by Cranston's treatment plant to determine: (1) the potential for pass through of pollutants; (2) the plant's ability to treat the increased flow and chemical content without violating its permit limits; (3) local limits for each proposed discharge at point of entry to Cranston's sewer system; and (4) whether or not the wastewater characterization at the treatment plant's headworks has changed significantly from that used to develop the present permit. If the wastewater stream has changed significantly, Cranston needs to apply to RIDEM for a permit modification by submitting a new NPDES application form 180 days in advance of their plant's accepting a changed wastewater.

This report's characterization of the Central Falls Landfill's leachate raises the possibility that Cranston's permit may require modification in order to regulate additional organic chemicals and heavy metals not presently regulated. Presently, Cranston's permit only regulates two organic chemicals and seven metals.

Cranston's acceptance of additional potentially toxic wastewaters could result in its sludge containing higher concentrations of heavy metals and organic chemicals or a greater variety of those substances than at present. Therefore, the Corps should contact RIDEM to see what sludge requirements might be added to Cranston's permit to comply with Implementation of Interim Sludge Requirement Section 405(d) of the Clean Water Act, Agreement between RIDEM and EPA dated June 18, 1990. The Corps report indicates Cranston has on-site sludge incineration, but makes no mention of disposal practices related to that incinerator's ash. Due to Cranston's present wastewater flow and the complex industrial wastewater it receives, Cranston is considered a Class One Sludge Management Facility. Presently, their permit contains no sludge requirements as it was issued on May 1, 1989 prior to Implementation Agreement with RIDEM in June 1990.

Storm water permits for landfills and industrial sites mentioned in this report need to be addressed. For instance, any industrial site having storm water runoff that is collected and conveyed by a point source conveyance (pipe or channeled berm) to waters of the United States needs to apply for a storm water permit. Landfills have been placed in the industrial category; therefore, are required to submit an application for a separate stormwater permit along with industrial sites to RIDEM by November 18, 1991. Whether or not antidegradation issues will apply to storm water runoff applicants discharging to a high quality water (Class A or B) will be decided later on a case-by-case basis.

Comments by Charles Conway of Municipal Evaluation Section, Mail Code WCM-510, Tel. No. (617) 565-3517:

Have an independent consultant evaluate the existing wastewater treatment plant in order to determine if that plant can achieve the proposed advanced treatment standards.

Comments by Mark Spinale of Municipal Evaluation Section, Mail Code WCM-510, Tel. No. (617) 565-3520:

1. Any wastestream must meet local limits and comply with local, state and federal prohibitions.

2. The city of Cranston will have to determine through its pretreatment program the acceptability and conditions of any wastestream from each project.

3. Cranston must issue a control document (permit) including a standard conditions section that is agreed to by each waste generator.

4. Cranston must reassess their local limits to account for the additional pollutant loadings from industrial/residential areas and especially toxics in leachate from landfill/CERCLA sites. CERCLA stands for Comprehensive Environmental Response, Compensation, and Liability Act of 1980.

5. Cranston must make sure that the wastestreams generated from these projects are not "hazardous" prior to there acceptance by the Publicly Owned Treatment Works (POTW). Hazardousness is determined by using the Toxicity Characteristic Leaching Procedure, called a TCLP test. If the wastestreams are determined to be hazardous, then the POTW must operate under the Resources Conservation & Recovery Act's (RCRA) permit-by-rule.

Comments by Beverly Baker of Water Quality Management Section, Mail Code WQP-425, Tel. No. (617) 565-3475:

Surface and Groundwater Quality in Study Area

1. The most up-to-date analysis of water quality and biotic conditions in the Pawtuxet River and surface waterbodies in the study area is found in the RI 1990 "State of the State's Waters" report. Biological monitoring at 2 stations in the Pawtuxet (including 1 at the U.S. Geological Survey's gage in Cranston) over the past decade indicates the presence of a compromised benthic community (primarily pollution tolerant and intermediate species). In addition to whatever pollutants or practices contribute to this condition, low Dissolved Oxygen (<1 mg/l) at critical low flow periods prevents a healthier biological community from becoming established.

Also reported in the 305(b) report is the occurrence in 1989 of a fish kill in Johnston attributed to the chronic failure of a sewage pumping station. I would therefore disagree with the assertion in the draft report that no harm is actually occurring in the main stem of the Pawtuxet.

