Volume 1 of 3
Main Report and Environmental Assessment

Wastewater Conveyance Feasibility Investigation, Cranston, RI

May 1995

US Army Corps
of Engineers
New England Division

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The Water Resources Development Act of 1990, Public Law 101-640 authorized the Corps of Engineers (Corps), in consultation with the Environmental Protection Agency (EPA), to conduct a wastewater conveyance feasibility study for transporting contaminants from the Central Landfill site and other sources of pollution in Rhode Island to a wastewater treatment facility in Cranston, Rhode Island, through the use of a regional connector system.

The study strategy was to develop and assess options to address future wastewater conveyance needs. Sites are located in Cranston and Johnston, Rhode Island. Several options were identified based on analysis of the city's existing sewer system, review of the city's wastewater flow projections, and coordination with the city. The study options include a combination of improvements to the existing system and construction of new sewers and pumping stations.

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Wastewater Conveyance Feasibility Investigation
Cranston, Rhode Island

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Wastewater Conveyance Feasibility Investigation
Cranston, Rhode Island

VOLUME 1
MAIN REPORT
AND
ENVIRONMENTAL ASSESSMENT

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

May 1995

Executive Summary

The Water Resources Development Act of 1990, Public Law 101-640 authorized the Corps of Engineers (Corps), in consultation with the Environmental Protection Agency (EPA), to conduct a wastewater conveyance feasibility study of wastewater management options for transporting contaminants from the Central Landfill site and other sources of pollution in Rhode Island to a wastewater treatment facility in Cranston, Rhode Island, through the use of a regional connector system. The Energy and Water Development Appropriations Act of 1992, Public Law 102-104 directed the Corps to conduct the study. In December 1992, the New England Division of the Corps of Engineers signed a cost share agreement with the City of Cranston for the wastewater conveyance study. The study was initiated in January 1993.

The study strategy was to develop and assess options to address future wastewater conveyance from city identified study sites. Sites are located in Cranston and Johnston, Rhode Island. Several options were identified based on analysis of the city's existing sewer system, review of the city's wastewater flow projections, and coordination with the city. The study options include a combination of improvements to the existing system and construction of new sewers and pumping stations.

The feasibility study was conducted in two phases. The first phase was the initial assessment of wastewater conveyance options to select a proposed project. The first phase included feasibility level design, cost estimating, water quality, ecological, archaeological and historic analysis of options; selection of the proposed project in consultation with the city; and preparation of the Environmental Assessment. The second phase was preparation of preliminary design and cost estimate for the proposed project. In the second phase, changes were made in the wastewater conveyance system design based on additional detailed analysis, new topographic mapping of west Cranston, results of geotechnical explorations along the proposed alignments, and other new information generated during the study process.

The Main Report (Volume 1 of 3) presents a summary of developed information. The Supporting Documentation Reports (Volumes 2 and 3) contain the interim task reports prepared for the feasibility study. Volume 2 contains appendices

specific to the proposed project. Volume 3 contains appendices specific to the initial assessment.

As directed in the authorizing legislation, the feasibility study considered potential wastewater flows from Rhode Island Solid Waste Management Corporation's (RISWMC) Central Landfill in Johnston. Central Landfill is located near Cranston's northwest sewer service area. EPA is investigating Central Landfill under the authority of Comprehensive Environmental Response and Liability Act (CERCLA) or "Superfund" program.

Past disposal practices at the landfill have resulted in contamination of groundwater. Part of the EPA proposed remediation plan is to cap the landfill and pump and treat contaminated groundwater. The groundwater may be discharged to either on-site surface water or the Cranston sewer system. Also leachate is collected from the landfill and other sanitary flows are generated at the landfill.

RISWMC, recognizing the potential need for wastewater disposal at Central Landfill, contracted with the city of Cranston to accept flows. However, any wastewater discharges to the Cranston sewer system must meet the city's sewer use ordinance and pretreatment requirements to avoid interference with treatment processes at the WWTF and pollution of the Pawtuxet River. The city is currently designing and plans to construct a new wastewater pumping station for this service area. The city has already constructed a new 14-inch force main/variable grade sewer, 16,000 feet long, from the service area to the existing sewer system. Based on the feasibility analysis of study options, it appears that improvements to the existing system to be made by the city can adequately serve Central Landfill and there is no need to extend a regional connector system to the landfill.

Other problems considered in the study include projected wastewater conveyance needs from residential, industrial, institutional, and other landfill sites. *Based on the feasibility analysis of study options, it appears that the area of west Cranston, south of Scituate Avenue could be served by a new sewer system.* This area is primarily residential, with an area of about 140 acres of proposed industrial development. This area currently depends on on-site septic systems for wastewater disposal needs. *The proposed sewer project includes a pumping station, force main,*

and four trunk sewers to serve this area.

Within northwest Cranston, the feasibility study also considered the extension of the city's existing sewer system to the location of the future "Village Center" proposed in the city's Comprehensive Plan. This area currently supports low density residential development. *At the request of the city, a new force main/variable grade sewer and pumping station to serve this area is included in the proposed sewer project.*

The estimated initial cost for the sewer project to serve west Cranston is $8,908,000. Further costs for improvements to handle year 2045 flows is estimated at $782,000. The estimated cost to provide an extension of the city's sewer system to serve the future "Village Center" in northwest Cranston is $1,930,000. The city is responsible for construction of lateral sewer systems from existing and future developments. This cost is not included in the estimated cost of the proposed sewer project.

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ENVIRONMENTAL ASSESSMENT, SECTION 404 (b)(1) EVALUATION, FINDING OF NO SIGNIFICANT IMPACT

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Chapter 1: INTRODUCTION

This report documents the results of studies performed as part of the Cranston Wastewater Conveyance Feasibility Investigation. The information presented should assist the city in the decision making process regarding future expenditures for improvements to and expansion of the existing sewer system. The preliminary design information developed for the proposed sewer project should assist the city in final design of these systems. *The preparation of the feasibility report in no way obligates either party to budget for or implement a project.* At the present time, projects being assigned budgetary priority by the Corps are those that provide primarily commercial navigation, flood or storm damage reduction, and environmental restoration outputs. The Corps effort on this project is limited to the preparation of the feasibility report.

The feasibility study was conducted in two phases. The first phase was the initial assessment of wastewater conveyance options to select a proposed project. The first phase included feasibility level design, cost estimating, water quality, ecological, archaeological and historic analysis of options; selection of the proposed project in consultation with the city; and preparation of the Environmental Assessment. The second phase was preparation of preliminary design and cost estimate for the proposed project. In the second phase, changes were made in the wastewater conveyance system design based on additional detailed analysis, new topographic mapping of west Cranston, results of geotechnical explorations along the proposed alignments, and other new information generated during the study process.

The Main Report (Volume 1 of 3) presents a summary of developed information. The Supporting Documentation Reports (Volumes 2 and 3) contain the interim task reports prepared for the feasibility study. Volume 2 contains appendices specific to the proposed project. Volume 3 contains appendices specific to the initial assessment.

STUDY AUTHORITY

Section 117 of the Water Resources Development Act of 1990, Public Law 101-640 authorized the Corps of Engineers, in consultation with the Environmental Protection Agency (EPA), to conduct a feasibility study of wastewater management

options for transporting contaminants from the Central Landfill site and other sources of pollution in Rhode Island to a wastewater treatment facility in Cranston, Rhode Island, through the use of a regional connector system. The Corps was further authorized after the completion of the feasibility study to conduct a technology demonstration project of the connector system to determine the operational capability of the system design. The language authorized the appropriation of $1,000,000 to conduct the feasibility study and $10,000,000 to implement the demonstration project. The Federal share for carrying out the efforts is 50 percent.

The Energy and Water Development Appropriations Act, 1992, Public Law 102-104 directed the Corps of Engineers to use $500,000 to conduct the study as authorized by Section 117 of Public Law 101-640.

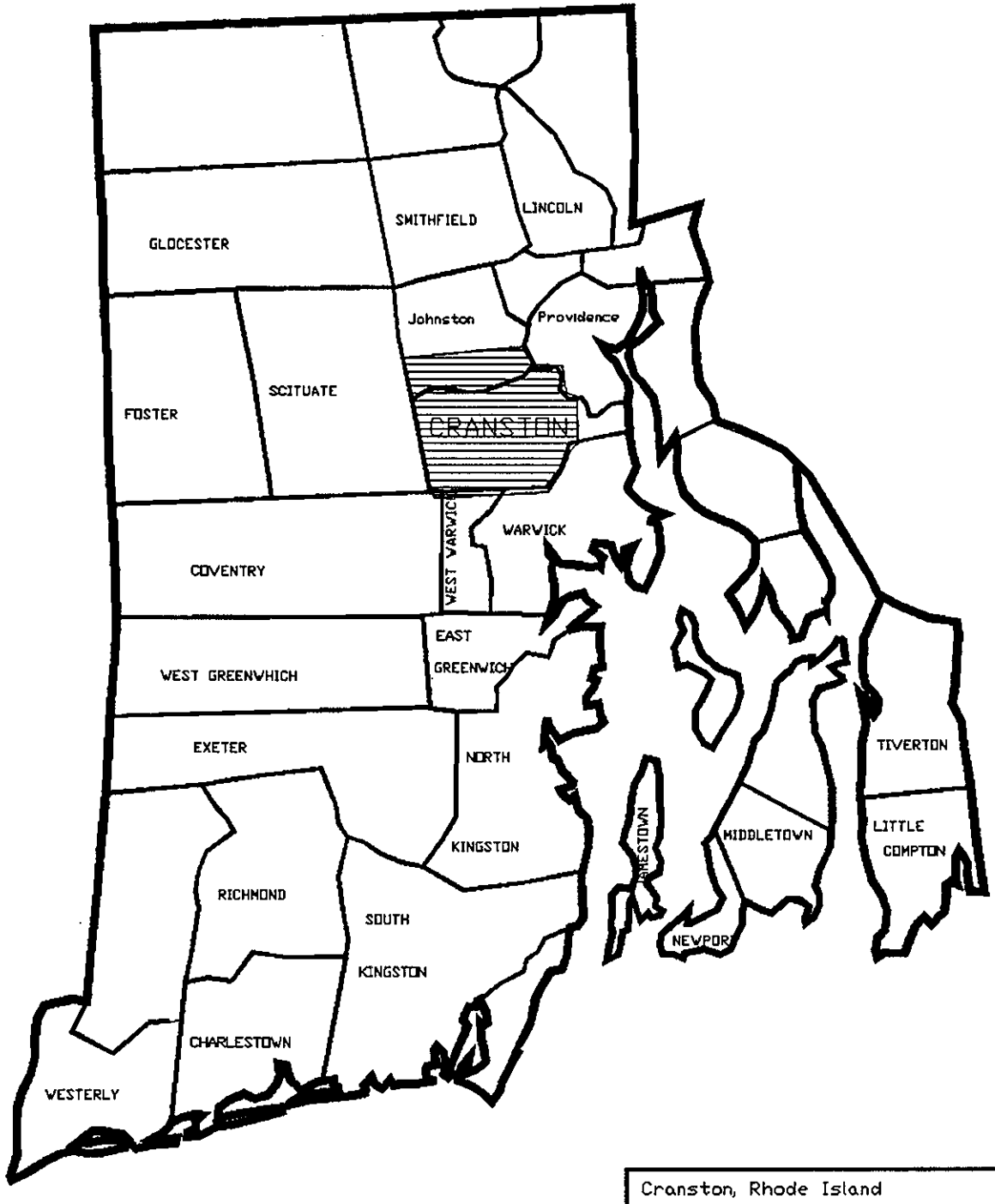
STUDY PURPOSE

The purpose of the study is to conduct a feasibility investigation of options for transporting wastewater from pollution sites in Cranston, Rhode Island. In addition to Cranston, the study area includes land in Johnston, Rhode Island. Problems and solutions are assessed from a regional perspective and the most effective means of conveying the wastewater to the treatment facility is identified and evaluated. Applicable Federal, State and local laws and regulations are considered in the planning process.

STUDY AREA

The study area includes lands in Cranston and southern Johnston. Cranston is a medium sized city immediately south of Providence, Rhode Island. It borders Warwick and West Warwick on the south; Scituate in the west; and Johnston on the northwest (See Figure 1).

The City of Cranston occupies a land area of about 17,750 acres. The census population for Cranston in 1990 was 76,060. Several major highways provide access to the city including Interstates 95 and 295 and State Routes 37, 14 (Plainfield Pike), 12 (Scituate Avenue) and 5.



Cranston, Rhode Island
Wastewater Conveyance Feasibility Investigation

STUDY AREA

FIGURE 1

Existing land use includes residential, commercial, industrial, institutional development, farmland and undeveloped land. Interstate Highway 295 roughly divides Cranston into an east and west section. The majority of east Cranston is characterized by urban/suburban development with undeveloped space remaining primarily in west Cranston.

The town of Johnston occupies a land area of about 15,425 acres. The census population for Johnston in 1990 was 26,542. The area in Johnston included in the study is west of Interstate 295 along Plainfield Pike.

The study sites considered in west Cranston are: existing and future industrial, commercial, and residential lands. The study sites in east Cranston are: the Capuano Landfill, the State of Rhode Island Howard Center, and the Howard Industrial Park. The study sites in southern Johnston in the vicinity of Plainfield Pike are: the Rhode Island Solid Waste Management Corporation's (RISWMC) Central landfill, the Vinagro landfill, and potential industrial land (See Figure 2).

SCOPE OF WORK

The scope of work for this study was developed in coordination with city of Cranston officials. The scope of work includes: identification and selection of options to increase the city's wastewater conveyance capacity; feasibility level design and assessment of options; selection of the proposed project; preliminary design; and a preliminary cost estimate for the proposed project. The scope of work does not include design of lateral sewer collection systems. The investigation utilized existing information from on-going wastewater facilities studies being conducted by the city. The scope of work for the feasibility study was divided into several tasks. These are:

Task 1&2	Study Management and Study Coordination
Task 3	Identification of Wastewater Flows
Task 4	Review of Information on Cranston's Wastewater Treatment Facility Capacity

Task 5	Identification of Existing Sewer System Capacity
Task 6	Identify and Select Alternatives
Task 7	Feasibility Level Design of Alternatives
Task 8	Survey and Mapping
Task 9	Cost Estimates for Alternatives
Task 10	Assessment of Alternatives
Task 11	Select Proposed Project and Prepare Environmental Assessment
Task 12	Preliminary Design of Proposed Project
Task 13	Cost Estimates for Proposed Project
Task 14	Feasibility Report

Individual interim task reports prepared for the feasibility study are included as appendices in the Wastewater Conveyance Feasibility Investigation Report, Volumes 2 and 3.

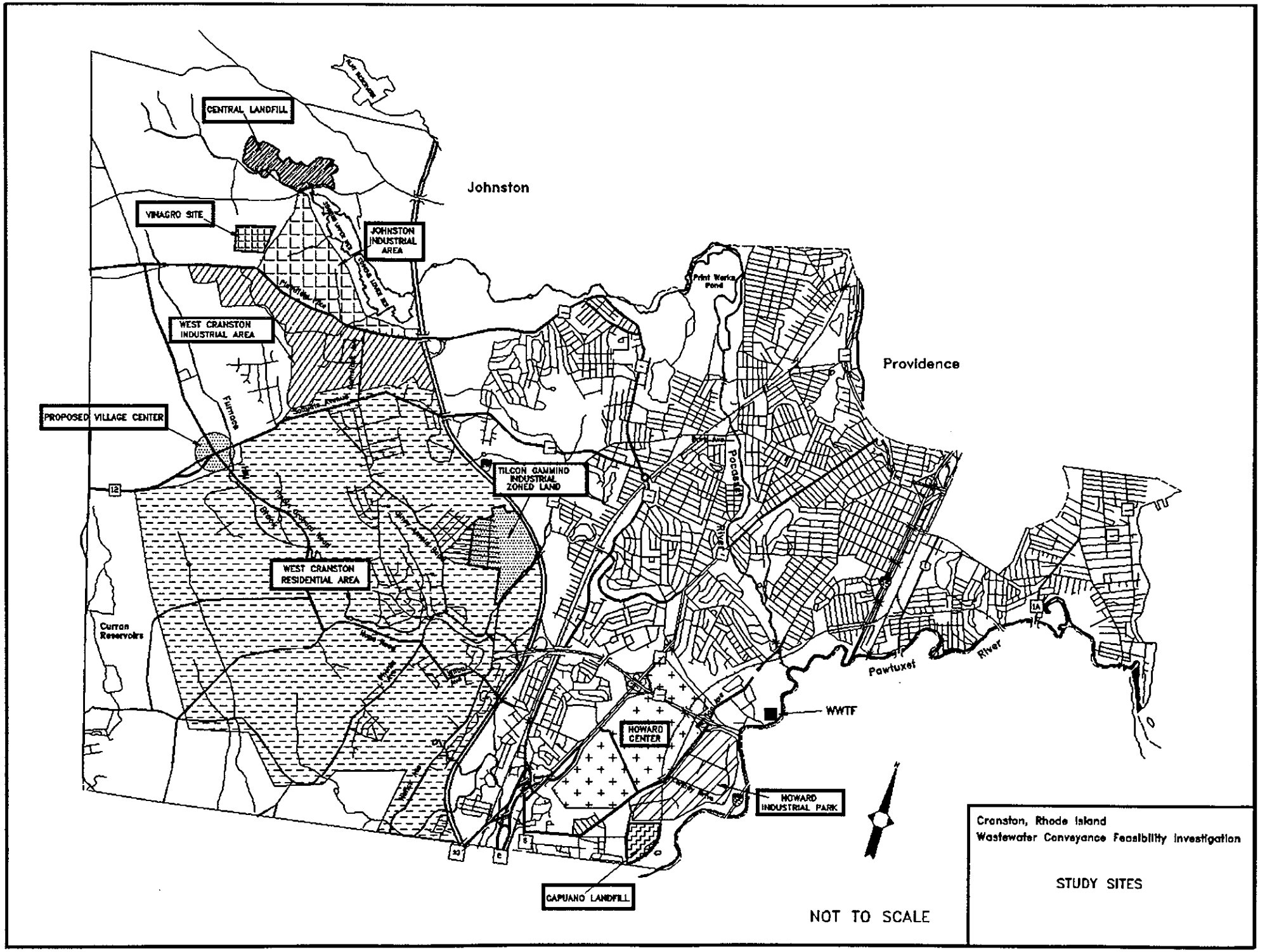

CENTRAL LANDFILL
Johnston
VINAGRO SITE
JOHNSTON INDUSTRIAL AREA
WEST CRANSTON INDUSTRIAL AREA
Print Works Pond
Providence
PROPOSED VILLAGE CENTER
Furnace
TILCON GAMMINO INDUSTRIAL ZONED LAND
WEST CRANSTON RESIDENTIAL AREA
Pocasset River
Curran Reservoirs
Pawtuxet River
WWTF
HOWARD CENTER
HOWARD INDUSTRIAL PARK
GAPUANO LANDFILL
NOT TO SCALE
Cranston, Rhode Island
Wastewater Conveyance Feasibility Investigation
STUDY SITES

FIGURE 2

PRIOR INVESTIGATIONS

Wastewater problems at the study sites were initially investigated under the Corps, "Planning Assistance to States Program" (USACOE, May 1992). The report includes a description of the sites and an assessment of five alternatives to handle potential wastewater flows. The alternatives investigated were: no action; modifications to the existing Cranston sewer system; construction of local wastewater treatment plants; a new sewer interceptor through west Cranston; and wastewater flow management to decrease wastewater flows. The report concluded that wastewater conveyance problems could be addressed through the construction of a new interceptor through the western portion of the City; through modifications to the existing sewer system; or through a combination of both plans. The report suggested the City should continue to pursue opportunities to address inflow and infiltration reduction and demand management.

Before, during, and after the above mentioned report was written several studies, plans, and actions have been issued and undertaken by the city. Information from these studies was utilized for this feasibility study. Also on-going actions by the city influenced the development of wastewater conveyance options. These reports are:

"City of Cranston, Comprehensive Plan", February 1992.

"Letter report, Wastewater Flow Projections for the City of Cranston", February 1993, prepared by Tutela Engineering Associates.

"Wastewater Facility Plan Amendment Northwest Cranston", February 1993, prepared by Tutela Engineering Associates.

"Draft Infiltration/Inflow Study, Cranston, Rhode Island", January 1993, prepared by Tutela Engineering Associates.

"Draft Wastewater Facility Plan, Cranston Rhode Island", April 1992, Volume I and II, prepared by Tutela Engineering Associates.

"Report on Rhode Island Site Specific Criteria Development Program", Volume I and II, April 1992, prepared by Tutela Engineering Associates.

"Wastewater Facility Plan Amendment", April 1992, prepared by Tutela Engineering Associates.

"Non-Point Pollution Study", October 1991, prepared by Tutela Engineering Associates.

"Wastewater Facility Plan, Interim Report on Regional versus Individual Alternatives", March 19, 1991 prepared by Tutela Engineering Associates.

The Rhode Island Solid Waste Management Corporation has also conducted a Remedial Investigation and Feasibility Study Report under EPA direction and oversight for the Central Landfill Superfund Site in Johnston, Rhode Island. The proposed remediation plan was published in February 1994. Remedial design is scheduled to begin in 1995. Currently EPA is continuing investigations of pollution that has migrated off site. The EPA study is being conducted independent of this wastewater conveyance feasibility study.

Chapter 2: BACKGROUND INFORMATION

POPULATION

In 1990 Cranston ranked third in population among Rhode Island's 39 cities and towns. The Census population for Cranston in 1990 was 76,060. This represented a 5.7 % increase from the 1980 population of 71,992. Population for the years 1920 to 1990 are shown below in Table 1:

Table 1. Cranston Rhode Island Population

Year	Population
1920	29,407
1930	42,911
1940	47,085
1950	55,060
1960	66,766
1970	74,287
1980	71,992
1990	76,060

Tutela Engineering Associates projects a population of 83,020 people by the year 2015 and a population of 91,370 by 2045 under existing zoning conditions (Tutela Engineering Associates, Draft Wastewater Facility Plan, April 1992 [1]). Most of this population increase is projected to take place in west Cranston.

[1] Assumptions regarding population growth and industrial and commercial growth in Cranston were made by Tutela Engineering Associates for the on-going Wastewater Treatment Facility Plan and have been adopted for this study at the request of Cranston city officials.

ECONOMY

In 1992 employment occurred in over 2,000 establishments in Cranston with an annual payroll of over 500 million dollars. Cranston has a diverse portfolio of business in a variety of industries and sectors. Employment for the city of Cranston is in the areas of Agriculture, Construction, Manufacturing, Transportation, Communications and Public Utilities, Finance, Insurance and Real Estate, and Wholesale and Retail Trade and Services. About thirty percent of the employment was in the manufacturing sector.

The city's constructive partnership with the State of Rhode Island and with private developers to create modern attractive industrial parks that capitalize on the city's favorable transportation access has helped the city maintain it's manufacturing employment (Comprehensive Plan, 1992, page 102 and 104). Two of these sites included in the study are the Howard Industrial Park and the northwest Cranston Industrial Park.

LAND USE

Existing resources in Cranston include developed commercial, industrial, and residential areas, farms, historic villages, and open land. Resources associated with the feasibility study sites are discussed in the following paragraphs.

The city's Comprehensive Plan recognizes that the most important issue in the next two decades concerning future land use patterns will be the management of growth in west Cranston in a manner that will balance the objectives relating to housing, economic development, natural resources, open space, public services, and facilities. The objectives of the city in west Cranston relative to residential development is to promote actions that protect natural resources and serve a variety of housing needs.

In order to achieve a balance between open space and continued growth in west Cranston, the Plan suggests a strategy for development in west Cranston, direct preservation of 124 acres of open space through acquisition, easement, or similar methods. Residential development that would have occurred on this land is proposed

to be transferred to the development of a 120-acre Village Center near the intersection of Pippin Orchard Road and Scituate Avenue. The Comprehensive Plan suggests 180 residential units and associated community facilities (school, library, post office, bank, and convenience shopping) be located at the future Village Center.

Also the Comprehensive Plan proposes protecting another 370 acres of developable land by promoting clustering of new residential developments in west Cranston. Under this plan the same number of units would be built on a tract of land, however the individual units would have smaller lots and 25 percent of the tract would be preserved as "common open space".

East Cranston is not expected to undergo the same development pressure as west Cranston. In east Cranston the main concern is maintenance of existing housing units and preservation of housing resources for a wide range of income and housing needs (City of Cranston, Comprehensive Plan, 1992).

Regarding industrial land use the city's goal is to ensure that sufficient land is properly zoned and equipped with adequate infrastructure to provide for the city's future industrial development needs. In regards to the study sites the city's Comprehensive Plan states the city's desire to protect the capacity and integrity of roads, sewers, and water systems servicing the Howard and northwest Cranston industrial parks.

About a third of the area for industrial development is located in west Cranston in two areas, one area is along Plainfield Pike and Comstock Parkway and the other area is along Natick Avenue (current site of Tilcon Gammino gravel operation). In east Cranston the Howard Industrial Park contains about a tenth of the city's total industrial land.

Most of the city's commercial land is currently located in east Cranston. The city's goal as stated in the Comprehensive Plan is to ensure that new and expanded commercial development located along major roadways exhibits a high standard of design and is compatible with the existing roadway functions and adjacent residential neighborhoods.

In Cranston, there is also a large complex of State correctional, health and human services facilities known as the Howard Center. As noted in Cranston's Comprehensive Plan "the continued expansion of the facilities at the Howard Center have become an issue of concern to the city, especially as existing buffers - between institutional uses in the complex and residential and commercial uses outside it have diminished".

Chapter 3. ENVIRONMENTAL SETTING

TOPOGRAPHY AND GEOLOGY

Rhode Island is located in the Seaboard Lowland section of the New England physiographic province. The hilly topography in west Cranston results in many small watersheds with streams draining primarily south and east (elevation change about 350 feet from northwest to southeast). A sewer system to serve this area would consist of several main sewers to collect flows from the individual drainage basins. Any wastewater flow collected in west Cranston must then be pumped to reach the wastewater treatment Facility (WWTF) in east Cranston on the Pawtuxet River. East and west Cranston is separated by Interstate-295. This highway is located in a low area along Meshanticut Brook. To the east of I-295 is a long high ridge (elevation change about 150 feet from Meshanticut Brook). Wastewater flows collected near Meshanticut Brook and I-295 must be pumped over this ridge to the WWTF.

The area has been glaciated several times and the modern landscape is largely one of remnant surficial deposits of glacial origin overlying bedrock. The surficial materials were deposited during the last glacial period known as the Wisconsin stage which occurred approximately 10,000 to 13,000 years ago. Deposits in west Cranston are characterized by tills (unstratified glacial drift consisting clay, sand, gravel, and boulders intermingled), with lenses of sand and gravel. Stratified glacial outwash deposits are found in east Cranston.

In general, west Cranston soils are considered to be of poor suitability for the installation of on-site wastewater disposal systems. However, this area has been developed utilizing these types of systems. All on-site systems in Cranston must be approved by the Rhode Island, Department of Environmental Management. Design criteria includes testing of soil percolation rates and identification of groundwater elevation relative to the bottom of the proposed system. If septic systems are designed, installed, and maintained properly they should not cause a pollution problem to surface or groundwater. If the groundwater table is too high, or soils not sufficiently permeable or become clogged, wastewaters can seep to the surface. This may result directly in surface water contamination, but more commonly, pollutants do not reach streams until rainfall washes them into a water body.

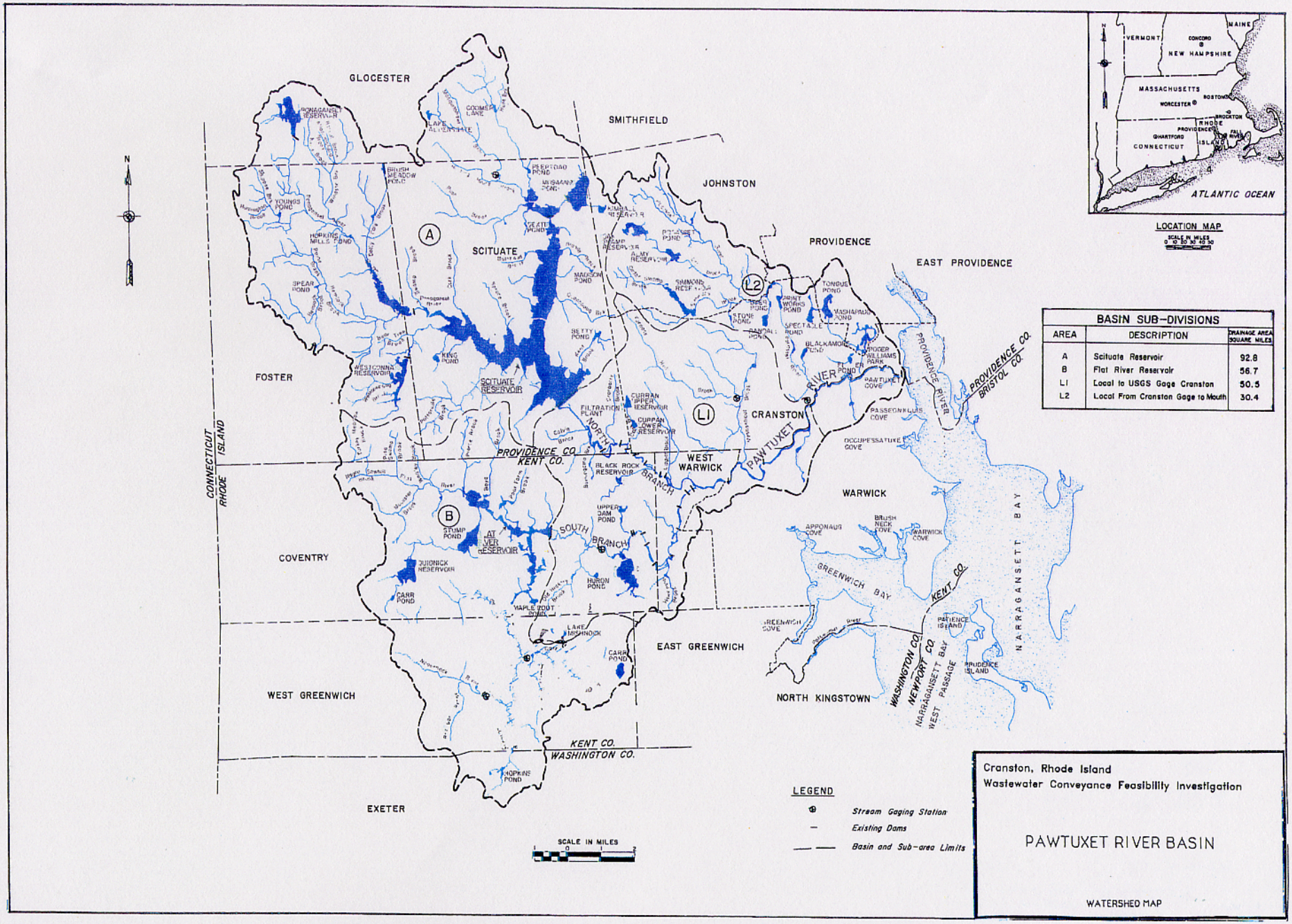
WATER RESOURCES

The study area is located in the Pawtuxet River basin (Figure 3). The main stem of the Pawtuxet River flows south to east along the easterly boundary of Cranston and empties into Pawtuxet Cove adjacent to the Providence River. The Cranston Wastewater Treatment Facility (WWTF) discharges to the Pawtuxet River. Several streams flow through the study area and discharge to the Pawtuxet River, including Meshanticut Brook and its major tributary Furnace Hill Brook. Also the Pocasset River flows through east Cranston and discharges to the Pawtuxet River.

The main stem of the Pawtuxet River, including the section bordering Cranston, is designated class C. These waters are suitable for boating, fish habitat, and industrial processes. Water quality in the Pawtuxet River is impacted by non-point pollution sources, interactions of the water column and the river sediments, and discharges from the three wastewater treatment facilities (WWTF): Cranston, Warwick, West Warwick. The potential impact of the wastewater treatment facilities' discharges on the Pawtuxet River is regulated under the Clean Water Act, National Pollutant Discharge Elimination System Permit Program (NPDES). Rhode Island's Department of Environmental Management has been delegated responsibility by EPA for this program. This program includes issuances of permits for wastewater discharges and monitoring of municipalities' compliance with issued permits.

Tributaries to the Pawtuxet River that drain through west Cranston (Furnace Hill Brook and Meshanticut Brook) are designated Class B. These waters are considered suitable for public water supply (after appropriate treatment), agriculture uses, swimming, and fish and wildlife habitat. Little information is available on the existing condition in these streams. Poorly operating on-site septic disposal systems in west Cranston may be impacting the water quality of these streams (Tutela Engineering Associates, October 1991, Non-Point Source Pollution Study). However, limited data is available to document this problem.

Groundwater throughout the watershed is generally clean or has trace levels of organic contamination. In the study area, groundwater in the vicinity of the three landfills: Central Landfill, Vinagro Landfill, Capuano Landfill appears to have been impacted by the past disposal practices at these sites. At Central Landfill,



LOCATION MAP

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

LEGEND

- Stream Gaging Station
- Existing Dams
- Basin and Sub-area Limits

Cranston, Rhode Island
Wastewater Conveyance Feasibility Investigation

PAWTUXET RIVER BASIN

WATERSHED MAP

FIGURE 3

groundwater contamination is being addressed in studies being conducted under the EPA "Superfund Program". The other two landfills in the study area are currently undergoing further contamination characterization studies by EPA.

TERRESTRIAL AND AQUATIC ECOSYSTEMS

East Cranston is extensively developed and contains most of the city's residential, commercial and industrial land use. Wildlife species common to the area are generally those species which are tolerant of human interaction.

West Cranston contains residential, institutional, agricultural, outdoor recreation, commercial, and gravel mining land uses. Upland vegetation provides food, cover, breeding and nesting habitat to terrestrial wildlife species. In addition, vegetated tracts of land provide travel corridors for wildlife to move through developed areas. This is an important function for larger mammals such as white-tail deer which need large areas and a diversity of habitat types. Travel corridors are also important to song birds which frequently stop to rest and eat during their migrations.

Aquatic habitats in the study area include Furnace Hill Brook, Meshanticut Brook, unnamed tributaries to these brooks, the Pocasset River, and the Pawtuxet River. The Rhode Island Division of Fish and Wildlife (RIDFW) stocks trout in Furnace Hill Brook (native brook trout, Salvelinus fontinalis, have also been observed by the RIDFW). The Pawtuxet River and contributing streams in the study area would generally be considered a warm water fishery.

Freshwater wetlands are found throughout the study area associated with streams and in low areas. Wetlands in the study area include forested wetlands. Wetlands have many valuable functions including flood control, fish and wildlife habitat, nutrient retention, sediment trapping, and visual/ aesthetic quality.

In the past, urban development in Cranston has resulted in a significant reduction in the amount of wetlands. Wetland habitat provides food, cover, breeding and nesting habitat to a variety of wildlife species. When upland habitat is reduced, such as in an urban/suburban setting, wetlands become increasingly valuable to

terrestrial species as well. Some upland species such as the white-tailed deer, may be forced to adapt to wetland environments when upland environments are developed for human use. Wetlands are often the only remaining vegetated tracts left in an urban environment and may function as travel corridors for wildlife to move through developed areas. Wildlife species observed utilizing wetlands in the study area include the belted kingfisher (Megaceryle alcyon), muskrat (Ondatra zibethicus), and winter wren (Troglodytes).

ARCHAEOLOGICAL AND HISTORIC RESOURCES

Cranston has many historic and archaeological resources. These resources are related to various periods of history including: the Archaic period (10,000 - 2,700 Before Present); the habitation by the Narragansett tribe of the Algonquin Indian nation; the European settlement in the 1600's; and early industrial development along some of Cranston's waterways. Resources include historical buildings, archaeological sites, and historic cemeteries. *Appendix L: Task 10d-Archaeological/Historic Assessment lists specific sites in Cranston.* Three of these sites included in the study area are listed below.

- Furnace Hill Brook Archaeological District - The district includes the Oaklawn Soapstone Quarry (Archaic peoples), the Cranston Furnace and the Cranston Ore Beds (early industrial development) and is listed on 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, the property was subdivided in this area and sold as lots. 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 historic district is on the National Register of Historic Places.

- The State Institutions at Howard (Howard Center) - 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. 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 Works Progress Administration (WPA) during the 1930's.

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Chapter 4. EXISTING WASTEWATER FACILITIES

Wastewater in Cranston is disposed of in two ways, either by on-site disposal systems or into the city's municipal sewer system. The municipal sewer system conveys flows to the Cranston Wastewater Treatment Facility which discharges to the Pawtuxet River.

CRANSTON's MUNICIPAL SEWER SYSTEM

Construction of Cranston's sewer system began as a WPA project in 1939 and is continually being upgraded to meet the city's needs. Figure 4 shows the approximate dates of construction of the different portions of the system. The Cranston sewer system consists entirely of sanitary sewers; and there are no combined sewers carrying both wastewater and stormwater flow. The sewer system includes an estimated 260 miles of main sewer, 8 miles of force main as well as many miles of lateral sewers. There are three major interceptors in the sewer system, all are located in east Cranston; two of these, the "Pocasset Interceptor" and the "Sockanosset Interceptor", are considered in this feasibility study.

There are 20 pumping stations plus one ejector station in the sewer system (See Figure 5). Three of these pumping stations are evaluated in the feasibility study: Howard, I-295, and Pontiac pumping stations. The Howard Pumping station serves the Howard Center and the Howard Industrial Park. The new I-295 pumping station in northwest Cranston is planned for construction by the city to replace the existing Welsh pumping station. The Pontiac Pumping station in east Cranston pumps a majority of the city's wastewater flows to the WWTF.

The east section of the city is sewered. Northwestern Cranston is partially sewered, although the first sewers were not constructed in this area until 1972. Flows from northwest Cranston are pumped by the existing Welsh, Plainfield, Randall, and Pontiac pumping stations before they reach the city's wastewater treatment facility. A large portion of west Cranston south of Scituate Avenue does not have city sewer service and depends on on-site septic systems. An exception is the Briggs Farm Elementary School located on Hope Road in west Cranston; a small variable grade sewer line conveys clarified flows from the school's septic tank to a

gravity sewer on Wilbur Avenue east of Interstate-295. Also some areas in southwest Cranston along the West Warwick border are proposed to discharge to the West Warwick sewer system.

An unusual feature of Cranston's sewer system is a 3-mile, 14-inch diameter force-main/variable grade sewer (FM/VGS). This sewer is not currently used by the city, but is planned to convey flows from the new I-295 pumping station. This FM/VGS starts at Plainfield Pike west of I-295 and discharges into an existing interceptor sewer manhole at the intersection of Cranston and Randall Street. The first 1,150 feet of sewer is a force main which lifts the wastewater approximately 35 feet. The remaining pipe is a variable grade sewer with a 240 foot drop in elevation from the end of the force main to the point of discharge. The sewer is located parallel to the existing sewer interceptor main. A lateral with a gate valve branches off the variable grade sewer at each low point and connects to an existing adjacent sewer manhole. This will allow periodic draining of any solids that may collect at low points in the variable grade sewer. The FM/VGS by-passes the Plainfield and Randall pumping stations (Tutela Engineering Associates, Wastewater Facility Plan Amendment , February 1993).

A hydraulic assessment was performed for the city's existing interceptor sewer lines that are projected to receive an increase in wastewater flow in the future from the study sites. *This assessment was based on the city's sewer plans and information provided by Tutela Engineering Associates and is included in Appendix H: Task 5-Identification of Existing Sewer System Capacity.*

WASTEWATER TREATMENT FACILITY

As part of the feasibility study, available information on the existing treatment facility was reviewed to determine if there will be sufficient treatment capacity to accommodate future wastewater flows from study sites. *This review was completed in July 1993 and is included in Appendix G: Task 4-Review of Information on Cranston's Wastewater Treatment Facility* Capacity.

The Cranston Wastewater Treatment Facility is located in east Cranston on the Pawtuxet River. In 1992, the average daily flow to the treatment plant was 12.3

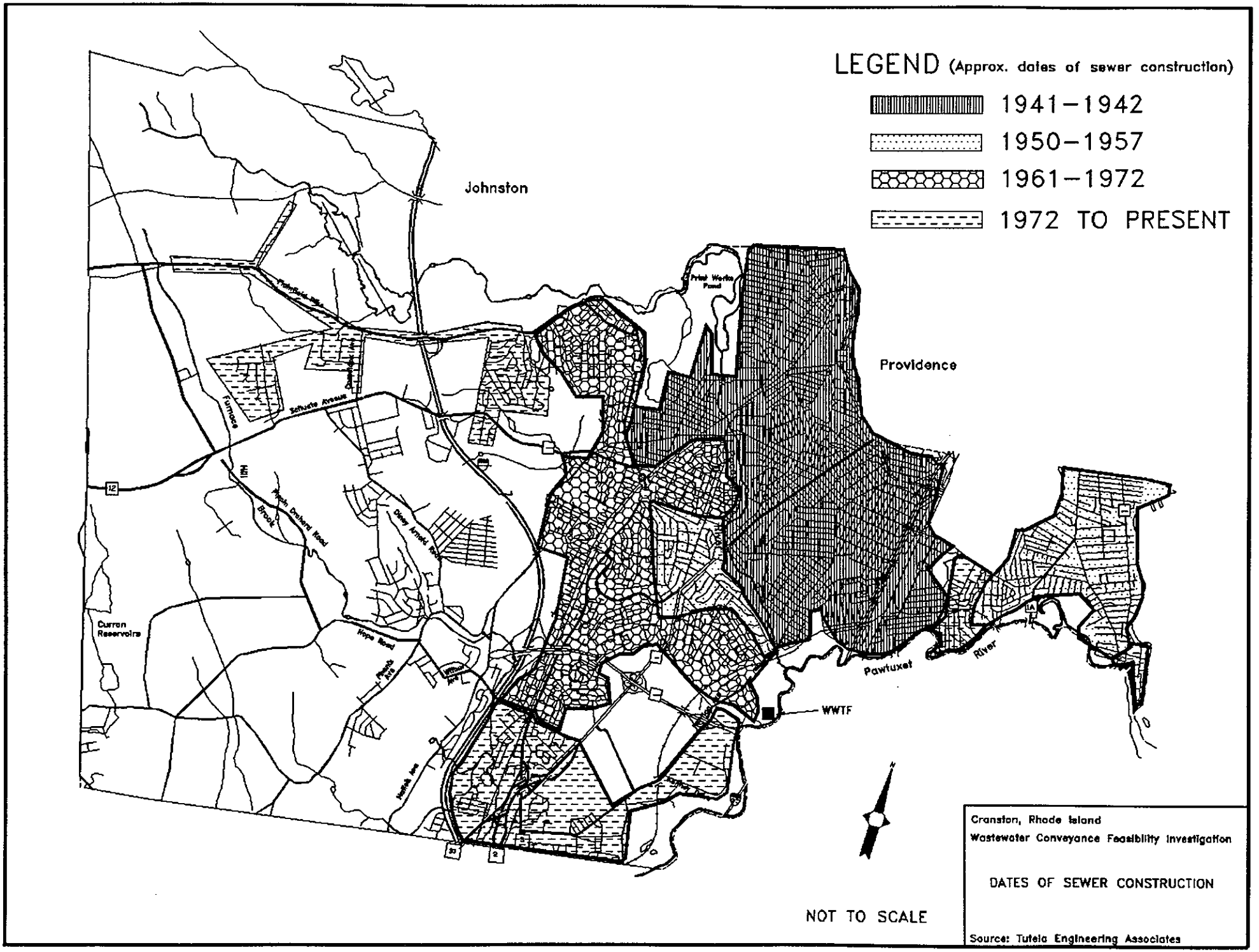

LEGEND (Approx. dates of sewer construction)
1941–1942
1950–1957
1961–1972
1972 TO PRESENT
Johnston
Providence
Print Works Pond
Furnace Hill
Scituate Avenue
Pawtuxet River
WWTF
Curran Reservoirs
Hope Road
Pleasant Ave
Hartford Ave
Diney Arnold Road
Pinch Orchard Road
Brook
12
1A
31
2
NOT TO SCALE
Cranston, Rhode Island
Wastewater Conveyance Feasibility Investigation
DATES OF SEWER CONSTRUCTION
Source: Tutela Engineering Associates

FIGURE 4

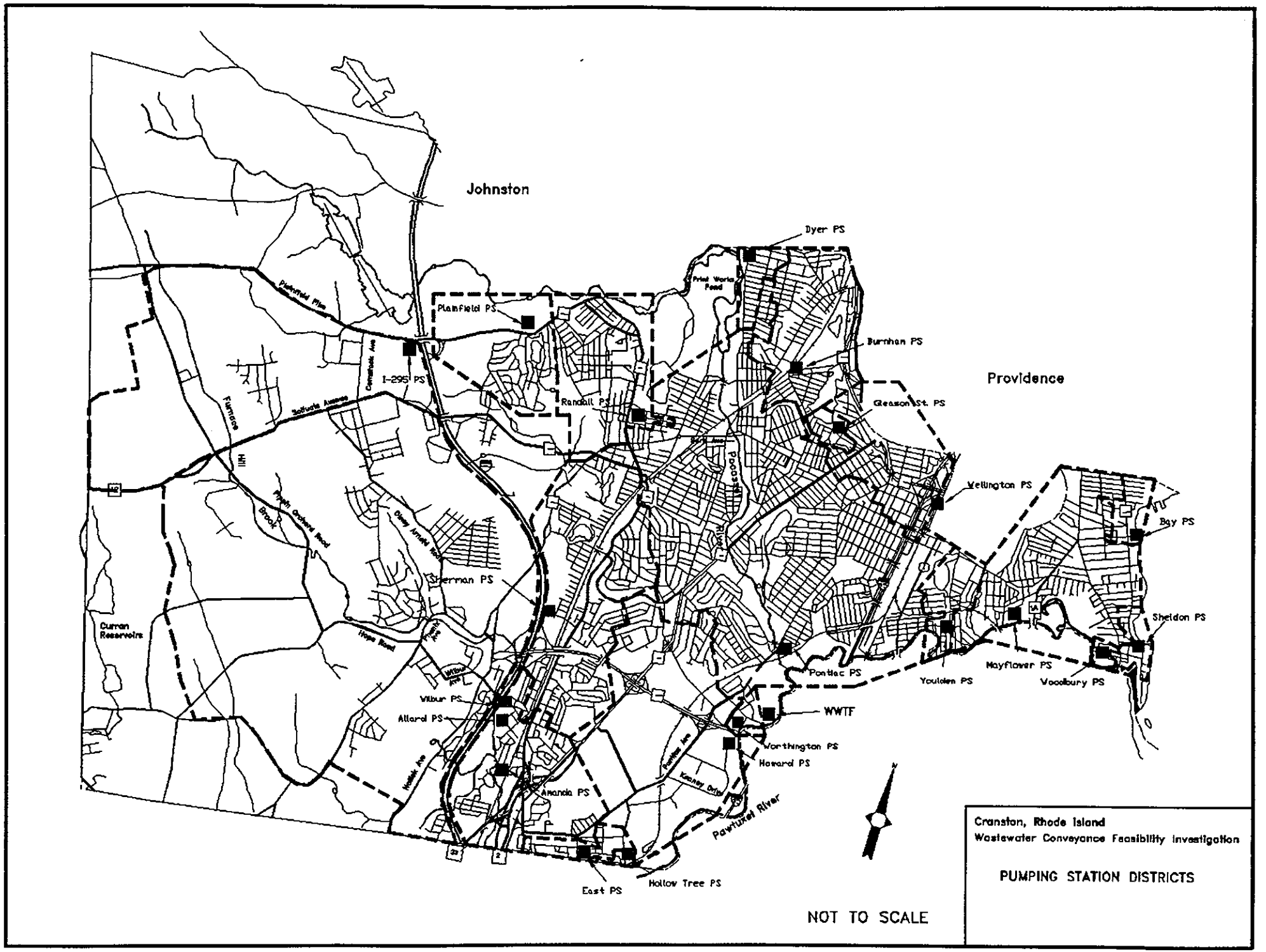

Johnston
Providence
Dyer PS
Plainfield PS
Burnham PS
I-295 PS
Randall PS
Gleason St. PS
Wellington PS
Bay PS
Sheldon PS
Sherman PS
Curran Reservoirs
Pontiac PS
Youlden PS
Mayflower PS
Woodbury PS
WWTF
Wilbur PS
Allard PS
Worthington PS
Howard PS
Amanda PS
East PS
Hollow Tree PS
Pawtuxet River
Cranston, Rhode Island
Wastewater Conveyance Feasibility Investigation
PUMPING STATION DISTRICTS
NOT TO SCALE

FIGURE 5

million gallons per day (mgd). The current facility has a 23 mgd average flow capacity and went on line in 1983 replacing the old facility. The old facility was first operational in 1942.