2. In October, 1989, Dr. Ray Wright of the University of Rhode Island Civil Engineering Department conducted a 12-hour water quality survey of the Pocasset River and Simmons Brook. The study was to provide a preliminary estimate of dry weather inputs to the Pocasset from the Central Landfill and to look at the effects of the Pocasset on the Pawtuxet River. Stream flow measurements were made in addition to quality measurements. Results from the study are as yet unpublished but may be extremely valuable to this planning study.

3. Consideration must be given to the impacts on sediments of various activities. It has been brought to my attention that cover material from the Central Landfill has contributed to a sedimentation problem in the Upper Simmons Reservoir. In addition to burying existing communities and reducing habitat, chemically contaminated sediments may be acutely or chronically toxic to benthic organisms and fish.

4. Despite its urban setting, many of the waters in the study area are considered valuable recreational resources. Fish are stocked in Meshanticut Brook and the state operates a park at Meshanticut Pond. Maintenance and protection of these resources and uses should be a primary consideration in the planning study.

5. The cause for non-attainment of water quality standards in many of the study area waterbodies is given in the 305(b) report as urban and stormwater runoff. A secondary cause is given as agricultural runoff. As certain watersheds within the study area convert from primarily agricultural fields to urban uses, non-point source contributions from Individual Subsurface Disposal System (ISDS) such as septic tank/leach field, impervious surface runoff, and erosion and sedimentation will have increasing significance and may represent a threat to existing water quality conditions. For this reason, a review under Rhode Island's antidegradation provisions of their water quality standards may be required for the proposed project. Also, this effort should include plans for addressing present and future stormwater runoff through either the permitting process or Best Management Plans.

6. Although several waterbodies in the study area suffer from adverse water quality and have been given "C" classifications by RIDEM, Division of Water Resources, the goal of the Clean Water Act is for waterbodies to meet "fishable/swimmable" criteria or to be designated Class "B" or better. All activities should be conducted with the Clean Water Act goal in mind including consideration of bacterial pollutant levels.

Comments by Melvin Peter Holmes, Wetlands Protection Section, Mail Code WWP-425, Tel. No. (617) 565-4433:

Based on the study and its proposed alternatives, the Wetland Protection Section has no real comments except that the future placement of sewer interceptors would require compliance to the Section 404 (b)(1) Guidelines under section 404 of the Clean Water Act.

Thank you for the opportunity to review this study plan.

Sincerely,

Edward K. McSweeney, Chief
Wastewater Management Branch

cc: Frederick B. Gay
Charles Conway
Mark Spinale
Beverly Baker
Melvin Peter Holmes

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203-2211

June 28, 1991

Joseph Ignazio, Chief
Planning Directorate
US Army Corps Engineers
New England Division Bldg 114
Waltham, MA 02254-9149

Re: Draft Report Section 22 Planning Study for Cranston, Rhode Island

Dear Mr Ignazio:

In your letter of May 30, 1991 it was requested that the Environmental Protection Agency review the innovative and alternative features proposed by the City of Cranston and your review of the conclusion summarized in that letter.

Based upon the information presented we have concluded the following. The technologies are neither innovative or alternative. Insufficient information was presented to determine if the proposed project would result in cost savings or if there is a need to demonstrate the proposed technologies. As explained to Ms. Blumeris and Mr. Kennelly before any formal determination could be reached additional detailed information would be needed comparing alternatives, capital costs and operating costs. In short a Facilities Plan to include a cost effective analysis is required. In addition the proposed technologies need to be reviewed in accordance with the guidelines set forth in EPA's Innovative and Alternative Technology Assessment Manual (430/9-78-009).

We agree with the conclusions reached in your letter of May 30, 1991.

If you have additional questions or concerns please contact me at 617/565-3575.

Sincerely yours,

Gerald C. Potamis, P.E., Chief
Wastewater Management Section (WMN)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203-2211

August 5, 1991

Colonel Philip R. Harris, Division Engineer
U.S. Army Corps of Engineers
New England Division
424 Trapelo Road
Waltham, MA. 02254-9149

Re: Review of Section 22 Cranston, Rhode Island, Wastewater Investigation, Draft Report, June 1991.