Wastewater treatment units include: preliminary treatment (2 grit removal tanks and two induced-air, grease flotation tanks), primary settling (three center feed circular clarifiers), activated sludge (four aeration basins), final clarifiers (four center feed circular clarifiers, but only three operate and are equipped with sludge collection mechanisms), disinfection (two chlorine contact tanks). Sludge collected from the clarifiers is dewatered by three recessed plate frame presses and incinerated in one of two multiple hearth incinerators. Sludge ash, screenings and grit are disposed of at the Central Landfill. Sludge and septage are accepted for treatment and disposal.

The WWTF provides secondary treatment and meets the conditions in its original discharge permit. However, in 1989 RIDEM issued a new wastewater discharge permit for the WWTF the limits of which can only be achieved through advanced treatment. The new RIPDES permit imposed more stringent seasonal limits for biochemical oxygen demand and total suspended solids, and new limits for ammonia, chlorine residual, metals, total cyanide, and tetrachloroethylene. The permit also required daily monitoring for nitrite, nitrate, and phosphorus and monthly monitoring for trichloroethylene and 1,1,1,trichloroethane in anticipation of future RIDEM policies.

Following issuance of the 1989 permit, RIDEM entered a civil action complaint alleging the city had been or would be in violation of this new permit. As the goal of both parties was towards improved water quality in the river, the complaint was resolved through a Consent Decree and Judgement, dated November 1990. The Consent Decree involves the city in a regional effort to improve water quality in the Pawtuxet River by considering alternatives for advanced treatment of secondary effluent. The Consent Decree also called for the following items:

- development of a site specific bio-assay program for evaluation of WWTF effluent toxicity

- development of a chlorine residual compliance methodology

- o studies to assess non-point pollution to the Pawtuxet River
- o studies to assess infiltration and inflow in the Cranston sewer system
- o an evaluation of the sediment oxygen demand of benthic deposits in the river.

The City currently operates the WWTF under interim permit limits while studies are conducted on advanced treatment needs.

In order to meet the requirements of RIDEM's final discharge permits, advanced treatment will be required. This treatment will likely include removal of ammonia and chlorine residual. Removal of nitrogen, phosphorus, metals, and organic compounds may also be required. New regulations being considered by EPA and the State of Rhode Island may also affect methods for disposing of waste solids. To meet these future requirements, Cranston evaluated treating only its own waste or entering into a regional advanced treatment plan with Warwick and West Warwick.

However, as final decisions had not been reached by the city and RIDEM concerning advanced treatment requirements and modifications to the facility to meet these requirements, no firm conclusions can be reached on the facility's ability to accept future flows from upstream study sites. It is the city of Cranston's responsibility to assure compliance with current and future RIPDES permit limits for its WWTF. Prior to construction of any extensions to the city sewer system, the city will be responsible for demonstrating to RIDEM that the planned wastewater treatment capacity will be sufficient to accommodate flows from study sites.

INDUSTRIAL PRETREATMENT PROGRAM

The National Pretreatment Program, established under the Clean Water Act, requires publicly operated treatment facilities to control toxic pollutants discharged into the sewer systems that may interfere with, pass through or otherwise upset the WWTF treatment process. This is typically accomplished through Sewer Use Ordinances. To implement general prohibitions and national categorical standards for pretreatment, Cranston calculated the amounts of pollutants industries are allowed to

discharge to the WWTF. Cranston established concentration limits for cadmium, chromium, copper, lead, nickel, silver, zinc, total cyanides, and total toxic organics. These concentration limits are called local limits. They apply to about 60 of the 300 potential industrial dischargers regulated by Cranston's Industrial Pretreatment Program, and typically exceed domestic background concentrations by one or two orders of magnitude.

An industry may propose to discharge into Cranston's sewers any substance for which there are no discharge limits in Cranston's WWTF permit. If proposed discharge concentrations exceed background levels, the industry must show that the proposed discharge will not interfere with treatment processes at the facility or aquatic life in the river.

Permit requirements are being expanded to require all industrial users to comply with any and all applicable pretreatment standards and requirements, including but not limited to, EPA Categorical Pretreatment Standards [Title 40 Code of Federal Regulations Subchapter N], National Prohibited Discharges (general and specific) [Title 40 Code of Federal Regulations Parts 403.5 (a) and (b)] and all requirements of the Federal EPA General Pretreatment Regulations for Existing and New Sources of Pollution. [Title 40 Code of Federal Regulations Part 403.12].

Reducing its liability under the Comprehensive Environmental Resource Conservation Act (CERCLA, Superfund) and the Resource Conservation and Recovery Act (RCRA) regulations is in Cranston's own best interest. The city does not intend to allow CERCLA wastes to be discharged without pretreatment to nonhazardous levels. It will incorporate these specific requirements in its Industrial Pretreatment Program. These will include expanding the list of parameters subject to compliance inspection to all pollutants existing in a potential CERCLA waste. In the event an industry proposed to discharge a substance for which no local limits have been established, Cranston will conduct a specific analysis of pretreatment requirements to prevent pass through, inhibition, and sludge contamination in its WWTF, and develop enforcement activities to ensure compliance.

INFILTRATION/INFLOW

The city's consultant, Tutela Engineering Associates (TEA), performed an infiltration/inflow (I/I) study of the Cranston sewer system and prepared a preliminary draft report in January 1993. According to this report, the system's age and a number of deteriorated pipe connections and manholes cause excessive I/I compared to EPA guidelines. If I/I problems are not addressed they could interfere with the sewer systems' ability to carry projected flows, and the WWTF's ability to treat them. However, the city's consultant TEA has indicated in correspondence with the Corps that all excessive I/I is targeted for elimination.

Chapter 5: FORMULATION OF STUDY OPTIONS

In the next several years, the city of Cranston will be faced with several strategic decisions regarding expenditures to upgrade existing wastewater facilities and expenditures to improve and extend the existing sewer system. This feasibility study should provide information that will assist the city in the decision making process regarding conveyance of wastewater flows from the selected study sites. Formulation of conveyance options included:

- o review of study sites
- o identification of future wastewater flows
- o identification of existing sewer lines that could convey future flows
- o coordination with the city regarding plans for improvements to the existing system
- o review of environmental resources in the study area

GENERAL DESCRIPTION OF STUDY SITES

Study sites were grouped into three service areas based on their location in the city, proximity to the existing sewer system, and the city's plans for sewer service in west and northwest Cranston. These service areas are described below (See Figure 6).

Service Area 1

This service area includes: residential and industrial lands in northwest Cranston and the future Village Center in northwest Cranston proposed in the city's Comprehensive Plan; proposed industrial land in Johnston along Plainfield Pike; and Central and Vinagro Landfills in Johnston.

Industrial Land in Northwest Cranston and Johnston. Industrial land in

northwest Cranston is located off of Plainfield Pike (State Route 14) with easy access to Interstate Route 295. The western Cranston industrial Park located off Plainfield Pike and Comstock Parkway contains about 350 acres with about 162 acres currently in use. Presently, there are about 27 firms and 2,200 employees located within the park. There is also additional land area zoned for industrial development adjacent to the park and along Plainfield Pike outside the park. At total build-out in northwest Cranston there is projected to be about 470 acres of industrial/commercial development (Tutela Engineering Associates, Wastewater Flow Letter Report, February 1993.) The city has extended sewer service along Plainfield Pike.

In nearby Johnston along Plainfield Pike, there are about 100 undeveloped acres of potential industrial land. The Town of Johnston "Draft Comprehensive Community Plan", 1991 identifies this area as future industrial zoned land. Further, the plan identifies that municipal water is presently available to the site, however municipal sewer service is not available.

The plan notes that arrangements would be necessary to tie into the Cranston collection system. However, the town has not formally approached the city to request such a sewer tie-in. This site is not included in Cranston's designated service area and is not considered in the city's on-going Facility Plan. A tie-in of future industries in this area would require a modification to the city's approved pretreatment program. (See Attachment II.)

The city of Cranston would like to encourage light industrial development in this area of Johnston compatible with the development occurring along Plainfield Pike in Cranston. However, the city is concerned that the town of Johnston is allowing strip commercial development in this area. The Cranston Comprehensive Plan, states: "that the city should work with the town to ensure that development on the northerly side of the Plainfield Pike enhances and reinforces the image and the function of the Pike to the benefit of both communities." The feasibility study assumes the communities will work together to develop compatible industrial use of the land in this area.

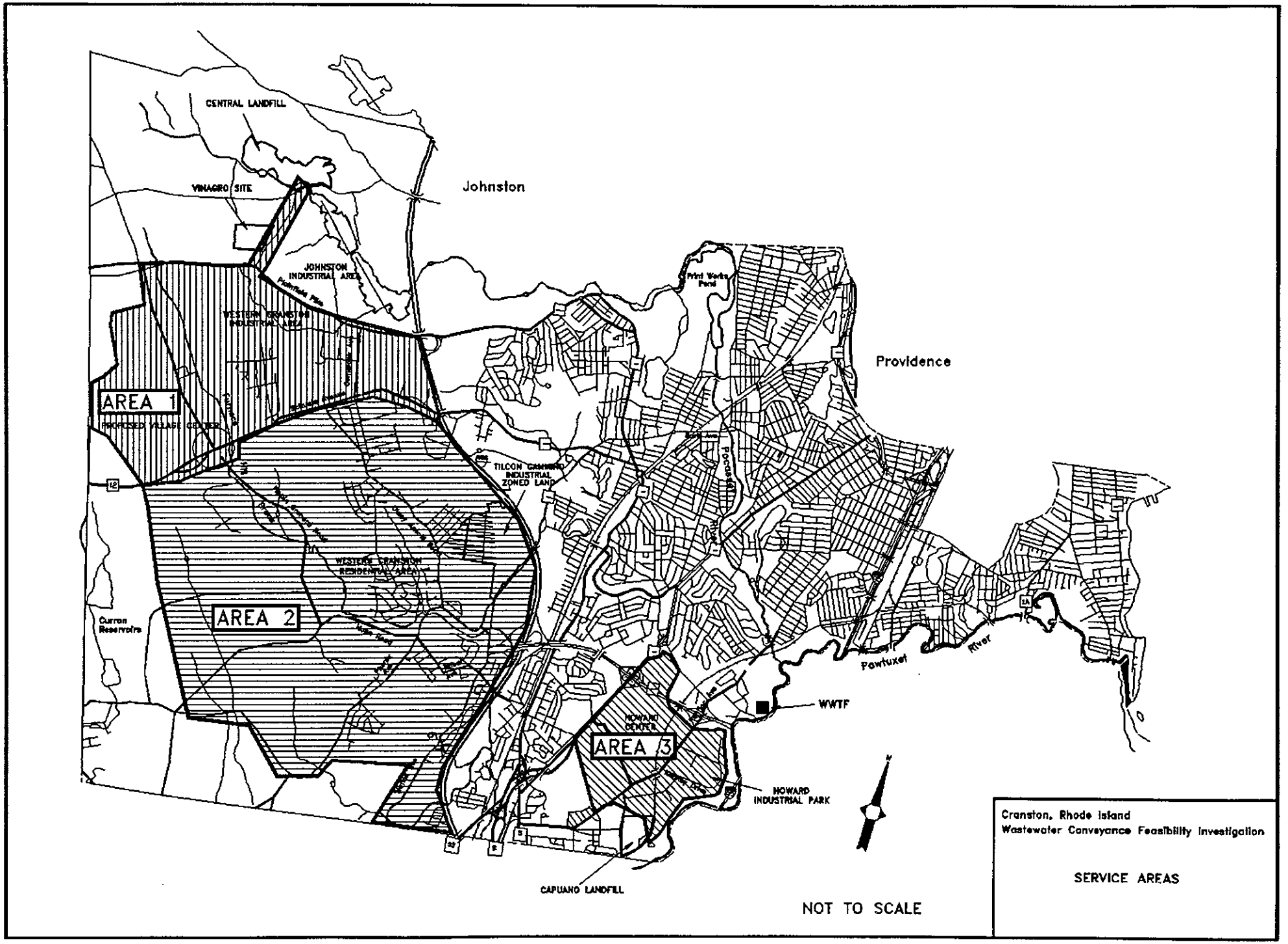

CENTRAL LANDFILL
VINAGRO SITE
Johnston
JOHNSTON INDUSTRIAL AREA
WESTERN CRANSTON INDUSTRIAL AREA
Print Works Pond
Providence
AREA 1
PROFESSIONAL VILLAGE CENTER
TILCON CANNING INDUSTRIAL ZONED LAND
WESTERN CRANSTON RESIDENTIAL AREA
AREA 2
Scituate Reservoir
Pawtuxet River
WWTF
HOWARD CENTER
AREA 3
HOWARD INDUSTRIAL PARK
CAPUANO LANDFILL
NOT TO SCALE
Cranston, Rhode Island
Wastewater Conveyance Feasibility Investigation
SERVICE AREAS

FIGURE 6

Village Center. The city's Comprehensive Plan suggests focusing new growth with one or more new "villages" which would serve as community centers and focal points for residential neighborhoods in west Cranston. One location for a Village Center which is suggested in the Plan is near the intersection of Scituate Avenue and Pippin Orchard Road. The center would include a mix of residential, commercial, public, civic, and institutional uses in order to function as an integral community center. This area currently supports low density residential development and is not supplied with sewer service. Real estate in this area is owned by private citizens and it is not clear what mechanism the city would use to encourage the development of the Village Center by the current landowners. An exception to this is the new church constructed (1994) at the northeast corner of Scituate Avenue and Pippin Orchard Road. The church is connected to the city's sewer system. However, this service was sized only for the church's needs and not for future growth in the area.

Central Landfill. The landfill consists of a 154 acre parcel within a 610-acre parcel called "Central Landfill" operated by the Rhode Island Solid Waste Management Corporation (RISWMC).

This landfill is located north of Cranston in the town of Johnston on Shun Pike. The site was first used as a landfill in the 1960's and accepted liquid wastes in the 1970's. The site is comprised of two areas: a 121 acre area known as the Phase I area; and a 33 acre expansion area known as the Phase II and III areas. Waste disposal activities in the Phase I area stopped as of April 1993. Twelve acres of the 33 acre expansion are currently being used for the disposal of nonhazardous municipal solid waste.

In anticipation of wastewater disposal needs at the site, RISWMC entered into a contract in 1988 with the City of Cranston to dispose of 400,000 gallons per day (gpd) of leachate and other wastewater flows from the landfill into Cranston's sewer system. The RISWMC has built a connection to the city sewer in Plainfield Pike. Plans are underway to collect and pretreat leachate from the landfill and discharge the effluent. On August 27, 1992, the city issued RISWMC an industrial wastewater discharge permit to allow 100,800 gpd of discharge.

Groundwater contamination at the site as a result of past waste disposal

practices in the Phase I area are being addressed in Superfund investigations being conducted by the Rhode Island Solid Waste Management Corporation under EPA direction and oversight. The EPA recently, June 1994, issued a Record of Decision regarding the Phase I area clean-up. The proposed plan includes:

1. Constructing a multi-layer cap over 89 acres of the 121 acre Phase I area; (The remaining 32 acres of the 121 acre area are currently capped with a RIDEM approved cap. The 32 acre RIDEM cap will be retained and incorporated into the new cap.)

2. Extracting contaminated groundwater from the "hot spot" and pretreating it before it is discharged to either on-site surface water or the Cranston wastewater treatment facilities;

3. Implementing deed restrictions on groundwater use and land development within property owned by RISWMC;

4. Long-term sampling and analysis of groundwater, surface water and air;

5. Evaluating in detail the existing landfill gas collection and combustion system;

6. Preventing access.

The groundwater collection system will consist of several deep wells extracting an estimated 30,000 gallons of contaminated groundwater per day from the hot spot area. The extracted groundwater will be treated on-site to remove metals and organic compounds. The final discharge location will be selected during the remedial design phase. The remedial design phase is expected to begin in 1995.

Impacts to off-site areas caused by contaminants that have already migrated from the 121 acre Phase I area are the subject of an on-going investigation being conducted by RISWMC and EPA. After the nature and extent of off-site impacts is determined, a range of cleanup plans will be developed.

Vinagro Landfill. This is a 40-acre site also located on Green Hill Avenue in Johnston. The site includes a closed landfill, a hog farm, a recycling facility, and demolition debris facility. On-site groundwater monitoring wells have been found to contain volatile organic compounds. The Rhode Island Department of Environmental Management has ordered some corrective actions at the site, including covering the landfill, however, treatment of groundwater below the site has not been required.

This site is also under investigation by the EPA's Superfund program, Site Assessment Group. The EPA completed the Screening Site Inspection Report in October 1989 and determined the site should go to the next step in the evaluation process. EPA, in conjunction with RIDEM, is currently conducting a Site Prioritization Report for the Vinagro Landfill. Following this study, the site will be prioritized for further action under the Superfund program. Information from these studies will be used to compute a hazard ranking score for the site. The hazard ranking score will determine whether or not EPA will be involved in future remedial action planning at the site.

Future groundwater remedial actions at the site are not known at this time. Wastewater effluent studies and a city industrial discharge permit would be required, if actions were to include consideration of pumping, pretreating contaminated groundwater, and discharging the effluent to the Cranston collection system. Also the Vinagro Landfill, although adjacent to the Central Landfill, is not included in Cranston's designated sewer service area and is not considered in the city's on-going Facility Plan. Any tie-in of this area would require a modification to the city's approved pretreatment program. (See Attachment II.)

Service Area 2

This area includes existing and future residential and industrial land in west Cranston south of Scituate Avenue and west of I-295. This area is within the city's designated sewer service area. However, except for the Briggs Farm school on Hope Road, the area does not have Cranston municipal sewer service.

Residential Land. Residential zoning in this area ranges from 8,000 to 80,000 square foot lots. Existing residential development is primarily concentrated in subdivisions near Natick Avenue, Phenix Avenue, Wilbur Avenue, Hope Road, Kimberly Lane, Olney Arnold Road, and South Comstock Parkway.

Industrial Land. There is about 140 acres of industrially zoned land on Phenix Avenue. This is the current location of the Tilcon Gammino gravel operation.

Service Area 3

This service area is located in east Cranston and includes the Howard Center, the Howard Industrial Park, and the Capuano Landfill. These sites are within the city's existing sewer service area.

Capuano Landfill. The Capuano Landfill otherwise known as the Cranston Sanitary Landfill is a 47-acre closed landfill located on Pontiac Avenue adjacent to the Pawtuxet River. The landfill began operation in 1943 for disposal of domestic waste and eventually began accepting industrial wastes till operation ceased in the 1980's. Reportedly hazardous wastes were disposed of at the landfill during the 1970's. Volatile organic compounds and inorganic elements have been detected in groundwater samples from monitoring wells located on-site. The RIDEM has ordered corrective actions at the site, including capping the landfill, however, treatment of groundwater below the site has not been required.

The Capuano Landfill site is also under investigation by the EPA's Superfund, Site Assessment Group. The EPA completed the Screening Site Inspection Report in October 1982 and determined that the site should go on to the next step in the evaluation process. Currently EPA, in conjunction with RIDEM is preparing an Expanded Site Investigation Report for the Capuano Landfill. Information from this report will be used to develop a hazard ranking score for the site. This score will determine whether or not EPA will be involved in future remedial action planning at the site.

Future groundwater remedial actions at the site are not known at this time. If they were to include consideration of pumping and pretreating of the contaminated

groundwater and discharging of the effluent to the Cranston sewer system, wastewater effluent studies and a city industrial discharge permit would be required.

The Howard Center. The Howard Center is a State facility located near the intersection of Route 37 and Route 2 (New London Avenue). This multi-use complex includes health care facilities, correctional facilities, office buildings, and service buildings. Portions of the Center were built in the late 1800's and other portions added in the 1930's. In recent time, two new prison facilities have been constructed.

As noted in Cranston's Comprehensive Plan *"the continued expansion of the facilities at the Howard Center have become an issue of concern to the city, especially as existing buffers - between institutional uses in the complex and residential and commercial uses outside it have diminished"*. The city's goal is to ensure that reuse, reorganization and/or disposition of State facilities do not result in either physical expansion of the complex or more intensive use for correctional purposes, and are consistent with community development needs and objectives. A city policy related to this goal is to establish a cap on the total prison population based on current building capacity.

The Howard Industrial Park. The Industrial Park is located east of Pontiac Avenue. The park is an important industrial site for the city with easy access to Route 37. The park houses about 38 companies with a total work force of about 3,000 people. There are about 190 acres zoned for industrial use at this site.

IDENTIFICATION OF WASTEWATER FLOWS

The identification of projected wastewater flows from study sites, and portions of the existing sewer system to convey flows from study sites, is detailed in Appendix F: Task 3-Identification of Wastewater Flows. Table 2 provides a summary of wastewater flows by Service Area.

TABLE 2. Projected Average Daily Flow by Service Area

	2015 (MGD)	2045 (MGD)
Service Area 1 - northwest Cranston and Central Landfill (without Johnston Plainfield Pike Potential Industrial Area and Vinagro Site)	1.1	1.4
Service Area 1 - northwest Cranston and Central Landfill (with Johnston Plainfield Pike Potential Industrial Area and Vinagro Site)	1.2	1.6
Service Area 2 - west Cranston south of Scituate Avenue	1.3	2.5
Service Area 3 - Howard Center and industrial park, and Capuano site	2.3	2.3

The majority of the wastewater flow assumptions and methodologies for calculations, and calculations were provided to the Corps by TEA who is conducting the city's on-going Wastewater Facilities planning effort.

In addition to obtaining flows from the city, it was necessary to project the amounts of wastewater flows that might be generated by landfill sites included in the study area. This projection was uncertain, as the amount of wastewater discharged from landfills to the Cranston sewer system depends on future groundwater remediation plans selected at the sites, the ability to pretreat the discharge to meet the city's Industrial Pretreatment Program requirements and city sewer use ordinances;

and the city's and RIDEM's acceptance of the flows into the system. However, to provide a complete picture of potential future needs for feasibility analysis, an allowance was made for potential flows from the landfill sites. In the case of Central Landfill, the contracted amount of 400,000 gallons per day (gpd) between the city and the RISWMC was assumed. For Vinagro and Capuano sites estimated rates of potential groundwater pumping of 35,000 gpd and 60,000 gpd, respectively was made. In estimating groundwater pumping for these landfills, it was assumed that the required pumping would be that necessary to keep the plume from moving off-site. This would be equal to the groundwater movement under the site. Assuming minimum streamflow is related to groundwater movement, an estimate of 0.001 cubic feet per second per acre of groundwater flows was used (see Appendix F, page F-12). These estimates were for the planning purposes of this study.

Because the feasibility study is for a regional connector system, potential needs for the Town of Johnston along Plainfield Pike were considered. This area is not located in the city's designated sewer service area. For planning purposes, it was considered possible for the city to accept flows from this area. However, this would require an agreement between the communities and an amendment to the city's Facility Plan.

FEASIBILITY STUDY OPTIONS

Various options were considered for conveying wastewater flows from the service areas to the Cranston Wastewater Treatment Facility (WWTF). Development of study options was an iterative process. Conveyance options were identified for each Service Area and reviewed with the city.

- Options for Service Area 1 (which includes Central Landfill) were determined based on the city's Wastewater Facility Plan Amendment (Tutela Engineering Associates, February 1993). This amendment provided a master plan for future sewer service to this area.

- Options for Service Area 2 were determined based on: the desire of the city to provide sewer service to this portion of west Cranston; consideration of possible locations and alignments for new pumping stations and sewers; review of past plans prepared by others including the Wastewater Facility Plan prepared for the city in 1976 (Universal Engineering Corporation, September 1976); and information provided by Tutela Engineering Associates.

- Options for Service Area 3 were determined based on a review of the existing system in this area and the city's and state's plans for the area.

In consultation with the city, the following options were selected for feasibility analysis. Options selected included a mix of improvements to the existing system and components of a new connector system.

Service Area 1

Option 1A. This option provides for conveyance of projected wastewater flows from Service Area 1 to the WWTF through improvements to and expansion of the existing sewerage system. (See Figures 7, 8, and 9.)

Under this option wastewater flows from Service Area 1 would be pumped from the I-295 pumping station (designed and scheduled for construction by the city)

into the existing 14-inch force main/variable grade sewer which discharges to the gravity sewer in Cranston Street. Wastewater would flow by gravity through sewers in Cranston Street, Park Avenue, and the Pocasset Interceptor to the Pontiac pumping station. Flows at the Pontiac pumping station would be pumped to the WWTF.

In addition, if the proposed future Village Center is pursued by the city, a new pumping station will be required to collect flows in the area of Pippin Orchard Road and Scituate Avenue. The city's facility plan proposes a new pumping station, the "Scituate Pumping Station", and a new force main/variable grade sewer from the pumping station to the I-295 pumping station (Wastewater Facility Plan Amendment, February 1993, Tutela Engineering Associates).

New lateral sewers would also be required in Service Area 1 to collect future wastewater flows from currently unsewered areas. However, the design and cost of these are not included in the feasibility assessment.

Option 1B. This option is similar to Option 1A. However, projected wastewater flows for the Vinagro Landfill and the Johnston industrial area are not included.

Option 1C. This option includes the new Scituate pumping station and 6-inch force main/variable grade sewer, only.

Service Area 2

Option 2A. This option provides a connector system to convey projected wastewater flows from Service Area 2 to the WWTF. Wastewater would be pumped from a proposed pumping station located near I-295 and Wilbur Avenue through the proposed "Garden Hills" force main/variable grade sewer to the WWTF.
(See Figures 9 and 10.)

Option 2B. This option is considered as an alternative to Option 2A. The proposed Garden Hills force main/variable grade sewer of Option 2A is replaced with a proposed force main/gravity sewer.

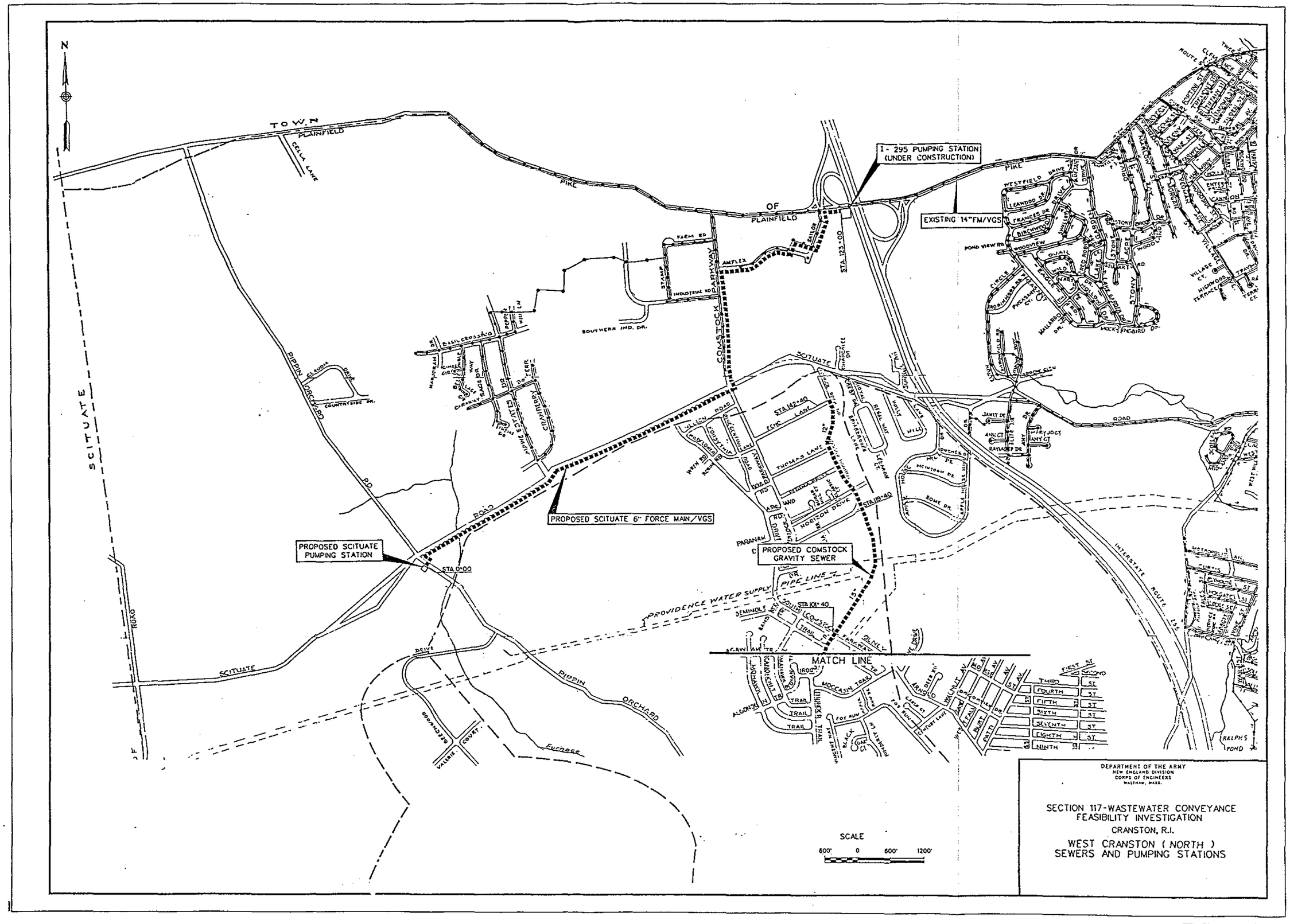
Option 2C. This option is considered as an alternative to Options 2A and 2B. The proposed force main to the existing Sockanosset Interceptor replaces the Garden Hills sewer. Wastewater would be pumped to the interceptor at Belvedere Drive and flow by gravity through the interceptor sewer to the "siphon" chamber and 16 and 27-inch sewers in Webb Street and to the influent screw pumps at the WWTF.

Option 2D. This option considers the location and cost of trunk sewers in Service Area 2. Flows from this area would flow to the proposed Wilbur pumping station included in Options 2A, 2B, and 2C. Trunk sewers considered include: the proposed Brookdale gravity sewer; the proposed Tilcon gravity sewer, the proposed Comstock gravity sewer, and the proposed Natick/Phenix gravity sewer. These trunk sewers would collect wastewater flows from an area generally east of Pippin Orchard Road and east of the south portion of Phenix Avenue. In addition to the trunk sewers, lateral sewer lines would be required to collect existing and future wastewater flows from this area. However, design and cost of these are not included in this feasibility study. (See Figure 10.)

In addition to the proposals noted above, a future pumping station and force main are proposed near the intersection of Phenix Avenue and Burlingame Road. This pumping station would be located so as to collect flows from the area west of Pippin Orchard Road and west of the south portion of Phenix Avenue. This is an area of low density residential development with a large tract of land in use as a golf course. The Phenix pumping station and force main are not required until the city proposes to sewer this area and this will depend on whether or not the area experiences problems with existing or future on-site disposal systems.

Service Area 3

Option 3A. This option provides for conveyance of projected wastewater flows from Service Area 3 to the WWTF through improvements to the existing sewerage system. Wastewater flows would be conveyed by gravity through the existing main sewers in Kenny Drive, Ross-Simmons Drive, and Sharpe Drive to the Howard pumping station. Flows would then be pumped through the Howard force main to the "siphon" chamber and 16 and 27-inch sewers in Webb Street into the screw pumps at the WWTF. (See Figure 9.)



N
TOWN OF PLAINFIELD
PIKE
I - 295 PUMPING STATION (UNDER CONSTRUCTION)
EXISTING 14"FM/VGS
COMSTOCK PARKWAY
STA 123+00
SCITUATE
PROPOSED SCITUATE 6" FORCE MAIN/VGS
PROPOSED SCITUATE PUMPING STATION
STA 0+00
PROPOSED COMSTOCK GRAVITY SEWER
PROVIDENCE WATER SUPPLY PIPE LINE
MATCH LINE
PIPPIN ORCHARD
INTERSTATE ROUTE 295
SCALE
600' 0 600' 1200'
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.
SECTION 117-WASTEWATER CONVEYANCE
FEASIBILITY INVESTIGATION
CRANSTON, R.I.
WEST CRANSTON (NORTH)
SEWERS AND PUMPING STATIONS

FIGURE 7

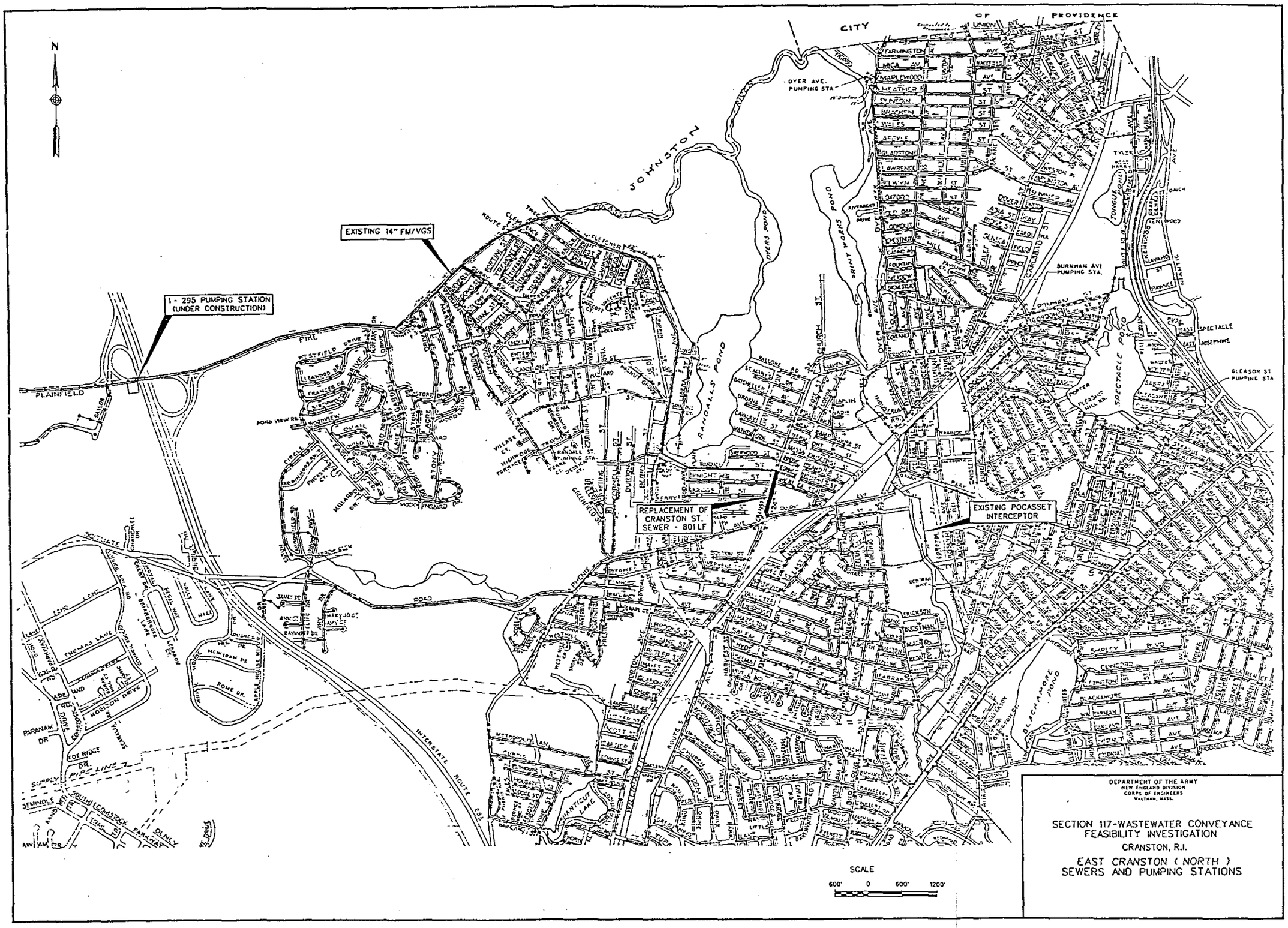

N
EXISTING 14" FM/VGS
I-295 PUMPING STATION (UNDER CONSTRUCTION)
REPLACEMENT OF CRANSTON ST. SEWER - 801 LF
EXISTING POCASSET INTERCEPTOR
DYER AVE. PUMPING STA
BURNHAM AVE PUMPING STA.
GLEASON ST PUMPING STA
SPECTACLE POND
RANDALLS POND
DYERS POND
PRINT WORKS POND
BLACKAMORE POND
JOHNSTON
CITY OF PROVIDENCE
PLAINFIELD PIKE
INTERSTATE ROUTE 295
PIPE LINE
SCALE
600' 0 600' 1200'
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.
SECTION 117-WASTEWATER CONVEYANCE FEASIBILITY INVESTIGATION
CRANSTON, R.I.
EAST CRANSTON (NORTH)
SEWERS AND PUMPING STATIONS

FIGURE 8

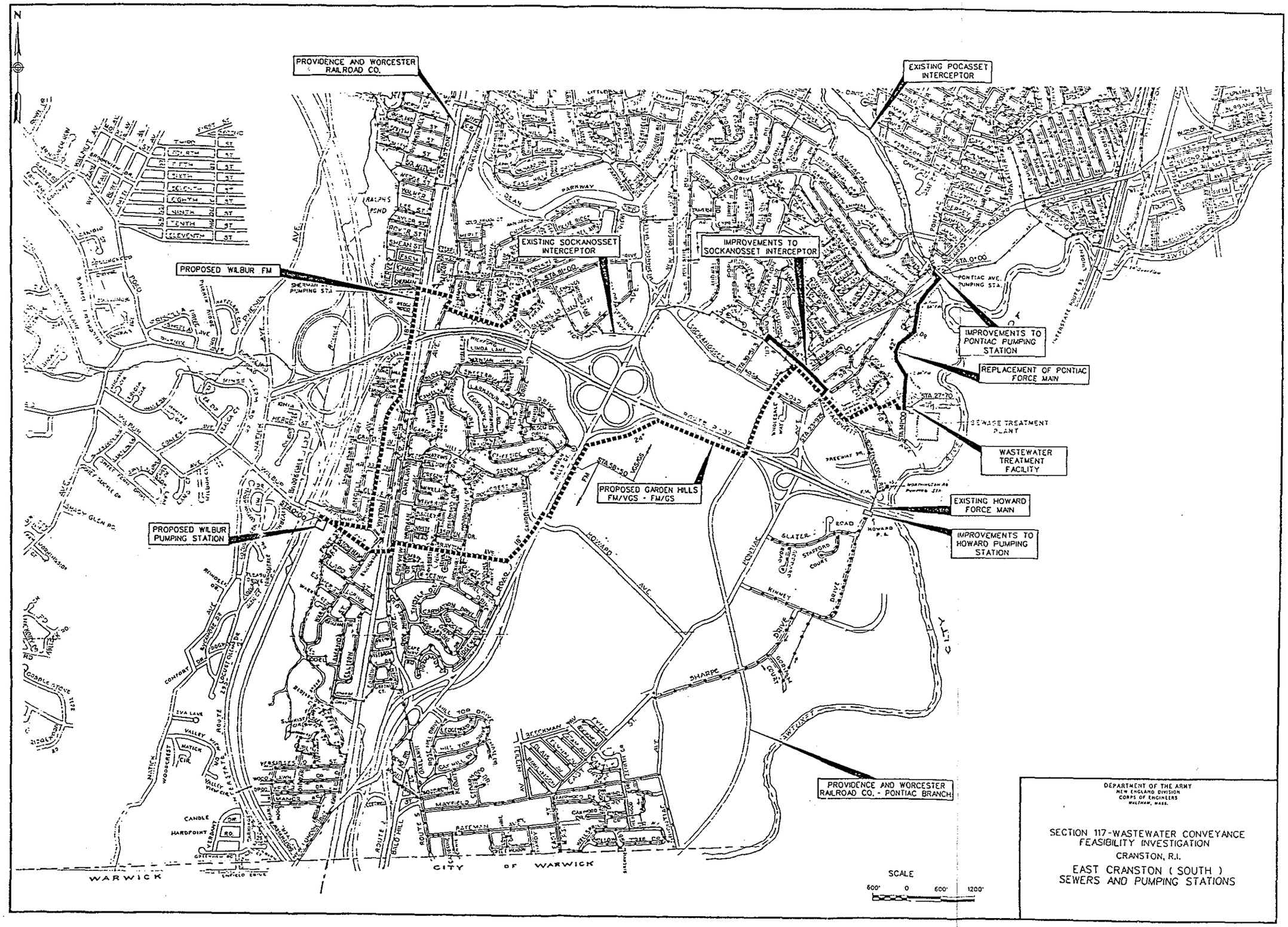

PROVIDENCE AND WORCESTER RAILROAD CO.
EXISTING POCASSET INTERCEPTOR
EXISTING SOCKANOSSET INTERCEPTOR
IMPROVEMENTS TO SOCKANOSSET INTERCEPTOR
PROPOSED WILBUR FM
IMPROVEMENTS TO PONTIAC PUMPING STATION
REPLACEMENT OF PONTIAC FORCE MAIN
WASTEWATER TREATMENT FACILITY
PROPOSED GARDEN HILLS FM/VGS - FM/GS
EXISTING HOWARD FORCE MAIN
IMPROVEMENTS TO HOWARD PUMPING STATION
PROPOSED WILBUR PUMPING STATION
PROVIDENCE AND WORCESTER RAILROAD CO. - PONTIAC BRANCH
CITY OF WARWICK
WARWICK
SCALE
600' 0 600' 1200'
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.
SECTION 117-WASTEWATER CONVEYANCE FEASIBILITY INVESTIGATION
CRANSTON, R.I.
EAST CRANSTON (SOUTH)
SEWERS AND PUMPING STATIONS

FIGURE 9

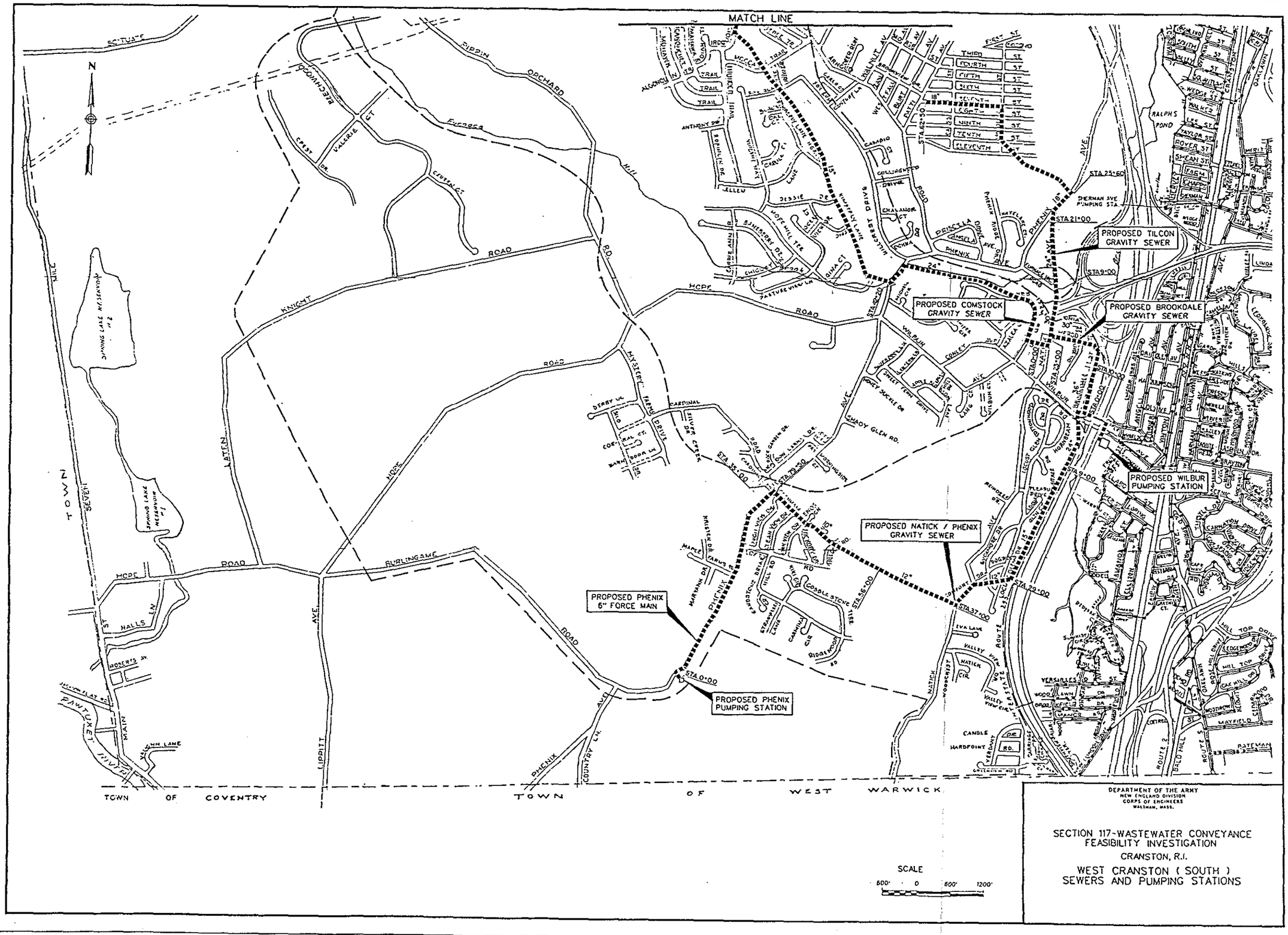

MATCH LINE
PROPOSED TILCON GRAVITY SEWER
PROPOSED COMSTOCK GRAVITY SEWER
PROPOSED BROOKDALE GRAVITY SEWER
PROPOSED WILBUR PUMPING STATION
PROPOSED NATICK / PHENIX GRAVITY SEWER
PROPOSED PHENIX 6" FORCE MAIN
PROPOSED PHENIX PUMPING STATION
SHERMAN AVE PUMPING STA.
RALPHS POND
SPRING LAKE RESERVOIR #1
SPRING LAKE RESERVOIR #2
TOWN OF COVENTRY
TOWN OF WEST WARWICK
SCALE
600' 0 600' 1200'
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.
SECTION 117-WASTEWATER CONVEYANCE
FEASIBILITY INVESTIGATION
CRANSTON, R.I.
WEST CRANSTON (SOUTH)
SEWERS AND PUMPING STATIONS

FIGURE 10

Chapter 6: INITIAL ASSESSMENT

After identification of study options, feasibility level engineering analyses, environmental assessments, and costs were prepared to allow for screening of the connector system components and selection of the connector project. Engineering components and feasibility costs are discussed in:

APPENDIX I — Task 7 and 9 - Report on Feasibility Level Design and Cost Estimates for Wastewater Conveyance

Water quality and hydrology, ecological, historic and archaeological, and socio/economic assessments of study options are discussed in:

APPENDIX J — Task 10b - Socio/Economic Assessment

APPENDIX K — Task 10c - Water Quality and Hydrology Assessment

APPENDIX L — Task 10d - Archaeological/Historic Assessment

APPENDIX M — Task 10e - Ecological Assessment

ENGINEERING ANALYSIS

Options 1A and 1B

I-295 Pumping Station. The I-295 pumping station has been designed and is scheduled for construction by the city. The station is located adjacent to I-295 and Plainfield Pike just south of the existing Welsh pumping station. (Ultimately the Welsh pumping station will be demolished.) The station is to be cast-in-place concrete with separate wet and dry wells. A mechanical screen is to be installed. The station will house three 1,890 gpm sewage pumps and an emergency generator.