Dear Colonel Harris:

Thank you for the opportunity to comment on the subject draft report. While reviewing you report I focused primarily on the sections discussing Central Landfill. My comments to these sections are:

1. Paragraph 7 on page 9 says "No information was available from EPA..." It should say that information available from EPA indicates that a ground water remediation alternative will be investigated. However, at the time of this report an estimate of the amount of ground water requiring remediation was not available.

2. On pages 30 and 31 there is an estimate of 230,000 gpd for ground water pumping. Please give your reference for this estimate.

If you have any questions please call me at (617) 573-9630 or Mr. Jim Brown of my staff at (617) 573-5779.

Sincerely,

Richard C. Boynton

Richard Boynton
Chief, Rhode Island Superfund Section

cc: Barbara Blumeris, USACE NED
Gerald Potamis, EPA
Jim Brown, EPA

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J.F.K. FEDERAL BUILDING, BOSTON, MA 02203-2211

MEMORANDUM

DATE: February 11, 1991

SUBJ: U. S. Army Corps of Engineers Section 22, Study, Craston, RI

FROM: Richard C. Boynton, Chief RCB 2/11/91
RI Superfund Section

TO: Joseph Ignazio, Chief of Planning Directorate
U.S. Army Corps of Engineers

The following comments relate to sections of the Draft Report, Section 22 Study Cranston Rhode Island, December 1990 that make reference to the Central Landfill Superfund Site.

Comments:

Page 6 Site Description last paragraph.

The Central Landfill Superfund Site is described as the 154 acre refuse disposal area including an approximately one-third acre former liquid hazardous waste disposal area. The hazardous waste disposal area was operated from December 1976 until May 1979. Based upon hazardous waste manifests on file at the RIDEM, it is estimated that approximately 1.5 million gallons of hazardous waste were disposed at the Site during 1978 and 1979.

In April 1987, the EPA and RISWMC entered into a Consent Order to study hazardous substance contamination at the site. Under the terms of the consent Order, RISWMC will conduct a Remedial Investigation (RI) to determine the nature and extent of contamination at the Site and a Feasibility Study (FS) to evaluate alternatives for clean up of the hazardous contamination at the site.

The characterization of contamination at the Site (the RI) is expected to be completed in the fall of 1991. The completion of this phase of the work will be followed by an evaluation of the cleanup alternatives and completion of an F.S. report. EPA will make the findings of the RI and the F.S. report available to the public and after soliciting and evaluating public comment will make a final decision on a cleanup remedy for the Site in 1992.

Page 7 Problem Discussion, 3rd paragraph

I think that it is more accurate to say that the RISWMC as part of its overall closure plan, which is a RIDEM Solid Waste Management requirement, will develop a solution to deal with the leachate generated by the sector of the landfill that includes the former hazardous waste disposal area. EPA's remedy will be focussed on controlling the infiltration through the former hazardous waste disposal area and remediation of the contaminated groundwater beneath and down gradient of the former hazardous waste disposal area.

I suggest that you contact Ron Gagnon at the RIDEM for the details of the landfill closure plan.

cc: Barbara Blumeris, ACOE
Ron Gagnon, RIDEM
Alicia Good, RIDEM
Clyde Shufelt, EPA
Julie Serowik, RISWMC

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Environmental Management
OFFICE OF THE DIRECTOR
9 Hayes Street
Providence, R.I. 02908

277-2771

22 August 1991

Mr. Phillip R. Harris
Colonel, Corps of Engineers
Department of the Army
New England Division
424 Trapelo Road
Waltham, MA 02254-9149

Re: Cranston, Rhode Island
Wastewater Investigation

Dear Mr. Harris:

The Department of Environmental Management has completed its review of the draft report for "Cranston, Rhode Island, Wastewater Investigation."

Our comments are as follows:

1. The following are specific comments furnished by the Solids Waste Section, Division of Air and Hazardous Materials:

   Page 10, Paragraph 2 - The fact that the eight inch (8") main on Green Hill Road is dedicated to SWMC use only, may prevent a connection to the Vinagro facility since his only access to the sewer line is by Green Hill Road.

   Page 12, Paragraph 4 - The Vinagro site contains a hog farm, paper, plastic and glass recycling facility, a wood recovery facility and a construction and demolition debris facility. Vinagro has recently received a license for a transfer station, however this facility has not been built yet.