The present design of the station accommodates projected year 2015 and 2045 flows 1,890 gpm and 2,724 gpm, respectively (Option 1B) for northwest Cranston and Central Landfill. Addition of flows from the Johnston and Vinagro sites would

result in slightly higher projected flows 2,095 gpm in year 2015 and 3,018 gpm in year 2045 (Option 1A). Pumping station plans provided by the city show that flow is to be evenly divided between two pumps with a third installed as back-up. Pumps are available which have the capacity to meet either future design condition. If the higher flow (Option 1A) is to be accommodated, the pumps selected by the city's design engineer would need to be modified. For further discussion see, Supporting Documentation Report, Volume 3 of 3 page I.3-5).

Existing 14-inch Force main/Variable Grade Sewer. The I-295 pumping station is designed to discharge into an existing 14-inch, 16,000 feet long force main/variable grade sewer. This new line and additional gravity sewers feeding the Welsh pumping station were constructed by the city during 1988-1991. In February 1993, the city submitted a Facility Plan Amendment to RIDEM for this modification to the existing sewer system. The force main/variable grade sewer is not currently in use by the city.

Cranston Street Gravity Sewer. The force main/variable grade sewer from the I-295 pumping station discharges into twin 18-inch gravity sewers in Cranston Street. An assessment indicated that replacement of about 800 feet of the 18-inch sewer with 24-inch may be required depending on future flow conditions. Based on projected flows this improvement is not expected to be required until flows exceed projected year 2015 flow conditions for Option A. (This option includes flows from the Vinagro and Johnston study sites.)

Park Avenue Gravity Sewer. The gravity sewers in Cranston Street discharge to the 24-inch gravity sewer in Park Avenue. There is about 1,500 feet of 24-inch diameter sewer. A hydraulic assessment, based on the city's sewer plans and projected flows, conducted as part of this investigation indicated a maximum of 2.1 feet of pipe friction surcharge with projected year 2045 flow conditions and about a tenth of a foot with projected year 2015 flow conditions. Based on city sewer plans, calculated 2045 pipe friction surcharge is expected to exceed the depth of one listed service connection. It is suggested that this sewer be monitored to provide information that will allow the city to determine if and when sewer improvements are required.

Pocasset Interceptor. The gravity sewer in Park Avenue discharges to the Pocasset interceptor. Assessment of pipe hydraulic capacity versus projected year 2015 and 2045 flows indicated that projected year 2045 flows exceed pipe capacity in about 270 feet of pipe in Reservoir Avenue. However, estimated surcharge in year 2045 was small and thus pipe replacement was not considered at this time. However, there may be excessive infiltration in this interceptor (Tutela Engineering Associates, Inc. "Draft Infiltration/Inflow Study", January, 1993). This problem, if present will need to be corrected. The city should undertake monitoring of flows in this sewer line to determine if sewer repair or improvements are necessary and to determine the extent of the I/I problem in the interceptor. If I/I problems are not addressed they could interfere with the sewer systems' ability to carry projected flows.

Pontiac Pumping Station and Force Mains. (Same analysis for Option A and B.) The Pocasset interceptor discharges to the Pontiac pumping station. This pumping station is located northeast of the Pocasset River on Pontiac Avenue and was constructed in the early 1940's. The pumping station has separate wet and dry wells. The pumping station has five sewage pumps, two variable speed, and three constant speed pumps. The pumps discharge to two 24-inch force mains each about 2,770 feet in length. An emergency generator is located outside the station. The existing station capacity is 16,600 gpm.

Existing peak flow to the station is 15,500 gpm. Projected peak hourly design flow for the year 2015 is about 21,000 gpm and in the year 2045 is about 26,100 gpm. Improvements to the pumping station to meet the year 2015 flow projections include rebuilding the three constant speed pumps by installing larger impellers, larger motors, and larger bearing frames. This results in five pumps with a capacity of 5,250 gpm each. Also the existing generator would be replaced with a new 650 KW unit. Possible improvements to meet the year 2045 flow projection include replacing the existing force mains with a new 42-inch force main and trimming the impellers of the five sewage pumps to adjust the pump capacity to 6,525 gpm each. The new 42-inch force main would be located in the existing 35 feet wide city sewer easement. A portion of the easement may need to be widened.

Scituate Pumping Station and 6-inch force main/variable grade sewer. The initial proposed station location is near the intersection of Pippin Orchard Road and

Scituate Avenue. There appears to be sufficient undeveloped land near this site for a small pumping station. Land in this area is privately owned and will need to be acquired by the city. (Further analysis and coordination with the city during the preliminary design phase resulted in the proposed site for the Scituate pumping station being located farther south on Pippin Orchard Road.)

The feasibility cost analysis assumed that the station will be cast-in-place concrete with separate wet and dry wells. The station will house two constant speed sewage pumps and appropriate mechanical and electrical equipment. The pumping station is designed to operate at a pumping rate of about 500 gpm. The pumps will discharge to a 6-inch force main/variable grade sewer .

The proposed 6-inch PVC force main/variable grade sewer (about 12,300 feet in length) will be located in Scituate Avenue, Comstock Parkway, Amflex Drive, and Sailor Way. Automatic air release valves are to be located at relative high points and cleanout manholes located at low points. The purpose of the cleanout manholes is to provide access for maintenance of the variable grade sewer.

Option 1C

This option includes the new Scituate pumping station and 6-inch force main/variable grade sewer.

Option 2A

Wilbur Pumping Station. The station location considered in the initial analysis is east of I-295 and south of Wilbur Avenue. Inflow to the station is a proposed gravity sewer through the existing sewer sleeve under I-295 north of Wilbur Avenue. The sewer sleeve invert is about 25 feet below the ground surface. This results in a deep station to accommodate the sewer.

The station is cast-in-place-concrete with separate wet and dry wells. For initial study purposes, it was assumed a grinder/comminutor and manually cleaned bar rack would be installed.

The station will house three sewage pumps and appropriate mechanical and electrical equipment. Peak flow to the pumping station is estimated at 2,830 gpm in 2015 and 5,144 gpm in 2045. Initially, two pumps are to be installed. Space would be provided for a third pump to be added when increased flows warrant. Pumps will be operated at variable speeds to match outflow to inflow. However, when inflows are low and result in velocities in the variable grade sewer of less than 2 feet per second or in peak velocities insufficient to resuspend solids, a minimum pumping rate may need to be considered. This issue is considered further in the preliminary design section. An emergency generator will be installed in a separate enclosure.

Garden Hills 18-inch Force Main/Variable Grade Sewer. The Wilbur pumping station discharges into a proposed 18-inch diameter PVC force main/variable grade sewer (14,100 feet in length). The first 5,850 feet of sewer is a force main which lifts the wastewater about 155 feet. The remaining pipe is a variable grade sewer that follows topography and will be constructed at minimum cover. The sewer contains four automatic air release manholes and two cleanout manholes.

The sewer will be located in Wilbur Avenue and Brayton Avenue and crossing and alongside New London Avenue (Route 2). From New London Avenue the sewer is located cross-country between Route 37 and prison facilities on the Howard Center state institutional property. Leaving state property the sewer is located in the abandoned Providence and Worcester Railroad right-of-way until it meets the city's exiting sewer easement for the Sockanosset interceptor. New sewer easements will be required along New London Avenue, Howard Center property, and the railroad. The existing city easement which is about 25 feet wide and contains a 30-inch gravity sewer may need to be expanded about 5 feet.

At the end of the easement the sewer crosses Pontiac Avenue and is located in Pettaconsett Avenue and Webb Street until it reaches the WWTF. The sewer would discharge to the WWTF influent pumps.

Option 2B

Wilbur Pumping Station. The Wilbur pumping station will be the same as described in Option 2A.

Garden Hills 18-inch Force Main/24-inch Gravity Sewer. This sewer follows the same alignments as Option B. The Wilbur pumping station discharges to a proposed 5,850 feet long 18-inch PVC force main which lifts wastewater about 155 feet to a high point on New London Avenue. At the high point the force main discharges to a new gravity interceptor. The interceptor comprises about 8,250 feet of reinforced concrete gravity sewer and contains 38 sanitary sewer manholes. The depth of the gravity sewer varied depending on the topography along the alignment with a maximum depth of approximately 21 feet.

WWTF Influent Pumps. Wastewater flows from the gravity sewer will be pumped to the head works of the WWTF by the existing WWTF influent pumps. At present these are three Archimedes screw pumps each with a flow capacity of about 5,200 gpm. This will allow for a total inflow of about 10,400 gpm with one pump as back-up. These pumps were purchased by the city in 1980. It appears the existing pumps should be able to handle year 2015 peak flow conditions. However, to accommodate year 2045 peak flow conditions a fourth screw pump may need to be added. Further analysis is presented in the preliminary design section.

Option 2C

Wilbur Pumping Station. The Wilbur pumping station would be the same as described in Option 2A.

Wilbur Force Main. The Wilbur pumping station discharges into a proposed 8,100 feet, 18-inch diameter PVC force main which contains three automatic air release manholes at relative high points. The sewer alignment considered for the initial assessment is in Wilbur Avenue, Turner Avenue, Cranston Avenue, Sherman Avenue, Oaklawn Avenue, Freehold Street, and Belvedere Drive. In the first 2,800 feet the sewer lifts the wastewater about 60 feet to a high point on Turner Avenue, the sewer then drops about 25 feet to a low point on Cranston Street. At Sherman Avenue the sewer lifts the wastewater about 80 feet to a high point on Belvedere Drive. In Belvedere Street the sewer discharges into the existing 30-inch Sockanosset Interceptor. (In the inital assessment, Turner Avenue was considered for the force main location. However, for preliminary design Vinton Avenue was chosen over Turner Avenue to minimize potential utility interferences and

neighborhood disruptions during sewer construction.)

Sockanosset Interceptor. The proposed force main discharges to the existing 7,022 feet Sockanosset gravity interceptor. This interceptor was constructed in 1961 to conveys flows from southeast Cranston. Hydraulic analyses of sewer capacity and comparison to projected year 2015 peak flows indicated a small amount of surcharge might occur in a 90 feet sewer segment. This surcharge is not expected to impact wastewater conveyance.

Comparison of pipe capacity to year 2045 peak flows indicated about 3,450 feet of sewer would be surcharged. The estimated surcharge is about 0.5 foot or less and is expected to impact service connections north of Pontiac Avenue. In order to avoid this potential problem an additional 24-inch reinforced concrete gravity sewer (about 1,500 feet) and eight sanitary sewer manholes would be added in this area in the future (after 2015). The addition would be located in the existing 25-feet wide easement that contains the existing 30-inch interceptor. The easement may need to be expanded by about 5 feet.

The interceptor discharges to the "siphon" chamber and the 16 and 27-inch sewers in Webb Street. The estimated hydraulic capacity of the 27-inch and 16 inch sewers are estimated at about 12,400 gpm and 3,150 gpm, respectively. These sewers are expected to have sufficient capacity to convey projected flows to the WWTF influent pumps. Further information on these is presented in the preliminary design section.

WWTF Influent Pumps. Same as Option 2B.

Option 2D

This option includes trunk sewers to collect flows in west Cranston, Service Area 2 and deliver them to the proposed Wilbur pumping station. Four trunk sewers were investigated the "Brookdale", the "Tilcon", the "Comstock", and the "Natick/Phenix" sewers. Also a "Phenix" pumping station and force main are assessed. Sewer alignments were laid out during initial analysis and portions selected for further consideration are analyzed in more detail during the preliminary design.

Approximate trunk sewer service areas are shown in Figures 11 and 12. The extent of the actual service area of the trunk sewers will depend on the extent of the lateral sewer system developed by the city.

Brookdale Gravity Trunk Sewer. The trunk sewer alignment considered is about 2,300 feet in length. This trunk sewer collects flows from the other three trunk sewers and from local areas. The sewer starts at the end of the existing sewer sleeve at I-295, crosses under Meshanticut Brook, then goes north between Brookdale Street and Meshanticut Brook. At Herod Street, the sewer goes east and is located in Herod Street. The sewer terminates at the intersection of Herod Street and Natick Avenue. A new sewer easement will be required between Herod Street and the sewer sleeve. Laterals to collect flows from local areas will need to be constructed by the city.

Tilcon Gravity Trunk Sewer. The trunk sewer alignment considered is about 6,250 feet in length. The trunk sewer is located in Natick Avenue from the intersection with Herod Street north to Phenix Avenue. About 600 feet north of the intersection of Phenix Road and Natick Avenue the sewer goes northwest and is located on property associated with a gravel mining operation. A sewer easement would be required in this area. This is an area of future industrial and residential development. This trunk sewer would collect flows from areas along Olney Arnold Road and areas north of the gravel pit and south of Scituate Avenue. Lateral sewer systems to convey flows from these areas to the trunk sewer will need to be constructed by the city.

Comstock Gravity Trunk Sewer. The trunk sewer alignment is about 14,240 feet in length. The sewer starts in Natick Avenue for a short distance then crosses through residential lots to Hines Farm Road. The sewer is located in Hines Farm Road for about 1,200 feet and then goes off-road and is located south of Furnace Hill Brook along the rear of residential lots. The sewer crosses Furnace Hill Brook to Phenix Avenue and is located in Phenix Avenue and Kimberly Lane until it goes off-road and is located west of an unnamed tributary to Furnace Hill Brook along the rear of residential lots. From here the sewer is located in Iroquois Trail, an undeveloped subdivision, across a Providence Water Supply Board pipeline, and in Council Rock Road. Many new sewer easements will be required to construct this trunk sewer.

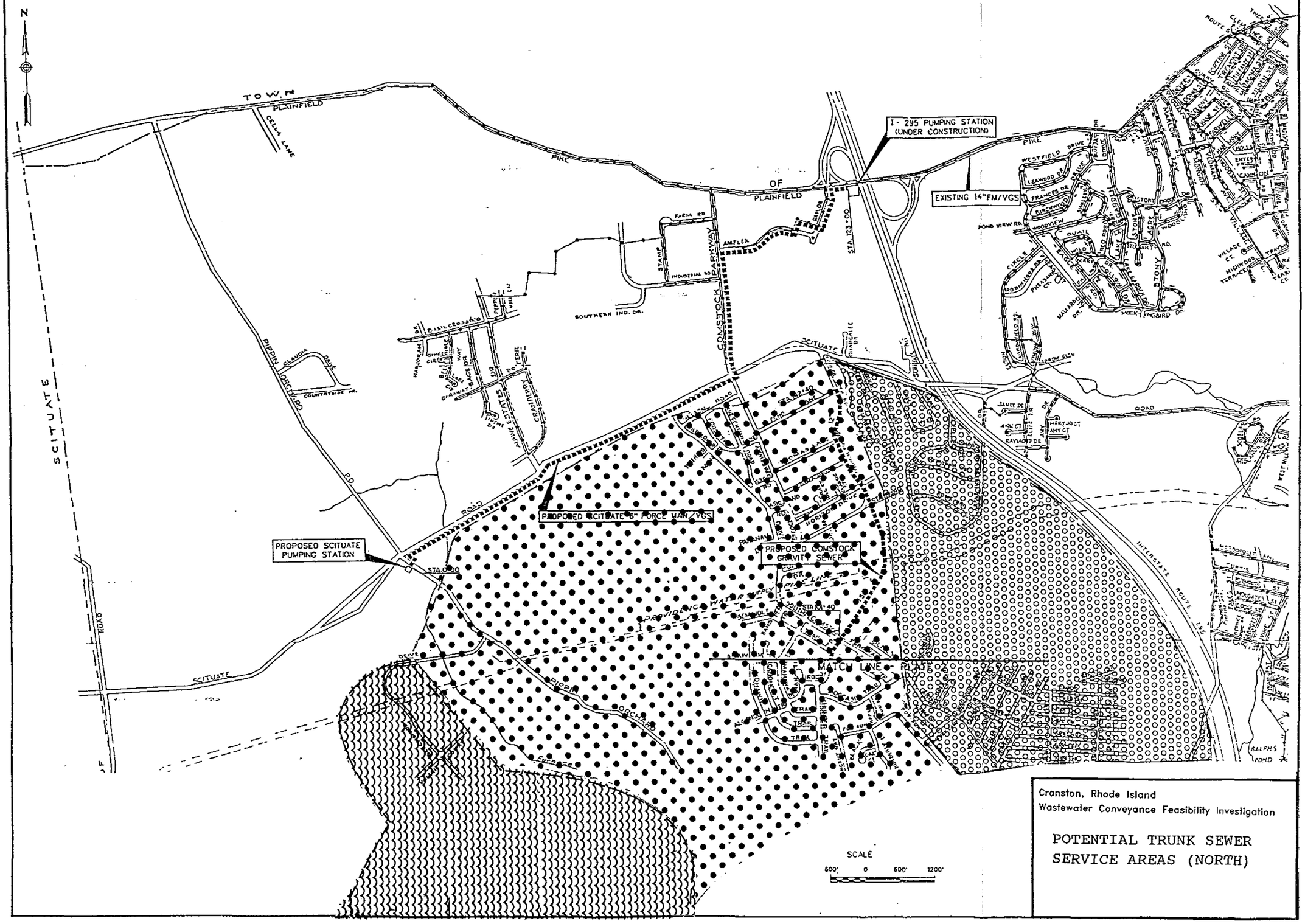

I-295 PUMPING STATION
(UNDER CONSTRUCTION)
EXISTING 14"FM/VGS
PROPOSED SCITUATE 6" FORCE MAIN/VGS
PROPOSED COMSTOCK
GRAVITY SEWER
PROPOSED SCITUATE
PUMPING STATION
MATCH LINE
SCALE
600' 0 600' 1200'
Cranston, Rhode Island
Wastewater Conveyance Feasibility Investigation
POTENTIAL TRUNK SEWER
SERVICE AREAS (NORTH)

FIGURE 11

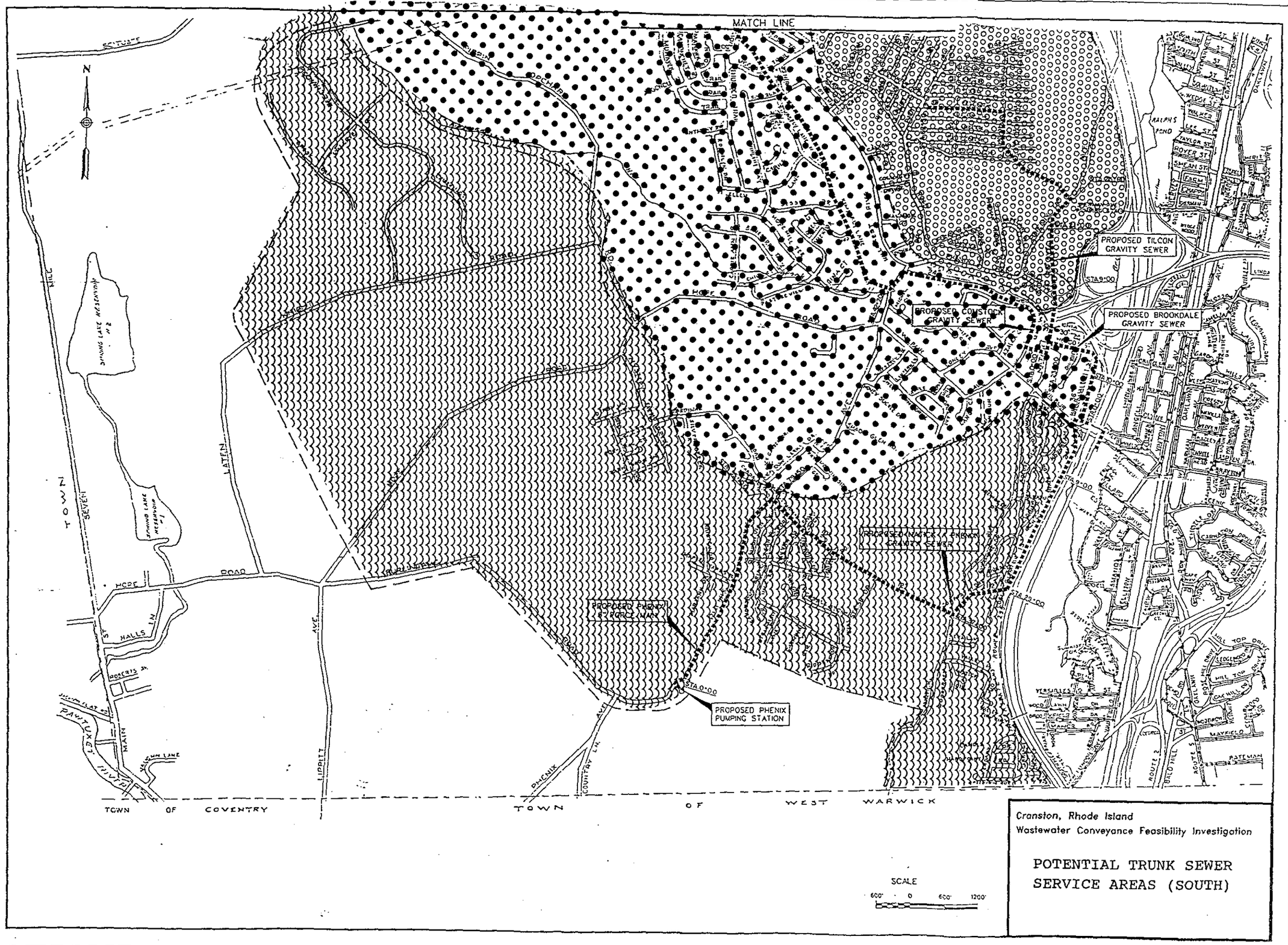

MATCH LINE
N
PROPOSED TILCON GRAVITY SEWER
PROPOSED COMSTOCK GRAVITY SEWER
PROPOSED BROOKDALE GRAVITY SEWER
PROPOSED NATICK & PHENIX GRAVITY SEWER
PROPOSED PHENIX 8" FORCE MAIN
PROPOSED PHENIX PUMPING STATION
STA.0+00
STA.9+00
STA.29+00
TOWN OF COVENTRY
TOWN OF WEST WARWICK
SCALE
600' 0 600' 1200'
Cranston, Rhode Island
Wastewater Conveyance Feasibility Investigation
POTENTIAL TRUNK SEWER
SERVICE AREAS (SOUTH)

FIGURE 12

This sewer would collect flows from areas near Hines Farm Road, Wilbur Avenue, Phenix Avenue (north of Glenham Road and south of Hillcrest Drive), Kimberley Lane, and east of Pippin Orchard Road. Lateral sewer systems to convey flows from these areas to the trunk sewer would be constructed by the city.

Natick/Phenix Trunk Sewer. This sewer alignment considered is about 7,950 feet in length. The first 3,500 feet of the trunk sewer is located along the rear of residential lots in the Natick Village subdivision. This alignment is adjacent to a Providence Water Supply Board's easement for their 102-inch aqueduct and Meschanticut Brook. From here, the sewer crosses Natick Avenue, goes cross-country (about 2,500 feet) in an undeveloped area to Glenham Road. New sewer easements would be required to construct the sewer behind the Natick Village subdivision and between Natick Avenue and Glenham Road.

This sewer collects flows from areas near Natick Village, Natick Avenue (south of Wilbur Avenue), and Glenham Road. This sewer might also convey future flows (after 2015) from the Phenix pumping station. Lateral sewer systems to convey flows from these areas to the trunk sewer will need to be constructed by the city.

Phenix Pumping Station and Force Main. The station location considered is about 1,200 feet east of the intersection of Phenix Avenue and Burlingame Road near an unnamed brook. There appears to be sufficient undeveloped land in this area for locating a pumping station. However, the terrain is irregular and heavily wooded. The final pumping station location will depend on the development of lateral sewer systems and roadways in this area. This pumping station collects flows from areas west of Pippin Orchard Road and west of the southern end of Phenix Avenue. However, these areas are not expected to be provided with sewer service until after 2015 and only where required to eliminate problems with faulty septic systems. Extensive lateral sewer systems will be required. Most of this area is zoned A-80 and septic systems may be adequate. Also the Cranston Country Club golf course currently occupies the land area just north of the pumping station.

The station feasibility cost analysis assumed that the station will be cast-in-place concrete with separate wet and dry wells. The station will house two constant speed sewage pumps and appropriate mechanical and electrical equipment.

Selected pump capacity is 581 gpm. A manually cleaned bar rack will be installed. An emergency generator will be located outside the building.

Pumps discharge to a 6-inch PVC force main which lifts the wastewater about 75 feet to the high point on Phenix Avenue. The force main, about 3,500 feet in length is located in Phenix Avenue. Wastewater flows from the Phenix force main will need to be conveyed to the Wilbur pumping station. These flows can be conveyed by either the proposed Natick /Phenix trunk sewer or the Comstock trunk sewer depending on the future development of the sewer system in this area.

Option 3A

Kenny Drive, Ross-Simmons Drive, and Sharpe Drive Gravity Sewers. The gravity sewers in Sharpe Drive, Ross-Simmons Drive, and Kenny Drive convey flows from the industries in the area and from the Howard Center to the Howard pumping station. There is about 10,700 feet of 12-inch to 24-inch diameter gravity sewers constructed in the late 1970's during the construction of the Howard Industrial Park. Evaluation of pipe capacity versus year 2015 projected peak flow indicated that flows may exceed pipe capacity in about 4,900 feet of sewer. Flows are not expected to increase beyond year 2015 projections.

Projected industrial flows to segments of the sewer are based on the size of the contributing area and an assumed wastewater flow factor of 5,770 gpd/acre. Actual flows may differ from assumed values. The decision to increase the capacity of these sewers can best be decided based on flow monitoring data. It is suggested that the city begin to monitor flows through these sewers to document existing conditions and to be able to anticipate future problems.

Howard Pumping Station and Force Main. This station was constructed in the late 1970's and is located at the end of Kenny Drive in the Howard Industrial Park. The pumping station has separate wet and dry wells. The city is planning to modify the pumping station by installing a mechanically cleaned bar screen on the incoming sewer line to prevent clogging of pumps with rags from the Howard Center. In coordination with the city it was deemed reasonable that the flows from this area would continue to be conveyed by the existing system with improvements.

The pumping station has four wastewater pumps and the existing station capacity is 3,000 gpm. The pumps discharge to a 1,885-feet long, 14-inch diameter force main. An emergency generator is located inside the building.

The existing peak flow to the pumping station is estimated at 2,600 gpm. Projected peak design flow for the year 2015 is about 4,640 gpm. Improvements to the pumping station to convey projected flows considered in this study include replacement of the four existing pumps and motors, replacement of the seal water system, and installation of a new generator. The existing force main hydraulic capacity appears adequate to convey projected flows.

The force main discharges to the "siphon" chamber and 16 and 27-inch sewers in Webb Street and from here flows are conveyed to the influent pumps at the WWTF. Based on the initial assessment, these sewers and the WWTF influent pumps are projected to have sufficient hydraulic capacity to convey projected flows from the Howard area. However, if flows are also to be conveyed from the Wilbur pumping station possible improvements to the influent pumps are assessed under options for Service Area 2.

FEASIBILITY COST ANALYSIS

Cost Estimates

Both project and operation and maintenance cost analyses were performed for feasibility study options (See Table 3). These cost analyses were for purposes of assessment only. They were developed to assist in the screening of project features for selection of preliminary design. Selected project features were investigated in more detail in preliminary design. Feasibility cost analyses considered: construction costs, real estate costs, engineering and design fees,and construction management fees. Cost considerations provided in Table 3 were based upon feasibility level examination of conveyance options. This level contained an initial examination of sewer alignments/options and pumping stations, with rough quantity estimates utilizing existing information.

Operation and Maintenance (O&M) costs for new pumping stations were based

on an estimate of annual energy costs and an estimate of materials and labor costs. Operation and Maintenance costs for existing pumping stations were based on the differential cost to pump additional wastewater flows. For these existing stations, it was assumed that labor and materials costs would not increase substantially over existing conditions as a result of the additional flows. Annual pumping costs were determined using the mean of the average daily flows for two periods: years 1995-2015; years 2016-2045. For purposes of the calculation, the average daily flow for the year 1995 was assumed to be the existing average daily flow at the station.

Costs for project features selected for preliminary design may change as a result of additional information and refinement of project design.

Table 3. Feasibility Cost Analysis (October 1993 Price Level)

Feasibility Study Option	Feasibility Project Cost ($)	Additional Cost ($) After 2015	Annual O&M Cost ($) 1995-2015	Annual O&M Cost ($) 2016-2045
Option 1A	2,284,000	954,900	67,500	98,500
Option 1B	2,284,000	821,100	66,700	96,800
Option 1C	1,864,600	0	17,700	20,500
Option 2A	4,694,800	305,500	53,700	97,700
Option 2B	4,743,100	396,400	55,600	104,800
Option 2C	3,642,100	680,700	47,800	84,400
Option 2D	4,282,000	777,100	6,000	25,140
Option 3A	243,700	0	2,300	4,600

Least Cost Analysis.

Of the options considered in the feasibility study only Options 2A, 2B, and 2C are mutually exclusive alternatives (e.g. one of the three is to be chosen for preliminary design). In order to determine the least expensive alternative, the present worth of these options was calculated (see Table 4). Present worth is based on a 50 year project life and an interest rate of 7.75 percent. This is the EPA rate for facilities planning on or after October 1, 1994. Option 2C is the least expensive option of the three.

Table 4. Present Worth of Study Options 2A, 2B, 2C

Option	Present Worth ($)
Option 2A	5,532,400
Option 2B	5,632,200
Option 2C	4,444,400

WATER QUALITY ASSESSMENT

General

Although most tributaries to the Pawtuxet River in Cranston are rated class B, some are severely impacted by non-point source contamination. The main stem of the Pawtuxet River is rated class C, but fails to meet the goals for that classification. A 1991 study by Tutela Engineering Associates concluded that non-point source pollution had a significant effect on water quality in the Pawtuxet River and its watershed. Potential sources of non-point source pollution include agricultural activities, landfills, failing on-site septic systems, road salt storage areas, and runoff from highways and commercial, industrial and residential areas. Areas most impacted

by non-point source contamination included Capuano Stream, Meshanticut Brook, and those receiving drainage from Interstate 95. Additionally, the study found that it may not be possible to achieve the desired water quality improvements in the Pawtuxet River solely by upgrading wastewater treatment facility (WWTF) discharges. Rather a combination of WWTF improvements and reductions in non-point source pollution will be required. The city is currently studying improvements to the WWTF.

Effects of wastewater conveyance options on water quality in the service areas depend on which combinations of options are chosen for construction. Also, the options considered in the study do not include the construction of lateral sewer systems. It is the extent of lateral sewer lines and service connections feeding the trunks sewers and pumping stations proposed in the options, rather than the trunk sewers themselves, which will determine the ultimate extent of water quality benefits.

Expected effects of implementing these options are improvements in water quality in areas affected by landfills or failing septic systems. Additional benefits would accrue from the reduction or elimination of wastewater overflows from overloaded pumping stations or surcharged sewer pipes. Changes in water quality will be too diffuse to describe quantitatively.

The Corps, as part of the feasibility analysis, requested data from the city and RIDEM regarding the number and locations of failing septic systems in west Cranston, in order to document the extent of the reported problem. However, only very limited data was available. Thus, it was not possible to document the extent of the problem or quantify the benefit of providing a sewer system to those areas in west Cranston that currently rely on on-site systems.

Water Quality During Construction

There will be water quality impacts during construction, mainly increases in turbidity and sedimentation from erosion during excavation activities. However, these will be temporary and can be controlled by proper construction and erosion control techniques, including silt fences, hay bales, and other means to control runoff from construction sites; covering stockpiled soil to limit erosion; and other similar activities.

ECOLOGICAL ASSESSMENT

The Ecological Assessment of the proposed wastewater conveyance options considers the impacts to endangered species, the terrestrial ecosystem (upland vegetation and wildlife), and the aquatic ecosystem (fisheries and wetlands).

Endangered Species

The U.S. Fish and Wildlife Service (USFWS) determined in a letter dated November 16, 1993 that no known Federally listed or proposed, threatened and endangered species were known to occur in the project area with the exception of occasional, transient endangered bald eagles (Haliaeetus leucocephalus) or peregrine falcons (Falco peregrinus anatum). In addition, the Rhode Island Natural Heritage Program (NHP) provided information regarding rare species and ecologically significant natural communities in the project area in a letter dated November 24, 1993. At this time, the NHP is not aware of any rare species or noteworthy natural communities in the study area. No impacts to these populations are expected as a result of the proposed project.

The Rhode Island Division of Fish and Wildlife indicates that little information is known concerning the population status of the American brook lamprey (Lampetra appendix), a State Endangered Species (phone coordination with Chris Powell, Rhode Island Division of Fish and Wildlife, January 31, 1994). This species has been found in the Blackstone Watershed in Rhode Island. The American brook lamprey is associated with cool, clear, high gradient streams with gravel bottoms and generally spawns in streams wider than 15 feet. Furnace Hill Brook appears to have appropriate habitat for this species however, no surveys have been conducted by the Rhode Island Division of Fish and Wildlife to determine its presence.

Terrestrial Ecosystem

General. The expected effects on the terrestrial ecosystem of the study options include temporary construction related impacts such as noise and dust during the installation of sewers and pumping stations. The majority of sewers are located in streets which minimize impacts to wildlife. However, in some cases the sewers

traverse terrestrial habitat to achieve a gravity flow system. Wildlife will move from the area during construction but will re-utilize the habitat once construction is complete. The largest stretch of upland habitat to be crossed by new sewer construction is the upper portion of the Natick/Phenix sewer between Natick Avenue and Glenham Road. This portion of the sewer was eliminated from consideration during the preliminary design phase.

The construction of new pumping stations will result in the permanent loss of habitat for the area of the pumping station footprint. The new pumping stations considered in the feasibility analysis are the Wilbur, Scituate, and Phenix pumping stations.

Wilbur Pumping Station. Several locations for the pumping station near Wilbur Avenue and the existing sewer sleeve under I-295 were considered. The site south of Wilbur Avenue and east of I-295 may require the removal of several large trees. These trees are part of a vegetated travel corridor for wildlife and also provide a visual and noise barrier to adjacent homeowners from the effects of I-295. The site in the median of I-295 will have minimal impacts due to the previous disturbance, lack of diversified plant community (mowed grass), and the location between the north and south bound travel lanes of the highway.

Scituate Pumping Station. The Scituate pumping station is proposed for the area near the intersection of Pippin Orchard Road and Scituate Avenue. The site preferred by the city, is at a low point on Pippin Orchard Road, north of Furnace Hill Brook. This area is former farmland and is currently vegetated with successional species.

Phenix Pumping Station. The location of the proposed Phenix pumping station may result in the loss of large trees. However, this pumping station is not proposed for construction at this time.

Other Related Impacts. According to the Cranston Comprehensive plan about 2,470 acres of land that is currently open or in other uses will be converted to residential use over the next several decades. Recognizing that the impact of this growth will be to alter the landscape of west Cranston, the city in its Comprehensive

Plan has proposed that 124 acres of open space be preserved through acquisition, easement or similar method. The development that would have occurred on this land would be transferred instead to a proposed Village Center. Also about 370 acres of open space would be preserved through the provision of common open space in cluster developments. The residential growth in west Cranston is expected to occur whether or not the area is supplied with sewer service. It is anticipated that providing the possibility of a sewer system as an alternative to on-site septic systems may increase the technical feasibility for siting cluster developments.

Because of the expected future development in west Cranston, additional compensation measures for loss of wildlife habitat value should be considered by the City of Cranston in its Natural Resources Action Program (City of Cranston Comprehensive Plan, 1992). Habitat loss could be compensated through environmental enhancement of remaining land such as increasing habitat diversity through forestry practices (selective cutting), installation of nest boxes, planting wildlife food plots, etc. There would be maintenance and monitoring requirements to sustain the effects of environmental enhancement features.

Fisheries

Portions of the sewer alignments are near or cross streams. During construction of the sewers, any large trees and under-story vegetation may need to be removed from the construction work area. The Rhode Island Division of Fish and Wildlife is concerned that removal of trees adjacent to streams may reduce shading and allow for increases in water temperature. Small increases in water temperature can be detrimental to cold water fish species such as trout which is currently stocked in Furnace Hill Brook. There is also a native population of brook trout in Furnace Hill Brook. Further coordination with the Rhode Island Division of Fish and Wildlife is required during final design of the sewers. A fisheries survey may be required in areas where sewer lines have close alignment to streams.

To minimize ecological impacts, construction activities conducted in or adjacent to streams should be performed during the low flow season. This timeframe also prevents adverse impact to spawning of fish fauna utilizing the area. (This is included in the Environmental Assessment, Actions to Minimize Environmental

Impacts section of the report at the request of the RIDEM, Division of Fish and Wildlife)

Wetlands

It appears that wetlands will be a primary concern to RIDEM during construction of the new sewer system components. Wetlands are regulated by the Rhode Island Division of Freshwater Wetlands (DFW) pursuant to the RIDEM Rules and Regulations Governing the Enforcement of the Fresh Water Wetlands Act (RIDEM, 1981). A permit is required from the Division of Freshwater Wetlands prior to conducting activities in freshwater wetlands and/or their regulated buffer zones. RIDEM's regulatory definition and jurisdiction for a wetland is, "a freshwater wetland shall include, but not be limited to, marshes;swamps;bogs;ponds;rivers;river and stream floodplains and banks; areas subject to flooding or storm flowage; emergent and submergent plant communities in any body of fresh water including rivers and streams and that area of land within 50 feet of the edge of a bog, marsh, swamp or pond". A river bank is described as being "land within 100 feet of the edge of a flowing water body 10 feet in width or less and land within 200 feet of the edge of a flowing water body 10 feet in width or more".

Options involving improvements to the existing system, include replacement of the Pontiac pumping station force main at some time in the future to handle increased flows. This force main is located along the periphery of the Pawtuxet River reservation, a large freshwater swamp.

Portions of components of options involving construction of new sewers and pumping stations include work near or in wetlands. Stream crossings are involved in all new sewer alignments, except for the force main from Wilbur pumping station to the city's existing Sockanosset Interceptor (Option 2C). The "Garden Hills Alignment" (Options 2A and 2B) an alternative to Option 2C requires work in a forested wetland. Also portions of the alignments of the trunk sewers in west Cranston require work near streams.

The impacts associated with the installation of trunk sewers in freshwater wetlands are generally temporary, lasting the construction timeframe and vegetation

recovery time. It has been demonstrated that wetland vegetation recovers from pipeline installation within one to two years with proper soil handling and construction techniques (Thibodeau, 1986 and Honig, 1991). To prevent damage to the pipeline (from roots) and enable access for maintenance purposes, the pipeline corridor will be maintained free of large vegetation. Forested wetlands along the pipeline corridor would be replaced by wetlands of different plant associations (emergent or small shrub vegetation) however, species composition recovers to be as diverse and rich as the original plant community (Thibodeau, 1986). Actions to minimize the environmental impacts of construction in these areas are discussed in the Environmental Assessment of this report.

The Division of Freshwater Wetlands closely evaluates proposals which may effect the values associated with wetlands defined by the Fresh Water Wetlands Act, Rules and Regulations. The applicant will be required to demonstrate that there are no reasonable alternatives to the proposed option alignment. If wetlands cannot be avoided, impacts to wetlands must be minimized and a mitigation plan to compensate wetland impacts may be required. The Rhode Island Division of Freshwater Wetlands will consider the advantages and disadvantages of sewering the west Cranston residential area during the permitting process.

HISTORIC/ARCHAEOLOGICAL ASSESSMENT

Study options that involve improvements to the existing system will have no impact on historic/archeological resources as this work is primarily proposed in previously disturbed areas. Options that involve new sewer system components in previously undisturbed areas have the potential to impact currently unknown archaeological sites. Also the proposed Wilbur pumping station is located in the Oaklawn Village Historic District, a National Register district in Cranston.

The Wilbur Pumping Station exterior appearance will need to be coordinated with the Rhode Island State Historic Preservation Office and The City of Cranston, Historic District Commission during final design. The Historic District Commission has suggested the structure be sided with wooden shingles or clapboard, that it resemble a shed or outbuilding, and that a tight evergreen landscape screen be provided. These items should not be difficult to incorporate in the final design of the

station. The Commission also requested a peaked roof for the structure. This request conflicts with Rhode Island Department of Transportation preference for a flat roof. The flat roof is preferred so the pumping station roof will not be directly visible by motorists using the highway. An acceptable solution will need to be coordinated with these agencies during final design.

Portions of the trunk sewers proposed in Option 2D will be located off-road in west Cranston. West Cranston contains several known historic and archeological sites, including the Furnace Hill Brook Archaeological District. As part of final design, an intensive level archaeological survey will need to be conducted in areas where the sewer alignments are off-road. The survey will determine if areas are undisturbed and whether archeological material is present or absent and if further testing is required. Also, pumping station locations may need to be investigated. (This issue is discussed further in the section on Identification of Permits and Approvals.)

SOCIO/ECONOMIC ASSESSMENT

The Socio/Economic assessment analyzes the short and long term impacts of construction and operation of study options on economic resources. The following is a summary of the information presented in Appendix J. Assumptions regarding population and industrial and commercial growth were developed by the city as part of their on-going Wastewater Facility Plan and were adopted for the study.

Long Term Impacts

Industrial Land Use. In Service Area 1 there are several areas of existing and proposed industrial development. The city is planning to serve the area in Cranston through improvements to the existing sewer system. Under build-out conditions (year 2045) it is expected there will be 470 acres of industrial/commercial development in northwest Cranston. Also there is an area in Johnston (100 acres) that may be open for industrial development. This area does not have sewer service and an agreement would need to be worked out with the city of Cranston to connect to the city's sewer system.

In Service Area 2, industrial development consists of the Tilcon Gammino gravel mining operation. This site is comprised of approximately 140 acres and currently employs approximately 155 workers. Although the Tilcon Gammino site is currently zoned for industrial use, there are some infrastructure improvements (including providing sewers) needed for its future use as an industrial park once the mining operation is exhausted. Access to the site along Natick Avenue and Phenix Avenue would need to be upgraded and adverse traffic impacts on residential neighborhoods would need to be mitigated. If access to Route 37 cannot be improved then this land may be developed for residential use.

In Service Area 3, the Howard Industrial Park is one of two major industrial sites in Cranston. It is located in east Cranston at the interchange of Interstate 95 and State Route 37. The park is almost totally developed. There are about 190 acres devoted to industrial use at this site.

Population. Population is expected to increase in Cranston. A population of 83,020 by the year 2015 and 91,370 by year 2045 under existing zoning conditions is projected. This growth is expected to occur with or without an increase in sewer service. Most of this growth is expected to occur in west Cranston (Service Area 1 and Service Area 2). There is not expected to be any identifiable impacts on population from an extension of the sewer system in Service Areas 1 or 2. The city does not believe that the municipal sewer system should be used to influence residential development.

Labor Force. The labor force impact in northwest Cranston is that an additional 5,300 jobs may be created in northwest Cranston at total build-out (year 2045 conditions) of the industrial zoned land. Also, it is projected that an additional 1,900 jobs may be created in Johnston at total build-out of the 100 acres.

In Service Area 2, employment is projected to increase by 2,700 at total build-out of the 140 acres (year 2045 conditions) at the Tilcon Gammino site. This increase assumes road and sewer improvements are provided to the Tilcon Gammino site.

Income. The job creation discussed above in Service Area 1 is projected to

provide an additional annual income of $143,908,000 under build-out conditions (year 2045). In Johnston, income growth will be $51,590,000 from build-out of the Johnston area (year 2045). In Service Area 2 if the Tilcon Gammino site is developed, an additional annual income of $73,312,000 is projected at build-out (year 2045).

Municipal Finances. Construction of the sewer options described in the feasibility analysis will have a financial impact on the city. It is not known what mechanism will ultimately be used by the city to fund the proposed improvements and new sewer system connector components. Also the cost of the lateral sewers are not included in these options.

Housing and School Enrollment. Housing units are expected to increase in Service Areas 1 and 2 with or without increased sewer service. School enrollment is projected to increase in Cranston. However, this is not considered to be an impact of the wastewater conveyance options.

Short Term Impacts

Short term increases are expected to occur in Providence County in the labor force, annual income, and sales as a result of the jobs created by the construction of the sewer options.

PROPOSED PROJECT

The following is a summary of the identification of the proposed project.

Service Area 1

The engineering analysis conducted indicates that Service Area 1 (north west Cranston) can be served by improvements to the city's existing system (Options 1A and 1B). The city has already begun to make these improvements. The city has installed a 16,000 feet long 14-inch force main/variable grade sewer and 830 feet of 18-inch gravity sewer. Based on the hydraulic analysis and year 2015 and 2045 projected flows, the city may also need to replace about 800 feet of 18-inch sewer in Cranston Street with 24-inch sewer in the future. Also it is suggested that the city undertake monitoring of the flows in the gravity sewers in Park Avenue and the Pocasset Interceptor to determine if sewer repair or replacement are required and to determine the extent of the I/I problem in the interceptor.

The city also has designed and plans to construct a new pumping station (the I-295 pumping station) to replace the existing Welsh pumping station for Service Area 1.

The Pontiac pumping station and force mains convey flows from Service Area 1 and east Cranston to the WWTF. The pumping station and force mains were assessed for projected year 2015 and 2045 flow conditions and possible improvements analyzed. The majority (about 90 percent) of the projected flows are from east Cranston. Thus the improvements were not considered as part of the sewer connector project for Service Area 1.

Engineering and cost analysis of these future improvements and environmental assessments indicated that use of the existing system with improvements was a practical means for conveying flows to the WWTF and there was no need to construct a new connector project to serve this area. However, the city requested extension of the existing sewer system to service the proposed Village Center (Option 1C) located within Service Area 1 to be considered in the proposed project.

Option 1C - The future Village Center is in the southwest corner of northwest Cranston near the intersection of Scituate Avenue and Pippin Orchard Road. The area is currently developed with two acre or greater lot sizes and depends on on-site septic systems for wastewater disposal. If this area is to develop as a Village Center at the densities proposed in the Comprehensive Plan, sewer service will likely be required. An exception is the newly constructed church (with sewer service already supplied) located at the intersection. The extension of sewer service to the proposed Village Center is also consistent with the city's facility planning for this area. This connector component consists of the proposed Scituate pumping station and the Scituate force main/variable grade sewer. This connector is addressed in the Environmental Assessment and included in the Preliminary Design.

Service Area 2

Service Area 2 currently depends on on-site septic systems for wastewater disposal. Residential zoning in this area ranges from 8,000 to 80,000 square foot lots. Existing residential development is primarily concentrated in subdivisions near Natick Avenue, Phenix Avenue, Wilbur Avenue, Hope Road, Kimberly Lane, Olney Arnold Road, and South Comstock Parkway. Also there is about 140 acres of industrially zoned land on Phenix Avenue. In general, west Cranston soils are considered to be of poor suitability for the installation of on-site wastewater disposal systems. The city would like to provide sewer service to this area.

Options 2A, 2B, 2C, and 2D were analyzed for conveying flows from Service Area 2 to the city's WWTF. Options 2A, 2B, and 2C involve construction of a new connector from Service Area 2 to the city's existing system. Option 2D involves the construction of trunk sewers in west Cranston.

Option 2C - Options 2A and 2B are a new force main/variable grade sewer or a force main/gravity sewer to the WWTF. Option 2C proposes a new force main and use of the city's existing sewer system. Of the three options, Option 2C is the least cost option. Also Option 2C was determined to have fewer environmental impacts as it involves sewer construction in existing roadways and sewer easements. Options 2A and 2B cross a forested wetland and would need to avoid a small historic cemetery. Option 2C was selected in consultation with the city for inclusion in the

Environmental Assessment and for Preliminary Design.

Several possibilities were considered for the location of the Wilbur pumping station near the existing sewer sleeve under I-295. The median of I-295 was selected as the location having the least environmental and residential impacts. The median has been previously disturbed and the vegetation is mowed grass. The area is in the Oaklawn Historic District, but any other site east or west of the highway would also be in the District. The median site is between the north and south bound lanes of the highway on the north side of Wilbur Avenue so the visual impact should be less than if the station were located next to a house in the Historic District. Accessing the sewer sleeve under the highway requires crossing Meshanticut Brook and a wetland permit will be required for this work. Also, the pumping station location is with 200 feet of the Brook. However, the highway embankment for the south bound lane of the highway separates the site from the Brook.

Option 2D - A system of gravity sewers is considered in the initial assessment to serve areas in west Cranston. Four trunk sewers considered were: the Brookdale, Tilcon, Natick/Phenix, and Comstock lines. The Phenix Avenue pumping station and Phenix 6-inch force main were also considered. The city would be responsible for development of all lateral collection sewers and any local pumping stations not considered in this study that might be necessary to convey wastewater to the trunk sewers.

The Brookdale sewer serves primarily to collect flows from the Tilcon and Comstock sewers. The possibility of locating the sewer in Brookdale Street, instead of along Meshanticut Brook, was considered as an alternative to avoid construction in a wetland area. However, the presence of the Providence Water Supply Board's 102-inch aqueduct in Brookdale Street made this alternative alignment impracticable.

The Tilcon sewer location considered in the initial assessment extends from Phenix Avenue to north of the Tilcon Gammino gravel mining operation. However, the portion of the sewer selected for the proposed project terminates at Phenix Avenue. This decision was made because of the uncertainty of the pattern of future industrial development at the site (after the mining operation is exhausted).

The Comstock sewer considered in the initial assessment extends north from Phenix Avenue to Council Rock Road. This sewer was selected for the proposed project to provide for sewer service to the existing and future residential development.

The Natick sewer considered in the initial assessment extends from Wilbur Avenue south through the Natick Village subdivision and west, cross-country to the Glenham Road/Phenix Avenue area. However, the portion of the sewer selected for the proposed project terminates at Natick Avenue. This decision was made because of the anticipated difficulty and cost in constructing this line and the uncertainty of future development patterns in this severely sloped area.

The development of the Phenix Avenue pumping station and force main will depend on future need. These areas are not expected to be provided with sewer service until after 2015 and only where required to eliminate problems with faulty septic systems. Future studies may identify alternative discharge locations depending on the distribution and occurrence of new development in this area and the location of laterals to service this development. The pumping station and force main are not included in the proposed project.

Service Area 3

This service area is currently conected by the city's existing sewerage system to the WWTF. Main gravity sewers in Sharpe Drive and Kenny Drive collect flows to the Howard pumping station and force main. The assessment for this area considered improvements to the existing system to convey projected year 2015 flows (flows are not expected to increase beyond year 2015). In coordination with the city it was deemed reasonable, that the flows from this area would continue to be conveyed by the existing system with improvements.

Chapter 7: PRELIMINARY DESIGN OF PROJECT

PREFACE

The following section presents a summary discussion of the main components of the proposed project (See Figure 13). In this phase, information was developed to allow for calculation of a preliminary cost estimate. Detailed information on preliminary design and preliminary plans are presented in the following Appendices contained in the Supporting Documentation Report, Feasibility Investigation, Volume 2. Information developed for this preliminary design should assist the city in final design of pumping stations and sewers.

APPENDIX A	Task 12b - Proposed Project, Hydraulic Analysis
APPENDIX B	Task 12d - Proposed Project, Pumping Station Mechanical Design
APPENDIX C	Task 12a - Proposed Project, Geotechnical Evaluation
APPENDIX D	Task 12c - Proposed Project, Pumping Stations and Sewers, Civil Engineering Design
APPENDIX E	Task 13b - Proposed Project, Real Estate Costs

During preliminary design, several issues were identified that impact on the final design of project features. This information is included in the following discussion.

SERVICE AREA 1

Scituate Pumping Station

Further analysis and coordination with the city during the preliminary design phase resulted in the proposed site for the Scituate pumping station on Pippin Orchard Road. The proposed station location is on the west side of Pippin Orchard Road,

about 900 feet south of Scituate Avenue. A 100-foot buffer will be maintained between the station and Furnace Hill Brook to the south. This area appears to have sufficient undeveloped land to accommodate the station. Site dimensions are 100 feet by 130 feet. Equipment building dimensions are 16 by 23 feet.

The initial analysis assumed that the station will be cast-in-place concrete with separate wet and dry wells. However, in preliminary design phase a "package" pumping station was also considered and determined to be the most economical design. The station will consist of a packaged pre-cast wet well with duplex submersible pumps. A basket strainer will be installed on the end of the incoming sewer pipe to strain out large debris. The strainer will be installed on guide rails and provided with a manual winch to facilitate removal for cleaning. The wet well will house two submersible pumps and associated electric motors. Discharge line check and gate valves will be located in a separate valve pit of pre-cast concrete. The wet well is about 15 feet deep and valve pit is about 10 feet deep. Other mechanical and electrical equipment will be located in a separate slab-on-grade building located near the wet well.

In order to maintain velocities in the force main/VGS which will be adequate to re-suspend settled solids and flush out low points (3-5 feet per second), it will be necessary to operate the pumps at close to the peak design flow rate. Two full size pumps were selected, each with design capacity of 504 gpm and 150 feet Total Developed Head (TDH). The pumps are constant speed and level controlled. This pumping capacity will meet the projected year 2045 flows. At the selected pumping rate the velocity in the force main is estimated at 5.6 fps. This should be sufficient to resuspend settled solids.

The wet well will be ventilated by a 4" mushroom vent. The equipment building will be provided with a roof mounted exhaust fan and a gas fired unit heater.

A motor control center will be provided. Alarm systems will be provided for intrusion detection, fire detection and equipment and system malfunction. Telephone and communication lines will be provided. Indoor lighting fixtures will be industrial fluorescent vapor tight. Outdoor lighting fixtures will be wall mounted high pressure sodium.

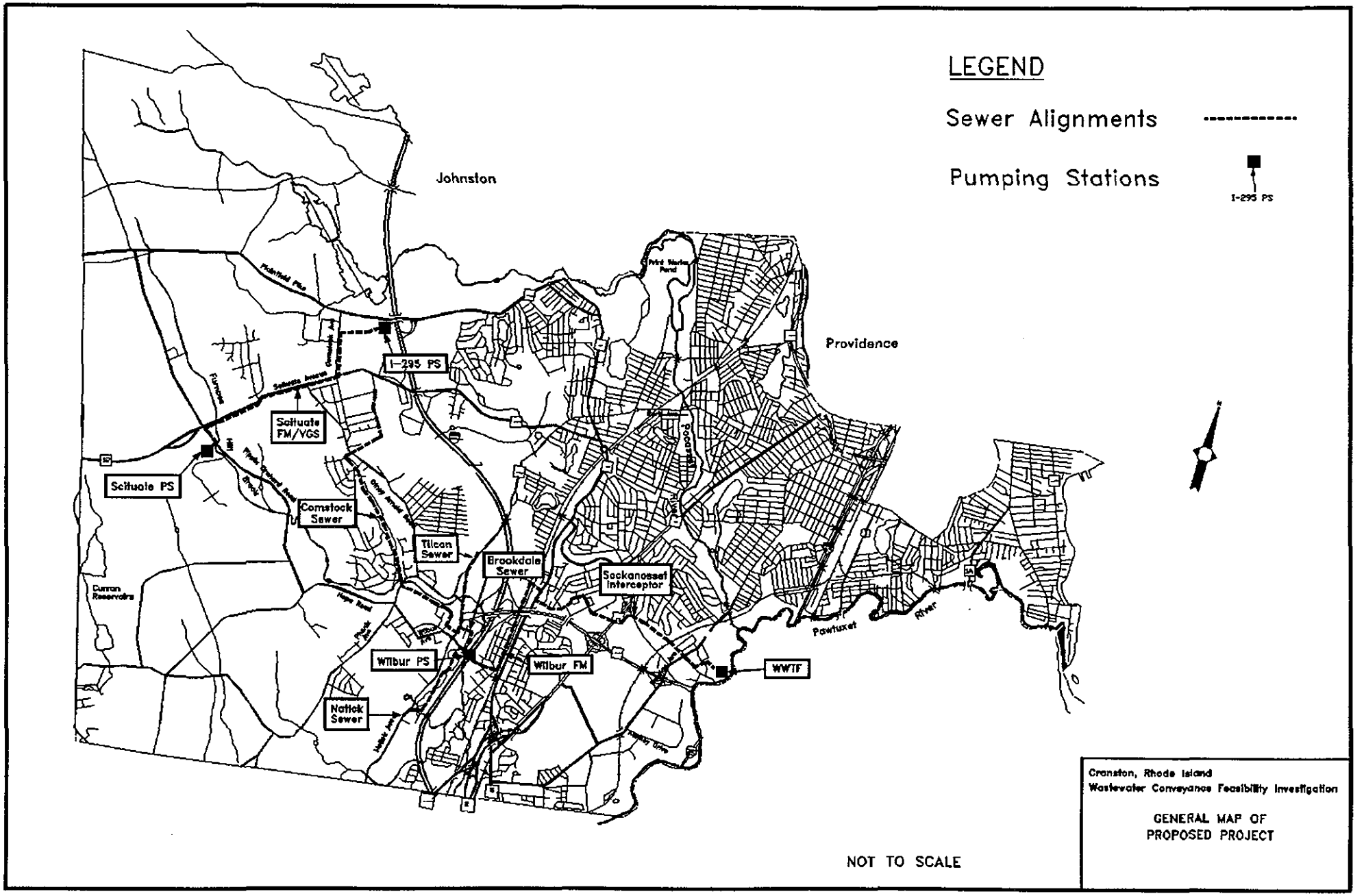

LEGEND
Sewer Alignments
Pumping Stations
I-295 PS
Johnston
Providence
I-295 PS
Scituate FM/VGS
Scituate PS
Comstock Sewer
Tilcon Sewer
Brookdale Sewer
Sockanosset Interceptor
Wilbur PS
Wilbur FM
WWTF
Nattick Sewer
Pawtuxet River
Durran Reservoirs
NOT TO SCALE
Cranston, Rhode Island
Wastewater Conveyance Feasibility Investigation
GENERAL MAP OF
PROPOSED PROJECT

FIGURE 13

Station power will be provided for one pump operation only. This will be sufficient to handle projected peak flows for the year 2045. Back up power will be provided in the form of a diesel powered emergency generator with automatic transfer switch also sized to back up one pump. The generator will be housed in a separate enclosure attached to the equipment building.

Before construction of the pumping station can begin, the city will be responsible for obtaining the lands for the project. The selected site is located on one end of a 5-acre privately owned land parcel. Archaeological Phase I testing may also be required at the pumping station location prior to construction.

Scituate 6-inch Force Main/Variable Grade Sewer.

The Scituate force main/VGS will be constructed of approximately 12,290 feet of 6-inch SDR 18 PVC bell and spigot pipe. The force main was sized to carry the design flow of 504 gallons per minute (gpm). Plastic pipe was chosen because it retains a smooth interior surface over time, thereby reducing friction losses and required pumping head. This was a concern for the Scituate pumping station because of the long force main/variable grade sewer (VGS) and high static lift required. A nominal 6-inch diameter pipe is required to convey the flow without causing unacceptable friction losses. The first 4,100 feet of the force main lifts wastewater about 70 feet to a high point on Scituate Avenue. The remaining portion of the pipeline is a variable grade sewer.

The volume of wastewater contained in the force main portion of the pipe is about 6,200 gallons. In order to ensure that the force main empties at least four times a day, thus reducing the potential for odor problems, a minimum daily inflow of 25,0000 gpd is recommended at the Scituate pumping station. However, if insufficient wastewater inflow is experienced during initial operation of the pumping station then odor control may need to be considered. Odor control was not considered in this study, but could be included in final design.

The force main/VGS is located within Pippin Orchard Road, the paved shoulder along the south side of Scituate Avenue (State Route 12), Comstock Parkway, Amflex Drive, an existing sewer easement, and Sailor Way before entering

the I-295 pumping station. Three automatic air release manholes located at relative high points and two cleanout manholes have been included in the design. The cleanout manhole at the intersection of Scituate Avenue and Comstock Drive may be replaced by a connection to future local gravity sewers.

The city will need to obtain a utility permit from the RIDOT to place the force main/variable grade sewer in the shoulder of Scituate Avenue, State Route 12. If the project is undertaken within five years of resurfacing the roadway (accomplished in 1994 by the State), the State may require resurfacing of Scituate Avenue in the area of the disturbance (6,300 feet) to its full width. The sewer alignment crosses Furnace Hill Brook where it flows under Scituate Avenue. A RIDEM wetlands permit will be required. The city will also be responsible for obtaining an increase in the width of the existing city sewer easement between Amflex Drive and Sailorway. The exact location will be determined during final design.

SERVICE AREA 2

Wilbur Pumping Station

The station location considered in the initial analysis is east of I-295 and south of Wilbur Avenue. However, during the preliminary design a location in the I-295 median north of Wilbur Avenue was considered . This location minimizes neighborhood and environmental impacts.

The site dimensions are estimated at 110 feet by 170 feet. The station building will be about 35 feet by 45 feet. A generator enclosure will be located behind the building. The station has been located in the median of Interstate-295 to minimize its visual impact on the surrounding historical district and to minimize residential and environmental impacts. The station will also be partially hidden behind appropriate plantings and/or fencing with an approximate 70-foot set back from Wilbur Avenue.

Inflows to the station will flow through a proposed 30-inch gravity sewer within the existing 60-inch sewer sleeve under I-295 north of Wilbur Avenue. Inflow to this gravity sewer will be from the 24-inch Brookdale gravity trunk sewer and the 18-inch Natick gravity trunk sewer. The sewer sleeve was constructed when I-295

was built in anticipation of the need for sewers in west Cranston. The sewer sleeve starts on the west side of the highway, passes under the median, and ends on the east side of the highway. Meshanticut Brook parallels the west side of the highway in this area. Construction of the 30-inch gravity sewer to the sewer sleeve will require crossing Meshanticut Brook. The sewer will be located below the brook invert.

The station will be cast-in-place-concrete with separate wet and dry wells. The station will be about 35 feet deep. The vertical pumps and motors will be located on the lower level of the dry well. All other mechanical and electrical equipment (including alarm systems and the motor control center) will be located on the upper level.

For initial study purposes, it was assumed a grinder/comminutor and manually cleaned bar rack would be installed at the Wilbur pumping station. However, as an alternative to the comminutor, the city has indicated a preference for a mechanically cleaned bar screen. A manually cleaned bar rack and mechanically cleaned bar screen will be installed in parallel on the incoming sewer line. Screenings will need to be removed and disposed of. The advantages and disadvantages of each option is discussed in Appendix B.

Initially, two variable-speed centrifugal pumps will be installed, each sized to accommodate the projected peak flow for the year 2015 (flow capacity of 2,830 gpm at 169 feet TDH). Space will be provided for the installation of a third pump so as to accommodate the projected peak flow for the year 2045 (5,144 gpm). In order to maintain flushing velocities of between 3 and 5 feet per second in the force main, it will be necessary to control the pumps so that they do not operate below a flow rate of 2000 gpm. At this flow rate the velocity in the force main is 3.4 fps which should be sufficient to resuspend settled solids.

An alternative pumping strategy would be to install three constant speed pumps. The advantages and disadvantages of each option is discussed in Appendix B. The variable speed pumps are preferred by the city and are included in the preliminary cost estimate.

The emergency generator for 2015 conditions is 400kw[2] and is sized based on backing up pumping capability for the 2015 projected peak flow rates only. The generator auxiliaries such as the enclosure and the fuel tank are sized to allow either addition of a second generator or replacement of the initial generator with a larger unit when additional pumping equipment is installed. The cost for a 650kw unit is included in the pumping station additional costs after year 2015.

The station location is in the 100-year floodplain for Meshanticut Brook. In order to minimize the loss of floodplain and the resulting requirement to provide for compensatory storage, the station has been located on higher ground at the rear of the site. Existing grades at the front of the site have been maintained, while grades to the rear of the station have been lowered to level the site and to compensate for the loss of flood storage created by the structure. The pumping station building will be constructed such that the building ground floor will be elevated above the 100-year flood elevation.

Retaining walls near the toe of the highway embankment are required to provide adequate clearance for construction and permanent access around the pumping station. A concrete-capped steel sheet pile wall (6 foot high average), anchored with tie-backs into the existing highway embankment, has been assumed for preliminary design.

The city will be required to obtain an easement from the Rhode Island Department of Transportation (RIDOT) to site the pumping station in the median of Interstate-295. Final design plans including drainage calculations for the site will

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[2] Budget price estimates were obtained from a manufacturer's sales representative for a 400 kw engine/generator unit ($65,000) and a 650 kw engine/generator unit ($125,000). Both budget prices include costs for appropriately sized automatic transfer switches. Installation costs were estimated at $3,000 for the 400 kw unit and $4,500 for the 650 kw unit. Cost comparisons are based on a present worth comparison of two options using a 7-3/4% discount rate. The first option was to install the 650 kw unit in 1995. The present worth cost of that option is $129,500. The second option was to install a 450 kw unit in 1995 and a 650 kw unit in the year 2015. The present worth cost of that option is $97,102. The present worth cost of installing the smaller unit now and the larger unit in 2015 is $32,398 less than the present worth cost of installing the larger unit now.

need to be developed and submitted to RIDOT for approval.

The selected site is in the Oaklawn Historic District. The appearance of the building will need to be coordinated with the Rhode Island Historic Commission and the Cranston Historic Commission during final design. The minutes of the June 14, 1994 meeting of the Cranston Historic Commission made recommendations that the structure be sided with wood shingles or clapboard, that it resemble a shed or outbuilding, and that a tight evergreen landscape screen be provided. These items will be incorporated in final design of the station. The Historic Commission also requested that a pitched roof be incorporated in the final design. The RIDOT has indicated a strong preference for a flat roof design so that the roof is not visible above the highway road elevation. A solution acceptable to both parties will need to be developed during final design.

A wetland permit will be required from RIDEM for the Meshanticut Brook crossing and pumping station construction.

Wilbur Force Main

The Wilbur pumping station would discharge into a proposed 9,000 feet long 16-inch diameter SDR 18 PVC force main which contains three automatic air release manholes at relative high points. The force main was sized to carry the 2045 projected peak flow rate of 5,140 gpm. Plastic pipe was chosen because it retains a smooth interior surface over time, therefore reducing friction losses and required pump head. This was a critical concern for the Wilbur pumping station because of the long force main and high static lift required. Because of the length of the force main, the high peak flow velocity, and the high pumping head required, consideration should be given to surge protection for the force main in final design. This could take the form of a controlled closing type check valve on each pump discharge and/or a surge relief valve piped from the common discharge header back to the pumping station.

The proposed force main alignment is in Wilbur Avenue, Vinton Avenue, Cranston Avenue, Sherman Avenue, Oaklawn Avenue, Freehold Street, and Belvedere Drive. In the initial assessment, Turner Avenue was considered instead of

Vinton Avenue for the force main location. However, for preliminary design, Vinton Avenue was chosen over Turner Avenue to minimize potential utility relocations and neighborhood disruption during sewer construction.

The total volume of wastewater contained in the force main is about 87,000 gallons. In order to ensure that the force main empties at least 4 times a day, thus reducing the potential for odor problems, a minimum daily inflow of 350,000 gpd is recommended at the pumping station.

The force main lifts the wastewater a total of 115 feet vertically to the city's Sockanosset Interceptor. In the first 2,000 feet, the sewer lifts the wastewater to a high point in Vinton Avenue (about 50 feet vertically). The sewer then drops to a low point in Cranston Street (about 20 feet vertically). At Sherman Avenue the sewer rises to a high point on Belvedere Drive (about 85 feet vertically). At Belvedere Drive the force main discharges to the city's existing Sockanosset Interceptor.

Sockanosset Interceptor Improvements

This interceptor was constructed in 1961 to conveys flows from southeast Cranston. It is 7,022 feet in length (based on the city sewer plans) and consists of 30-inch (5,359 feet), 22-inch (861 feet), and 18-inch (802 feet) diameter gravity sewers. There are 36 manholes. About 4,700 feet of the interceptor is located in a city sewer easement. The interceptor currently conveys flows from the city's Sherman pumping station and lateral sewers directly tributary to the interceptor.

The city requested that, as part of the preliminary design, a closed circuit television (CCTV) inspection of the sewer line be performed to determine its condition. This was accomplished and a report and video recording prepared by New England Pipe Cleaning Company. In general, the sewer appears to be in good condition; however, there are areas requiring rehabilitation. Problems noted during the CCTV inspection are included in Table 5. Also there appeared to be more lateral sewer connections noted during the field inspection than are recorded on the city's sewer record plans.

Table 5. Sockanosset Interceptor, Sewer Line Defects and Possible Rehabilitation		
Defect	Number of sites	Rehabilitation*
I/I at Lateral	16 sites	Service Connection TV Inspection at 16 sites
Misaligned Joint/Open Joint	15 sites	Joint sealant with root inhibitor 13 sites Joint testing and sealing two sites
Misaligned Joint/Visible gasket	6 sites	4 sites spot repair 2 sites section replacement
Crack in pipe	1 site	Rehabilitation is listed as unknown, location of crack is station 12+02, 30-inch sewer in Hoffman Avenue

* See *"Sockanosset Interceptor Sewer, Cranston, RI, Closed Circuit Television Inspection Report"*, July 1994, prepared by New England Pipe Cleaning Company, Watertown, Connecticut

Costs associated with the normal operation and maintenance of existing sewer lines which will be used as part of the proposed project were assumed to be the responsibility of the city. The city should consider repairing the sewer as part of its sewer maintenance program. The New England Pipe Cleaning Company Report provides some rough estimates for spot repair.

A particular area for further investigation is the 18-inch sewer segment of the interceptor. Six exposed joints were noted from manhole 57+09.7 to 51+97.7 (512 feet). Also, the city from its review of the video tape noted that the smaller 18-inch diameter pipe appears to be affected by corrosion as indicated by exposed aggregate. The total length of the 18-inch sewer is 802 feet with 11 drop manholes.

For informational purposes, a cost to rehabilitate the 802 feet, 18-inch sewer using cured in place pipe reconstruction was obtained from a pipe rehabilitation company (Inliner, USA, Telecom March 29, 1995). The estimate provided was $150 per foot for pipe rehabilitation plus mobilization which would be about $30,000 to $40,000. Thus a rough cost estimate for this work is about $150,000. However, before a method or repair decision is made further engineering and economic evaluation of the various rehabilitation options should be made by the city. This evaluation should be conducted prior to the final design of the Wilbur pumping station and force main.

Another problem noted during the inspection was that a portion of the 30-inch sewer upstream from the siphon chamber (about 225 feet) was flowing full. Because of the full pipe flow this portion of the interceptor was not inspected.

This problem had been noticed during a site visit prior to the CCTV inspection. It was thought to be related to stop logs located in the siphon chamber. Following the site visit, but before the CCTV inspection, the city removed some of the stop logs from the chamber. (These stop logs appear to be included in the siphon chamber design to control flow from the chamber into either the 16 or 27-inch diameter pipeline.) However, partial removal of the stop logs did not solve the problem. There is a need to investigate what is impacting the free flow in the 30-inch sewer. This problem could interfere with the conveyance of additional flows from the Wilbur pumping station.

A comparison of estimated sewer hydraulic capacity based on the city's sewer plans, and projected year 2015 and 2045 flows to the interceptor including the Wilbur pumping station, indicated that the sewer will have capacity to handle the projected year 2015 flows. However, calculated surcharge in the sewer for the year 2045 flows is estimated to impact service connections north of Pontiac Avenue. Therefore, improvements are suggested to increase the capacity of a portion of the sewer for year 2045 flows. An additional 24-inch reinforced concrete gravity sewer (about 1,500 feet) will need to be added parallel to a portion of the existing 30-inch sewer at the end of the interceptor between station 23+97 and Station 39+51. The portion of the interceptor to be improved starts in Pontiac Avenue and continues in a sewer easement between residential property and an existing 100-foot Providence Water Supply Board right of way. The right of way contains a 42-inch water main.

An issue to be resolved by the city before the Wilbur pumping station and force main can be built is the amount of I/I entering the Sockanosset interceptor and its tributary area (including Sherman, Allard, and Amanda pumping station drainage areas). Data provided by the city for a high flow event in March 1994 appear to indicate a problem with I/I. Any excessive I/I flows in the interceptor will need to be corrected by the city, or they could interfere with the conveyance of future flows from the Wilbur pumping station. The city should quantify existing flows to the Sockanosset Interceptor before final design of the Wilbur pumping station and force main is undertaken.

Siphon Analysis

Flows from the Sockanosset interceptor as well as flows from the Howard and Worthington pumping stations enter the "siphon chamber". The pipeline which carries flows from the "siphon chamber" to the Cranston WWTF consists of two pipes: one 27- inches and the other 16- inches in diameter.

Originally, the siphon was a fairly conventional design; however, when the WWTF was upgraded, the head works location was changed and new connections were added to the pipeline to carry flow to the headworks. These connections are immediately upstream of the drain chamber which is the lowest point on the pipeline. This layout allows cleaning either pipe with minimal time out of service. It also

means that this pipeline does not operate as a conventional siphon. Hydraulic calculations for these pipes, based on the city sewer plans, indicate the capacity of the 16-inch sewer is 3,150 gpm and the 27-inch sewer is 12,400 gpm. The combined capacity of the two pipes is 15,200 gpm. (This is less than the sum of the individual pipes because flow from both lines pass through a 30-inch pipe in the connection piping between the siphon and WWTF. Losses for fittings in the line between the siphon and headworks--including bends, valves and the flow meter--were estimated by approximating the 30-inch line with fittings as similar to a 27-inch line without fittings. Projected year 2015 and 2045 average daily flows to the pipeline are about 3,900 gpm and 5,000 gpm. If flows increase as projected the 16-inch pipe will not meet RIDEM siphon criteria that either pipe be capable of carrying the average daily flow. This criteria is included in case one of the sewers were to become blocked. However, this system is not a conventional siphon due to improvements made during an upgrade of the WWTF. The current layout allows cleaning of either pipe with minimal time out of service. Therefore, the cost for replacing the 16-inch sewer with a larger diameter pipeline is not included in the connector project. However, this cost is provided for informational purposes in Chapter 8, "Preliminary Estimates".

WWTF Influent Pumps

At present there are three Archimedes screw pumps at the WWTF which lift wastewater from the end of the 16 and 27-inch pipeline to the headworks of the WWTF. Each has a flow capacity of 5,210 gpm. This allows for a total inflow of 10,420 gpm with two pumps operating and one as back-up. There is a fourth empty screw pump bay. The projected year 2015 peak flow into these pumps with the construction of the Wilbur pumping station and improvements to the Howard pumping station is about 10,440 gpm. Therefore, the existing pumping capacity should be adequate assuming the pumps are maintained in good condition by the city .

As flows increase beyond year 2015 projections, the output of the existing pumps and motors could be increased to a maximum of about 5,600 gpm each (11,200 gpm for two) by increasing pump operating speed. This would be most easily accomplished by replacing the existing motor sheave on each V-belt drive with a larger diameter sheave, and replacing the belts. This improvement should be sufficient to handle the projected increase in flows to the screw pumps from the

Wilbur pumping station. However, if flows also increase from the Howard pumping station, the additional flows could not be accommodated without adding a fourth pump. The following points were considered when evaluating the need for the fourth screw pump after the year 2015. First, the additional flows are not expected to exceed the pump capacity until the year 2025, assuming a linear increase in peak flow rate. Second, the existing screw pumps will be 35 years old in the year 2015 and may require replacement because of their age. Therefore, based on these considerations only the cost for the improvements to the existing screw pumps are considered in calculating the additional cost after year 2015 for the connector project.

Brookdale Gravity Trunk Sewer

The Brookdale trunk sewer (2,065 feet) will collect flows from the Comstock and Tilcon gravity trunk sewers and the local area immediately northwest of the proposed Wilbur pumping station. The sewer is in Natick Avenue and Herod Street before turning south off-road between Brookdale Street and Meshanticut Brook. A new sewer easement will be required between Herod Street and the pumping station (about 1,400 feet). Hydraulic analysis for preliminary design revised the 30 and 36-inch diameter pipes specified in the initial assessment to 24-inch diameter.

A wetlands permit from RIDEM will be required for the portion of the sewer along Meshanticut Brook.

Tilcon Gravity Trunk Sewer

The Tilcon trunk sewer (2,595 feet) will provide a collection point for flows from future lateral sewers along the north portion of Phenix Avenue and Olney Arnold Road and adjacent areas. In the initial assessment, the sewer line was considered to extend through the Tilcon Gammino gravel mining operation to Patti Avenue (initial length of 6,250 feet). However, for the preliminary design, the trunk sewer is terminated just above the intersection of Phenix Avenue and Natick Avenue. The portion of the trunk sewer extending through the gravel pit was not considered in the preliminary design because of the uncertainty of the pattern of projected future industrial development at the site (after the mining operation is exhausted).

The Tilcon sewer is located in Natick Avenue. The pipe diameters and lengths are: 1,470 feet of 18-inch and 1,125 feet of 24-inch. The sewer goes off road where Natick Avenue crosses Furnace Hill Brook. Hydraulic analysis for the preliminary design revised the 30 and 24-inch pipes specified in the initial assessment to 24 and 18-inch diameter sewers.

A wetlands permit from RIDEM will be needed for the Furnace Hill Brook crossing and for sewer work in the road just below the location where an a unnamed stream crosses Natick Avenue.

A new sewer easement will be required where the alignment goes off road (about 200 feet).

Comstock Gravity Trunk Sewer

The Comstock trunk sewer (14,160 feet) will provide a collection point for flows from future lateral sewers from residential developments extending from Hines Farm Road, Wilbur Avenue, Phenix Avenue (north of Glenham Road and south of Hillcrest Drive), Hope Road, Kimberley Lane, and east of Pippin Orchard Road. Also, capacity is included in the portion of the trunk sewer starting at Phenix Avenue to accommodate possible future flows from the Phenix pumping station proposed in the feasibility assessment. Future flows from the Phenix pumping station and possibly the Glenham road area may be routed to the Natick or Comstock trunk sewer depending on future housing and lateral sewer development patterns.

The trunk sewer will start at Natick Avenue, go cross-country for a short distance to Hines Farm Road, and follow Hines Farm Road. From Hines Farm Road, the sewer will be located in Spring Meadow Court (a proposed road in a planned development between Hines Farm Road and Phenix Avenue) to Phenix Avenue, to Kimberly Lane. The sewer is in Kimberly Lane until it goes cross-country between Fox Run and Iroquois Trail. In this area the sewer alignment is near an unnamed stream. From Iroquois Trail, the sewer will go cross-country to Council Rock Road.

The pipe diameters and lengths are: 1,645 feet of 12-inch, 3,380 feet of 15-

inch, 4,840 feet of 18-inch, and 4,295 feet of 24-inch pipe. Hydraulic analysis for the preliminary design revised a portion of the pipe diameter that was 15-inch in the initial assessment to an 18-inch diameter pipe.

Portions of the sewer in the Hines Farm Road area near Furnace Hill Brook in the initial assessment were located away from the brook. However, the sewer still crosses Furnace Hill Brook at the foot of Kimberly Lane, and two other unnamed streams near Iroquois Trail and below Echo Lane. A wetland permit from RIDEM will be required for these stream crossings. Also a wetland permit for the cross-country portion between Kimberly Lane and Iroquois Trail may be required.

A new sewer easement will be required in areas where the alignment is off-road (about 4,500 feet).

Natick Gravity Trunk Sewer

The Natick trunk sewer will provide a collection point for flows from future lateral sewers from residential developments including Natick Village and Natick Avenue (south of Wilbur Avenue). Future flows from the Phenix pumping station and possibly the Glenham road area may be routed to the Natick or Comstock trunk sewer depending on future housing and lateral sewer development patterns.

In the initial assessment, the trunk sewer was proposed to go cross-country between Natick Avenue and Glenham Road in an undeveloped hillside. In the preliminary design, this reach of the sewer was eliminated due to the anticipated difficulty and cost in constructing this line and the uncertainty of the development pattern in this severely sloped area.

The total length of the sewer considered in preliminary design is 4,655 feet. The sewer includes: 3,910 feet of 18-inch pipe and 745 feet of 12-inch pipe.

The Natick sewer will originate at the junction of the Brookdale trunk sewer and the Wilbur pumping station inlet. From the Wilbur inlet, the sewer will cross Brookdale Street and Wilbur Avenue and run cross-country between Wilbur Avenue and Hornbeam Drive. Following Hornbeam Drive south to Locust Glen Drive, the

sewer will then continue in a southerly direction for about 2,250 feet along Locust Glen Drive before turning west across residential property to Comfort Drive. Hornbeam Drive, Locust Glen Drive, and Comfort Drive are located in the Natick Village subdivision. It will then exit Natick Village and terminate on Natick Avenue approximately 745 feet south of Comfort Drive.

The alignment of the Natick sewer in roads in the Natick Village subdivision was selected for preliminary design. In the initial assessment an alignment behind the Natick Village subdivision adjacent to Meshanticut Brook and the 102- inch diameter Providence Water Supply Board Aqueduct was analyzed. However, because of wetland issues, real estate concerns, and location of the aqueduct, the road alignment was considered a better location.

A new sewer easement will be required for about 500 feet in the area where the sewer is off-road. Also in final design, special consideration should be given to the initial portion of the trunk sewer that passes under the 102-inch diameter Providence Water Supply Aqueduct.

Chapter 8: PRELIMINARY ESTIMATES AND DESIGN AND CONSTRUCTION ACTIVITIES

COST ESTIMATES

Preliminary cost estimates are presented in Table 6 for Service Area 1 and Table 7 for Service Area 2. Total project costs include construction; real estate; engineering and design; and construction management costs. Construction costs[3] for sewers were developed based upon an estimation of the cost for:

- excavation and backfill
- earth support
- control and diversion of water
- traffic control
- environmental protection
- site work
- pavement removal and replacement
- sewer line appurtenances
- existing utility relocations/protection
- site restoration/landscaping

Pumping station estimates also included structure and mechanical and electrical equipment costs. Construction cost estimates include a contingency of 12 percent.

Real estate costs include temporary construction easements, permanent sewer easements, fee acquisition or easements for pumping station property, and land acquisition costs. Land values for easements and fee acquisition were based on a review of real estate sales data for Cranston and review of the proposed sewer alignments and pumping station locations. For real estate cost estimating purposes, where the sewer is off-road, a 30-foot width is assumed for new permanent sewer easements and a 20-foot width for temporary sewer construction easements. Land

[3]Preliminary construction cost estimate information for the project is included as Attachment I to the Main Report.

acquisition costs include costs for mapping, surveying, legal description, title evidence, appraisal, negotiations, closing, and administrative costs. This cost is estimated at $7,000 per ownership. Real Estate cost information is included in Appendix E.

The following estimates were used for engineering and design costs for the project:

Initial	Engineering and Design Costs
Service Area 1	9 percent of the basic construction cost
Service Area 2	8 percent of the basic construction cost

Additional Cost After Year 2015	Engineering and Design Costs
Service Area 1	NA
Service Area 2	9 percent of the basic construction cost

These fee percentages are developed for the projects in total and should not be applied to individual project components.

Construction management includes supervision and administration costs during construction and were estimated at:

Initial	Construction Management Costs
Service Area 1	$127,000
Service Area 2	$295,000

These estimates are based on two contracts. If the projects are awarded as more than two contracts, additional administration costs will need to be added for each contract.

Additional Cost After Year 2015	Construction Management Costs
Service Area 1	NA
Service Area 2	6 percent of the basic construction cost

TABLE 6. SERVICE AREA 1 – ESTIMATED SEWER CONNECTOR PROJECT COST PRICE LEVEL, AUG 1994		
	INITAL COST	
SCITUATE PUMPING STATION		
Estimated Basic Construction Cost	$307,000	
Real Estate Cost	$208,000	
SCITUATE FORCE MAIN/VARIABLE GRADE SEWER		
Estimated Basic Construction Cost	$1,131,000	*
Real Estate Cost	$28,000	
Subtotal Basic Construction Costs	$1,438,000	
Real Estate Costs	$236,000	
Engineering and Design Costs	$129,000	
Construction Management Cost	$127,000	
TOTAL	$1,930,000	

* Note: resurfacing of Route 12 in the project area would increase the FM/VGS basic construction cost by $231,000.

TABLE 7. SERVICE AREA 2 – ESTIMATED SEWER CONNECTOR PROJECT COST PRICE LEVEL, AUG 1994	INITIAL COST	ADDITIONAL COST AFTER YEAR 2015
WILBUR PUMPING STATION		
Estimated Basic Construction Cost	$1,907,000	$301,000
Real Estate Cost	$39,000	$0
WILBUR FORCE MAIN		
Estimated Basic Construction Cost	$1,167,000	$0
Real Estate Cost	$9,000	$0
SOCKANOSSET INTERCEPTOR IMPR0VEMENTS		
Estimated Basic Construction Cost	$0	$277,000
Real Estate Cost	$0	$114,000
INFLUENT PUMPS AT WWTF IMPROVEMENTS		
Estimated Basic Construction Cost	$0	$3,000
Real Estate Cost	$0	$0
BROOKDALE GRAVITY TRUNK SEWER		
Estimated Basic Construction Cost	$492,000	$0
Real Estate Cost	$123,000	$0
COMSTOCK GRAVITY TRUNK SEWER		
Estimated Basic Construction Cost	$2,675,000	$0
Real Estate Cost	$324,000	$0
NATICK GRAVITY TRUNK SEWER		
Estimated Basic Construction Cost	$610,000	$0
Real Estate Cost	$84,000	$0
TILCON GRAVITY TRUNK SEWER		
Estimated Basic Construction Cost	$565,000	$0
Real Estate Cost	$25,000	$0
Subtotal Basic Construction Costs	$7,416,000	$581,000
Subtotal Real Estate Costs	$604,000	$114,000
Engineering and Design Costs	$593,000	$52,000
Construction Management Cost	$295,000	$35,000
TOTAL	$8,908,000	$782,000

Note: replacing the 16-inch R.C.P.P. diameter sewer (1,248 LF) to the influent pumps with a a 24-inch diameter R.C.P.P. would increase the basic construction cost by $217,000.

DESIGN AND CONSTRUCTION ACTIVITIES

At this time involvement of the Corps in the proposed project, is limited to preparation of the feasibility report. If the Corps was to become involved further in project implementation, the following are possible actions towards project construction. These items require coordination with local agencies and submittal of information from the final design phase of the work for project permits and approvals.

- o Develop and execute Project Cooperation Agreement with local sponsor
- o Establish project financing
- o Obtain all lands and easements necessary for project purposes
- o Prepare final design and preparation of plans and specification. Further information required for final design of sewers and pumping stations includes: utilities survey and topographic survey, possible hazardous waste testing, and additional geotechnical explorations.[4] Also archeological testing will be required in areas that are not previously disturbed.[5] Fisheries survey may be required in areas where the sewer has a close alignment to streams.
- o Apply for required permits and approvals

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[4] Information on additional investigations and further explorations recommended for final design are included in *"Appendix C: Task 12a - Proposed Project, Geotechnical Evaluations"* and *"Appendix D: Task 12c-Proposed Project Pumping Stations and Sewers, Civil Engineering Design"*.