   Page 13, Paragraph 3 - Groundwater data for the Vinagro site is available and on file at the Solid Waste Section. The facility is required to do quarterly groundwater monitoring.

Page 23, Paragraph 3 - Chamber Waste System of RI has been negotiating with the City of Cranston for a sewer connection for their transfer station.

Page 23, Page 29 - The Capuano site is currently installing a system to flare landfill gas. This system includes storage tanks for condensate, that will require pumping when full. Should the feasibility of connecting this flow to a proposed sewer be investigated?

General Comment: The SWMC must complete construction of the baseliner within 12+ months to ensure solid waste disposal capacity for the State.

2. The following are specific comments furnished by the Groundwater Section, Division of Groundwater and ISDS:

   Page 11, 2nd Paragraph - The observed TCE in upgradient wells to the fill area of the Central Landfill, originated off-site (Lot 66). This lot was later purchased by the SWMC.

   Page A.5 - Wellhead Protection Program was approved in February 1990 by EPA.

   Page B.8, Section 4.6 - Other sources of groundwater contamination also include dry-cleaners (Heritage Cleaners) which also use degreasers (TCE).

3. It is our understanding that discharge of any wastewater, in particular leachate and groundwater, may not be allowed by EPA until the CERCLA investigation is complete for any Superfund site.

   RIDEM, then would not be able to issue an Order of Approval for discharge of these wastewaters into the Cranston Sewer System until EPA makes its final decision or otherwise approves such a discharge.

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4. As the draft report indicates, there are currently several studies underway with regard to the identified EPA Superfund site at Central Landfill (SWMC), overall wastewater facilities planning for the City of Cranston, and the Comprehensive Community Plan for Cranston.

   RIDEM agrees that further evaluation of alternatives to convey and treat wastewater from the sources being considered, particularly from the Central Landfill facility, should be done. Many of the issues that need to be considered would typically be covered as part of a Comprehensive Wastewater Facilities Plan (or update). As the draft report indicates, the City of Cranston is currently having the previous Section 201 Facilities Plan updated and the scheduled completion date for that work is April, 1992.

It is RIDEM's policy that projects be at least consistent with a Wastewater Facilities Plan to receive an Order of Approval. In addition, RIDEM can only issue approvals for projects which are consistent with the approved Comprehensive Community Plan in accordance with the Rhode Island Comprehensive Land Use Act [(RIGL 45-22.2)].

RIDEM is aware that the City of Cranston and SWMC have entered an agreement concerning the discharge of wastewater; however, this is considered to be a significant modification of the wastewater system and requires approval by RIDEM [(RIGL 46-12-3(j)(n)&(o)] and [(RIGL 46-17.1(1))]. In addition, this project is not consistent with the previous 201 Facilities Plan. RIDEM will only issue an Order of Approval for discharge of these wastewaters into the Cranston sewer system based on a complete evaluation of both the impacts to the Cranston wastewater facilities and alternatives for conveying and treating the total flows. This evaluation must be included as part of the ongoing Wastewater Facilities Plan update.

Thank you for the opportunity to comment on the draft "Wastewater Investigation Report."

If you have any questions or require any further information, please do not hesitate to contact Warren Towne of my staff at (401) 277-3961.

Very truly yours,

Louise Durfee

Louise Durfee, Director
Department of Environmental Management

LD/WMT/abb

cc: Gerald Potamis, Chief, USEPA
Richard Boyton, Chief, USEPA
Dan Varin, Assoc. Dir., Dept. of Admin.
Dante G. Ionata, Asst. Dir., RI Solid Waste Mgmt.
Ray Azar, Director, Cranston Public Works
Victor Bell, Chief Envir. Coord., RIDEM
Sue Kiernan, Groundwater, RIDEM
Ron Gagnon, Solid Waste Section, RIDEM

cwharris.abb

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Environmental Management
DIVISION OF WATER RESOURCES
291 Promenade Street
Providence, R.I. 02908 - 5767

277-3961

December 28, 1990

Mr. John Kennelly
Planning Directorate
Basin Management Division
New England Division - Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

RE: Western Cranston, Rhode Island Interceptor Sewer Alternative Study Draft Report; December 1990

Dear Mr. Kennelly:

This office has reviewed the draft report furnished to Warren Towne of my staff at your December 12, 1990 coordination meeting. The following comments are submitted for your consideration:

1. The Municipal Wastewater Treatment Plant in Cranston section (Page 4) states, "The City plans to use this excess capacity to handle leachate and wastewater flows from Central Landfill in Johnston, for wastewater flow from future industrial and commercial development, and for potential wastewater flow from western Cranston."