[5] The areas of concern for the project are those areas in west Cranston that are located off road in previously undisturbed locations. These locations will need to be archaeologically tested at the Phase I intensive survey level, prior to construction. Approximately $50,000 will be required for the performance of this work. (This is an estimate and may not reflect actual cost.) It should be noted that if any significant cultural resources are uncovered or discovered then additional investigations would be required. The cost for these studies cannot be estimated at this time.

- After completion of plans and specifications, acquisition of required real estate, approvals, and permits, the project is advertised for bids. Evaluate bids and if considered responsive award construction contract.

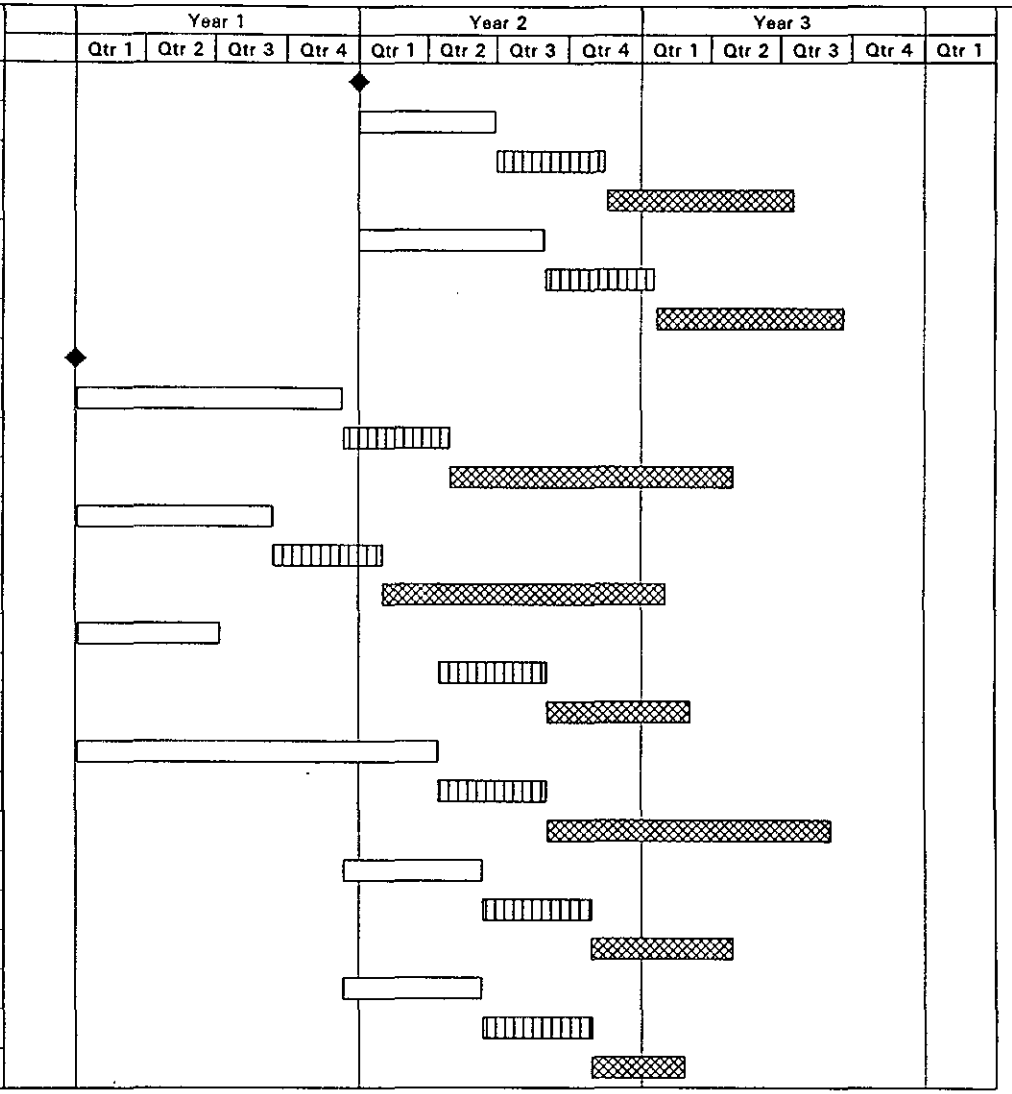
- Start construction

Possible design and construction durations are shown in Figure 14.

Construction time includes preparation and approval of shop drawings, mobilization time, construction, and final review and acceptance of the project. This estimate does not include any adjustments in construction activities required for environmental windows or other special considerations as it is not known when initial construction would be undertaken.

Figure 14. Design and Construction Durations

ID	Name
1	SERVICE AREA 1
2	Scituate PS, Design and Plans & Specs
3	Scituate PS, Review and Coordination
4	Scituate PS, Construction
5	Scituate FM/VGS, Design and Plans & Specs
6	Scituate FM/VGS, Review and Coordination
7	Scituate FM/VGS, Construction
8	SERVICE AREA 2
9	Wilbur PS, Design and Plans & Specs
10	Wilbur PS, Review and Coordination
11	Wilbur PS, Construction
12	Wilbur FM, Design and Plans &Specs
13	Wilbur FM, Review and Coordination
14	Wilbur FM, Construction
15	Brookdale TS, Design and Plans &Specs
16	Brookdale TS, Review and Coordination
17	Brookdale TS, Construction
18	Comstock TS, Design and Plans &Specs
19	Comstock TS, Review and Coordination
20	Comstock TS, Construction
21	Natick TS, Design and Plans & Specs
22	Natick TS, Review and Coordination
23	Natick TS, Construction
24	Tilcon TS, Design and Plans & Specs
25	Tilcon TS, Review and Coordination
26	Tilcon TS, Construction



Start and completion dates assume funding is available, permits and regulatory review and approval are obtained in a timely manner. Adjustments in construction activities for environmental windows or other special considerations are not included.

Design and P&S
Review & Coord.
Construction

Chapter 9: IDENTIFICATION OF PERMITS AND APPROVALS

Wetlands Permit

During the Environmental Assessment process wetlands impacts were identified. A mitigation plan was included in the Environmental Assessment to minimize any impacts.

Wetlands regulation is under the jurisdiction of the Rhode Island, Department of Environmental Management, Division of Freshwater Wetlands. The city will need to submit an application to the RIDEM Division of Freshwater Wetlands for approval to work in wetlands associated with the proposed project. The estimated time for approval is approximately 4 to 6 months (possibly longer if a public hearing is required). As part of the application process wetlands will need to be delineated in the field along with limits of proposed construction activities.

Water Quality Certification

As part of the wetlands application and review process, it is anticipated that the Division of Freshwater Wetlands will request a Water Quality Certification for the project from the Rhode Island Division of Water Resources. The city may be required to provide technical documentation beyond that required for the wetlands review for RIDEM to complete the Water Quality Certification review process. The time for approval is assumed to be concurrent with the Wetlands application.

Fisheries Resources

Based on discussions with the Rhode Island Division of Fisheries and Wildlife, it is possible that RIDEM may require a fisheries survey in areas where sewer lines have close alignments to streams.

Order of Approval to Construct Install or Modify Any System or Means of Wastewater Treatment

The RIDEM Division of Water Resources requires a permit for installation or

modification of a wastewater treatment system. It is anticipated that as part of the approval process, it will be necessary for the city to demonstrate that any infiltration/inflow problems to the Sockanosset interceptor that might interfere with the conveyance of flows from the Wilbur pumping station and force main to the WWTF will be corrected. Also, the city will likely be required to demonstrate that the WWTF will have the ability to treat the additional flows. It is anticipated that the approval process could exceed several months.

Archaeological Testing

The Rhode Island Historic Commission has identified the need to conduct archeological Phase I testing in areas in west Cranston that are not previously disturbed. If significant cultural resources are uncovered as a result of the Phase I study, then additional investigations at the Phase II (site examination) level would be necessary to determine the significance of these resources. If the resources are determined to be eligible for listing on the National Register of Historic Places and would be impacted by the proposed project, then a Phase III Data Recovery level excavation would be required in order to extract and recover information the resources may contain, prior to impact by project actions.

Chapter 10: CONCLUSION

This report documents the results of studies performed as part of the Cranston Wastewater Conveyance Feasibility Investigation. A summary of the proposed project is shown in Table 8.

The feasibility study was conducted in two phases. The first phase is the initial assessment of wastewater conveyance options. Study sites in Cranston were identified by the city. The first phase included engineering, cost estimating, water quality, ecological, archaeological and historic analysis; selection of the sewer connector project in consultation with the city; and preparation of the Environmental Assessment. The second phase is preparation of preliminary design for the project and development of a preliminary cost estimate. The Main Report ,Feasibility Investigation - Volume 1, presents a summary of developed information. Volumes 2 and 3 contain the technical appendices.

The project selected for preliminary design includes conveyance of wastewater flows from residential and industrial areas in west Cranston that do not currently have sewer service. The project does not include conveyance of flows from Central Landfill.

The information presented in this report should assist the city in the decision making process regarding future expenditures for improvements to and expansion of the existing sewer system. The preliminary design information developed for the connector project should assist the city in final design of this system.

This report does not evaluate the merits of providing sewers to west Cranston nor does it provide justification for further Corps involvement. The decision as to whether to extend sewers to west Cranston rests with the city. If the city decides to undertake the project, state agencies, especially the Rhode Island Department of Environmental Management, will be involved in project review and approving permits.

Table 8. Proposed Project Summary Information

SERVICE AREA 1

Scituate Pumping Station

Pumping Station located on Pippin Orchard Road

Fee acquisition of 0.3 acres

Archeological testing at site

Maintain 100 foot buffer from Furnace Hill Brook

Two 504 gpm submersible wastewater pumps

70Kw emergency generator

Pre-cast concrete wet well and valve pit

Equipment building 16 ft X 23 ft

Basic Construction Cost $307,000

Real Estate Cost $208,000 (includes severance damages)

Scituate Force Main/Variable Grade Sewer

FM/VGS crosses Furnace Hill Brook

Expand existing sewer easement between Amflex Drive and Sailor Way, estimate 0.1 acre

Utility permit from RIDOT

12,290 feet of 6-inch pipe

6,300 feet of FM/VGS located within shoulder of State Route 12

Basic Construction Cost $1,131,000

Real Estate Cost $28,000

Service Area 1 - Estimated Project Cost

Basic Construction Cost	$1,438,000
Real Estate Cost	$236,000
Engineering and Design Cost	$129,000
Construction Management Cost	$127,000
Total	$1,930,000

Table 8. Proposed Project Summary Information (continued)

SERVICE AREA 2

Wilbur Pumping Station

Pumping Station located in median of I-295

Easement required from RIDOT, estimate 0.4 acres

Site within 100-year flood plain for Meshanticut Brook

Structure to comply with State and City requirements for construction in the Oaklawn National Register Historic District and RIDOT requirements for construction in the Median of I-295

Influent gravity sewer to Pumping Station crosses Meshanticut Brook

Two 2,830 gpm wastewater pumps (with space for future installation of a third pump)

Cast in-place concrete with separate wet and dry wells

400 Kw emergency generator

Pumping station building 35 ft x 45 ft

Mechanically-cleaned bar screen

180 feet of 30-inch pipe within existing sewer sleeve

Basic Construction Cost $1,907,000

Real Estate Cost $39,000

Additional Construction Cost After Year 2015 $301,000

Wilbur Force Main

Located in city streets

Discharges to City's existing Sockanosset Interceptor at Belvedere Drive

9,000 feet of 16-inch pipe

Basic Construction Cost $1,167,000

Real Estate Cost $9,000

City's Existing Sockanosset Interceptor

Located in City streets and existing sewer easements

Additional Construction Cost After Year 2015 $277,000

Additional Real Estate Cost After Year 2015 $144,000

City's Existing Influent Pumps at WWTF

Additional Construction Cost After Year 2015 $3,000

Table 8. Proposed Project Summary Information (continued)

SERVICE AREA 2

Brookdale Gravity Trunk Sewer

Portion of sewer adjacent to Meshanticut Brook	2,065 feet of 24-inch pipe
Archaeological testing where sewer is located off-road in previously undisturbed locations	Basic Construction Cost $492,000
New sewer easements, estimate 1 acre	Real Estate Cost $123,000

Tilcon Gravity Trunk Sewer

Sewer crosses Furnace Hill Brook	
Sewer terminates just south of unnamed brook	length 2,595 feet: 1,470 feet of 18-inch pipe 1,125 feet of 24-inch pipe
Archaeological testing where sewer is located off-road in previously undisturbed locations	Basic Construction Cost $565,000
New sewer easements, estimate 0.1 acre	Real Estate Cost $25,000

Comstock Gravity Trunk Sewer

Sewer crosses Furnace Hill Brook	length 14,160 feet: 1,654 feet of 12-inch pipe
Sewer crosses unnamed stream south of Iroquois Trail	3,380 feet of 15-inch pipe 4,840 feet of 18-inch pipe 4,295 feet of 24-inch pipe
Archaeological testing where sewer is located off-road in previously undisturbed locations	Basic Construction Cost $2,675,000
New sewer easements, estimate 3.1 acres	Real Estate Cost $324,000

Natick Gravity Trunk Sewer

Sewer crosses unnamed stream at Natick Avenue	length 4,655 feet: 3,910 feet of 18-inch pipe 745 feet of 12-inch pipe
Archaeological testing where sewer is located off-road in previously undisturbed locations	Basic Construction Cost $610,000
New sewer easements, estimate 0.3 acres	Real Estate Cost $84,000

Table 8. Proposed Project Summary Information (continued)

Service Area 2 - Estimated Project Cost	Initial Cost	
	Basic Construction Cost	$7,416,000
	Real Estate Cost	$604,000
	Engineering and Design Cost	$593,000
	Construction Management Cost	$295,000
	Total	$8,908,000
	Additional Cost After Year 2015	
	Basic Construction Cost	$581,000
	Real Estate Cost	$114,000
	Engineering and Design Cost	$52,000
	Construction Management Cost	$35,000
	Total	$782,000
Total Estimated Cost - Service Area 1 and Area 2		**$10,838,00**
Additional Costs After Year 2015		**$782,000**

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REFERENCES (Main Report)

Cranston, Rhode Island (city of), *Comprehensive Plan*, February 1992.

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Tutela Engineering Associates,*Wastewater Facility Plan Amendment*, North West Cranston, February 1993.

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Tutela Engineering Associates, *Draft Infiltration/Inflow Study, Cranston, Rhode Island*, January 1993.

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Tutela Engineering Associates, *Wastewater Facility Plan, Interim Report on Regional versus Individual Alternatives*, March 1991.

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U. S. Army Corps of Engineers, *Section 22, Planning Assistance to States, Wastewater Investigation, Cranston, Rhode Island*, May 1992.

ATTACHMENT I

Preliminary Construction Cost Estimate Information

Feasibility Study - Section 117
Wastewater Conveyance
SECTION 117
Cranston, Rhode Island

Designed By: CENED ED DC/DG/WQ/GD
Estimated By: CENED ED DG/C

Prepared By: NEW ENGLAND DIVISION
CENED ED C

M C A C E S G O L D E D I T I O N
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Release 5.20J

The estimate presented here is for construction only and does not include real estate costs. Neither are the costs for engineering and design, supervision and inspection, and administration included.

This estimate does include a total mark-up of 30 percent.

THE ESTIMATE IS ROUNDED TO THE NEAREST $1000.

N.B. The following costs were developed but not included as part of the initial costs.

01-06	# Resurfacing of Route 12
02-01.03	Additive Cost for PS for Year 2045
02-09	* Siphon Inlet Replacement
02-10	* WWTF Screw Pumps
02-4A	* Mod. Sockanosset Interceptor

PRICE LEVEL DATE: 08/94.

** PROJECT OWNER SUMMARY - LEVEL 3 (Rounded to 1000's) **

		QUANTY	UOM	CONTRACT	CONTINGN	TOTAL COST
01	SERVICE AREA 1 NW. CRANSTON					
01-01	Option A/B - Scituate Ave. PS	Additional information for the Scituate PS is included on Summary Page A				
01-01.01	SITE WORK			68,000	8,000	76,000
01-01.02	PUMP STATION			206,000	25,000	231,000
	Option A/B - Scituate Ave. PS			274,000	33,000	307,000
01-02	Scituate Ave. - 6" FM/V.G.S.					
01-02.01	# SITE PREPARATION			17,000	2,000	19,000
01-02.02	# TRAFFIC CONTROL			43,000	5,000	48,000
01-02.04	# PROTECT EXISTING UTILITIES	12300	LF	14,000	2,000	16,000
01-02.05	PAVEMENT REMOVAL (5")	5400.00	SY	46,000	6,000	52,000
01-02.06	EXCAVATION	7400.00	CY	103,000	12,000	115,000
01-02.07	ROCK EXECAVATION	1000.00	CY	32,000	4,000	36,000
01-02.08	6" PVC PRESSURE PIPE	12300	LF	100,000	12,000	112,000
01-02.09	6" GATE VALVE AND BOX	4.00	EA	5,000	1,000	5,000
01-02.10	CLEANOUT MANHOLE	2.00	EA	4,000	0	4,000
01-02.11	AIR RELEASE MANHOLE	6.00	EA	15,000	2,000	17,000
01-02.12	BACKFILL MATERIAL	3400.00	CY	17,000	2,000	19,000
01-02.13	SAND BLANKET	700.00	CY	10,000	1,000	12,000
01-02.14	GRAVEL BACKFILL - BORROW	1800.00	CY	27,000	3,000	30,000
01-02.15	TEMPORARY PAVEMENT - 2""	5400.00	SY	65,000	8,000	73,000
01-02.16	REMOVAL OF TEMPORARY PAVEMENT	5400.00	SY	24,000	3,000	27,000
01-02.17	# SAW CUT PAVEMENT	23000	LF	33,000	4,000	37,000
01-02.18	# TACKCOAT	5900.00	SF	0	0	0
01-02.19	# 2" SURFACE COURSE	6700.00	SY	54,000	6,000	60,000
01-02.20	2" BINDER COURSE	6700.00	SY	41,000	5,000	46,000
01-02.21	18 " COMPACTED GRAVEL	2100.00	SY	13,000	2,000	15,000
01-02.22	THRUST BLOCKS, CONCRETE	30.00	CY	7,000	1,000	8,000
01-02.23	CONCRETE ENCASEMENT - (60LF)	5.00	CY	1,000	0	1,000
01-02.24	TURF	2600.00	SY	5,000	1,000	6,000
01-02.25	EARTH SUPPORT SYSTEMS			308,000	37,000	345,000
01-02.26	CLEARING AND GRUBBING	0.50	ACR	2,000	0	2,000
01-02.27	CONTROL & DIVERSION OF WATER			23,000	3,000	26,000
	Scituate Ave. - 6" FM/V.G.S.	12300	LF	1,010,000	121,000	1,131,000
01-06	# RESURFACING OF ROUTE 12					
01-06.01	SITE PREPARATION			8,000	1,000	10,000
01-06.02	TRAFFIC CONTROL	14.00	DAY	10,000	1,000	11,000
01-06.04	MOD/PROTECT EXISTING UTILITIES			14,000	2,000	16,000
01-06.05	PAVEMENT RESURFACING	6300.00	LF	252,000	30,000	282,000
01-06.06	PAVEMENT PAINTING			8,000	1,000	9,000

		QUANTY UOM	CONTRACT	CONTINGN	TOTAL COST
	# RESURFACING OF ROUTE 12	6300.00 LF	292,000	35,000	328,000
	SERVICE AREA 1 NW. CRANSTON	1.00 EA	1,576,000	189,000	1,765,000
02	SERVICE AREA 2 - W. CRANSTON				
02-01	Option A/B/C - WILBUR PUMP STA.		Additional information for the Wilbur PS is included on Summary Page B		
02-01.01	SITE WORK - MEDIAN OF I-295		563,000	68,000	631,000
02-01.02	PUMP STATION (FOR YEAR 2015)		1,139,000	137,000	1,276,000
02-01.03	ADDITIVE COST TO PS FOR YR 2045		269,000	32,000	301,000
	Option A/B/C - WILBUR PUMP STA.		1,971,000	237,000	2,208,000
02-04	Opt.C: WILBER FORCE MAIN				
02-04.01	SITE PREPARATION		2,000	0	2,000
02-04.02	TRAFFIC CONTROL		33,000	4,000	37,000
02-04.03	ENVIRONMENTAL PROTECTION	450.00 LF	3,000	0	3,000
02-04.04	PROTECT/MODIFY EXT. UTILITIES	9000.00 LF	16,000	2,000	18,000
02-04.06	CONTROL/DIVERSION OF WATER	9.00 DAY	8,000	1,000	9,000
02-04.07	PAVEMENT REMOVAL (3")	5500.00 SY	25,000	3,000	28,000
02-04.08	EARTH SUPPORT SYSTEM		93,000	11,000	104,000
02-04.09	EXCAVATION	7500.00 CY	109,000	13,000	122,000
02-04.10	ROCK EXCAVATION	700.00 CY	22,000	3,000	25,000
02-04.11	16" PRESSURE PIPE	9000.00 LF	428,000	51,000	480,000
02-04.12	12" DUCTILE IRON PIPE	40.00 LF	2,000	0	2,000
02-04.13	16" GATE VALVE & BOX	5.00 EA	41,000	5,000	46,000
02-04.14	12" GATE VALVE & BOX	5.00 EA	13,000	2,000	14,000
02-04.15	AIR RELEASE MANHOLE	3.00 EA	7,000	1,000	8,000
02-04.16	BACKFILL MATERIAL - RANDOM	2600.00 CY	13,000	2,000	15,000
02-04.17	PIPE BEDDING - (SANDY GRAVEL)	740.00 CY	11,000	1,000	12,000
02-04.18	GRAVEL BACKFILL - BORROW	2100.00 CY	31,000	4,000	35,000
02-04.19	18" COMPACTED GRAVEL BASE	3500.00 SY	2,000	0	2,000
02-04.20	TEMPORARY PAVEMENT (2")	4500.00 SY	53,000	6,000	60,000
02-04.21	REMOVAL OF TEMPORARY PAVEMENT	4500.00 SY	20,000	2,000	23,000
02-04.22	SAW CUT PAVEMENT	18000 LF	26,000	3,000	29,000
02-04.23	TACK COAT	4500.00 SF	0	0	0
02-04.24	1 1/2" BIT CONC SURFACE COURSE	5500.00 SY	33,000	4,000	37,000
02-04.25	1 1/2" BIT CONC BINDER COURSE	5500.00 SY	25,000	3,000	28,000
02-04.26	THRUST BLOCKS/ENCASEMENT	110.00 CY	26,000	3,000	29,000
	Opt.C: WILBER FORCE MAIN	9000.00 LF	1,042,000	125,000	1,167,000
02-05	Opt.D: W. CRANSTON TRUNK SEWERS		Additional information for the trunk sewers is included on Summary Pages C through F		
02-05.01	BROOKDALE TRUNK SEWER (GRAVITY)	2065.00 LF	439,000	53,000	492,000

		QUANTY	UOM	CONTRACT	CONTINGN	TOTAL COST
02-05.02	NATICK/PHENIX TRUNK SEWER	4655.00	LF	544,000	65,000	610,000
02-05.03	COMSTOCK GRAVITY SEWER	14160	FT	2,389,000	287,000	2,675,000
02-05.04	TILCON GRAVITY SEWER	2595.00	LF	505,000	61,000	565,000
	Opt.D: W. CRANSTON TRUNK SEWERS	23475	LF	3,877,000	465,000	4,342,000
02-09	*SIPHON INLET REPLACEMENT					
02-09.01	SITE PREPRATION	1250.00	LF	2,000	0	2,000
02-09.02	TRAFFIC CONTROL			9,000	1,000	10,000
02-09.03	CONTROL AND DIVERSION OF WATER	12.50	DAY	1,000	0	2,000
02-09.04	PAVEMENT REMOVAL	910.00	SY	8,000	1,000	9,000
02-09.05	EARTH SUPPORT SYSTEM - TRENCH BX	13.00	DAY	2,000	0	2,000
02-09.06	EXCAVATION	1800.00	CY	24,000	3,000	27,000
02-09.07	ROCK EXCAVATION	14.00	CY	0	0	1,000
02-09.08	REMOVAL OF EXISTING 16" RCCP	1250.00	LF	64,000	8,000	72,000
02-09.09	INSTALL NEW 24 RC PRESSURE PIPE	1250.00	LF	32,000	4,000	36,000
02-09.10	COMPACTED RANDOM FILL	680.00	CY	3,000	0	4,000
02-09.11	GRAVEL BORROW	650.00	CY	10,000	1,000	11,000
02-09.12	PIPE BEDDING	150.00	CY	2,000	0	3,000
02-09.13	COMPACTED GRAVEL BASE - 18"	630.00	SY	8,000	1,000	9,000
02-09.14	TEMPORARY PAVEMENT (2")	75.00	TON	8,000	1,000	9,000
02-09.15	REMOVAL OF TEMPORARY PAVEMENT	770.00	SY	4,000	0	4,000
02-09.16	SAW CUT PAVEMENT	2500.00	LF	6,000	1,000	6,000
02-09.17	TACKCOAT	630.00	SF	0	0	0
02-09.18	1 1/2" BIT. CONC. SURFACE COURSE	910.00	SY	5,000	1,000	6,000
02-09.19	1 1/2" BIT. CONC. BINDER COURSE	910.00	SY	4,000	0	5,000
	*SIPHON INLET REPLACEMENT			194,000	23,000	217,000
02-10	*WWTF SCREW PUMPS					
02-10.01	7.5" DIAM, 3 BELT SHEAVE	3.00	EA	2,000	0	2,000
02-10.02	SF BUSHING	3.00	EA	0	0	0
02-10.03	5V X 800 BELT	9.00	EA	1,000	0	1,000
	*WWTF SCREW PUMPS	3.00	EA	3,000	0	3,000
02-4A	*Opt C: MOD. SOCKANOSSET INTER.					
02-4A.01	SITE PREPARATION			2,000	0	2,000
02-4A.02	TRAFFIC CONTROL			10,000	1,000	12,000
02-4A.03	ENVIRONMENTAL PROTECTION	155.40	LF	1,000	0	1,000
02-4A.04	PROTECT/MODIFY EXT. UTILITIES	1554.00	LF	3,000	0	3,000
02-4A.05	CLEARING AND GRUBBING	0.80	ACR	3,000	0	3,000
02-4A.06	CONTROL/DIVERSION OF WATER	8.00	DAY	7,000	1,000	8,000
02-4A.07	PAVEMENT REMOVAL - 3" (150 lf)	110.00	SY	0	0	1,000
02-4A.08	EARTH SUPPORT SYSTEM			96,000	12,000	107,000

** PROJECT OWNER SUMMARY - LEVEL 3 (Rounded to 1000's) **

		QUANTY	UOM	CONTRACT	CONTINGN	TOTAL COST
02-4A.09	EXCAVATION	2800.00	CY	31,000	4,000	35,000
02-4A.10	ROCK EXCAVATION	100.00	CY	3,000	0	4,000
02-4A.11	24" PIPE, REINFORCED CONCRETE	1554.00	LF	43,000	5,000	48,000
02-4A.12	SANITARY SEWER MANHOLE(S)	8.00	EA	15,000	2,000	17,000
02-4A.16	RANDOM BACKFILL MATERIAL	2000.00	CY	10,000	1,000	11,000
02-4A.17	PIPE BEDDING (SANDY GRAVEL)	190.00	CY	3,000	0	3,000
02-4A.18	GRAVEL BACKFILL (BORROW)	570.00	CY	9,000	1,000	10,000
02-4A.19	18" COMPACTED GRAVEL BASE	75.00	SY	0	0	1,000
02-4A.20	TEMPORARY PAVEMENT (2")	10.12	TON	1,000	0	1,000
02-4A.21	REMOVAL OF TEMPORARY PAVEMENT	92.00	SY	0	0	0
02-4A.22	SAW CUT PAVEMENT	300.00	LF	0	0	0
02-4A.23	TACK COAT	75.00	SF	0	0	0
02-4A.24	1 1/2" BIT CONC SURFACE COURSE	110.00	SY	1,000	0	1,000
02-4A.25	1 1/2" BIT CONC BINDER COURSE	110.00	SY	0	0	1,000
02-4A.27	TURF (6")	3900.00	SY	8,000	1,000	8,000
	*Opt C: MOD. SOCKANOSSET INTER.	1554.00	LF	247,000	30,000	277,000
	SERVICE AREA 2 - W. CRANSTON	1.00	EA	7,334,000	880,000	8,214,000
	Feasibility Study - Section 117	1.00	EA	8,910,000	1,069,000	9,979,000

		QUANTY	UOM	CONTRACT	CONTINGN	TOTAL COST
01	SERVICE AREA 1 NW. CRANSTON					
01-01	Option A/B - Scituate Ave. PS					
01-01.01	SITE WORK					
01-01.01.01	SITE PREPARATION			5,000	1,000	6,000
01-01.01.02	ENVIRONMENTAL PROTECTION	440.00	LF	0	0	0
01-01.01.03	CONTROL AND DIVERSION OF WATER	30.00	DAY	28,000	3,000	31,000
01-01.01.04	ROCK EXCAVATION	130.00	CY	7,000	1,000	8,000
01-01.01.05	EXCAVATION	320.00	CY	3,000	0	3,000
01-01.01.09	FOUNDATION WATERPROOFING	1200.00	SF	1,000	0	1,000
01-01.01.10	COMPACTED GRAVEL BORROW	100.00	CY	2,000	0	2,000
01-01.01.12	1 1/2" SURFACE COURSE	540.00	SY	3,000	0	3,000
01-01.01.13	1 1/2" BINDER COURSE	540.00	SY	3,000	0	4,000
01-01.01.15	PC CONCRETE BUMBERS	2.00	EA	0	0	0
01-01.01.16	18" GRAVEL FILL - COMPACTED	270.00	CY	3,000	0	4,000
01-01.01.17	CHAIN LINK FENCE W/GATE - 6'	310.00	LF	8,000	1,000	9,000
01-01.01.18	UTILITIES			2,000	0	2,000
01-01.01.19	LANDSCAPING			2,000	0	2,000
01-01.01.20	TURF - TOPSOIL AND SEEDING	600.00	SY	1,000	0	1,000
	SITE WORK			68,000	8,000	76,000
01-01.02	PUMP STATION					
01-01.02.01	Architectural			45,000	5,000	51,000
01-01.02.03	Electrical			12,000	1,000	13,000
01-01.02.04	Mechanical (2015 & 2045)			149,000	18,000	167,000
	PUMP STATION			206,000	25,000	231,000
	Option A/B - Scituate Ave. PS	1.00	EA	274,000	33,000	307,000

		QUANTY UOM	CONTRACT	CONTINGN	TOTAL COST
02	SERVICE AREA 2 - W. CRANSTON				
02-01	Option A/B/C - WILBUR PUMP STA.				
02-01.01	SITE WORK - MEDIAN OF I-295				
02-01.01.01	SITE PREPARATION		6,000	1,000	6,000
02-01.01.02	ENVIRONMENTAL PROTECTION	550.00 LF	0	0	0
02-01.01.03	CONTROL AND DIVERSION OF WATER	60.00 DAY	63,000	8,000	71,000
02-01.01.04	EARTH SUPPORT SYSTEM(S)	262.80 TON	290,000	35,000	324,000
02-01.01.05	STRUCTURAL EXCAVATION	3700.00 CY	9,000	1,000	10,000
02-01.01.06	PERIMETER DRAIN - 4"	145.00 LF	1,000	0	1,000
02-01.01.07	OUTLET PIPE- 12" RCP	60.00 LF	1,000	0	1,000
02-01.01.08	30" REINFORCED CONC PIPE	56.00 LF	3,000	0	3,000
02-01.01.09	FOUNDATION WATERPROOFING	6000.00 SF	12,000	1,000	13,000
02-01.01.12	1 1/2" SURFACE COURSE	740.00 SY	5,000	1,000	5,000
02-01.01.13	1 1/2" BINDER COURSE	740.00 SY	5,000	1,000	5,000
02-01.01.14	CONCRETE STAIRWAY	20.00 CY	2,000	0	2,000
02-01.01.15	PC CONCRETE BUMBERS	2.00 EA	0	0	0
02-01.01.16	GRAVEL FILL - COMPACTED	550.00 CY	7,000	1,000	8,000
02-01.01.17	CHAIN LINK FENCE W/GATE - 6'	400.00 LF	5,000	1,000	6,000
02-01.01.18	UTILITIES		3,000	0	3,000
02-01.01.19	LANDSCAPING		4,000	0	4,000
02-01.01.20	TURF - TOPSOIL AND SEEDING	1100.00 SY	2,000	0	2,000
02-01.01.21	TRAFFIC CONTROL		45,000	5,000	50,000
02-01.01.23	(SAND BLANKET) PIPE BEDDING	10.00 CY	0	0	0
02-01.01.24	SCREENED GRAVEL BACKFILL		1,000	0	1,000
02-01.01.26	REMOVE 60" SEWER SLEEVE	45.00 LF	16,000	2,000	18,000
02-01.01.27	CONCRETE, MISC	856.00 CY	42,000	5,000	47,000
02-01.01.28	PAVEMENT REMOVAL	33.00 SY	2,000	0	3,000
02-01.01.29	SAW CUT PAVEMENT	75.00 LF	0	0	0
02-01.01.30	BITUMINOUS CONCRETE SWALE	75.00 LF	3,000	0	4,000
02-01.01.31	18" GRAVEL BASE	740.00 SY	5,000	1,000	5,000
02-01.01.32	METAL HANDRAIL	55.00 LF	2,000	0	2,000
02-01.01.33	COMPACTED RANDOM FILL	250.00 CY	1,000	0	1,000
02-01.01.34	COMPACTED GRAVEL BORROW	810.00 CY	17,000	2,000	19,000
02-01.01.35	GRAVEL BORROW	30.00 CY	1,000	0	1,000
02-01.01.36	30" HDPE PIPE IN SLEEVE	180.00 LF	13,000	2,000	15,000
	SITE WORK - MEDIAN OF I-295		563,000	68,000	631,000
02-01.02	PUMP STATION (FOR YEAR 2015)				
02-01.02.01	ARCHITECTURAL		470,000	56,000	527,000
02-01.02.02	MECHANICAL (2015)		582,000	70,000	651,000
02-01.02.03	ELECTRICAL		87,000	10,000	98,000
	PUMP STATION (FOR YEAR 2015)		1,139,000	137,000	1,276,000
02-01.03	ADDITIVE COST TO PS FOR YR 2045				
02-01.03.01	MECHANICAL (2045)		266,000	32,000	298,000
02-01.03.02	ELECTRICAL		3,000	0	3,000
	ADDITIVE COST TO PS FOR YR 2045		269,000	32,000	301,000
	Option A/B/C - WILBUR PUMP STA.		1,971,000	237,000	2,208,000

		QUANTY	UOM	CONTRACT	CONTINGN	TOTAL COST
02-05	Opt.D: W. CRANSTON TRUNK SEWERS					
02-05.01	BROOKDALE TRUNK SEWER (GRAVITY)					
02-05.01.01	TRAFFIC CONTROL	2065.00	LF	12,000	1,000	14,000
02-05.01.02	ENVIRONMENTAL PROTECTION	1035.00	LF	6,000	1,000	7,000
02-05.01.03	PROTECT/MODIFY EXT UTILITIES	2065.00	LF	7,000	1,000	8,000
02-05.01.04	CLEARING AND GRUBBING	0.70	ACR	3,000	0	3,000
02-05.01.05	CONTROL & DIVERSION OF WATER	23.00	DAY	21,000	3,000	24,000
02-05.01.06	PAVEMENT REMOVAL (3")	520.00	SY	2,000	0	3,000
02-05.01.07	EARTH SUPPORT SYSTEMS			188,000	23,000	211,000
02-05.01.08	EXCAVATION	3800.00	CY	48,000	6,000	54,000
02-05.01.09	ROCK EXCAVATION	190.00	CY	6,000	1,000	7,000
02-05.01.10	REINFORCED CONCRETE PIPE (24")	2065.00	LF	53,000	6,000	60,000
02-05.01.12	SANITARY SEWER MANHOLES	10.00	EA	23,000	3,000	26,000
02-05.01.13	BACKFILL MATERIAL	2000.00	CY	10,000	1,000	11,000
02-05.01.14	PIPE BEDDING (SANDY GRAVEL)	260.00	CY	4,000	0	4,000
02-05.01.15	GRAVEL BORROW (BACKFILL)	750.00	CY	16,000	2,000	17,000
02-05.01.16	COMPACTED GRAVEL BASE (18")	360.00	SY	2,000	0	2,000
02-05.01.17	TEMPORARY PAVEMENT (2")	440.00	SY	5,000	1,000	6,000
02-05.01.18	REMOVAL OF TEMPORARY PAVEMNENT	440.00	SY	2,000	0	3,000
02-05.01.19	SAW CUT PAVEMENT	1400.00	LF	3,000	0	4,000
02-05.01.20	TACK COAT	360.00	SF	0	0	0
02-05.01.21	1 1/2" BIT CONC SURFACE COURSE	42.90	TON	3,000	0	3,000
02-05.01.22	1 1/2" BIT CONC BINDER COURSE	42.90	TON	2,000	0	3,000
02-05.01.23	TURF - 6"	3700.00	SY	17,000	2,000	18,000
02-05.01.24	CONCRETE ENCASEMENT/CRADLE	9.00	CY	3,000	0	3,000
02-05.01.25	SITE PREPARATION			1,000	0	1,000
	BROOKDALE TRUNK SEWER (GRAVITY)	2065.00	LF	439,000	53,000	492,000

		QUANTY UOM	CONTRACT	CONTINGN	TOTAL COST
02-05.02	NATICK/PHENIX TRUNK SEWER				
02-05.02.01	TRAFFIC CONTROL		20,000	2,000	22,000
02-05.02.02	ENVIRONMENTAL PROTECTION	4000.00 LF	2,000	0	3,000
02-05.02.03	PROTECT/MODIFY EXT. UTILITIES	4655.00 LF	32,000	4,000	36,000
02-05.02.04	CLEARING AND GRUBBING	0.40 ACR	1,000	0	1,000
02-05.02.05	CONTROL/DIVERSION OF WATER	8.00 DAY	7,000	1,000	8,000
02-05.02.06	PAVEMENT REMOVAL (3")	2200.00 SY	10,000	1,000	11,000
02-05.02.07	EARTH SUPPORT SYSTEMS		73,000	9,000	82,000
02-05.02.08	EXCAVATION	7600.00 CY	98,000	12,000	109,000
02-05.02.09	ROCK EXCAVATION	740.00 CY	24,000	3,000	26,000
02-05.02.10	REINFORCED CONC PIPE - 18"	3910.00 LF	64,000	8,000	72,000
02-05.02.11	REINFORCED CONC PIPE - 12"	105.00 LF	2,000	0	2,000
02-05.02.12	SANITARY SEWER MANHOLES	30.00 EA	58,000	7,000	65,000
02-05.02.13	BACKFILL MATERIAL - RANDOM FILL	4200.00 CY	21,000	3,000	24,000
02-05.02.14	PIPE BEDDING - (SANDY GRAVEL)	480.00 CY	7,000	1,000	8,000
02-05.02.15	GRAVEL BACKFILL - BORROW	1600.00 CY	24,000	3,000	27,000
02-05.02.16	COMPACTED GRAVEL BASE - 18"	900.00 CY	11,000	1,000	12,000
02-05.02.17	TEMPORARY PAVEMENT (2")	2200.00 SY	26,000	3,000	29,000
02-05.02.18	REMOVAL OF TEMPORARY PAVEMENT	2200.00 SY	10,000	1,000	11,000
02-05.02.19	SAW CUT PAVEMENT	8000.00 LF	12,000	1,000	13,000
02-05.02.20	TACK COAT	2000.00 SF	0	0	0
02-05.02.21	1 1/2" BIT CONC SURFACE COURSE	2600.00 SY	15,000	2,000	17,000
02-05.02.22	1 1/2" BIT CONC BINDER COURSE	2600.00 SY	12,000	1,000	13,000
02-05.02.23	TURF - 6"	1900.00 SY	4,000	0	4,000
02-05.02.24	12" REIN CONC PIPE	640.00 LF	9,000	1,000	10,000
02-05.02.26	SITE PREPARATION	1.00 EA	4,000	0	4,000
	NATICK/PHENIX TRUNK SEWER	4655.00 LF	544,000	65,000	610,000

		QUANTY	UOM	CONTRACT	CONTINGN	TOTAL COST
02-05.03	COMSTOCK GRAVITY SEWER					
02-05.03.01	TRAFFIC CONTROL			49,000	6,000	55,000
02-05.03.02	ENVIRONMENTAL PROTECTION	4720.00	LF	3,000	0	4,000
02-05.03.03	PROTECT/MODIFY EXT UTILITIES	7120.00	LF	12,000	1,000	14,000
02-05.03.04	CLEARING AND GRUBBING	2.50	ACR	8,000	1,000	9,000
02-05.03.05	CONTROL & DIVERSION OF WATER	36.00	DAY	34,000	4,000	38,000
02-05.03.06	PAVEMENT REMOVAL (3")	5100.00	SY	23,000	3,000	26,000
02-05.03.07	EARTH SUPPORT SYSTEMS			774,000	93,000	867,000
02-05.03.08	EXCAVATION	27000	CY	374,000	45,000	419,000
02-05.03.09	ROCK EXCAVATION	7100.00	CY	227,000	27,000	254,000
02-05.03.10	REINFORCED CONC PIPE - 12"	1645.00	LF	22,000	3,000	25,000
02-05.03.11	REINFORCED CONC PIPE - 15"	3380.00	LF	51,000	6,000	57,000
02-05.03.12	REINFORCED CONC PIPE - 24"	4295.00	LF	124,000	15,000	139,000
02-05.03.13	SANITARY SEWER MANHOLES	63.00	EA	104,000	12,000	116,000
02-05.03.14	BACKFILL MATERIAL	16000	CY	81,000	10,000	90,000
02-05.03.15	PIPE BEDDING - SANDY GRAVEL	1400.00	CY	21,000	3,000	23,000
02-05.03.16	GRAVEL BACKFILL - BORROW	4400.00	CY	66,000	8,000	74,000
02-05.03.17	COMPACTED GRAVEL BASE - 18"	5100.00	SY	32,000	4,000	35,000
02-05.03.18	TEMPORARY PAVEMENT (2")	6100.00	SY	71,000	9,000	80,000
02-05.03.19	REMOVAL OF TEMPORARY PAVEMENT	6100.00	SY	27,000	3,000	31,000
02-05.03.20	SAW CUT PAVEMENT	18000	LF	26,000	3,000	29,000
02-05.03.21	TACK COAT	4500.00	SF	0	0	0
02-05.03.22	1 1/2" BIT CONC SURFACE COURSE	7100.00	SY	45,000	5,000	50,000
02-05.03.23	1 1/2" BIT CONC BINDER COURSE	7100.00	SY	34,000	4,000	38,000
02-05.03.24	TURF - 6"	12000	SY	19,000	2,000	21,000
02-05.03.25	18" R.C.Concrete Pipe	4840.00	LF	100,000	12,000	112,000
02-05.03.26	SEWER DROP MANHOLES	15.00	EA	51,000	6,000	58,000
02-05.03.27	SITE PREPARATION	1.00	EA	12,000	1,000	13,000
	COMSTOCK GRAVITY SEWER	14160	FT	2,389,000	287,000	2,675,000

** PROJECT OWNER SUMMARY - LEVEL 4 (Rounded to 1000's) **

		QUANTY	UOM	CONTRACT	CONTINGN	TOTAL COST
02-05.04	TILCON GRAVITY SEWER					
02-05.04.01	TRAFFIC CONTROL			14,000	2,000	15,000
02-05.04.02	ENVIRONMENTAL PROTECTION	2595.00	LF	6,000	1,000	7,000
02-05.04.03	PROTECT/MODIFY EXT UTILITIES	2595.00	LF	5,000	1,000	5,000
02-05.04.04	CLEARING AND GRUBBING	0.20	ACR	1,000	0	1,000
02-05.04.05	CONTROL & DIVERSION OF WATER	20.00	DAY	19,000	2,000	21,000
02-05.04.06	PAVEMENT REMOVAL (3")	1600.00	SY	7,000	1,000	8,000
02-05.04.07	EARTH SUPPORT SYSTEMS			201,000	24,000	225,000
02-05.04.08	EXCAVATION	5500.00	CY	53,000	6,000	60,000
02-05.04.09	ROCK EXCAVATION	280.00	CY	9,000	1,000	10,000
02-05.04.10	18" REINFORCED CONCRETE PIPE	1470.00	LF	27,000	3,000	30,000
02-05.04.11	24" REINFORCED CONC PIPE	1125.00	LF	32,000	4,000	36,000
02-05.04.13	SANITARY SEWER MANHOLES	12.00	EA	21,000	3,000	24,000
02-05.04.14	BACKFILL MATERIAL - RANDOM FILL	4900.00	CY	25,000	3,000	28,000
02-05.04.15	PIPE BEDDING - (SAND BLANKET)	290.00	CY	4,000	1,000	5,000
02-05.04.16	GRAVEL BACKFILL	860.00	CY	18,000	2,000	20,000
02-05.04.17	COMPACTED GRAVEL BASE - 18"	540.00	SY	3,000	0	4,000
02-05.04.18	TEMPORARY PAVEMENT (2")	1300.00	SY	15,000	2,000	17,000
02-05.04.19	REMOVAL OF TEMPORARY PAVEMENT	1300.00	SY	7,000	1,000	7,000
02-05.04.20	SAW CUT PAVEMENT	4600.00	LF	8,000	1,000	9,000
02-05.04.21	TACK COAT	133.33	SY	0	0	0
02-05.04.22	1 1/2" BIT CONC SURFACE COURSE	1600.00	SY	10,000	1,000	11,000
02-05.04.23	1 1/2" BIT CONC BINDER COURSE	1600.00	SY	7,000	1,000	8,000
02-05.04.24	TURF - 6"	700.00	SY	5,000	1,000	6,000
02-05.04.25	SITE PREPARATION			1,000	0	1,000
02-05.04.26	CONCRETE ENCASEMENT/CRADLE	24.00	CY	7,000	1,000	8,000
	TILCON GRAVITY SEWER	2595.00	LF	505,000	61,000	565,000

ATTACHMENT II

PERTINENT CORRESPONDENCE
(Additional pertinent Correspondence is included in the Environmental Assessment Document)

DEPARTMENT OF THE ARMY
OFFICE OF THE SECRETARY OF THE ARMY
WASHINGTON, DC 20310-0101

REPLY TO
ATTENTION OF

11 OCT 1991

Honorable John H. Chafee
United States Senate
Washington, D. C. 20510

Dear Senator Chafee:

Pursuant to our conversation, I directed the Chief of Engineers to provide funds to the New England Division to prepare a Feasibility Study Cost Sharing Agreement for the Cranston, Rhode Island, study funded in the Energy and Water Development Appropriations Act of 1992. As you stated, the Cranston study was authorized in the Water Resources Development Act of 1990.