   Providing collection facilities and treatment for flows not previously considered in the 1976 Facilities Plan, such as leachate and wastewater flows from Central Landfill, should be carefully evaluated as part of the ongoing Facilities Planning Update. Treatment of flows being proposed may limit regional alternatives that all three Pawtuxet River communities (Cranston, Warwick and West Warwick) are required to consider.

   This proposal should also be carefully evaluated as part of the Services and Utilities Element of the City's Comprehensive Community Plan now being developed.

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Also, the City of Cranston needs to do a detailed engineering study to determine whether the existing sewer systems have sufficient capacity to convey the total estimated flows or a new, separate, system is required. It is not clear from the information presented that this work has been undertaken or completed to-date.

2. Central Landfill, Problem Discussion

(Page 7, Paragraph 4) - It should be noted that leachate removed from portions of the site which are outside the Superfund area may also require pretreatment to meet the City's approved program regulations.

(Page 8, Paragraph 5) - Please note that RIDEM does require that pump station design capacity be based on peak future flow and that at least one (1) pump unit be provided as back-up.

3. The Groundwater Section has reviewed the chapter entitled, "Problem Definition - Central Landfill" in the Corps of Engineers' Draft Report on the western Cranston Interceptor. The Section's comments are presented below:

   - The issue of the extent of the contaminant plume at the Central Landfill (CLF) has not been adequately addressed. Groundwater quality data and water table evaluations at CLF have been routinely collected since the early 1980's. This data has yielded a lot of information on the extent of the plume and the direction of groundwater flow. DEM believes a reasonable understanding of the plume exists.

   - There is no data indicating that there is a connection between landfill leachate at CLF and the Scituate Reservoir via deep fracture traces. All the available data suggests that the groundwater flow in the glacial deposits and fractured bedrock to a depth of 275 feet is toward Simmons Reservoir, with the exception of the northeast corner of the CLF, which flows into Almy Reservoir. Therefore, the argument of possible contamination of Scituate Reservoir should not be used as part of the proposal to upgrade the Western Cranston Wastewater Interceptor. On the other hand, the capacity problem is a valid argument and should be considered.

- The City of Cranston has signed an agreement with the Solid Waste Management Corporation to accept the CLF leachate. This agreement will ensure that the leachate will be properly disposed of and will aid with the proper functioning of this solid waste facility.

4. Western Cranston Residential Area (Page 12)

   Current needs to provide sewers for existing residential development should be considered as part of the City's Comprehensive Community Planning effort and Facilities Planning Update. The City may also wish to consider re-zoning some undeveloped areas in western Cranston to establish larger minimum lot sizes based on the soils' severe limitations for suitability for septic tank absorption fields.

5. Please provide the figures and plates indicated as soon as they are available.

Thank you for the opportunity to submit these comments on the draft report. If you have any questions, please do not hesitate to contact Warren Towne at (401) 277-3961.

Sincerely,

Edward S. Szymanski

Edward S. Szymanski, P.E., Chief
Division of Water Resources
Department of Environmental Management

ESS/WT:alm

cc: James Fester, RIDEM
Sue Kiernan, RIDEM
Sofia Bobiak, RIDEM

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Administration
DIVISION OF PLANNING
One Capitol Hill
Providence, RI 02908-5870

August 14, 1991

Colonel Philip R. Harris
Division Engineer
Department of the Army
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

Dear Colonel Harris:

This letter is in response to your request of July 9, 1991, for comments on the draft report "Cranston, Rhode Island, Wastewater Investigation." Our review of the document indicates that it incorporates the data collected and discussed by the committee which assisted the Corps with its preparation. In general, the explanation of the engineering aspects of the various alternatives is clear, as well as objective.