While these study funds have been released, I must point out that budgetary constraints require the Corps to limit its efforts to the high-priority functions of commercial navigation, flood damage prevention, shore protection projects, and environmental restoration related to Corps projects.

Therefore, in order not to mislead the potential sponsor as to the Department of the Army's commitment to the study and construction of any project identified in the study, the Corps will include a provision in the Feasibility Cost Sharing Agreement that will limit Army's participation. In general, the provision will state that it does not anticipate that the feasibility study will identify any solution in which construction would be budgeted and that the extent of Federal participation will be limited to the amount provided by Congress.

I appreciate your interest in this study and hope that it will be a productive effort.

Sincerely,

Nancy P. Dorn
Assistant Secretary of the Army
(Civil Works)

10.18.91 01:46 PM P02

UNITED STATES SENATE
WASHINGTON, D C.

JOHN H. CHAFEE
RHODE ISLAND

October 23, 1991

The Honorable Nancy P. Dorn
Assistant Secretary of the Army (Civil Works)
Room 2E570 The Pentagon
Washington, DC 20310-0108

Dear Nancy:

Thank you for your attention to my request regarding funding for the Cranston, Rhode Island study included in the Energy and Water Development Appropriations Act of 1992. I appreciate your speedy response.

As you know, the Corps funded a reconnaissance study of the Cranston project through the Planning Assistance to States Program last year. The current funding will assure that the project remains on track. Nonetheless, I was dismayed to learn that you would require a provision in the Feasibility Cost Sharing Agreement that will limit the Army's future participation. The local sponsor is well aware of the Department's attitude toward the project. I certainly hope that language can be omitted from the final agreement.

Again, thank you for your personal assistance.

Sincerely yours,

John

John H. Chafee

Many thanks!

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Administration
DIVISION OF PLANNING
One Capitol Hill
Providence, RI 02908-5870

January 21, 1993

Rec'd ltr 1-26-93

Mr. Joseph L. Ignazio
Director of Planning
New England Division
Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

Dear Joe:

This will confirm my telephone conversation yesterday with Barbara Blumeris. Bob Griffith, Chief of Strategic Planning, will be our contact person on the plan for the Howard Reservation and for your feasibility study of wastewater management options in Cranston and Johnston. He can be reached at the letterhead address or by telephone: (401) 277-1220.

The review draft of Phase I of the Master Plan for Howard Center will be completed in the next few days. It should provide some useful information for your study.

Yours very truly,

Daniel W. Varin
Associate Director

DWV:cac

cc: R. Griffith

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203-2211

February 3, 1993

Brink P. Miller
Colonel, Corps of Engineers
Division Engineer
New England Division
Corps of Engineers
424 Trapelo Rd.
Waltham, MA 02254-9149

Re: Cranston, RI Feasibility Study

BFM

Dear Colonel Miller:

Thank you for your letter of January 15, 1993, regarding the Cranston, RI Wastewater Management Feasibility Study.

Mr. Gerald C. Potamis of our Water Management Division will continue to be the main point of contact for this project. You are also encouraged to contact Mr. Richard Boynton, Chief of the RI Superfund Section directly on all matters dealing with Superfund. I believe that Ms. Barbara Blumeris, the Corps project manager, has already contacted Mr. Boynton to set up the meeting requested in your letter.

In addition, I recommend that you contact Ms. Alice Goode, Chief of Water Resources, RI Department of Environmental Management (DEM). The State of Rhode Island has been delegated responsibility by EPA for the National Pollutant Discharge Elimination System Permit Program and the Federal Industrial Pretreatment Program. In addition, the State of Rhode Island has primary responsibility for administering funding under the Construction Grants and State Revolving Fund Programs of the Clean Water Act. Therefore, RIDEM would be the primary permitting agency for the regional connector system being studied.

Sincerely,

Paul Keough

Paul G. Keough
Acting Regional Administrator

cc: Louise Durfee, Director, RIDEM
Alicia Goode, RIDEM

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STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Environmental Management
DIVISION OF WATER RESOURCES
291 Promenade Street
Providence, R.I. 02908 - 5767
(401) 277-3961

February 16, 1993

Mr. Joseph L. Ignazio
Director of Planning
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

Dear Mr. Ignazio:

The Department of Environmental Management, Division of Water Resources (DEM) thanks you for the notification provided in your letter to Louise Durfee dated January 14, 1993. As indicated in your letter, the U.S. Army Corps of Engineers and the City of Cranston have initiated a feasibility study to consider options for transporting wastewater from several sites in Cranston and Johnston to Cranston's Wastewater Treatment facility.

DEM appreciates the opportunity to participate in the progress meetings that are being planned. I'd like to designate Mr. Warren Towne, a Supervising Sanitary Engineer on my staff, as the point of contact for this study. Please notify him of the dates and times for future progress meetings.

Please note the following comments and observations based on the brief description provided in your letter.

1) Portions of some options for transporting wastewater from the sites mentioned may have already been constructed. This includes approved sewers connecting the Solid Waste Management Corporation Landfill leachate collection system to Cranston's sewer system. Any existing facilities should be clearly indicated in the study report.

2) The Corps should also be aware that the City of Cranston has recently completed a draft Wastewater Facilities Plan Update which is eligible to be funded in part by a grant from the Pawtuxet River Water Quality Bond Fund. It is the intent that this update also meet all requirements of the State Revolving Loan Fund Program (SRF) so that the City qualifies for future funding from any State or Federal assistance programs. Please be aware that the feasibility study should also meet all requirements of the SRF program so that funding for subsequent phases can be provided from all possible sources.

3) Please be aware that there may be issues concerning pretreatment of wastewater that will need to be addressed, since some of the sites being considered are industrial in nature and are outside Cranston's municipal boundaries. For instance, any tie-in of Johnston's facilities would require a major modification to the approved pretreatment program.

Again, thank you for the notification you provided and we look forward to working with the Army Corps of Engineers on this study.

Sincerely,

Alicia M. Good

Alicia M. Good, P.E., Chief
Division of Water Resources

AMG/WMT/alm

cc: Louise Durfee, Director, DEM
Warren M. Towne, DEM
M. Peter Alviti, Director of Public Works, Cranston

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203-2211

April 1, 1993

Ms. Barbara Blumeris
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254-9149

Dear Ms. Blumeris:

The Wastewater Management Branch of EPA, Region I, has completed it's review of the feasibility study assessing the need for expansion of the Cranston wastewater collection system located in Cranston, Rhode Island, per your request.

The Compliance and Water Quality Branches of the Water Management Division have also reviewed the Study to determine their program's authority over it. Each branch has concluded that this project, given it's current status, does not require our further consideration.

The Wastewater Management Branch administers the National Pollutant Discharge Elimination System (NPDES) program. The purpose of the NPDES program is to regulate discharges to waters of the United States. Your request is for review of a feasibility study for expansion of a wastewater collection system, the Program has no authority over this study, therefore, this Branch does not see any further need to review or comment on it.

In addition, since Rhode Island is a delegated state, it is the NPDES permitting authority, any requests for potential discharge permits should be made to them. The Wastewater Management Branch only oversees the State program.

Should you have any further questions regarding this matter, please feel free to contact me at 617-565-3588.

Sincerely,

Sharon M. Leitch
Environmental Engineer

cc: G. Potamis, Chief, Wastewater Management Section
R. Boynton, Chief, Rhode Island Superfund Section

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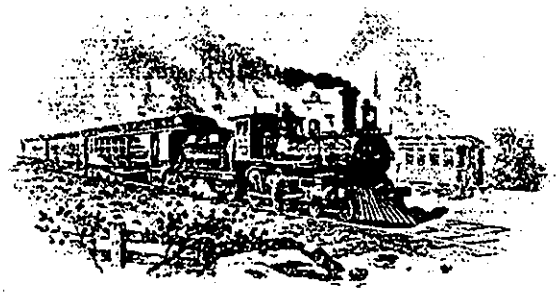

FOUNDED 1844

July 13, 1993

Mr. Joseph L. Ignazio
Director of Planning
Department of The Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

Dear Mr. Ignazio:

With regards to your letter dated July 7, 1993, concerning the feasibility of obtaining a sewer easement over a portion of land in Cranston, Rhode Island known as the Pontiac Branch, the Providence and Worcester Railroad Company would be happy to negotiate a sewer easement for the project.

Please contact me so that we may discuss this matter further.

Very truly yours,

Ronald P. Chrzanowski

Ronald P. Chrzanowski
Vice President Real Estate
and Engineering

RPC:jsb
79318

PROVIDENCE AND WORCESTER RAILROAD COMPANY
75 HAMMOND STREET, WORCESTER, MA 01610 P.O. BOX 1188, WORCESTER, MA 01601
TELEPHONE (508) 755-4000

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

HISTORICAL PRESERVATION COMMISSION
Old State House
150 Benefit Street
Providence, Rhode Island 02903
401-277-2678 • FAX 401-277-2968 • TDD 401-277-3700

July 28, 1993

Mr. Marcos Paiva
Planning Directorate
Impact Analysis Division
New England Division
U. S. Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

Re: Sewer Interceptor Project
Cranston

Dear Mr. Paiva:

The Rhode Island Historical Preservation Commission has received and reviewed the information you have provided our staff on the above-referenced project.

The Cranston Sewer Interceptor Project includes several locations that are potentially sensitive for archaeological resources. They include the Furnace Brook and the Howard Center areas. Due to the recent development in the former area and the potential for previous disturbance at Howard, it is our conclusion that an archaeologist should conduct a disturbance assessment along these two and any other sections of proposed sewer lines that pass through presently undeveloped lands. A scope of work for this type of archaeological assessment is enclosed for your information.

These comments are provided in accordance with Section 106 of the National Historic Preservation Act.

Very truly yours,

Richard E. Greenwood
Project Review Coordinator

Enclosure

(3:90)

PRESERVATION 1968 25 1993 PROGRESS

Scope of Work

Archeological Assessment Studies

for Dot "3R" Projects and Similar Undertakings

Many "3R" highway projects generally involve small-scale construction activities such as pavement recycling, installing new curbing or sidewalks, repairing or installing new drainage facilities, and road widening within the state highway right-of-way line. Other similar undertakings include the installation of utility lines, or larger projects within areas with a high potential for previous disturbance. It may be expected that some of these activities will take place within previously disturbed soils while others will take place within undisturbed soils. These undisturbed areas may contain important archaeological resources.

The objectives of an assessment study are to determine if impact areas are undisturbed and whether archaeological material are present or absent. The following scope of work is recommended to achieve these objectives:

1. Conduct a background study of the project area, including, but not limited to, a check of the historical and archaeological property files at the Rhode Island Historical Preservation Commission, town and local histories, historic maps and soil maps.

2. Conduct a windshield survey and walkover to determine the extent of land modification and the presence of surface features such as historic foundations.

3. Conduct limited subsurface testing (soil auger or shovel) as indicated by the windshield/walkover survey to evaluate the extent of land modification and soil disturbance.

4. If soils are undisturbed, conduct limited shovel test pit testing to determine the presence or absence of archaeological materials.

5. Prepare a short memorandum that contains the engineering map of impact areas, a description of soil conditions or other justification of decision to conduct subsurface testing, a description of any archaeological materials recovered, and recommendations for additional investigation, if necessary.

6. Supervisory personnel must be well acquainted with the historic and prehistoric archaeology of Rhode Island and must meet the professional qualifications set by the National Park Service (36 CFR) 66, appendix C).

7. A permit from the Rhode Island Historical Preservation Commission is required.

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

HISTORICAL PRESERVATION COMMISSION
Old State House
150 Benefit Street
Providence, Rhode Island 02903
401-277-2678 • FAX 401-277-2968 • TDD 401-277-3700

December 22, 1993

Mr. Joseph Ignazio
Director of Planning
New England Division
U. S. Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

Re: Feasibility Study, Wastewater Conveyance System
Cranston

Dear Mr. Ignazio,

The Rhode Island Historical Preservation Commission staff has reviewed the information you provided on the above-referenced project in your letter of December 7, 1993. We find that the summary of cultural resource issues prepared by Marc Paiva is essentially correct in its assessment of the historic and cultural resources affected by the different alternatives. We do wish to bring to your attention that the Nathan Westcott House, Joy Homestead, Sheldon House, Potter-Remington House and Oak Lawn Village Historic District have all been listed on the National Register of Historic Places.

We concur that Phase I archaeological testing is warranted in the nine areas identified in the assessment where ground disturbance would occur outside of existing roadways in environmentally sensitive areas. In the case of the Wilbur Road pump station, the assessment correctly notes the need to design the structure so that it does not intrude on the setting of the Oak Lawn National Register Historic District. The scale, roof and building forms, door and window pattern, exterior materials and siting should all be selected to harmonize with the setting. Materials such as clapboards for the wall surfaces, a gable or hip roof, and a siting plan that positions the building so that it does not disturb the rhythm of the other elements of the streetscape. If fencing is required, then landscape treatment may be needed as well. As the Oak Lawn District is covered by a local historic district ordinance, we will need to coordinate the station design with the Cranston Historic District Commission.

PRESERVATION 1968 25 1993 PROGRESS

These comments are provided in accordance with Section 106 of the National Historic Preservation Act. If you have any questions or comments, please contact Richard E. Greenwood, Project Review Coordinator for this office.

Very truly yours,

Edward F. Sanderson
Executive Director
Deputy State Historic
Preservation Officer

cc: Lynn Furney, Cranston Planning Dept.

Z75

RIDOT

Rhode Island Department of Transportation

Division of Maintenance
90 Calverley Street
Providence, R.I. 02908
(401) 277-2378
(401) 277-2963 - Fax

STATE OF
RHODE ISLAND
AND PROVIDENCE
PLANTATIONS

December 27, 1993

Mr. Joseph L. Ignazio
Director of Planning
Department of the Army
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254-9149

Dear Mr. Ignazio:

In response to your letter of October 19, 1993, the Rhode Island Department of Transportation has reviewed the feasibility of installing a wastewater pumping station in the area of I-295 at Wilbur Avenue, Cranston. It appears that the median location is better suited to your needs and will not adversely affect the operations of the Department of Transportation. If you are to proceed with your project, the following conditions must be met.

1. Access to the property must be via Wilbur Avenue, you will not be permitted to access the property from the interstate.

2. Final siting must be approved by the department. An easement must be received from the department prior to siting any structure on the freeway right-of-way.

3. If rock removal is required, the method must be approved by the department prior to construction.

Early coordination of this proposal with the department should minimize delays and avert potential problems.

Very truly yours,

Thomas E. Jackyony, Jr.
Assistant Director

TEJ/JN/dd

cc: James R. Capaldi
Edmund T. Parker
John D. Nickelson
File

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Environmental Management
DIVISION OF WATER RESOURCES
291 Promenade Street
Providence, R.I. 02908 - 5767
(401) 277-3961

March 21, 1994

Ms. Barbara Blumeris
Department of the Army
New England Division, Corps of Engineers
Planning Directorate, Impact Analysis Division
424 Trapelo Road
Waltham, MA 02254-9149

RE: Wastewater Conveyance Feasibility Study
Cranston, Rhode Island

Dear Ms. Blumeris:

The Rhode Island Department of Environmental Management (RIDEM) would like to thank you for inviting representatives of this office to the Technical Briefing held March 1, 1994 on the above referenced project. The briefing was very informative and answered many questions this office had regarding the objectives of the Study.

I would like to take this opportunity to reiterate RIDEM's concerns raised at the briefing regarding the recommended conveyance facilities in Western Cranston. The use of variable grade sewers (VGS) to convey wastewater flows from Western Cranston has been widely recommended in the Study (Options 1B, 1C and 2C). RIDEM's concerns lie primarily with operation and maintenance of these systems and the potential for the deposition of solids and generation of odors, especially in the initial years of service when the flows conveyed are only a fraction of the ultimate design flow. As I mentioned at the briefing, RIDEM strongly recommends that the ACOE address the issues of hydraulics, minimum velocities, solids settling, and odor generation potential in these VGS systems, as part of the preliminary design that will be done for this study. This office has been unable to obtain data on the use of large diameter VGS's for conveying wastewater flows other than those systems where the VGS's convey septic tank effluent. In this case, there are little or no solids being conveyed through the system, thus the concerns of solids settling, adequate cleansing velocities and resulting odor problems are minimized. A 14" VGS in Plainfield Pike (Study Option 1B) is already constructed but, to our knowledge, has not been utilized to date. Therefore, no operational data exists on this type of system. At the present time, the flows from the Hope Highland Elementary School in Western Cranston are pumped from an on-site septic tank via a small diameter (3") VGS to the existing system. We are not aware of any operational, maintenance or odor problems associated with that system.

This office also offers the following comments on the information contained in the briefing handout:

- Refer to Page 2, last paragraph under IDENTIFICATION OF WASTEWATER FLOWS:

  We note that the ACOE will consider phasing conveyance components based on projected year 2015 wastewater flows, but that the hydraulic design will be based on build-out conditions (year 2045 flows).

  However, based on the CCP, sewer service will only be provided, in general, for areas in the western portion of Cranston where required to eliminate problems with faulty septic systems. RIDEM suggests that the hydraulic design be based on current and year 2015 needs initially while making provisions for the future flows that could develop from failures of ISDS systems, if and when that need arises.

- Refer to Page 7, Table 3:

  Table 3 indicates the siphon to be two (2) barrels with diameters of 16" and 27", respectively, and a design capacity of 20,700 gpm. The projected peak flow for 2015 to be conveyed to the siphon is indicated to be 10,444 gpm. Does each barrel, especially the 16", have the capacity to convey the estimated years 2015 and/or 2045 average daily flows? Is the design capacity reported in this Table a total capacity for both barrels? RIDEM, as well as best engineering practices, requires that siphons be designed with a minimum of two (2) barrels and that each should be sized to handle the average daily flow should one (1) barrel experience a blockage or be taken out of service. Please explain whether the capacity of the existing siphon structure will need to be analyzed as part of the Feasibility Study.

In conclusion, while RIDEM has no objection to the use of VGS systems, in general, as a means of conveying wastewater flows, we are concerned that there is insufficient information available to determine if these systems can perform in the applications for which they are proposed in Western Cranston, particularly for the low flows that will result from the initial phases of the project. If the ACOE can provide this office with any literature or case studies or know of any other municipalities around the country who utilize these large diameter VGS systems in similar applications, then please let us know where we can obtain this information.

We look forward to working with the ACOE and the City as the Feasibility Study nears completion and in subsequent design and construction phases. If you have any questions, please feel free to call me at (401) 277-3961.

Sincerely,

Warren M. Towne, P.E.
Supervising Sanitary Engineer

WMT/AZ/alm

cc: Peter Alviti, Cranston DPW
Alicia Good, RIDEM

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

HISTORICAL PRESERVATION COMMISSION
Old State House
150 Benefit Street
Providence, Rhode Island 02903
401-277-2678 • FAX 401-277-2968 • TDD 401-277-3700

June 6, 1994

Mr. Joseph L Ignazio
Director of Planning
Impact Analysis Division
New England Division
U. S. Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

Re: Wilbur Avenue Pump Station Design
Wastewater Conveyance System Study
Cranston

Dear Mr. Ignazio:

The Rhode Island Historical Preservation Commission staff has reviewed the information you have provided in your letter of May 12, 1994 on the proposed design and setting of the Wilbur Avenue pump station. We note that the pump station has been relocated to a site in the median of the Route I-295 overpass. The plan indicates that the station itself will stand outside of the Oaklawn Village National Register Historic District, although it appears that the station and fencing will still have a visual effect on the district.

Therefore, an appropriate landscape screen and a visually compatible exterior of the station should be incorporated into the design, as you note, to insure that the visual effect is not adverse. We are presently consulting with the Cranston Historic District Commission regarding the details appropriate for the station design. We should be able to report on the results of that consultation after the Commission's meeting on June 14.

These comments are provided in accordance with Section 106 of the National Historic Preservation Act. If you have any questions or comments, please contact Richard E. Greenwood, Project Review Coordinator for this office.

Very truly yours,

Edward F. Sanderson
Executive Director
Deputy State Historic
Preservation Officer

cc: Lynn Furney, Cranston Planning Dept.

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Rhode Island Department of Transportation
Program Support
Real Estate
Two Capitol Hill, RM 317
Providence, RI 02903 - 1124
PHONE 401 - 277 - 2411; FAX 401 - 277 - 6038; TDD 401 - 277 - 4971

July 13, 1994

Mr. Joseph L. Ignazio
Director of Planning
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9139

Dear Mr. Ignazio:

SUBJECT: Easements Required for Installation of Pump Station
Wilbur Avenue, Cranston

Please be advised that formal easements will be required for the installation of a pumping station on R.I.D.O.T. property off Wilbur Avenue in the City of Cranston.

The easement documents and compensation will be required prior to any work being performed. It is necessary to know who will be the legal party named in and executing these agreements. Final approval will be subject to the Federal Highway Administration and the State Properties Committee.

Enclosed are the general map and utility plan of the area in question. Please have the proposed profiles that you submitted super-imposed with a scale so that our appraisal staff can accurately calculate the costs of these easements.

Should you have any questions in this regard please contact Ms. Louise Coppola of my staff at your convenience.

Sincerely,

William J. McCarthy (L)

William J. McCarthy
(ACTING) Assistant Director

PTC:lc

Enclosures

Certified Mail/Return Receipt Requested

cc: John Nicholson, Thomas Jackvony, David Sasso, Paul Carcieri, File

Town Hall, 1886

Historic District Commission

Michael A. Traficante
Mayor

City Hall, Cranston, Rhode Island 02910

City Hall, 1937

Dennis P. Albert
Chairman
Robert M. Drew
Vice Chairman
Michael E. Bell
Lynn M. Furney
Joanne P. Gregory
Angela P. Regine
Martha G. Werenfels

July 19, 1994

Mark Paiva
Impact Analysis Division
New England Division
U.S. Army Corps of Engineers
424 Trapelo Road - Bldg. 113 North
Waltham, MA 02254-9149

Dear Mr. Paiva,

Enclosed is a copy of the minutes from the June 14, 1994 meeting of the Cranston Historic District Commission.

I have highlighted on the second and third pages, the portion of the meeting which addressed the proposed pump station to be constructed on Wilbur Avenue in the median strip between the north and southbound lanes of Route 295.

I have also forwarded a copy of the minutes to Mr. Richard Greenwood at the Rhode Island Historical Preservation Commission.

The Cranston Historic District Commission has requested that they be kept informed of the plans as they are developed further.

Sincerely,

Lynn M. Furney

Lynn M. Furney
Associate City Planner

LMF:td
Enclosure

Historic District Commission

Michael A. Traficante
Mayor

City Hall, Cranston, Rhode Island 02910

Town Hall, 1886

City Hall, 1937

Dennis P. Albert
Chairman
Robert M. Drew
Vice Chairman
Michael E. Bell
Lynn M. Furney
Joanne P. Gregory
Angela P. Regine
Martha G. Werenfels

MINUTES

June 14, 1994

Commissioners present were Robert Drew, Michael Bell, Martha Werenfels, Angela Regine, Dennis Albert, Katharine Smith, Robert Lynch and CLG designee, Lynn Furney.

The meeting was held in the Committee Room, 2nd floor, City Hall.

Chairman Bell called the meeting to order at 8:08 p.m.

Chairman Bell introduced the newly appointed member, Robert Lynch, and welcomed him to the Commission. Mr. Bell had received a letter from Mayor Traficante in May, announcing Mr. Lynch's appointment to the Commission. The other members extended their salutations as well.

Ms. Furney gave each commissioner a copy of the amended minutes for the April 1994 meeting. After reading them, Martha Werenfels made a motion to accept the amended minutes. Dennis Albert seconded the motion which carried unanimously.

Mr. Bell then asked if there were any corrections/additions to the May 10, 1994 minutes which were mailed to each member. There being none, Martha Werenfels made the motion to accept the minutes as written. Robert Drew seconded the motion, which carried unanimously.

Mr. Bell opened the hearing for a Certificate of Appropriateness for a fence at 239 Wilbur Ave., in the Oaklawn Village Local Historic District. The property is owned by Lance Gershenoff and Katharine Smith (Commission member).

Mrs. Smith presented the application and presented photographs of the property. She explained that there is an existing farm/field fence in the rear of the property along part of the property line. The plan is to continue the

fence along the rest of the rear property line as well as along the westerly property line south to the garage. This will enclose her rear yard to contain small farm animals which she currently owns. The fence will consist of square wooden posts and wire, and not be visible from the front of the property.

The application also requested a Certificate of Appropriateness for a low wooden picket fence, to be placed along the front property line, starting at the driveway. The fence will have a gate opening with box posts for the walkway to the front door.

The Commissioners asked Mrs. Smith some questions, including the height of the wooden picket fence. She said it would not be any higher than 4 feet, and would conform with zoning regulations.

The Commissioners agreed that the application met Standard #9 of the Secretary of the Interiors Standards for Rehabilitation.

There being no other questions, the Chairman called for a motion. At this point, Kate Smith recused herself from all further discussion and vote on the application.

A motion was made by Martha Werenfels, seconded by Dennis Albert, to grant a Certificate of Appropriateness for a new 3-4 foot wooden picket fence to be installed along the front property line at 239 Wilbur Ave., as well as new field fencing to be installed along the rear and side property line.
Also voting in favor, Robert Lynch, Robert Drew and Angela Regine.

Mrs. Furney told the Commissioners that she had been contacted by Marc Paiva, Project Archaelogist of the U.S. Army Corps of Engineers, about a proposed Pump Station that is going to be built on the median between the north and southbound lanes of Route 295, on the northerly side of Wilbur Ave.

In a letter to Edward Sanderson at RIHPC, the Army Corps indicated that the design of the building will be such, that it does not intrude upon the integrity and setting of the Oaklawn Village District.

Preliminary plans submitted to RIHPC proposed a flat roofed structure as opposed to a peaked roof which would be visible from the highway (Route 295). If required, the building construction will include materials such as clapboards for the wall surfaces. A chain link fence will be situated around the structure with appropriate landscape treatments.

Ms. Furney spoke to Richard Greenwood, Project Review Coordinator at the Rhode Island Historic Preservation Commission.
She said that since Cranston's Historic District Commission had not seen any plans for the pump station, she asked Mr. Greenwood if he would forward all the information he had received to date from the Army Corps to the Planning Department, so that the Commission could discuss the plans at their next meeting on June 14, 1994.

Ms. Furney showed the Commission what Mr. Greenwood had sent to her. The plans were very vague, but did show the proposed lacation of the building between the north and south bound lanes of Route 295, and set back about 50' from the sidewalk on Wilbur Ave. The building would be enclosed by a 6 foot chain link fence.

There were no elevations of the building itself, but there was a profile drawing of the highway and building. According to the drawing, the proposed height of the flat roofed pump station would be about 20 feet above ground level.

Ms. Furney asked the Commissioners to put together some recommendations to be incorporated into the design of the pump station, and she would send a letter to the Army Corps, outlining those requests.

After much discussion, Robert Drew made a motion to include the following recommendations to the Army Corps:

1. The exterior of the building is to be wood shingles or clapboard, and to have an opaque stain or be painted.
2. The building is to resemble a shed or outbuilding.
3. The pitch of the roof is to be comparable with older district structures and be either gable or gambrel.
4. A tight evergreen screen (Hemlock) be installed along the chain link fence which parallels Wilbur Ave.
5. A set of building elevations be sent to the Historic District Commission for their review and approval.

Robert Lynch seconded the motion, which carried unanimously.

Kate Smith informed the Commission that during an evening walk through her neighborhood, she noticed an addition being constructed at 11 Warren Ave. She said she assumed it was not within the Local Historic District, since the Commission did not hear an application for a Certificate of Appropriateness for the addition. Ms. Furney told the Commissioners that the property was in the District, as well as a second priority structure. Her only explanation was that maybe the addition was built without a building permit. She said she would check into it and report next month.

Under old business, Ms. Furney told the Commissioners that she had contacted the Ethics Commission. She said the reason that no Ethics forms were sent to the Commissioners was that the Ethics Commission thought that all of the Historic District Commissioner's terms had expired. Ms. Furney told her the Commission was still an active board. The woman said she would send out forms to everyone, and thank-you for informing the Commission. Mrs. Regine said she had already received the form (and so have the remaining Commissioners).

Oaklawn Church. Martha Werenfels reported that she had attended a meeting of the Oaklawn Church Building Committee. They had contacted her & requested that she attend. There were 5 members present. She said they told her they had heard all of the pros for vinyl siding, but none of the cons. She made a presentation with her slide show, which depicted Pawtuxet Baptist Church being vinyl sided, and the irreversible damage that was done.

She didn't know if her presentation had any impact, since the members had already voted to vinyl side prior to this meeting.

Robert Drew said he would call Jim Ellison (the moderator) and talk to him about reconsidering.

Historic Curriculum. Angela Regine said she had spoken to Katharine Ciarlo about our involvement in the curriculum development including local history.

Ms. Ciarlo said she would need a list of areas and structures to be studied, as well as sources for information, speakers we would provide, etc. The studies will be presented in grades K thru 4.

Kate Smith volunteered to be on a committee with Angela to put some of the requirements together. Ms. Furney said she would supply Kate with a map of Cranston which shows all of the schools in Cranston, and outlines their various districts.

Mrs. Regine said she had spoken with Brook DeMerchant once again, and invited him to attend the next Commission meeting, and to bring materials he has on his "Hope Cottage" on Hope Road. Ms. Furney said she would contact him to attend the August meeting, since there will be no July meeting.

The next meeting will be August 9, 1994.

There being no other business, the meeting adjourned at 10:05 p.m.

Respectfully submitted,

Lynn Furney

Lynn Furney
Secretary

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203-2211

March 23, 1995

Mr. Joseph L. Ignazio
Director of Planning
U.S. Army Corps of Engineers
New England Division
424 Trapelo Road
Waltham, MA 02254-9149

Subj: Comments to US Army Corps of Engineers Report, Wastewater Conveyance Feasibility Investigation, Cranston, RI

Dear Mr. Ignazio:

The following are the Rhode Island Superfund Section's comments to the subject Corps of Engineers Report. These comments are in response to your March 15, 1995 letter to me. Our permits program will defer to comments from the Rhode Island Department of Environmental Management (RIDEM).

1. *Executive Summary, page ii* - First paragraph, second sentence, Johnston is a Town not a City.

2. *Volume 1, page 6* - Last paragraph, delete the first sentence and replace it with the following: The Rhode Island Solid Waste Management Corporation has also conducted a Remedial Investigation and Feasibility Study Report under EPA direction and oversight for the Central Landfill Superfund Site in Johnston, Rhode Island.

3. *Volume 1, page 25, 26* - Delete the last sentence starting at the bottom of page 25 and continuing on page 26 and replace it with the following: Groundwater contamination at the site as a result of past waste disposal practices in the Phase I area are being addressed in Superfund investigations being conducted by the Rhode Island Solid Waste Management Corporation under EPA direction and oversight.

4. *Volume 1, page 26* - delete item 6. and replace it with the following: 6. Preventing access.

PRINTED ON RECYCLED PAPER

5. ***Volume 1, Page 30, Table 2*** - Its not clear what is meant by "without Johnston" and "with Johnston". Are you talking about the Town of Johnston or some site in Johnston other than the Central Landfill Site.

Thank you for the opportunity to offer our comments. If you have any questions concerning these comments, please contact Mr. James Brown of my staff at (617) 573-5779.

Sincerely,

Richard C. Boynton

Richard C. Boynton, Chief
Rhode Island Superfund Section

cc: Gerald Potamis, Chief, EPA Wastewater Management Section
Jim Brown, EPA, RI Superfund Section

c:\wp\data\central\inhouse\usace.com

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Environmental Management
OFFICE OF ENVIRONMENTAL COORDINATION
83 Park Street
Providence, RI 02903-1037
(401) 277-3434
FAX (401) 277-2591
TDD (401) 831-5508

April 14, 1995

Mr. Joseph L. Ignazio, Director
Planning Directorate
Building 114
US Army Corps of Engineers, New England Division
424 Trapelo Road
Waltham, Massachusetts 02254-9149

Subject: "Wastewater Conveyance Feasibility Investigation, Cranston, RI."

Dear Mr. Ignazio:

Thank you for the opportunity to review the above-referenced environmental study. The enclosed inter-office memo from Art Zeman, Principal Sanitary Engineer, RIDEM Division of Water Resources, to Carolyn Weymouth, of my staff, constitutes our Department's comments upon this document. The subject memo, dated 4/14/95 is incorporated into this letter by reference.

RIDEM would also like to make you aware that we have adopted new Rules and Regulations Governing the Administration and Enforcement of the Freshwater Wetlands Act, 1994. Copies of these regulations are available from the RIDEM Division of Freshwater Wetlands, 291 Promenade Street, Providence, RI. It would be helpful if you became thoroughly familiar with these regulations before proposing any alteration to freshwater wetlands.

I hope that these comments are of assistance to you. Please feel free to contact me should you have further questions.

Sincerely,

Janet Keller

Janet Keller, Chief

enclosure

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APR 17 1995

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

INTER-OFFICE MEMO

TO: Carolyn Weymouth
Office of Environmental Coordination

DATE: 04/14/95

FROM: Art Zeman, Principal Sanitary Engineer
Division of Water Resources

DEPT: Environmental Management

SUBJECT: Comments on "Wastewater Conveyance Feasibility Investigation Cranston, RI"

The Army Corps of Engineers (ACOE) requested that the Division of Water Resources review and comment on the above referenced document by April 14, 1995. I have concluded my review of the document and have no major comments or concerns at this time. The ACOE satisfactorily addressed our comments issued in a letter dated March 21, 1994 by revising the document to reflect those comments. I do have some minor comments that might be worth mentioning to the Corps. These are:

- On page 81 of Volume 1 under Design and Construction Activities, the bullet indicating "Apply for required permits and approvals" should be last chronologically. As far as DEM is concerned, most permits we issue require final design plans and specifications to be submitted concurrently or at least before the applicant applies for those permits.

- On page 83 of Volume 1 under the Wetlands Permit section, the correct name of that Division is RIDEM Division of Freshwater Wetlands, not **Groundwater and** Freshwater Wetlands.

- On page 15 of the Environmental Assessment (blue pages), last paragraph, they mention that the Pawtuxet River is proposed to be upgrade to Class B in 1994 and that a draft of these changes will be available for public comment in spring 1994. The draft Water Quality Regulations are currently out to public notice and April 28, 1995 is the deadline for public comment. Therefore, this paragraph could be edited to reflect the above information. Basically, the Corps can change the 1994 dates to 1995.

- On page 20 of the Environmental Assessment (EA), paragraph f. Septic Systems, the ACOE cites RIDEM regulations dated 1989. These regulations were updated in June 1992 and perhaps the information they present in this paragraph changed from 1989's regs. to 1992's regs. Perhaps let the ACOE know of the updated regulations and to revise this paragraph accordingly.

- Similarly, on page 23 of the EA, second paragraph, the Wetlands Regulations cited were dated 1981. As you are aware, these regs. were also updated (1994) and perhaps the information presented in this paragraph needs to be updated as well.

Finally, please reiterate to the ACOE that the information contained in this Feasibility Study will be incorporated as part of the City of Cranston's ongoing Wastewater Facilities Plan compilation. This has been previously discussed with the City, their consultant (Tutela Engineering) and the ACOE.

cc: Warren Towne

April 19, 1995

Joseph L. Ignazio,
Director of Planning
Army Corps of Engineers
New England Division
424 Trapelo Road
Waltham, MA 02254-9149

RE: Wastewater Conveyance Feasibility Investigation: Cranston, Rhode Island - March 1995

Dear Sir,

Save The Bay has received and reviewed the March 1995 draft of the Wastewater Conveyance Feasibility Study prepared for the city of Cranston in relation to the extension of public sewer lines to service the Central Landfill, existing and planned industrial development and existing and future residential development in western Cranston.

Save The Bay understands that this study does not commit either the Army Corps or the city of Cranston to the performance of any construction program or extension of any sewer lines recommended in this document. Nevertheless, we believe the expenditure of large amounts of time and resources by both the city and the Army Corps will ultimately result in construction and extension of public sewer facilities to western Cranston.

Save The Bay has several concerns with the overall proposal that need to be addressed prior to final decisions on sewer extension locations. Our primary concern is with the quality and quantity of the influent to the proposed sewer lines and how this influent will impact the Pawtuxet River and ultimately Narragansett Bay. On February 15, 1995 Cranston (along with Warwick and West Warwick) received from RIDEM the final site specific criteria for metals with proposed permit limits for their WWTF discharge to the Pawtuxet River. Save The Bay is extremely concerned with the city's ability to receive "pre-treated" groundwater from more than one Superfund site and a potential flow increase of 50 percent over current conditions and still meet the proposed discharge permit limits that protect the water quality of the Pawtuxet River. It is our understanding that studying this potential conflict is not currently within the scope of this investigation. We believe this issue must be addressed before any final decision is made by the city of Cranston.

Our second concern is with the number and extent of stream crossings and wetland disturbance areas. Stream crossings usually have short-term construction impacts. Save The Bay urges the city and the Army Corps to investigate alternate construction

practices that minimize these short-term impacts to the greatest extent possible. Any wetland disturbance area will suffer long-term effects due to the necessity of keeping the sewer easement clear for maintenance purposes. While this is appropriate from the utility perspective, this cleared area will detrimentally alter the typical wooded/shrub wetland ecosystem that is prevalent in this portion of Rhode Island. In addition, the methods used to maintain this cleared pattern will no doubt involve the spraying of herbicides on an annual or semi-annual basis. Save The Bay urges the city and the Army Corps to investigate realignments to avoid wetland disturbance wherever possible. For example, realignments may include moving proposed sewer line locations to "skirt" a wetland edge rather than dividing an undisturbed wetland in half.

Save The Bay's final concern is focused on the policy perspectives of this project. Save The Bay agrees that the potential for migration of leachate or contaminated groundwater from the Central landfill and other closed or semi-active landfills constitutes a serious threat to the public drinking water supply provided by the Scituate Reservoir. In addition, we enthusiastically support the city of Cranston's proposal for clustered residential development and the planned Village Center in western Cranston. Our chief concern is one of equity, fairness and the economic practicality of some of the proposed public sewer extensions. The intent of the study, of course, is to provide the engineering details for a public sewer extension to western Cranston from the existing system in east Cranston. The study was not designed to look at options such as small wastewater treatment facilities ("package treatment plants") that may be appropriate for the proposed Village Center area. These options may be more practicable economically and environmentally than an extension of existing public sewer lines. In addition, these alternatives may address our concerns with the fairness of increasing wastewater discharges to the lower reaches of the Pawtuxet River, a seemingly remote and unrelated location.

Thank you for the opportunity to comment on this draft document. I look forward to working with you and the city of Cranston in the future to reach appropriate and practical solutions to wastewater disposal problems in Cranston and its surrounding communities.

Sincerely yours,

Nicole M. Cromwell

Nicole M. Cromwell
Policy Specialist

cc: Barbara Blumeris

ENVIRONMENTAL ASSESSMENT

SECTION 404 (b)(1) EVALUATION

FINDING OF NO SIGNIFICANT IMPACT

SECTION 117 CRANSTON, RHODE ISLAND
WASTEWATER CONVEYANCE SYSTEM FEASIBILITY INVESTIGATION

May 1994

NEW ENGLAND DIVISION
ARMY CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254-9149

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I. ENVIRONMENTAL ASSESSMENT

A. INTRODUCTION

Legislation in the Water Resources Development Act of 1990, Section 117, authorizes the Corps to prepare a feasibility report and construct a demonstration project of a regional wastewater connector system. The language authorized the appropriation of $1,000,000 to conduct the feasibility study and $10,000,000 to complete the demonstration project. The Energy and Water Development Appropriations Act, 1992, Public Law 102-104 directed the Corps to use $500,000 to conduct the study. On 21 December 1992, NED signed a cost-sharing agreement with the City of Cranston. The Federal share for carrying out this effort is 50 percent.

This Environmental Assessment considers the ecological, water quality, socio-economic and historic and archaeological impacts associated with the implementation of a regional connector system in Cranston, Rhode Island. To determine the impacts associated with implementation of the Federal project, the with project condition is compared to the without project condition over the life of the project (to the year 2045). This Environmental Assessment was prepared in compliance with the National Environmental Policy Act of 1969 (NEPA), appropriate laws and regulations as well as in coordination with Federal, State and local authorities.

B. PURPOSE AND NEED FOR THE PROJECT

The purpose of the study is to conduct a feasibility investigation of options for transporting wastewater from pollution sites in Cranston to the wastewater treatment facility in Cranston, Rhode Island. Problems and solutions are assessed from a regional perspective and the most effective means of conveying the wastewater to the treatment facility is identified and evaluated. Applicable Federal, State and local laws and regulations are considered in the planning process.

Management of wastewater is an integral part of the City of Cranston's land use planning strategy. The City of Cranston Comprehensive Plan (Comprehensive Plan, 1992) provides the framework for land use management as Cranston continues to grow into the future. The Plan was developed in compliance with the Rhode Island Comprehensive Planning and Land Use Regulation Act of 1988. Goals and strategies were developed through a survey of citizen opinion and attitude, public hearings and meetings of the Citizens Advisory Committee. West Cranston has the majority of remaining open space and therefore, has the most development potential with or without the Federal project. The city recommends compact residential development in conjunction with emphasis upon the preservation of large tracts of open space (cluster development). Extending the city's sewer service to west Cranston may facilitate the design of a proposed Village Center and cluster residential development by providing an alternative to on-site septic sytstems.

C. PROJECT HISTORY

A prior New England Division study conducted under the Section 22, Planning Assistance to States Program was completed in May of 1992. This study provided a review of the wastewater conveyance problems and defined the problems identified by the city, formulated and evaluated solutions to correct the problems, and suggested a future course of action for the city to undertake to solve the problems. The Section 22 study indicated a new sewer interceptor or modifications to the existing system appeared feasible to convey regional flows to the wastewater treatment facility, and recommended a detailed study to determine which design would be most effective (ACOE, 1992). The following is a brief discussion of two other plans considered in the Section 22 report.

1. Local Wastewater Treatment Plant

The Section 22 wastewater investigation (ACOE, 1992) looked at the possibility of constructing local treatment facilities to treat wastewater flows and discharge them to a receiving water. Two different options were considered: building new advanced treatment plants near study sites or using decentralized package treatment plants at study sites.

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 monitoring of the proposed receiving stream. Studies would be required to demonstrate that the new discharge would meet the Rhode Island Department of Environmental Management (RIDEM) anti-degradation policy.

Staff from Environmental Protection Agency (EPA) and the RIDEM contacted regarding this issue indicated it would be very difficult to obtain a new surface water discharge permit in the west Cranston area due to regulatory constraints, and soils in this area are not suitable for groundwater discharge. The RIDEM also indicated that no new discharges would be permitted to the Pawtuxet River as the wasteload allocation for the river was established on the existing and future needs of the current users. Therefore, this was not considered to be a viable option.

2. Wastewater Management Plan

The Section 22 wastewater investigation (ACOE, 1992) also evaluated various wastewater management activities to reduce future flows to the Cranston wastewater system. These measures included a water demand management component (low flow domestic device retrofit program, etc.), decreasing excessive infiltration/inflows (I/I) to the system, and consideration of establishing a local septic system management program in west Cranston.

Implementation of the water demand management component (low flow domestic device retrofit program, etc.) to decrease water use and thus wastewater flow is currently being implemented. The Providence Water Supply Board (PWSB)

supplies the city east of I-295, the City of Cranston Water Department (CCWD) supplies the portion west of I-295, and the Kent County Water Authority supplies the southwest corner of the city. The PWSB has started a program to distribute free residential water conservation retrofit kits. The CCWD has conducted water conservation programs that include mailings of water conservation literature and leak detection dye tablets. The CCWD is currently preparing a Water Supply Management Plan to meet rules and regulations established in the "Rhode Island Department of Environmental Management Rules and Regulations for Water Supply Management Planning, August, 1992". These rules require that about 10 percent of homes be targeted annually by water suppliers for distribution and installation of water saving devices. In addition, the 1990 Rhode Island state plumbing code requires use of 1.6 gallons per flush (gpf) toilets, 2.5 gallons per minute (gpm) faucets, and 2.5 gpm shower heads. As a result, new homes built in Cranston after 1990 should be fitted with water efficient fixtures.

The city's consultant, Tutela Engineering Associates, performed an infiltration and inflow (I/I) study of the Cranston sewer system, and prepared a preliminary draft report in January 1993 (TEA, 1993b). According to this report, the system's age and the number of deteriorated pipe connections and manholes, cause excessive I/I during peak infiltration/inflow conditions. The draft I/I report indicates problem areas where a detailed sewer system evaluation study should be performed to determine which areas should be rehabilitated. If excessive I/I problems are not addressed, they could interfere with the sewer system's ability to carry projected future flows, and the WWTF ability to treat them.

Most of the residential development in west Cranston disposes of wastewater with on-site septic systems. The Rhode Island Department of Environmental Management (RIDEM) is the agency responsible for regulation of new septic system design and installation and repair of existing systems. There is no local program for septic system management. The city's Comprehensive Plan, Natural Resource Element (page 119) recommends the city establish a local program in west Cranston through implementation of a Wastewater Management District. The authority for this type of district is provided in the Rhode Island Septic System Maintenance Act of 1987, General Laws Title 45, Chapter 24.5.

With the adoption of an appropriate ordinance the city could establish a septic system inspection program; hire or contract for the necessary program personnel; provide for passage of septic system inspectors onto private property; and raise funds for the program. This type of program would allow for the identification and documentation of existing Individual Sewage Disposal System (ISDS) problems. In the case of an identified failing or problem system, the homeowner would be responsible for obtaining the necessary repair permit from the RIDEM and for system repair.

Each of these activities provide benefits to the efficient function of the existing sewerage system and to management of future flows. However, these measures need to be implemented in conjunction with modification to the existing system or a regional connector system in order to provide sufficient conveyance capacity for the projected wastewater flows and achieve goals for improved water quality.

D. PROJECT DESCRIPTION

Based on the recommendations of the Section 22 investigation, a plan to modify the existing sewerage system/construct a connector system was developed and a more detailed investigation of the impacts associated with the plan was undertaken.

The study area is within the Pawtuxet River basin. The main stem of the Pawtuxet River flows south to east along the easterly boundary of Cranston and empties into Pawtuxet Cove adjacent to the Providence River. The City of Cranston occupies a land area of about 17,750 acres. Several major highways provide access to the city including Interstate 95, Interstate 295 and Route 37. Existing land use includes residential, commercial, industrial, institutional development, farmland and undeveloped land. The majority of the area is characterized by urban/suburban development with about 5,840 acres of undeveloped space remaining in the west Cranston area (TEA, 1993a) (see Figure 1, Location Map).

Study sites were grouped into three service areas for development of wastewater conveyance options. These areas were delineated based on the city's plans for sewer service in west and northwest Cranston (see Figure 2, Service Area Map).

Service Area 1. Service Area 1 study sites include the Rhode Island Solid Waste Management Corporation's Central landfill, industrial and residential land in northwest Cranston including the proposed "Village Center", proposed industrial land in southwest Johnston, and the Vinagro Landfill. The Johnston industrial area and the Vinagro landfill are not currently connected to the Cranston sewer system and are outside the city's designated service area. The Cranston industrial development and some of the residential area wastewater flow is connected to the existing system. Also the Solid Waste Management Corporation (Central Landfill) has an existing connection and an industrial wastewater discharge permit for a 108,000 gallons per day (gpd) discharge and a contract with the city to accept up to 400,000 gpd.

Service Area 2. Service Area 2 includes residential and industrial land in southwest Cranston. Residential zoning in this area ranges for 8,000 to 80,000 square foot lots. Existing residential development is primarily concentrated in subdivisions off of Natick Avenue, Phenix Avenue, Wilbur Avenue, Kimberly Lane, Olney Arnold Road, and South Comstock Parkway. There is also about 140 acres of industrially zoned land off of Phenix Avenue. This area is within the city's designated service area.

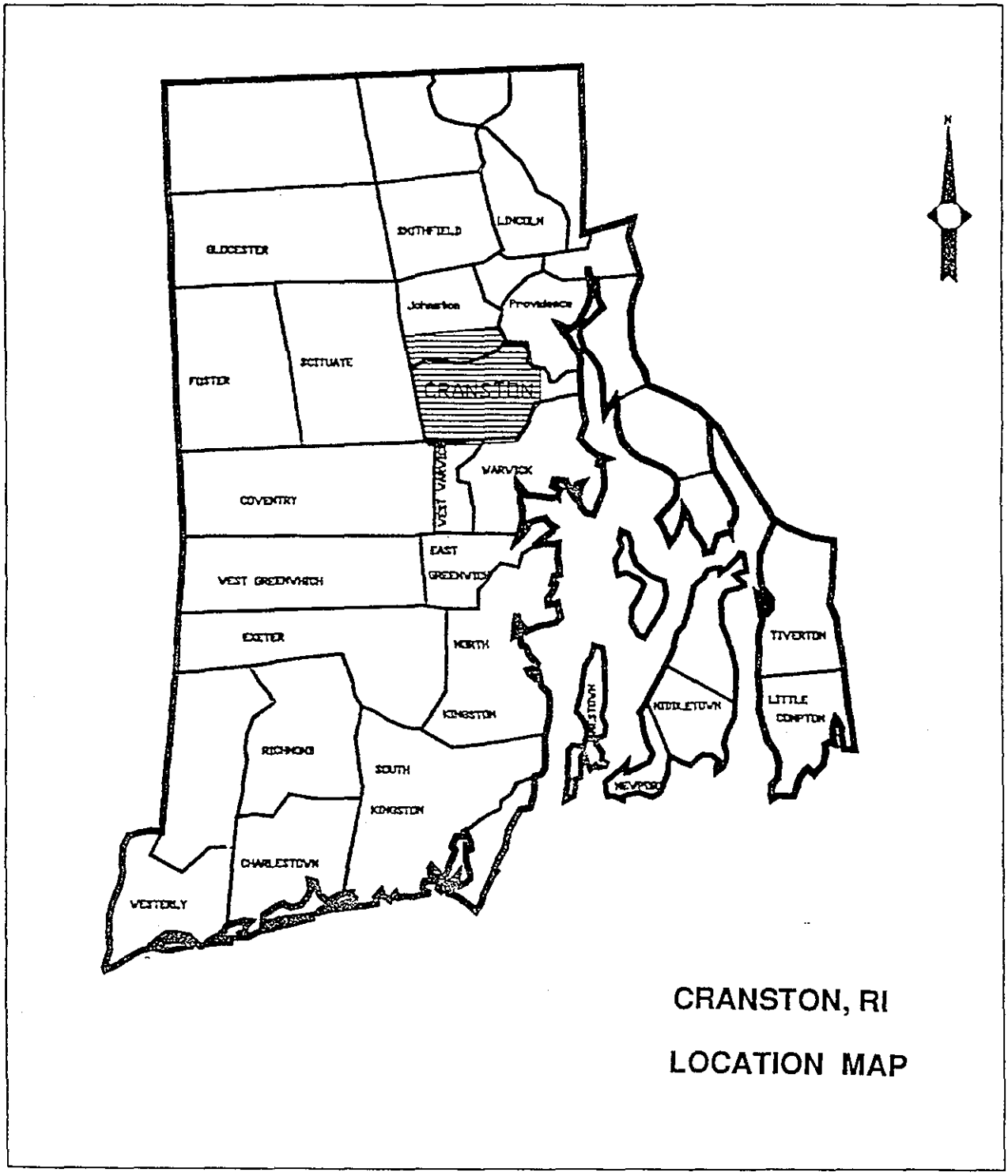
N
GLOCESTER
SMITHFIELD
LINCOLN
Johnston
Providence
FOSTER
SCITUATE
CRANSTON
WARWICK
WEST WARWICK
COVENTRY
EAST GREENWICH
WEST GREENWICH
EXETER
NORTH KINGSTON
NARRAGANSETT
MIDDLETOWN
NEWPORT
TIVERTON
LITTLE COMPTON
RICHMOND
SOUTH KINGSTON
CHARLESTOWN
WESTERLY
CRANSTON, RI
LOCATION MAP

FIGURE 1

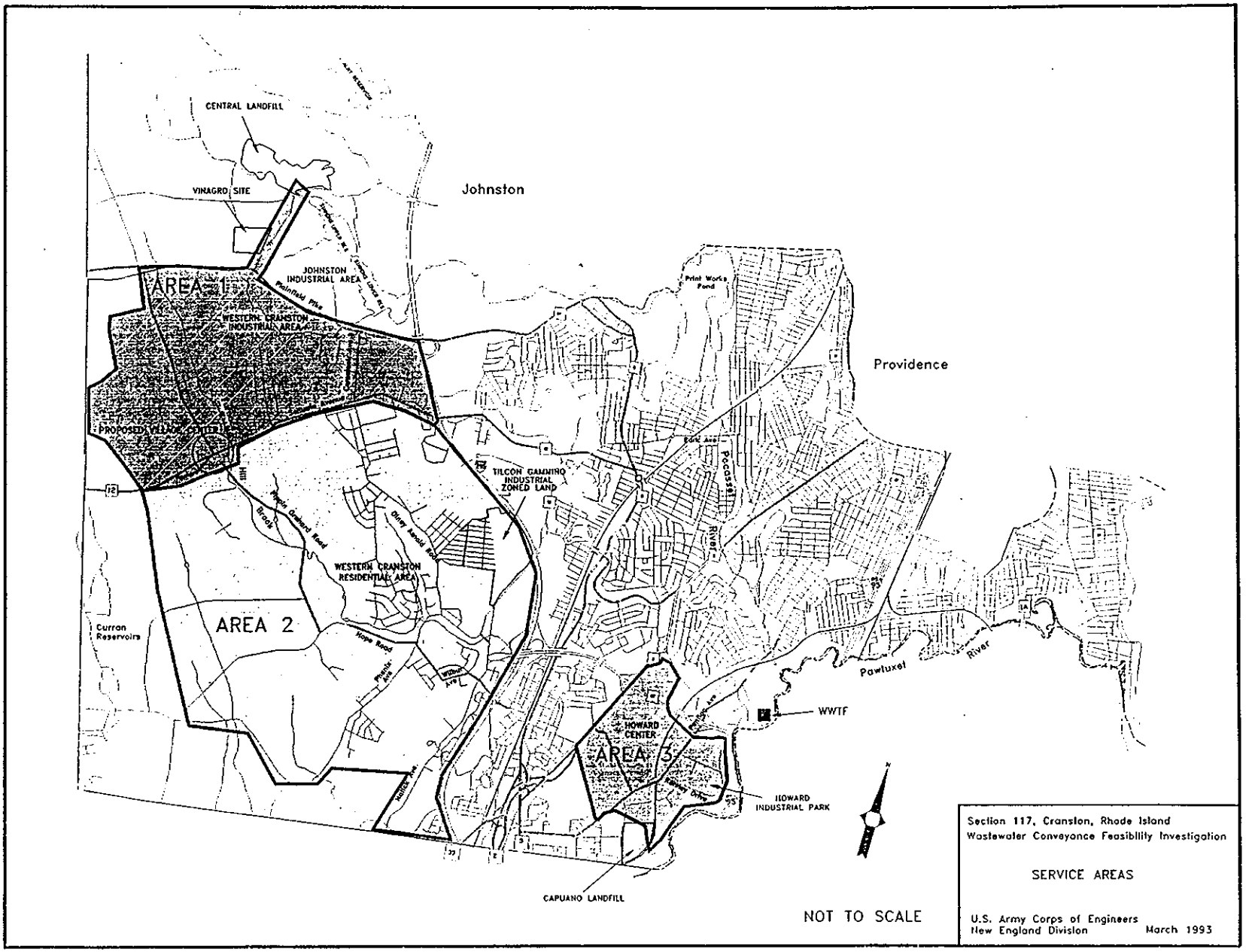
CENTRAL LANDFILL
VINAGRO SITE
Johnston
JOHNSTON INDUSTRIAL AREA
AREA 1
WESTERN CRANSTON INDUSTRIAL AREA
Plainfield Pike
Print Works Pond
Providence
PROPOSED VILLAGE CENTER
TILCON GAMMINO INDUSTRIAL ZONED LAND
Pocasset River
Purgatory Brook
Purgatory Road
Olney Arnold Road
WESTERN CRANSTON RESIDENTIAL AREA
AREA 2
Curran Reservoirs
Hope Road
Pawtuxet River
WWTF
HOWARD CENTER
AREA 3
HOWARD INDUSTRIAL PARK
CAPUANO LANDFILL
NOT TO SCALE
Section 117, Cranston, Rhode Island
Wastewater Conveyance Feasibility Investigation
SERVICE AREAS
U.S. Army Corps of Engineers
New England Division
March 1993

FIGURE 2

Service Area 3. This area is located in east Cranston and includes the Howard Center, the Howard Industrial Park, and the Capuano Landfill. These sites are within the city's existing sewer service area. The Capuano Landfill is not currently connected to the Cranston sewer system.

E. DISCUSSION OF ALTERNATIVES

1. Project Options

In consultation with the city, several wastewater conveyance options were selected for feasibility analysis. Options selected represented a mix of with and without federal project conditions. Detailed components of feasibility study options are listed in Table 1 and Appendix A. The location of option components are shown on Plates 1 through 4. An analysis of these options lead to the selection of the proposed Federal project.

Service Area 1. Option 1A, 1B and 1C address flows from Service Area 1. Option 1A and 1B assess the feasibility of modifying the existing system to convey future wastewater flows and are part of the without Federal project conditions. Option 1C assesses the feasibility of extending sewer service to the proposed Village Center at the intersection of Pippin Orchard Road and Scituate Avenue and is part of the selected Federal project. Also to convey wastewater flows additional lateral sewers would be required, but these are not part of the Federal project.

Service Area 2. The without Federal project assumes municipal sewerage would not be extended to this area and development would continue to rely on on-site septic systems. The with Federal project conditions is represented by Options 2A, 2B, 2C, and 2D which assess the feasibility of extending sewer service to this area. Options 2A, 2B, and 2C are mutually exclusive alternatives for extending the city's sewer service. Option 2D assesses the construction of trunk sewers in the service area. Option 2C and portions of Option 2D were selected as the Federal project. Also to convey wastewater flows additional lateral sewers would be required, but these are not part of the Federal project.

Service Area 3. Option 3A assesses the feasibility of modifying the existing system to convey future wastewater flows and is part of the without Federal project condition. No Federal project options are proposed for this area.

Trunk sewer alignments (Option 2D) follow roads as much as possible to reduce impacts to natural resources in the project area. However, to achieve a gravity flow system,in some cases, topography necessitates close alignments of sewers to streams or sewers traverse streams/wetland/cultural resource areas. An alternative to placement of gravity sewers is the construction of additional pump stations/force mains. The short term impacts associated with pump station construction include noise, dust and the temporary loss of wildlife habitat. The long term impacts associated with pump station construction includes possible social/visual/aesthetic impacts (location of a pump station adjacent to homes), permanent loss of wildlife habitat, operational costs, and maintenance costs. The use of additional pump stations (long term impacts) as a means of avoiding temporary impacts to natural resources was not considered prudent.

TABLE 1

LIST OF STUDY OPTIONS
SECTION 117 CRANSTON, RHODE ISLAND
WASTEWATER CONVEYANCE SYSTEM FEASIBILITY INVESTIGATION

SERVICE AREA 1

OPTION 1A

Proposed Scituate pumping station

Proposed Scituate Avenue 6-inch force main/variable grade sewer (12,300 feet)

Under construction I-295 pumping station

Existing 14-inch force main/variable grade sewer (16,000 feet)

Proposed Improvements to Cranston Street gravity sewer, replace 18-inch gravity sewer with 24-inch gravity sewer (800 feet) after the year 2015

Existing Park Avenue and Pocasset Interceptor gravity sewers

Proposed improvements to existing Pontiac pumping station

Proposed replacement of Pontiac force main with new 42-inch force main (2,770 feet) after the year 2015

OPTION 1B

Same as Option 1A, except improvements to Cranston Street gravity sewer are not required

OPTION 1C

Proposed Scituate pumping station

Proposed Scituate Avenue 6-inch force main/variable grade sewer (12,300 feet)

SERVICE AREA 2

OPTION 2A

Proposed Wilbur pumping station

Proposed Garden Hills 18-inch force main/variable grade sewer (14,100 feet)

TABLE 1 (continued)

LIST OF STUDY OPTIONS
SECTION 117 CRANSTON, RHODE ISLAND
WASTEWATER CONVEYANCE SYSTEM FEASIBILITY INVESTIGATION

OPTION 2B

Proposed Wilbur pumping station

Proposed Garden Hills 18-inch force main (5,850 feet)

Proposed Garden Hills 24-inch gravity sewer (8,250 feet)

Proposed improvements to influent pumps at WWTF after 2015

OPTION 2C

Proposed Wilbur pumping station

Proposed Turner 18-inch force main (8,100 feet)

Proposed improvements to Sockanosset Interceptor, construct additional 24-inch gravity sewer after 2015 (1,500 feet)

Proposed improvements to influent pumps at WWTF after 2015

OPTION 2D

Proposed Brookdale gravity trunk sewer, 36 and 30-inch (2,300 feet)

Proposed Tilcon gravity trunk sewer, 30, 24, and 18-inch (6,250 feet)

Proposed Comstock gravity trunk sewer, 24, 15, 12-inch (14,240 feet)

Proposed Natick/Phenix gravity trunk sewer, 24, 15, 10-inch (7,950 feet)

Proposed Phenix pumping station after 2015

Proposed Phenix Avenue 6-inch force main after 2015 (3,500 feet)

SERVICE AREA 3

OPTION 3A

Existing Kenny Drive, Ross-Simmons Drive, and Sharpe Drive 12 to 24-inch gravity sewers (10,740 feet)

Proposed improvements to Howard pumping station

Existing Howard force main (1,885 feet) and WWTF influent pumps

2. Without Federal Project (No Action)

This section provides a description of future conditions in the study area over the life of the project (to the year 2045) without the Federal project. This is an important aspect of the Environmental Assessment because impacts of the Federal project are based on comparison of the with and without project conditions (No Action).

Service Area 1. Flows from Service Area 1 will be conveyed to the city's WWTF by the city's existing sewer system with possible future modifications to be conducted by the city (Options 1A/1B). The city is currently building a higher capacity pumping station, the "new I-295 pumping station" to replace the existing Welsh pumping station, construction is scheduled for 1994. The 14-inch force main/variable grade sewer for the station has already been built.

The new station has been designed to handle the projected flows from northwest Cranston as well as potential flows from Central Landfill, an estimated average daily flow of about 1.1 and 1.4 million gallons per day (mgd) in the years 2015 and 2045, respectively. The Solid Waste Management Corporation's Central Landfill has an existing connection and an industrial wastewater discharge permit for a 108,000 gallons per day (gpd) discharge. Selection of the appropriate pumps for this station by the city would also allow for potential conveyance of additional flows from the proposed Johnston industrial area and Vinagro Landfill estimated at about 0.1 mgd and 0.2 mgd average daily flow in the years 2015 and 2045, respectively. The sewer lines between the I-295 pumping station and the Pontiac pumping station should be adequate to convey projected flows through the year 2015. However, if the city agreed to accept flows from the Vinagro Landfill and proposed Johnston Industrial area in the future, the city may need to increase the capacity of the sewer in Cranston Street.

The Pontiac pumping station has a pumping capacity of 16,600 gallons per minute (gpm). The estimated peak hourly flow to the pumping station for calender year 1992 was 22.3 mgd (15,500 gpm) and the average daily flow was 8.25 mgd (Tutela Engineering Associates, February 25, 1993). If flows from Service Area 1 and east Cranston increase as projected, the city will need to modify the existing Pontiac Pumping station for the year 2015 and year 2045 which have a projected peak flow of 30 mgd and 37 mgd, respectively and an average day flow of about 13.8 mgd and 16.8 mgd, respectively.

In the without project condition, it is assumed that the city's sewerage system will not be extended to service the proposed Village Center. Without the Scituate Pumping station and force main/variable grade sewer, the proposed Village Center will need to rely on on-site wastewater disposal systems and this may limit the proposed centralized residential and commercial development.

Service Area 2. This area depends on on-site septic systems for disposal of wastewater, except for the Briggs Farm Elementary School on Wilbur Avenue. The school is connected to the east Cranston sewerage system by a 4-inch force main/variable grade sewer. For Service Area 2, in the without project condition, residential development is assumed to continue throughout the area at the density prescribed in the city's Comprehensive Community Plan (1992) and homes will continue to rely on on-site septic systems for wastewater disposal. Industrial development is assumed to be constrained by the lack of municipal sewerage.

Service Area 3. This area is currently sewered. Wastewater flows from the Howard Industrial Park and Howard Center are conveyed by the city's existing sewerage system to the WWTF. This system was assessed to determine if there was a need for additional connector system components (Option 3A). The main gravity sewers in Kenny Drive, Ross-Simmons Drive, and Sharpe Drive appear adequate to convey projected flows. However, it is suggested that the city monitor flows from the Howard Center to document existing conditions in order to anticipate future problems. The capacity of the Howard pumping station will need to be increased to convey projected flows. The capacity of the station is about 4.3 mgd (3000 gpm) and the existing average daily flow at the pumping station is 1.2 mgd. The projected year 2015 average daily flow to the station is 2.3 mgd. Analysis indicated that modifications could be made to the existing pumping station to handle the increased flows.

3. Regional Connector System (Selected Plan)

The following discussion describes the proposed Federal project. Selection of the Federal project was based on a multi-disciplinary analysis of feasible options for conveying wastewater to the Cranston WWTF. The selected plan components are listed in Table 2.

Lateral sewer lines would also be required to collect existing and future wastewater flows from west Cranston. However, design and cost of these are not included in this feasibility study and are not considered part of the Federal project.

Service Area 1. Extension of the City's existing sewer system is proposed for the proposed "Village Center" area and this extension is considered to be the Federal project in Service Area 1 (Option 1C).

Extension of the sewer system to this area will require the construction of a pumping station "the Scituate pumping station" and force main/variable grade sewer to the I-295 pumping station. This pump station would be located near the intersection of Pipin Orchard Road and Furnace Hill Brook and is part of the "Scituate Basin" sewerage system proposed in the City's Facility Plan Amendment. The force main/variable grade sewer would be located along Scituate Avenue, Comstock Parkway, Amflex Drive and

Sailor Way. Because of the planned time frame for construction of the Village Center in the next five years, it was deemed reasonable to extend service to this area from the I-295 pumping station rather than connecting this area to a new connector system through west Cranston.

Service Area 2. Homes in west Cranston rely on on-site wastewater disposal systems. It is proposed that the city's sewerage system be extended to service this area and the wastewater flows from this area be conveyed to the city's WWTF by a new regional connector system. Of the alternatives analyzed (2A/2B/2C) to convey wastewater flows, Option 2C the new "Wilbur pumping station" and Turner force main to the city's existing Sockanosset gravity interceptor, siphon and influent WWTF pumps was determined to have the least cost and least environmental impacts. Option 2C is located predominantly in roadways (freshwater wetland impacts were estimated to be 0.33 acres compared to 0.62 acres for Option 2A/2B).

The Federal project would also consist of selected trunk sewers in west Cranston (Option 2D). Proposed trunk sewers were designed to collect wastewater flows from existing and future residential and industrial development. Industrial development is proposed only at the Tilcon Gammino site. The Brookdale trunk sewer is near Brookdale Avenue and crosses Meshanticut Brook at the location of the existing I-295 sewer sleeve to the proposed Wilbur pumping station. The proposed Comstock trunk sewer alignment is near Hines Farm Road, Furnace Hill Brook, Kimberley Lane, and Council Rock Road. The proposed Tilcon trunk sewer alignment is along Phenix Avenue. The proposed Phenix/Natick trunk sewer is behind the Natick Village development and extends west to Glenham Road. Also considered in the feasibility study was a proposed Phenix pumping station and Phenix Avenue 6-inch force main. However, since these components are not needed till after 2015, they are not selected as part of the Federal project.

Service Area 3. There is no proposed Federal project for this area.

TABLE 2

REGIONAL CONNECTOR SYSTEM (SELECTED PLAN)
SECTION 117 CRANSTON, RHODE ISLAND
WASTEWATER CONVEYANCE SYSTEM FEASIBILITY INVESTIGATION

SERVICE AREA 1

OPTION 1C

Proposed Scituate pumping station

Proposed Scituate Avenue 6-inch force main/variable grade sewer (12,300 feet) to the new I-295 pumping station

SERVICE AREA 2

OPTION 2C

Proposed Wilbur pumping station

Proposed Turner Avenue 18-inch force main (8,100 feet) to the existing Sockanosset Interceptor

Proposed improvements to the existing Sockanosett gravity interceptor and influent pumps at the WWTF (after 2015)

OPTION 2D *

Proposed Brookdale gravity trunk sewer, 36 and 30-inch (2,300 feet)

Proposed Tilcon gravity trunk sewer, 30 and 24-inch (2,200 feet)

Proposed Comstock gravity trunk sewer, 24, 15, 12-inch (14,240 feet)

Proposed Natick/Phenix gravity trunk sewer, 24, 15, 10-inch (7,950 feet)

* The proposed Phenix pumping station and force main and a portion of the Tilcon gravity trunk sewer were not selected as part of the Federal project.

F. AFFECTED ENVIRONMENT

1. General

The City of Cranston is located in Providence County in the State of Rhode Island. The study area is within the Pawtuxet River basin. The main stem of the Pawtuxet River flows south to east along the easterly boundary of Cranston and empties into Pawtuxet Cove adjacent to the Providence River. The City of Cranston occupies a land area of approximately 17,750 acres. Several major highways provide access to the City including Interstate 95, Interstate 295 and Route 37. Existing land use includes residential, commercial, industrial, institutional development, farmland and undeveloped land. The majority of the area is characterized by urban/suburban development with about 5,840 acres of undeveloped space remaining in the western Cranston area (TEA, 1993a) (see Figure 1, Location Map).

In Rhode Island, the winters are cold and the summers are warm with some moderating effects due to close proximity to the Atlantic Ocean. The average temperature in January, the coldest month of the year, is 28.5°F and during July, the hottest month, the average temperature is 72.4°F. Precipitation averages 44.45 inches per year and is generally spread evenly throughout the year. Average snowfall for the area is 36.7 inches during the winter season (USDA, 1981).

The physical features of the study area are the result of a combination of glaciation, geologic uplift and erosion. Eastern Cranston is generally of flat terrain and is primarily glacial outwash plains. In hilly western Cranston, the orientation of hills and valleys indicates that glaciation occurred in a north to northwest direction. Areas subject to flooding occur along the valley floors of river corridors and major contributing streams (TEA, 1992a).

Prior to the last glaciation, two major bedrock formations were uplifted and eroded several times to create the existing physiography and geology of the Cranston area. The softer sedimentary rocks of the Rhode Island Foundation eroded more easily and formed Narragansett Bay. The harder metamorphic rock of the Scituate granite gneiss remained at higher elevations to form the hills around the basin. The final deposition of glacial material occurred during the Wisconsin glaciation 10,000 to 12,000 years ago which caused steepening and widening of valleys and deposited glacial till and outwash around the area (TEA, 1992a).

In eastern Cranston, the surficial geology consists primarily of stratified glacial outwash deposits which are associated with terraces and valley floors. They consist of smaller particles such as silts, clays, sand, pebbles and cobbles. The unstratified glacial till is commonly associated with the higher elevations of the west Cranston area. This unsorted material ranges from clay to boulders and is characteristic of the underlying bedrock (TEA, 1992a).

The U.S. Soil Conservation Service (USDA, 1981) characterize the majority of soils in the Cranston area as having " a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow water transmission." Many of the soils in Cranston have a "perched water table" caused by a densely compacted subsurface soil horizon (hardpan) which impedes drainage. These soils are poorly suited to community development where installation of septic systems are required.

2. Water Quality

a. Existing Conditions

General Watershed. Important water bodies within the study area are Meshanticut Brook, the lower half of the Pocasset River, and portions of the Pawtuxet River. The bulk of the study area is within the watersheds of Meshanticut Brook and its major tributary, Furnace Hill Brook. Although it mostly flows through eastern Cranston and outside the study area, the Pocasset River is included because runoff from the Central Landfill goes into the Simmons Reservoirs which are tributary to the Pocasset. The Pawtuxet River is important because the entire study area is within its watershed and the Cranston wastewater treatment facility discharges to the river. Finally, the very small Capuano Stream drains the Capuano landfill site.

Water Quality Classification. Although its upper watershed is mostly designated class "A" and suitable for public water supply, by the time the Pawtuxet River reaches Cranston it is a class C stream. The Pocasset River from Print Works Pond to the Pawtuxet, which represents most of its length through Cranston, is also a class C stream. Meshanticut Brook and its tributaries are classified B. Streams, such as Capuano, which are too small to be given specific classifications, are generally classified B. Class B waters are suitable for public water supply after appropriate treatment, agricultural uses, swimming, and fish and wildlife habitat. Class C waters are suitable for secondary recreation, fish and wildlife habitat, and certain industrial processes.

Future Water Quality Classification. As required by the Clean Water Act, all freshwater rivers must have their classifications upgraded to a goal of class B, fishable/swimmable or better. Consequently, RIDEM is proposing to upgrade the goal for the Pawtuxet River to class B in 1994. However, as there will still be elevated coliform levels in the river, a subcategory of class B will be used to indicate an advisory or warning about actually swimming in the river. The Pocasset River, on the other hand, will be upgraded to a straight class B. A draft of these changes is proposed to be available for public comment in spring 1994, with the final issued in the summer (Carey, 1993).

b. Pollution Sources

Surface water quality in the Pawtuxet River Basin is primarily degraded by nonpoint sources, and effluents from three wastewater treatment facilities (WWTF): Cranston, Warwick, and West Warwick. The WWTF are currently being upgraded from secondary to advanced wastewater treatment processes. Tutela Engineering Associates (TEA) has also identified benthic deposits as a possible important factor which impacts water quality of the river (TEA, comment letter, January 21, 1994)

Groundwater quality is affected by nonpoint sources and one major point source, the Central Landfill which is an EPA Superfund site in the watershed (RIDEM, 1992). Outside of areas around the landfill and immediately downstream, groundwater in the study area is primarily degraded by nonpoint sources, including septic systems, leaking underground storage tanks, and fertilizers.

A 1991 study (TEA) found that nonpoint source pollution had a significant effect on water quality in the Pawtuxet River and its tributaries. The study concluded that it may not be possible to achieve desired water quality improvements in the river solely by upgrading WWTF discharges. Rather a combination of WWTF improvements and a reduction in nonpoint source pollution will be required. Areas in Cranston most impacted by nonpoint source contamination included Capuano Stream, Meshanticut Brook, and those receiving drainage from Interstate 95.

c. Surface Water Quality Conditions

Main Stem Pawtuxet River. The main stem of the 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, agricultural runoff, effects from failed or overloaded septic systems, and a buildup of contaminated sediments.

Water quality in the entire length of the main stem Pawtuxet River is considered by RIDEM not to be in support of designated uses, mainly aquatic habitat. Heavy metals including cadmium, copper, lead, mercury, and silver, petroleum hydrocarbons, ammonia, and low dissolved oxygen are causes of noncompliance (RIDEM, 1990a, 1992). Additionally, elevated levels of color, sodium, chloride, phosphorus, nitrate, and coliform bacteria have been observed, but not in concentrations exceeding class C criteria (RIDEM 1990a, 1992). Pollutant sources in the main stem include Warwick, West Warwick, and Cranston WWTFs; agricultural runoff, urban and highway runoff, and contaminated river sediments. Of the various water quality problems afflicting this stretch of river, low dissolved oxygen and elevated ammonia levels appear to be of most concern because of their effects on fish habitat. Some metals, especially lead and silver, are found extensively throughout the watershed in surface and groundwater at levels exceeding criteria. Consequently, RIDEM (1988a) reported that the criteria for these metals in the Pawtuxet River need to be reevaluated and the sources identified.

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 runoff from 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's 1990 report to Congress(RIDEM,1990). Sampling in August 1989, by Goldberg-Zoino & Associates, 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 (GZA, 1989). 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 (RIDEM, 1990).

Tributaries--Meshanticut Brook. Meshanticut Brook and its tributaries, are rated class B, but there is little information on the condition of Furnace Hill Brook, a major tributary to Meshanticut. The watershed for Meshanticut Brook includes much of "Service Area 2". A groundwater map for the area shows Furnace Hill Brook watershed as being entirely glacial till, where it is not exposed bedrock. Glacial till has very low permeability, making it poor quality for wells or septic systems. Since the area is not sewered and relies on septic systems for disposal of domestic wastewater, pollution of surface waters including Furnace Hill Brook would be expected, especially during rainstorms. A 1991 nonpoint source pollution study by TEA bore this out. Meshanticut Brook contained elevated levels of coliform bacteria and phosphorus, which are common contaminants in domestic wastewater. When homes are connected to properly functioning septic systems, movement of wastewater through the soil effectively removes bacteria and phosphorus. Their presence, in elevated concentrations in Meshanticut Brook, indicates septic systems discharging to saturated soils, or experiencing other serious problems.

TEA's 1991 study concluded that the ultimate solution, to correct the problems of septic systems polluting Meshanticut brook, was to provide municipal sewer collection and conveyance systems within the watershed.

Tributaries--Capuano Stream. This small stream has a watershed of only 120 acres, and flows through the Howard Industrial Park and along the perimeter of Capuano Landfill. It was included in the TEA 1991 nonpoint source study. Results of an initial dry-weather sampling showed very high concentrations of heavy metals, including cadmium, chromium, copper, lead, nickel, and zinc; and a pH as low as 3.5 SU. Later samplings did not repeat these initial results, leading TEA to speculate that possible periodic phenomenon such as illegal industrial discharges might be occurring. Wet weather samplings showed high levels of Biological Oxygen Demand (BOD) in drainage from the Howard Center; this was attributed to the first flush of solids at this location. Phosphorus and silver found in the stream were hypothesized by TEA to be coming from the landfill, or upstream sources.

Tributaries--Interstate Highway Drainage. The TEA 1991 nonpoint pollution study included runoff measurements from Interstate Highway Route 95. Although samples were taken in eastern Cranston, which is not part of this feasibility study area, results are likely typical of I-95 and I-295 in western Cranston. Sampling of dry weather flow found lead, but no detectable levels of total petroleum hydro-carbons (TPH). Wet weather sampling found lead, copper, zinc, and high levels of TPH, which were attributed to vehicular traffic.

d. Groundwater Quality

General. There are no sole source aquifers (SSA) within the study area. To qualify as a SSA, among other requirements, an area must rely on groundwater for more than 50 percent of its drinking water supply and have no feasible supply alternatives. Additionally, there are no groundwater reservoirs or critical portions of their recharge areas within the study area (RIDEM, 1992).

Classification. Most of the study area's groundwater is classified as threatened, except for portions under more developed portions of eastern Cranston which are considered impacted. Threatened areas are defined as groundwater which is presumed suitable for drinking water use, except for localized degradation. Nonpoint sources are prevalent in these areas and they threaten groundwater quality. Impacted areas have groundwater which is presumed not suitable for drinking water use due in large part to nonpoint source pollution (RIDEM, 1990).

Quality. Groundwater throughout the watershed is generally clean or has trace levels of organic contaminants. An exception is groundwater immediately within or downstream from the Central Landfill; which has higher concentrations of organic contaminants and metals. Highest levels of contamination are found in shallow wells directly within the landfill. Elsewhere in the watershed, groundwater contamination is principally caused by leaking underground storage tanks, salt storage sites, agricultural fertilizers, pesticides, and septic systems. Contaminants most commonly associated with groundwater pollution in Rhode Island include volatile organic compounds (VOCs), the pesticide aldicarb, nitrates, chlorides, bacteria, and metals. VOCs found in groundwater wells in the watershed, are typically substances like tricholorethylene, which was used as a degreasing compound in septic tanks, and methyl tertiary butyl ether, an anti-knock compound in gasoline. Groundwater contamination with the pesticide aldicarb appears to be a problem mostly in the southern part of the State and outside the study area (RIDEM, 1992). Nitrates enter the ground through septic tanks, and excessive fertilizer applications. Chlorides in groundwater originate in road salt storage sites and septic systems. Bacteria and metals most commonly enter groundwater through septic systems.

e. Landfills

Three landfills sites are included in the study area: Central, Vinagro, and Capuano. Concerns about these landfills include that they are and will continue to cause significant pollution unless leachate and contaminated groundwater are collected and treated.

Central Landfill. The Central Landfill is located in Johnston, Rhode Island, 1 mile north of the Cranston border, and across Green Hill Avenue from Simmons Upper Reservoir. Operated by the Solid Waste Management Corporation, the Central Landfill receives 80 percent of the State's solid waste.

Cedar Swamp Brook flows through the Central Landfill Site into Upper and Lower Simmons Reservoirs 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. 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.

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.

Groundwater taken 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 volatile organic compounds (VOCs) regularly show up in significantly elevated concentrations.

The EPA and Rhode Island Solid Waste Management Corporation are conducting a remedial investigation/feasibility study of the site under the Federal superfund program.

Vinagro Landfill. This landfill is located in Johnston on Green Hill Avenue between Plainfield Pike and the 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 construction and demolition debris. Future plans include operating a recycling center and cogeneration facility. There also remains a stockpile of pig waste, which is planned for disposal 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 list as a potentially contaminated hazardous waste site. RIDEM is working with EPA to investigate this site further.

Capuano Landfill. This landfill is located just north of the intersection of 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.

According to a study by Ecology and the Environment, Inc. 1982, 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 flood plain downgradient of the landfill. Contaminated ground and surface waters appear to be flowing towards the Pawtuxet River.

The site is currently on EPA's list as a potentially contaminated hazardous waste site.

f. Septic Systems

General. Septic systems deserve special attention because they are the primary potential source of pollution that can be reduced or eliminated by constructing new sewers in west Cranston.

Septic System Design. Septic tanks are designed to settle and remove solids and provide some biological degradation of dissolved and suspended organics. Clarified water from the tank flows into a leaching field of gravel or small stones. According to RIDEM regulations (RIDEM, 1989), this field should be designed so the bottom of the stone is at least 3 feet above the maximum elevation of the groundwater table. Leaching fields for septic tanks typically consist of 500 to 600 square feet of drain bed, 1 and 1/2 to 2 feet below the ground surface. Under ideal conditions, i.e., a percolation rate of 5 minutes per inch or less, RIDEM requires a minimum of 375 square feet of effective leaching area for a 3-bedroom dwelling. With percolation rates of 40 minutes per inch, 870 square feet of trench would be required for the same dwelling. Soil with a percolation rate of over 40 minutes per inch is unsuitable for disposal of sewage by any means of subsurface leaching. Shallow bed depth allows some evaporation and uptake of contaminants by plants. Placing the drain field near the surface permits aerobic conditions, with the result that some degradation of the waste and bacterial die-off occurs before the wastewater reaches the groundwater. A zone of unsaturated soil between the leach bed and the water table is important so that septic tank effluent does not discharge directly into the groundwater, especially if it is an aquifer used for drinking water supply.

Normal System--Groundwater Contamination. Even a properly designed and maintained septic tank system can cause localized pollution of groundwater with nitrates, chlorides, and bacteria. The average septic tank effluent contains 40 mg/l of total nitrogen. In addition, there may be metals contamination including lead and cadmium from plumbing drainage fixtures. However, the metals and bacteria are usually removed by adsorption, filtration, and die-off as the water moves through the soil, and nitrates and chlorides are diluted. As long as wells are not located too close to septic systems, the presence of such systems will not make the aquifer unsafe.

Serious groundwater contamination can occur with even the best designed and maintained system if organic compounds such as pesticides, paint thinners, and especially septic system cleaners and degreasing agents such as trichloroethane are allowed into them. Rhode Island has banned the use of septic system cleaners with organic solvents and those using acids, but this is difficult to enforce.

Failing System. Septic tank systems fail when they are improperly located, designed, installed, or maintained. This can lead to contamination of surface or groundwater. If the groundwater table is too high, or the soils are not sufficiently permeable or become clogged, wastewaters can seep to the surface. This may result directly in surface water contamination, but more commonly, pollutants do not reach streams until rainfall washes them into a water body. Contaminants of most concern under these conditions are bacteria and viruses, the algal nutrients, nitrogen and phosphorus, metals, and organic solvents or pesticides improperly disposed of in the system.

In west Cranston, soils consist largely of glacial till which has a low permeability and, therefore, is of poor quality for septic tank systems. Records from the Rhode Island Department of Health, and its successor in this area the Division of Groundwater and Individual Subsurface Disposal Systems, show a number of complaints of septic system waste at the ground surface.

When a septic tank system is installed with insufficient depth between the bottom of the field and water table, contaminants enter the groundwater without first passing through an aerobic layer of soil. Pathogens are the greatest concern. Metals and phosphates are more likely to be immobilized in an aerobic zone. Consequently, discharge of septic tank waste directly into the groundwater zone will increase the zone of contamination from these substances.

3. Terrestrial Ecosystem

The State of Rhode Island is included in the Central Hardwood Forest Region which has a variable climate, rich soils and fairly even precipitation (Brockman, 1979). The forest type is broadly characterized as Oak - Hickory with the majority of stocking being white oak (Quercus alba), red oak (Q. rubra) and black oak (Q. velutina) (Eyre, 1980). Common associates include pin oak (Q. palustris), shagbark hickory (Carya ovata), American elm (Ulmus americana), sugar maple (Acer saccharum), red maple (A. rubrum), white ash (Fraxinus americana) and green ash (F. pennsylvanica). Understory associates include American hornbeam (Carpinus caroliniana), eastern hophornbeam (Ostrya virginiana), witch-hazel (Hamamelis virginiana), viburnum (Viburnum spp.), spicebush (Lindera benzoin), mountain-laurel (Kalmia latifolia) and rhododendron (Rhododendron maximum). Herbaceous associates include wild grapes (Vitis spp.), false Solomon's-seal (Smilacina racemosa), trillium (Trillium spp.), Virginia creeper (Parthenocissus quinquefolia), aster (Aster spp.), goldenrod (Solidago spp.) and poisin ivy (Rhus radicans).

Eastern Cranston is extensively developed and consists of most of the city's residential, commerical and industrial land use. Wildlife species common to the area are generally species which are tolerant of human interaction such as the raccoon (Procyon lotor), opposum (Didelphis marsupialis) and the striped skunk (Mephitis mephitis). Western Cranston contains residential, agricultural, outdoor recreation and woodland areas which support the life history requirements of woodland species such as the white-tail deer (Odocoileus virginianus), gray squirrel (Sciurus carolinensis), and eastern chipmunk (Tamias striatus).

Upland vegetation provides food, cover, breeding and nesting habitat to terrestrial wildlife species. In addition, vegetated tracts of land provide travel corridors for wildlife to move through developed areas. This is an important function for larger mammals such as white-tail which need larger areas and a diversity of habitat types to satisfy their life history requirements. Travel corridors are also important to migrating song birds which frequently stop to rest and eat during their migration. The consequence of urban development in Cranston has been a significant reduction in the number and diversity of wildlife species.

Historically, Cranston was a farming community and western Cranston still retains much of its rural character and many active farms. According to the Soil Conservation Service (USDA, 1981), approximately 10 percent of soils in Cranston are considered prime farmland soils located predominantly in the west Cranston area. In addition to agriculture, prime farmland soils are suitable sites for housing development. In an effort to protect areas of prime farmland, the City of Cranston's Open Space and Recreation Plan includes prime farmland as one of the key components to identifying critical lands for protection as Cranston continues to grow into the future (Cranston Comprehensive Plan, 1992). A variety of methods have been used to preserve agricultural land: limiting infrastructure improvements, differential tax assessment, or outright purchase. In addition, developmental rights have been purchased to several farms in the Seven Mile Road area by the State of Rhode Island (Cranston Comprehensive Plan, 1992). Seven Mile Road is located on the boundary between the City of Cranston and the town of Scituate (and is not in the study area).

4. Aquatic Ecosystem

Water resources in the area which have close alignments or would be transversed by the proposed sewer options include Furnace Hill Brook, Meshanticut Brook, an unnamed tributary to Meshanticut Brook, the Pocasset River and the Pawtuxet River. In addition to the riverine wetlands, the proposed wastewater conveyance alignments traverse isolated freshwater wetland areas, predominantly forested wetlands. Vegetative species associated with forested wetlands in the study area include eastern cottonwood (Populus deltoides), eastern sycamore (Platanus occidentalis), silver maple (Acer saccharinum), red maple and American elm. Common understory species include red-osier dogwood (Cornus stolonifera), black willow (Salix nigra), speckled alder (Alnus rugosa), maleberry (Lyonia ligustrina), spicebush (Lindera benzoin), and common winterberry holly (Ilex laevigata). Skunk cabbage (Symplocarpus foetidus), grasses and ferns are common to the herbaceous layer.

Wetlands have many valuable functions including flood control, fish and wildlife habitat, nutrient retention, sediment trapping, shoreline anchoring and dissipation of erosive forces and visual/aesthetic quality. In the past, urban development in Cranston has resulted in a significant reduction in the amount of wetlands. Wetland habitat provides food, cover, breeding and nesting habitat to a variety of wildlife species. When upland habitat is reduced such as in an urban/suburban setting, wetlands become increasing valuable to terrestrial species as well. Some upland species such as the white-tailed deer, may be forced to adapt to the wetland environment when the upland environment is developed for human use. Wetlands are often the only remaining vegetated tracts left in an urban environment and may function as travel corridors for wildlife to move through developed areas.

Wetlands are regulated by the Rhode Island Division of Freshwater Wetlands (DFW) pursuant to the Rhode Island Department of Environmental Management Rules and Regulations Governing the Enforcement of the Fresh Water Wetlands Act (RIDEM, 1981). A permit is required from the DFW prior to conducting activities in freshwater wetlands and/or their regulated buffer zones. By definition, "a freshwater wetland shall include, but not be limited to marshes, swamps, bogs, ponds and rivers; river and stream floodplains and banks; areas subject to flooding or storm flowage; emergent and submergent plant communities in any body of fresh water including rivers and streams; and that area of land within fifty (50') feet of the edge of a bog, marsh, swamp or pond". (RIDEM, 1981). A river bank is described as being "land within one hundred feet (100') of the edge of a flowing water body ten feet (10') in width or less and land within two hundred feet (200') of the edge of a flowing water body ten feet (10') in width or more." (RIDEM, 1981).