Our major concerns are with statements on pages 45 and 46 under the topic of rezoning. The last paragraph on page 45 states, in part, "...the rezoning to 80,000 square-foot lots would result in a loss of 2,747 lots and would therefore leave only 740 lots available for development..." This statement seems to imply that lots will be increased in size by consolidation in order to meet the 80,000 square-foot criteria. Such a liberal approach to estimating flows from this area fails to take into consideration substandard lots of record. Unless contiguous lots are in the same ownership, they would remain intact under a rezoning proposal.

On page 46, the second paragraph states, in part, "...rezoning the 262 undeveloped acres to 80,000 square-foot residential lots, thereby, creating 88 lots at the industrial park and approximately 53 lots in the other industrial areas..." This statement also implies that all of the acreage in these areas can be reconfigured to 80,000 square-foot lots. As previously stated, such an assumption reflects an oversimplification of the zoning process. Secondly, the number of lots which are assumed to be created as a result of the rezoning reflects very little, if any, allowance for a street system. Again, we feel that this is much too liberal an approach to estimating future wastewater flows in these areas.

I wish to take this opportunity to express my appreciation to you and your staff for the preparation of this report, and I am sure that it will be instrumental in developing the appropriate solution to the wastewater conveyance problems in the study area.

Yours very truly,

Daniel W. Varin
Associate Director

DWV:cac

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

HISTORICAL PRESERVATION COMMISSION
Old State House
150 Benefit Street
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(401) 277-2078

August 16, 1991

Mr. Joseph L. Ignazio
Director of Planning
Impact Analysis Division
New England Division, Corps of Engineers
Department of the Army
424 Trapelo Road
Waltham, MA 02254-9149

Re: Section 22 Reconnaissance Wastewater Investigation
Cranston

Dear Mr. Ignazio:

The Rhode Island Historical Preservation Commission staff has reviewed the above-referenced report with particular attention to the discussion of significant cultural resources. It is our conclusion that this discussion is accurate and appropriate for a reconnaissance investigation of this nature. As the report notes, more detailed research and evaluation will be necessary should the investigation proceed to a more intensive level.

These comments are provided in accordance with Section 106 of the National Historic Preservation Act. If you have any questions, please contact Richard E. Greenwood, Project Review Coordinator of this office.

Yours very truly,

Richard E. Greenwood (for)

Edward F. Sanderson
Executive Director
Deputy State Historic
Preservation Officer

EFS:et

August 13, 1991

Mr. Joseph Ignazio, Director
Planning Directorate
U.S. Army Corp of Engineers
Building 114, 424 Trapelo Road
Waltham, MA 02254-9149

Dear Mr. Ignazio,

I am writing to comment on the Army Corp of Engineers' Section 22 Draft Report, "Cranston, Rhode Island, Wastewater Investigation." Thank you for providing this opportunity, especially since it is not customary to accept public comment on a Section 22 Report.

Save The Bay understands that this Section 22 Draft Report (hereafter, "the draft report") is in many ways a first cut on a very large problem -- how to best treat wastewater from eight sites. These sites are: the Central Landfill; Vinagro Site; Johnston Industrial Area; Western Cranston Industrial Area; Tilcon Gamino Industrial Zoned Land; Concentrated Western Cranston Residential Area (west of I-295 and east of Pipin Orchard Road); Howard Reservation and Industrial Park; and Capuano Landfill. While the study was undertaken in response to a Rhode Island Department of Administration request to examine a proposed regional sewer interceptor system, the draft report also considers alternative means to treat the wastewater flows from these eight sites. Given the preliminary nature of this reconnaissance level study, it would be premature for Save The Bay to take a position on the merits of the sewer interceptor or alternative proposals.

It is not too early, however, to comment on the criteria by which different proposals should be evaluated. In this regard, we wish to highlight three aspects of the draft report:

- the recognition that any wastewater conveyance system should be designed to meet the City's projected growth, rather than match the capacity of Cranston's existing wastewater treatment plant (WWTP);

- the observation that other ongoing studies could affect the findings of the draft report, particularly possible plans to use the Cranston WWTP for advanced treatment of Warwick, West Warwick and Cranston wastewater; and

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- the emphasis on wastewater management options, including water conservation, inflow/infiltration reduction and wastewater management districts, as an alternative or complement to an expanded conveyance system.

Each point merits individual attention.

Projected Growth. The Cranston WWTP, a secondary treatment facility, is operating well below capacity. Despite a design capacity of 23 mgd, it presently treats on average 12.1 mgd. While we can appreciate the desire to make use of the plant's excess capacity, this desire should not drive development decisions in Cranston. Instead, any modifications of the sewer system should be designed to meet the town's future growth potential as reflected in Cranston's forthcoming Draft Comprehensive Plan (DCP). Since the draft report predates the DCP, the Corp could not use the DCP as a starting point. But the Corp knew that local and state officials wish to maintain the rural character of the western-most portions of Cranston, so the draft report does not anticipate wastewater flows from this area. We commend the Corp's sensitivity to local land use plans, and trust that all other parties and future reports will do so as well.

Along these lines, Save The Bay recommends that the Corp of Engineers consult the DCP before finalizing the draft report. We expect this to be possible since the DCP should be completed by the end of this summer. Some of the draft report's base-line assumptions about land use in the study area may require revision in order to conform with Cranston's comprehensive planning effort.

Other Studies. For the purposes of the draft report, the Corp assumes that the full 23 mgd capacity of the existing Cranston WWTP would be available to treat the waste flows from the eight study sites. Among the many ongoing studies cited in the draft report, the results of one could undermine this assumption.

Cranston, Warwick and West Warwick are under court order to develop new wastewater facility plans by April 1, 1992. These plans may call for the advanced wastewater treatment (AWT) of all three cities' secondary level effluent at the Cranston WWTP. If this proves to be the case, Cranston could choose to retrofit some of the existing (and under-utilized) structures at its WWTP, rather than build new AWT facilities from the ground up. We realize that this is not always the best approach to AWT, but it has proven to be successful in some cases -- as in East Providence. If Cranston were to choose this route, it might not be able to easily accept wastewaters from the eight sites studied in the draft report.

Save The Bay does not expect the Corp of Engineers to introduce this hypothetical into its current Section 22 analysis. That said, we do wish to bring the possibility to the Corp's attention, and expect the results of Cranston's Wastewater Facilities Plan will be integrated into any subsequent studies by the Corp or other parties.

Wastewater Management. The report analyzes different wastewater management options that could be used to reduce wastewater flows. In our view, wastewater flow reduction is a very important goal for a number of reasons, including:

- reduced water demand, leading to wastewater reduction, places less stress on the states limited drinking water reserves and removes less water from its natural waterways;
- reduced wastewater flows could limit the need for additional conveyance capacity; and
- some studies, although not conclusive, have shown that wastewater treatment can be more efficient when the pollution is less diluted.

The report specifically recommends that the City institute an aggressive demand management program -- low flow domestic device retrofits, meter replacement and leak detection. The costs of such a program are judged to be modest ($26,000 per year) and the return great (average flow reductions between 340,000 and 740,000 gallons per day by the year 2040). The report also identifies opportunities for reducing inflow/infiltration at the Howard Reservation Facility. According to the report, these steps should be pursued "regardless of what specific options are selected to increase the conveyance capacity of the system." We applaud this conclusion. In addition, Save The Bay recommends that any subsequent Corp of Engineers study make an independent evaluation of the potential for further inflow/infiltration savings elsewhere in Cranston.

As part of the wastewater management options, the report recommends further study of a wastewater management district (WMD) for the Concentrated Western Cranston Residential Area. Failing septic systems may be polluting groundwater and surface waters in this area, and much of this pollution could find its way into the Pawtuxet River. In the long-term a WMD may or may not be more suitable than a tie-in to an interceptor. But if a septic problem can be documented in this area, Save The Bay believes that it would be best to form a WMD at least as an interim step.

Before closing, I would like to emphasize the importance of public participation in all research and planning efforts that address Cranston's wastewater treatment needs. Restoring the water quality of the Pawtuxet, one of the Rhode Island's most polluted rivers, is a concern of all who benefit from a healthy Narragansett Bay watershed. Plans that may impact point and non-point source discharges into the Pawtuxet are, thus, of great public interest. In this light, we appreciate the Corp's willingness to include Save The Bay, the state's largest environmental organization, in the draft report's development.

We look forward to participating in any follow-up efforts should Section 117 funding (of the Water Resources Development Act of 1990) or other monies become available. Sam Passmore, a Water Quality Specialist at Save The Bay, is the contact person here; please feel free to call him if you have any questions or wish to consult with Save The Bay on these matters.

Sincerely,

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KB/sp