Wildlife species observed utilizing wetlands in the study area include the belted kingfisher (Megaceryle alcyon), muskrat (Ondatra zibethicus), and winter wren (Troglodytes troglodytes). The Rhode Island Division of Fish and Wildlife (RIDWF) stocks trout in Furnace Hill Brook (native brook trout (Salvelinus fontinalis) have also been observed by the RIDFW). Otherwise, limited information is available concerning fisheries resources in the study area (RIDFW, 1994). The Pawtuxet River and contributing streams in the study area would generally be considered a warm water fishery. Species commonly found in warm water fisheries in New England include brown bullhead (Ictalurus nebulosus), yellow perch (Perca flavescens), chain pickerel (Esox niger), white sucker (Catostomus commersoni), and common shiner (Notropis cornutus).

5. Endangered or Threatened Species

The U.S. Fish and Wildlife Service (USFWS) determined in a letter dated 16 November 1993 that no known Federally listed or proposed, threatened and endangered species were known to occur in the project area with the exception of occasional, transient endangered bald eagles (Haliaeetus leucocephalus) or peregrine falcons (Falco peregrinus anatum). In addition, the Rhode Island Natural Heritage Program provided information regarding rare species and ecologically significant natural communities in the project area in a letter dated 24 November 1993. At this time, the NHP is not aware of any rare species or noteworthy natural communities in the study area.

The Rhode Island Division of Fish and Wildlife indicates, at the present time, little information is known concerning the population status of the American brook lamprey (Lampetra appendix), a State Endangered Species (phone coordination with Chris Powell, Rhode Island Division of Fish and Wildlife, 31 January 1994). This species has been found in the Blackstone Watershed in Rhode Island. The American brook lamprey is associated with cool, clear, high gradient streams with gravel bottoms and generally spawns in streams wider than 15 feet. Furnace Hill Brook appears to have appropriate habitat for this species however, no surveys have been conducted to determine its presence.

6. Historic and Archaeological Resources

a. General

The study area is located within the City of Cranston and can properly be divided into two distinct zones, east and west Cranston. Eastern Cranston is characterized as a heavily developed and urbanized sector, while west Cranston is distinguished as a combination of rural and expanding suburban development. The potential for cultural resources is decidedly less in east Cranston, while many known resources are located and presumably intact within portions of west Cranston. The following is a brief discussion of the prehistory and historical development of Cranston, as well as a description of known historic resources both within and in the vicinity of the study.

b. Historic Overview

The prehistoric period is usually divided into distinct time periods based on 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.), and the Contact Period (1524-1636 A.D.).

Paleo-Indian Period. The Paleo-Indian Period represents the earliest human presence in the Northeast following the last glacial retreat. The environment at that time probably supported a spruce and pine forest and large game animals such as caribou, mastodon and mammoth. The Native American populations 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 by 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. West 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 remains. 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. This period is further 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 in the vicinity of I-295.

Contact Period. The Contact Period begins with Verrazano's explorations of Narragansett Bay and ends with 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 today 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 Plainfield Pike consisted of acres of cultivated fields." (RIHPC, 1980:15). These include the Lippitt 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, but 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 revolutionary 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).

c. Historic Properties

There are numerous historic properties within the study area. Listed below are those properties that the Rhode Island Historic 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 archaeological sites in the area, of which varying information is available.

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.

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 listed on 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 also listed on the National Register.

Oaklawn Village Historic District - Oaklawn was one of Cranston's first suburban commuter villages. In 1872, Oaklawn has 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 historic district is on the National Register of Historic Places.

The State Institutions at Howard - "Occupying the old Stukely 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 Works Progress Administration (WPA) during the 1930s.

7. Social and Economic Resources

Resources described in this section of the report include land use, population, labor force, income, sales, school enrollment, municipal financing, utilities, public saftey and traffic. Projected future conditions without the project are described. Assumptions regarding population growth and industrial and commercial growth were made by Tutela Engineering Associates (TEA) for the on-going wastewater treatment facility plan and have been adopted for this study in agreement with Cranston city officials.

a. Land Use

In 1990 land use in Cranston in acres by activity was as follows (source, TEA, 1992):

Activity	Acres
Residential	6,822
Industrial	510
Transportation, Comm, & Utilities	272
Commercial	502
Institutional	826
Rec, Parks & Cem.	848
Farm	288
Undeveloped	5,840
Total	15,908.

Industrial Land Use. In Service Area 1, the Western Cranston Industrial Area is a 350 acre site located at the interchange of Interstate Route 295 and State Route 14. Currently, 27 firms and 2,200 employees are located within the park. The Cranston Office of Economic Development indicates that 162 acres are currently in use. In addition near the Plainfield Pike there are 30 acres that are currently commercially developed and another 30 acres that are not yet developed. By 2045, it is expected that there will be 470 acres of industrial/commercial development in northwest Cranston.

In nearby Johnston there are 100 acres that are currently undeveloped and it is expected that industrial development could occur there if the Town of Johnston could work out a plan with the City of Cranston to connect to the City's sewerage system.

In Service Area 2, industrial development consists of the Tilcon Gammino Gravel Pit. This site is comprised of approximately 140 acres and employs approximately 155 workers.

In Service Area 3, the Howard Industrial Park is one of two major industrial sites in Cranston. It is located in East Cranston at the interchange of Interstate 95 and State Route 37. The park is almost totally developed today housing 38 companies with a workforce of approximately 3,000. There are approximately 190 acres devoted to industrial use at this site.

Residential Land Use. Currently west Cranston contains 3,330 acres of residential development. At full build out under existing zoning, there is expected to be about 5,800 acres of residential development, about 75 percent of west Cranston's total area of 7,700 acres (Cranston Comprehensive Plan, 1992, P.29).

Tutela Engineering Associates estimates about 1,075 acres of development will be in the I-295 pumping station district (Service Area 1) and 4,460 acres in the Wilbur pumping station district (Service Area 2) (Tutela Engineering Associates, Wastewater Flow Letter Report, February 25, 1993,). Residential development in west Cranston is expected to occur with or without the Federal project.

b. Population

In 1990 Cranston ranked third in population among Rhode Island's 39 cities and towns. The Census population for Cranston in 1990 was 76,060. This represented a 5.7 % increase from the 1980 population of 71,992. Population for the years 1920 to 1990 are shown below:

Year	Population
1920	29,407
1930	42,911
1940	47,085
1950	55,060
1960	66,766
1970	74,287
1980	71,992
1990	76,060

Tutela Engineering Associates projects a population of 83,020 people by the year 2015 and a population of 91,370 by 2045 under existing zoning conditions (Tutela Engineering Associates, Draft Wastewater Facility Plan, 1992). Most of this population increase is projected to take place in west Cranston.

In Service Area 1 (I-295 pumping station district) population is expected to increase to 1,775 in 2015 and to 3,220 in 2045. In Service Area 2 (Wilbur pumping station district), population is expected to increase to 8,799 in 2015 and 11,890 in 2045. In Service Area 2 in the year 2015 the sewered population is estimated at 5,400 with the Federal project. No population increase is expected for Service Area 3 (Howard pumping station district). Population in Cranston is expected to increase with or without the Federal project.

c. Labor Force

In 1991 the resident Cranston labor force was comprised of 36,720 employed and 3,288 unemployed. The resident unemployment rate was 8.2 %. As a result of sewer expansion by the City of Cranston (without project condition) it is estimated that in Service Area 1, by the year 2015, an additional 2,300 jobs will be created in the I-295 District. Job expansion is likely to continue in the I-295 district after 2015 culminating with an additional 3,000 jobs (over 2015 levels). If the City of Cranston and Johnston can reach an agreement regarding the connection of the industrial area in Johnston to the system, then 1,300 jobs would be created in Johnston by 2015 and if expansion of the system continues, an additional 600 jobs would be created over the 2015 level. No job expansion is expected in Service Area 2 or Service Area 3 in the without project condition.

d. Income

The 1989 median family income for Cranston was $41,896. The annual payroll in 1992 for an average employment of 23,189 was $511,128,786. This employment occurred in 2,126 establishments in Cranston.

The job creation discussed above means that an additional $62,451,000 of income will be created by 2015 in the I-295 district growing to an increase of $143,908,000 by 2045. In Johnston income growth will be $35,298,000 by 2015 and $51,590,000 by 2045. All this expected income growth is in Service Area 1.

e. Sales

Gross retail sales in 1990 were $962,033,000. There were 444 firms involved in the retail trade in Cranston in 1992. In Providence County there were 3,903 firms involved in the retail trade in 1989.

f. Housing

According to the 1990 Census there was a total of 30,516 housing units in Cranston in 1990, of which, 29,349 were occupied. This would leave 1,167 units vacant. In 1980 there were 27,280 housing units in Cranston. The number of housing units increased by 3,236 units, or 11.9 % between 1980 and 1990.

In 1990, 16,619 of the 26,479 specified occupied housing units, or 62.8 %, were owner occupied. The median selling price of an existing single family home was $122,750. There were 9,860 specified housing units that were renter occupied and the median rent was $534 per month.

Anticipated and existing residential development by Service Area is shown below. It is assumed that the population per housing unit is 3 (TEA, 1992a). This growth in housing units is assumed to be independent of the Federal project.

	Housing Units		
	1990	2015	2045
Service Area 1	190	592	1,073
Service Area 2	2,074	2,933*	3,963

* In Service Area 2 in the year 2015 sewered housing units are estimated at 1800 with the Federal project.

g. Schools

Cranston has 24 schools which had a total enrollment of 9,776 in September 1992. There are 18 elementary schools and 6 secondary schools. The School Department had 748 professional staff members. The School System had a student teacher ratio of approximately 13:1. The cost of operating the public school system in Cranston for the 1991-92 school year was $54,715,388.

School enrollment in west Cranston is anticipated to increase by 3,400 by the year 2015 and 5,800 by the year 2045.

It is anticipated (Cranston Comprehensive Plan, 1992) that Cranston elementary schools will reach capacity by the 1995-1996 school year. Thus Cranston will need to realign grade structures that will allow for use of existing excess capacity in secondary grade buildings or embark on a construction program.

A new elementary school has been planned for west Cranston (Cranston Comprehensive Plan, 1992 P. 225). Construction cost has been estimated at $7 million. Additionally, the city estimates that it will cost approximately $1.5 million to acquire a 30 acre parcel for the school site. Thus total cost for the new school will be approximately $8.5 million. Land acquisition is anticipated in the next few years with construction phased in as enrollments warrant which is anticipated to be five years.

h. Municipal Finances

Revenues and expenditures for the fiscal year ending 1992 is shown on the following page (Official Statement of the City of Cranston Rhode Island, June 1993, page 28):

Revenue	
General Property	$76,639,118
Intergovernmental and Departmental Revenue	25,821,965
Licenses and Permits	1,095,521
Fines and Interest on Late Payments	824,059
Interest on Investments	276,636
Other Revenues	3,640,652
Total	$107,297,951
Expenditures	
General Government	$ 2,487,099
Financial Administration	2,177,517
Public Safety	23,512,722
Public Works	9,953,598
Human Resources	6,771,789
Education	61,112,178
Sundry	1,280,238
Total	$107,295,141

Note: Revenues add to $108,297,951.

The Fiscal Year 1992-93 tax rate on real estate and tangible personal property was $36.84 per $1,000 of assessed valuation. The city's fiscal year 1992 property taxes were levied on June 1, 1991, on assessed valuation as of December 31, 1990. The last valuation of property was effective December 1983 at 94 % of market value at that time. The rate of assessment for the fiscal year ending June 30, 1992 was 65% for real estate and 100% for motor vehicles. Education expenditures were approximately 57% of total expenditures for Fiscal Year 1992. Property taxes contributed approximately 71% of total revenues.

Sewer assessments are deposited in the Sewer Enterprise Fund and are sufficient to cover the cost of the operation of the Wastewater Treatment Facility as well as debt service on city debt incurred for sewer purposes. As of August 1992 user fees are $185 per residential unit and are $0.55 or $0.813 per 100 cubic feet for commercial users depending on the type of commercial business. In the without Federal project condition sewer rates are likely to rise with the city's sewer system expansion.

The water rates for residential users are $0.64 per 100 cubic feet up to 400,000 cubic feet and $0.64 per 100 cubic feet for industrial users up to 400,000 cubic feet and $0.32 per 100 cubic feet over 400,000 cubic feet.

i. Utilities

Wastewater Treatment and Sewers. The Cranston Wastewater Treatment Facility (WWTF) was designed to treat 23 million gallons of wastewater per day. Currently the average daily flow is approximately 12.3 million gallons. The City of Cranston is currently undergoing planning and design efforts to bring the WWTF into compliance with their discharge permit. Presently, almost 90% of the population is served by sewers with over 225 miles of sanitary sewers.

In Service Area 1 the city is expanding its sewer system capacity to allow greater flows from the I-295 district where in 1990, about 110 households were served. The population served in this district is expected to increase to 1,775 by 2015 and 3,220 by total build out in 2045.

In Service Area 2 in the without project condition it is assumed this area will continue to rely on on-site septic systems for wastewater disposal.

In Service Area 3 the city is expected to continue to provide sewer service and schedule modifications as appropriate.

Water Service. The city's water needs are served by the Water Division for Western Cranston, The Kent County Water Authority and the Providence Water Supply Board. In addition to the City of Cranston, the Providence Water Supply Board serves Providence, Johnston, North Providence, and parts of the City of Warwick and the Town of Smithfield. The primary source for these suppliers is Scituate Reservoir.

j. Public Safety

The Cranston Police Department has 215 employees including the chief and deputy chief. The Fire Department has a force of 195 including chief, four deputy chiefs, twelve captains, twenty-six lieutenants, and 120 hose persons. The Fire Department provides emergency medical services including ALS (advanced life support). The city also has four fire stations staffed by volunteers.

Currently west Cranston is served by volunteer fire companies. With residential growth in west Cranston volunteer fire stations most likely will have to be converted to full-time manned stations in order to maintain adequate response time.

k. Transportation

Residential growth in west Cranston is expected to add 550 to 790 dwelling units a decade resulting in an estimated 3,500 peak hour trips by the year 2045 (Cranston Comprehensive Plan, 1992, page 194). To support this growth existing highway capacity will need to be enhanced by upgrading existing roadways and developing a new arterial corridor and a number of roadway crossconnections.

G. ENVIRONMENTAL CONSEQUENCES

1. General

The Environmental Assessment of the proposed Federal project considers the impacts to water quality, the terrestrial ecosystem (upland vegetation and wildlife), the aquatic ecosystem (fisheries and wetlands), endangered species, cultural resources and socio/economic impacts. To determine impacts to environmental resources in the project area as a result of implementing the Federal project, the with project condition is compared to the without project condition over the life of the project (to the year 2045).

The Federal project is to construct two pumping stations, one force main, one force main/variable grade sewer, improvements to the existing Sockanosset Interseptor and Influent pumps at the WWTF (after 2015) and selected trunk sewers to provide the framework for a wastewater connector system to service portions of West Cranston. See Section E.3. for a description of the Federal project.

2. Water Quality

a. General

The expected effects on water quality include temporary construction related impacts and potential water quality improvements.

b. Water Quality During Construction

There will be water quality impacts during construction, mainly increases in turbidity and sedimentation from erosion during excavation activities. However, these will be temporary and can be controlled by proper construction and erosion control techniques, including silt fences, hay bales, and other means to control runoff from construction sites; covering stockpiled soil to limit erosion; and other similar activities.

c. Other Water Quality Effects

As the Federal project is for the connector components of the sewer system and trunk sewers, it is the extent to which the lateral sewer lines and house connections feeding the trunks, rather than the trunks themselves, which will determine the ultimate extent of water quality effects.

The following paragraphs describe qualitative improvements in water quality that can be expected from the proposed Federal project. Changes in water quality will be too diffuse to describe quantitatively.

Expected water quality improvements would be mainly due to extending sewers to previously unsewered areas with failing septic systems. Because the west Cranston area served by the Federal project has suspected water quality problems due to failing septic systems, implementing these options should result in improvements. Meshanticut Brook in particular would see improvements in the form of lower coliform bacteria levels. Improvements in Pawtuxet River quality would be smaller and not as easily noticed.

d. Hydrology

Hydrologic changes in the watershed, resulting from implementing the project, will be very small. Flows which presently reach surface water through septic systems will be sent through sewer pipes to the WWTF. This will result in a reduction in flow in surface tributaries to the Pawtuxet River, but basically the same amount of flow in the Pawtuxet River itself. However, these reductions in tributary flows will be very small. Furthermore, since water supply for these homes originates in the Scituate Reservoir watershed which is outside the study area, natural streamflow, in areas where sewers are being considered will be affected only slightly.

3. Terrestrial Ecosystem

a. General

The expected effects on the terrestrial ecosystem as a result of the Federal project includes temporary construction related impacts such as noise and dust with installation of sewers. The majority of sewers are located in streets which minimize impacts to wildlife, however to achieve a gravity flow system, the sewers traverse terrestrial habitat in some cases. A thirty foot (30') wide construction work area was determined to be necessary for installation of sewers. Wildlife will move from the area during construction but will reutilize the habitat once construction is complete. The construction of two pump stations will result in the permanent loss of habitat for the pump station footprint.

b. Impacts During Construction

The following paragraphs describe impacts to the terrestrial ecosystem as a result of the Federal connector project.

Option 1C. Option 1C collects flows from the proposed Village Center area by Pipin Orchard Road. The extension of the sewer system to this area will require the construction of the Scituate pumping station and force main/variable grade sewer to the I-295 pumping station. The force main/variable grade sewer would be located along Scituate Avenue, Comstock Parkway, Amflex Drive and Sailor Way. The Scituate pumping station would be located near the intersection of Pipin Orchard Road and Furnace Hill Brook.

The effects on the terrestrial ecosystem will be minimal during construction of Option 1C due to the force main/variable grade sewer alignment in existing streets. The proposed pumping station location is currently succession species such as white pine (Pinus strobus), red cedar (Juniperus virginiana) and juniper (J. communis) (the area is former farmland). The pump station footprint and maintenance area is approximately 100' by 100' (0.23 acres) and is in the wetland buffer zone (which will require a permit from the Rhode Island Division of Freshwater Wetlands). Although the area is currently sparsley undeveloped, a new church is currently being built on a ten acre parcel at the northeast corner of the intersection of Pippin Orchard Road and Scituate Avenue (Cranston Comprehensive Plan, 1992). In addition, other public

facilities associated with the planned Village Center will eventually be built near this intersection. To minimize the visual impact of the pumping station and compensate the loss of wildlife habitat, berry producing shrubs, such as flowering dogwood (Cornus florida) and wild cherry (Prunus spp.) should be used to landscape around the station.

Options 2C and 2D Options 2C and 2D provide for conveyance of projected flows from the proposed Wilbur pumping station district in west Cranston. Option 2D involves a trunk sewer to collect flows from Service Area 2, and deliver them to the proposed Wilbur pumping station. Option 2C provides for conveyance of flows from the Wilbur pumping station to the WWTF. Implementation of Option 2D requires implementation of Option 2C.

Minimal impacts are associated with the installation of Option 2C due to the force main alignment in existing roads. The proposed location of the Wilbur pumping station is the median strip of I-295 (and is also located in the wetland buffer zone which will require a permit from the Rhode Island Division of Freswater Wetlands). Construction in this location has minimal environmental impacts due to previous disturbance, a lack of a diversified plant community (currently mowed grass) and its location between the north and south bound lanes of a major highway. In a letter dated December 27, 1993, the Rhode Island Department of Transportation noted that the median location did not appear to adversely affect the operations of the Department. However, final siting will need to be approved by the Department. This area is currently being evaluated for its technical suitability. Alternatives to this location have additional environmental and socio/economic impacts (removal of large trees and nearby residences).

Trunk sewer alignments in west Cranston (Option 2D) follow roads as much as possible to reduce impacts to natural resources in the project area. However, to achieve a gravity flow system, sewer lines traverse terrestrial habitat in some cases. The Comstock line traverses two areas of upland habitat; from Council Rock Road the sewer line follows the shortest distance down hill to Comstock Parkway (approximately 2500' x 30' or 1.6 acres) and between Mollie Drive and Phenix Avenue (approximately 1000' x 30' or 0.7 acres). A development is currently planned in the area between Mollie Drive and Phenix Avenue. Consideration will be given in the final design of sewer alignments to the orientation of streets in this planned development. The Natick/Phenix line traverses one area of upland habitat between Hillock Road and Natick Avenue (approximately 2400' X 30' or 1.6 acres).

The installation of trunk sewers in west Cranston will result in the temporary loss of 4 acres of terrestrial habitat through construction related disturbances. To facilitate installation of the sewer line, large trees and understory vegetation will be removed from the 30' wide construction work area. In areas of large trees, this removal of vegetation should not significantly open the tree canopy as was observed along the sewer right-of-way adjacent to the Pawtuxet River Reservation (from the Pontiac Avenue pump station to the WWTF). To prevent damage to the pipeline (from roots) and enable assess for maintenance purposes, the pipeline corridor will be maintained free of large vegetation. Construction related impacts such as noise and dust will subside at the conclusion of construction. Although, woody vegetation will not be allowed to reestablish along the pipeline corridor,

herbaceous vegetation should recover within a period of two years. To stabilize the area before indigenous species become established, the impacted area will be planted with a grass seed mix which will be compatible with the existing, adjacent species and capable of growing on the site. Requirements to minimize construction impacts are summarized in Section H. Actions to Minimize Environmental Impacts. A monitoring plan will be undertaken to assure recovery of the habitat. This monitoring plan will most likely be the responsibility of the local sponsor and the U.S. Fish and Wildlife Service will be invited to attend the periodic site visits.

c. Other Related Effects

According to the Cranston Comprehensive Plan (1992), to the extent that future development adheres to existing zoning patterns, approximately 2,470 acres of undeveloped space will be converted to residential use in west Cranston. Approximately 124 acres of open space could be preserved through cluster development at the Village Center and 370 acres preserved through common open space in other cluster developments in the west Cranston area (Cranston Comprehensive Plan, 1992).

The growth management objectives for west Cranston include protection of wildlife habitat and critical areas such as prime farmland and farmland of statewide importance, land with historic value, land with scenic value, etc. through the preservation of open space in conjunction with cluster development. The City of Cranston's Open Space and Recreation Plan (Cranston Comprehensive Plan, 1992) recommends tying together existing open space and recreation areas through acquisition and protection to create linkages. Continued development is anticipated in west Cranston with or without the Federal project. However, cluster housing is a preferred means of development due to the simultaneous preservation of common open space. The Federal project increases the technical feasibility for siting cluster developments by providing an alternative to on-site septic systems.

Even with cluster development, half of the existing undeveloped residential land in west Cranston will be altered through development. Additional compensation measures for loss of wildlife habitat value should be considered by the City of Cranston in their Natural Resources Action Program (Cranston Comprehensive Plan, 1992). Habitat loss could be compensated through environmental enhancement of remaining land such as increasing habitat diversity through forestry practices (selective cutting), installation of nest boxes, planting wildlife food plots, etc. There would be maintenance and monitoring requirements to sustain the effects of environmental enhancement features.

4. Aquatic Ecosystem

a. General

The expected effects on the aquatic ecosystem as a result of the Federal project includes temporary construction related impacts such as noise and dust, loss or disturbance of vegetation and disturbance of soil in the designated construction work area. The impacts associated with the proposed

project are generally temporary, associated with the construction timeframe and time required to revegetate. The majority of sewers are located in streets which minimize impacts to freshwater wetlands and wildlife, however to achieve a gravity flow system, the sewers traverse aquatic habitat in some cases. In addition, the two pumping stations are located in the wetland buffer zone. Wildlife will move from the area during construction but will reutilize the habitat once construction is complete.

b. Wetland Impacts During Construction

Wetland impacts were quantitatively evaluated for each option alignment by determining the number of stream crossings or work within a wetland or regulated buffer zone. This evaluation was based on aerial photographs (scale 1 inch equals 400 feet), U.S. Geological Survey Quadrangles (scale 1 inch equals 2000 feet), sewer plans (scale 1 inch equals 600 feet) and field observations. These estimates are provided for planning purposes and do not represent field measurements or actual wetland delineations. A thirty foot (30') wide construction work area was determined to be necessary for installation of sewer options. A summary of freshwater wetland impacts for the proposed project is presented in Table 3. Acreage figures calculated for each option selected for the Federal project are displayed in Tables 4 and 5. The following paragraphs describe quantitative impacts to freshwater wetlands as a result of the Federal project.

Option 1C Wetland impacts associated with Service Area 1 - Option C (see Table 4) include construction of a pumping station in the river bank (0.23 acres) and one river crossings (0.14 acres) for a total of 0.37 acres.

Option 2C and 2D Wetland impacts associated with Service Area 2 - Option C include construction of a pumping station in the river bank (0.33 acres) (see Table 4). The majority of wetland impacts are associated with the installation of trunk sewers in the west Cranston area, Option 2D (see Table 5). The sewer lines follow roads as much as possible however, topography in some areas necessitates alignments adjacent to streams to achieve a gravity flow system. Wetland impacts associated with the Brookdale Line are the result of one stream crossing and construction in the river bank (1.04 acres). Wetland impacts associated with the Comstock Line are the result of three stream crossing and construction in the river bank (2.23 acres) and construction in wetlands and/or the 50' wetland buffer zone (1.37 acres) for a total of 3.60 acres. Wetland impacts associated with the Tilcon Line are the result of one stream crossings and construction in the river bank (0.28 acres) and construction in wetlands and/or the 50' wetland buffer zone (0.21 acres) for a total of 0.49 acres. Wetland impacts associated with the Phenix/Natick Line are the result of two stream crossings and construction in the river bank (0.28 acres) and construction in wetlands and/or the 50' wetland buffer zone (1.17 acres) for a total of 1.45 acres. In the final design phase of this project, it may be possible to further reduce freshwater wetland impacts for construction of the sewers, depending on topography, through adjustments to move the sewer line out of the river bank, wetlands and/or the 50' wetland buffer zone.

Approximately 7.28 acres of freshwater wetlands, as defined by the Rhode Island Freshwater Wetland Act, will be temporarily impacted by the proposed Federal project. The impacts associated with the installation of trunk sewers in freshwater wetlands are generally temporary, lasting the construction timeframe and vegetation recovery time. It has been demonstrated that wetland vegetation recovers from pipeline installation within one to two years with proper soil handling and construction techniques (Thibodeau, 1986 and Honig, 1991). To prevent damage to the pipeline (from roots) and enable assess for maintenance purposes, the pipeline corridor will be maintained free of large vegetation. Forested wetlands along the pipeling corridor would be replaced by wetlands of different plant associations (emergent or small shrub vegetation) however, species composition recovers to be as diverse and rich as the original plant community (Thibodeau, 1986).

To stabilize the impacted area before indigenous species become established, the impacted area will be planted with a grass seed mix which will be both compatible with the existing, adjacent species and capable of growing on site.

Section H. Actions to Minimize Environmental Impacts of this document discusses additional soil handling techniques to minimize construction related impacts to wetlands. A monitoring plan is also included in Section H. to assure recovery of plant communities/habitat value in affected wetland areas.

The DFW closely evaluates proposals which may effect the values associated with wetlands defined by the Fresh Water Wetlands Act, Rules and Regulations. The applicant will be required to demonstrate that there are no reasonable alternatives to the proposed option alignment. If wetlands cannot be avoided, impacts to wetlands must be minimized and a mitigation plan to compensate wetland impacts may be required. The Rhode Island Division of Freshwater Wetlands will consider the advantages and disadvantages of sewering the west Cranston residential area during the permitting process. Design criteria would include sediment erosion controls, temporary culverts or diversions on stream crossings, and potential construction windows to protect wildlife from construction disturbances.

c. Fisheries Impacts During Construction

To facilitate installation of the sewer line, large trees and understory vegetation will be removed from the 30' wide construction work area. In areas of forested wetlands, this removal of vegetation should not significantly open the tree canopy as was observed along the sewer right-of-way adjacent to the Pawtuxet River Reservation (from the Pontiac Avenue pump station to the WWTF). The Rhode Island Division of Fish and Wildlife is concerned that removal of trees adjacent to streams may reduce shading and allow for increases in water

temperature. Small increases in water temperature can be detrimental to cold water fish species such as trout which is currently stocked in Furnace Hill Brook (phone coordination with Chris Powell, Rhode Island Division of Fish and Wildlife, 31 January 1994). There is also a native population of brook trout in Furnace Hill Brook. Further coordination with the Rhode Island Division of Fish and Wildlife is required once sewer alignments are more firmly established to determine impacts to fisheries resources. A fisheries survey may be required in areas where sewer lines have close alignment to streams.

To minimize ecological impacts, construction activities conducted in or adjacent to streams will be performed during the low flow season. This timeframe also prevents adverse impact to spawning of fish fauna utilizing the area.

TABLE 3

FRESHWATER WETLAND IMPACTS SUMMARY

SECTION 117 CRANSTON WASTEWATER CONVEYANCE SYSTEM
FEASIBILITY INVESTIGATION

Location	Wetland* (acres)	Wetland Buffer** (acres)	River Bank*** (acres)	Stream Crossing (number)
Service Area 1				
Option C	0	0	0.37	1
Service Area 2				
Option C	0	0	0.33	0
Option D				
Brookdale	0	0	1.04	1
Comstock	I------1.37-----I		2.23	3
Tilcon	I------0.21-----I		0.28	1
Natick/Phenix	I------1.17-----I		0.28	2

*Wetland - This term includes marshes; swamps; bogs; rivers; river and stream flood plains; areas subject to flooding or storm flowage; emergent and submergent plant communities in any body of fresh water including rivers and streams.

**Wetland Buffer - This term includes land within fifty feet (50') of the edge of any bog, marsh, swamp or pond.

***River Bank - This term includes land within two hundred feet (200') of the edge of any flowing body of water having a width of ten feet (10') or more and land within one hundred feet (100') of the edge of any flowing body of water having a width of less than ten feet (10') during normal flow.

TABLE 4

FRESHWATER WETLAND IMPACTS

SECTION 117 CRANSTON WASTEWATER CONVEYANCE SYSTEM
FEASIBILITY INVESTIGATION

SERVICE AREA 1 - OPTION C

LOCATION	WORK IN FRESHWATER WETLANDS
Scituate Pumping Station	Work in the river bank 100X100' (0.23 acres)
Scituate Ave. FM/VGS	Stream (<10) crossing. Work in river bank 30x200' (0.14 acre)

Total Freshwater Wetland Impact for Option 1C - 0.37 Acres

SERVICE AREA 2 - OPTION C

LOCATION	WORK IN FRESHWATER WETLANDS
Wilbur Pumping Station	Work in the river bank 120X120' (0.33 acres)

Total Freshwater Wetland Impact for Option 2C - 0.33 Acres

TABLE 5

FRESHWATER WETLAND IMPACTS

SECTION 117 CRANSTON WASTEWATER CONVEYANCE SYSTEM
FEASIBILITY INVESTIGATION

SERVICE AREA 2 - OPTION D

LOCATION	WORK IN FRESHWATER WETLANDS
Brookdale line	Adjacent to Meshanticut Brook (>10') along Brookdale Street. Work in river bank 30x1200' (0.83 acres).
	Stream (>10') crossing behind Brookdale Steet. Work in river bank - 30x300' (0.21 acres).
	Total Freshwater Wetland Impact For Brookdale Line - 1.04 Acres
Comstock Line	Stream (<10') crossing below Echo Lane. Work in the river bank - 30x200'(0.14 acres).
	Stream (<10') crossing below Iroquois. Work in the river bank - 30x200'(0.14).
	Adjacent to stream (>10') Iroquois to Kimberly Lane. Work in wetlands/wetland buffer/river bank - 30x2000'(1.37 acres).
	Stream (>10') crossing at the end of Kimberly Lane. Work in the river bank 30x300'(0.21 acres).
	Adjacent to stream (>10') behind Mollie Drive and Hines Farm Road. Work in river bank - 30x2500' (1.72 acres).
	Adjacent to stream (<10') along Hines Farm Road. Work in the river bank - 30x30' (0.02 acres).
	Total Freshwater Wetland Impact For Comstock Line - 3.60 Acres

TABLE 5 (CONTINUED)

FRESHWATER WETLAND IMPACTS

SECTION 117 CRANSTON WASTEWATER CONVEYANCE SYSTEM
FEASIBILITY INVESTIGATION

SERVICE AREA 2 - OPTION D

LOCATION	WORK IN FRESHWATER WETLANDS
Tilcon Line	Adjacent to stream (<10') south of Phenix Ave. Work in the river bank - 30X300' (0.21 acres).
	Stream (>10') crossing - Furnace Hill Brook. Work in the river bank - 30X400' (0.28 acres).
	Total Freshwater Wetland For Tilcon Line - 0.49 Acres
Natick/Phenix Line	Stream crossing (<10') x-country between Hillock Road and Natick Ave. Work in the river bank - 30x200' (0.14 acres).
	Stream crossing (<10') Natick Ave. Work in the river bank - 30x200' (0.14 acres).
	Adjacent to stream (>10'). Work in wetlands/ 50' wetland buffer zone/river bank - 30x1700' (1.17 acres).
	Total Freshwater Wetland Impact For Phenix/Natick Line - 1.45 Acres

Total Freshwater Wetland Impacts for Option D - 6.58 Acres

5. Endangered or Threatened Species

No impacts will occur to Federal or State endangered or threatened species as a result of the proposed project. The U.S. Fish and Wildlife Service (USFWS) determined in a letter dated 16 November 1993 that no known Federally listed or proposed, threatened and endangered species were known to occur in the project area with the exception of occasional, transient endangered bald eagles (Haliaeetus leucocephalus) or peregrine falcons (Falco peregrinus anatum). In addition, the Rhode Island Natural Heritage Program provided information regarding rare species and ecologically significant natural communities in the project area in a letter dated 24 November 1993. At this time, the NHP is not aware of any rare species or noteworthy natural communities in the study area.

6. Historic and Archaeological Resources

The construction of sewers within existing roadways will not impact cultural resources, as these areas have been previously modified. The areas of concern for this study are those alignments in west Cranston that are located off-road or cross-country through previously undisturbed locations. A permanent easement of approximately 30 feet width will be required in these areas for the construction of the sewers. These locations will need to be archaeologically tested at the Phase I intensive survey level, prior to construction. A total of eight areas in western Cranston within the proposed project area will require archaeological investigation (see Table 6 - Areas of Archaeological Investigation). In addition, the proposed Wilbur pump station is to be located within the Oaklawn Village Historic District and will need to be constructed to standards established for building within a National Register Historic District. If Phase I archaeological studies uncover any historic or archaeological resources of potential significance, further studies would be required to determine eligibility of these resources to the National Register of Historic Places, and, possibly, Data Recovery investigations if impacts to these resources cannot be avoided. The Rhode Island State Historic Preservation Officer, in a letter dated 22 December 1993, has concurred with these determinations.

7. Socio/Economic Resources

This section discusses the most likely future conditions for the socio/economic resources identified in the Affected Environment Section. These impacts are a result of construction of Federal project options. Federal project options are for extension of the city's sewer system to the proposed Village Center (Option 1C) in Service Area 1 and to other areas of west Cranston in Service Area 2 (Option 2C and 2D). The socio/economic analysis includes all of Option 2D as presented in Table 1. The redefinition of Option 2D to exclude the Phenix pumping station and force main and a portion of the Tilcon gravity trunk sewer from the Federal project does not significantly affect the socio-economic impacts of Option 2D. Service Area 3 is not discussed as there is no Federal project option proposed for this area.

TABLE 6

AREAS OF ARCHAEOLOGICAL INVESTIGATION

SECTION 117 CRANSTON WASTEWATER CONVEYANCE SYSTEM
FEASIBILITY INVESTIGATION

The eight areas that will require archaeological investigation based on the feasibility study are:

1. the Scituate pumping station location

2. the Wilbur pumping station location

3. an area east of Brookdale Street location of a portion of the proposed Brookdale trunk sewer

4. an area west of Hines Farm Road within the Furnace Hill Brook Historic and Archeaological District location of a portion of the proposed Comstock trunk sewer

5. an area east of Kimberly Lane location of a portion of the proposed Comstock trunk sewer

6. an area north of South Comstock Parkway and south of Council Rock Road location of a portion of the proposed Comstock trunk sewer

7. an area between Natick Avenue and Glenham Roads location of the a portion of the Natick/Phenix trunk sewer

8. an area behind the Natick Village subdivision location of a portion of the proposed Natick/Phenix trunk sewer

The region of influence, or the area where impacts are measured, includes not only the three service areas and the City of Cranston, but also the wider area encompassing the County of Providence. The impact of activities occurring *in Cranston spillover into the surrounding County of Providence.*

Assumptions regarding population growth and industrial and commercial growth were made by Tutela Engineering Associates for the on-going Wastewater Treatment Facility Plan and have been adopted for this study in agreement with Cranston city officials.

a. Land Use

Industrial Land Use. In Service Area 1 no change in industrial land use is expected as a result of the Federal project.

In Service Area 2 with a federal project, industrial growth is anticipated to occur at the Tilcon Gammino gravel extraction site. This site comprises about 140 acres. Although the Tilcon-Gammino site is currently zoned for industrial use, there are some infrastructure improvements that would be needed for its continued use in this purpose. Access to the site along Natick Avenue and Phenix Avenue would need to be upgraded and adverse traffic impacts on residential neighborhoods would need to be mitigated. If access to Route 37 cannot be improved then this land may be developed for residential use (Cranston Comprehensive Plan, 1992 P. 37). Thus industrial land use is not expected to be impacted by the project. However, with a project the Tilcon Gammino site will be able to change industrial use. For the feasibility study, it is assumed that full build out at the site will occur by the year 2045 with 68 %, or about two thirds, of this industrial growth occurring by the year 2015. This assumption was made by Tutela Engineering Associates in planning for the wastewater treatment facility. Thus 93 acres are expected to be developed by 2015 and 140 acres developed by 2045.

Residential Land Use. In Service Area 1 construction of the Scituate Pumping station and force main/variable sewer (Option 1C) would facilitate the establishment of a Village Center comprising 120 acres of residential development and a mix of commercial, public, civic, and institutional uses. (Cranston Comprehensive Plan, 1992 P. 153).

In Service Area 2, the Federal project would not impact on residential land use as development is expected to occur with or without sewers. However, providing the framework for a sewer system in this area may facilitate the design of cluster residential development by providing an alternative to on-site septic systems. Cluster development permits the same number of dwelling units to be built on smaller lots while simultaneously designating common open space areas. The city's goal for cluster residential in west Cranston is 1,480 acres (Cranston Comprehensive Plan, 1992 P. 30).

If the Village Center and cluster development concept is implemented as proposed in the City's Comprehensive Plan, this would allow for preservation 124 acres of open space and 370 acres of common open space in west Cranston.

b. Population

There are not expected to be any identifiable direct impacts on population from an extension of the sewer system in Service Areas 1 or 2. Expanded population growth is the same as for the without project condition.

Due to secondary impacts, population in Providence County, which includes Cranston, is expected to increase due to job creation in Service Area 2 at the Tilcon Gammino site. This anticipated growth is an additional 4,400 people by 2045.

c. Labor Force

Long Term. With the Federal project, Service Area 2 employment is estimated to increase by 1,800 in 2015 and by 2,700 in 2045. These increases are expected assuming road improvements are made to provide access to the Tilcon Gammino site from Route. 37.

Employment projections discussed in the previous paragraph are the direct impacts of industrial development that would be permitted with an increase in sewer capacity. The indirect impacts of secondary spending rounds are expected to be felt over a wider area. In Providence County, which includes Cranston and Johnston, increases in employment of 2,800 and 4,100 are projected for the years 2015 and 2045.

Short Term. Also project construction will have impacts on annual employment for Providence County as shown below. For the purpose of employment analysis, it is assumed that construction will take approximately two years for project completion.

Option	Employment
1C	20
2C-2D	86

d. Income

Long Term. Projected changes in income are based on the current average annual income for the Cranston workforce. Income projections are obtained by multiplying the projected employment changes discussed above by the average annual wages for the employment mix that is anticipated to occur, $27,152 per employee. Again as with land use and employment this growth is projected to occur only in the with project condition (Options 2C combined with 2D).

In Service Area 2 (Tilcon Gammino site) income is expected to increase by $48,874,000 in 2015 and to $73,312,000 by the year 2045. For Providence County, the total increase in income earned in this county as a result of the project is $66,443,000 and $99,664,000 for the years 2015 and 2045, respectively. As discussed above, projected income increases in Service Area 2 are dependent on road improvements to provide access to Route 37.

Short Term. Also projected construction will have short-term construction impacts on income for Providence County as shown below. For purpose of the income analysis, it is assumed that construction will take approximately two years for project completion.

Option	Income
1C	$474,500
2C-2D	$1,972,000

e. Sales

Long Term. Not enough information exists to estimate sales increase in Cranston. However, for Providence County, as a result of the Federal project, it is estimated that direct sales could increase by $36,478,000 by the year 2015 with induced sales amounting to another $73,411,000 for a total sales impact of $109,889,000 annually. By the year 2045 this impact on spending is estimated to be $164,834,000 annually.

Short Term. The short term construction impacts on annual sales for Providence County are shown below. For purpose of the sales analysis, it is estimated that construction will take approximately two years for project completion.

Option	Sales
1C	$1,553,000
2C-2D	$6,452,000

f. Housing

Direct Impacts. The Federal project is not expected to have an impact on housing in any of the Service Areas. Providing sewer service to west Cranston could permit more intensive use of lands currently zoned for residential property. However, the City of Cranston does not wish to let the extent of city provided sewerage be a determining factor in their land use program and is assumed zoning would remain the same as the without Federal project condition.

Indirect Impacts. As a result of increased employment and income from industrial development at the Tilcon-Gammino dite in the with project condition there will be an increased demand for housing in Providence County. The increase in demand for owner occupied units and rental units is estimated for 2015 and for 2045.

Owner-occupied		Rental	
2015	2045	2015	2045
963	1,444	605	1,256

Indirect housing impacts depend on road improvements to provide access to the Tilcon-Gammino site from Rte 37.

f. Schools

Direct Impacts. As discussed above there are no anticipated impacts on population growth as a result of the Federal project.

Indirect Impacts. As a result of economic growth in Service Area 2 arising from the Federal project, the number of school age children in Providence County is projected to increase. Projected increases in school enrollment for the county in year 2015 and year 2045 are 718 and 1,077 respectively.

g. Municipal Finances

Construction of a federal project will have financial impacts on the city. The city would pay 50 % of the first cost of construction, 100 % of all operation and maintenance costs and possibly 100 % of future improvement costs. In addition, the city will have to pay for the lateral sewer lines. The estimated cost of the laterals is $20 million (Cranston Comprehensive Plan, 1992, P. 225). Although this is a very rough estimate and is not developed to the extent of the interceptor cost estimate, it does provide an order of magnitude for this additional cost. The costs for options considered as part of a federal project are given in Table 7. Costs presented are in October 1993 dollars. The annualized first cost and total project cost is based on an interest rate of 7.75 % and a 50 year project life.

The details on how this sewer project will be funded for the local share have not been worked out by the city. Sewer projects are not included in the Capital Budget but funded through sewer enterprise bonds. Whether all sewer users will be assessed or only those receiving the hook-up has not yet been determined.

h. Utilities

The Federal project would allow the extension of sewer service into west Cranston. However, the impact on water, electricity and other utilities is expected to be minor as these areas would develop with or without the project.

i. Public Safety

It is not anticipated that population will increase as a result of the project. Thus, there will be no impact on the operations of the fire and police departments in Cranston.

j. Transportation

Aside from some short-run traffic delays and detours, the additional workforce increases should have only minor impacts on roads and highways in Cranston.

TABLE 7

FEDERAL PROJECT COSTS

SECTION 117 CRANSTON WASTEWATER CONVEYANCE SYSTEM
FEASIBILITY INVESTIGATION

SERVICE AREA 1	
Option	1C
First Cost	$1,864,600
Future Improvements Cost	$ 0
Annualized First Cost	$ 148,100
Annual O&M	
1995 to 2015	$ 17,700
2016 to 2045	$ 20,500
Annualized Total Cost	$ 166,400

SERVICE AREA 2	
Option	2C
First Cost	$3,642,100
Future Improvements Cost	$ 680,700
Annualized First Cost	$ 297,600
Annual O&M	
1995 to 2015	$ 47,800
2016 to 2045	$ 84,400
Annualized Total Cost	$ 353,000

SERVICE AREA 2	
Option	2D
First Cost	$4,282,000
Future Improvements Cost	$ 777,100
Annualized First Cost	$ 349,500
Annual O&M Cost	
1995 to 2015	$ 6,000
2016 to 2045	$ 25,140
Annualized Total Cost	$ 359,400

H. ACTIONS TO MINIMIZE ENVIRONMENTAL IMPACTS

a. Timing for Construction

Construction activities in or adjacent to streams will be conducted during the low flow season to minimize ecological impacts. This timing will also protect fisheries resources during the spawning season.

b. Fisheries

Further coordination with the Rhode Island Division of Fish and Wildlife is required once sewer alignments are more firmly established to determine impacts to fisheries resources. A fisheries survey may be required in areas where sewer lines have close alignment to streams.

c. Soil Handling

To minimize mixing of upland and wetland soils, soil will be removed from the pipeline corridor and laid adjacent to the trench. The top live layer of mineral soil will be removed separately and segregated from the underlying mineral soil or parent material. Following pipeline installation, soils will be replaced in kind and regraded to the elevation of existing conditions.

Many of the soils in the west Cranston area have a "perched water table" resulting from a hardpan layer. When soils of this nature are disrupted by installation of the pipeline, the hardpan layer will be recompacted to restore the original hydrologic regime.

d. Erosion Control

To minimize water quality impacts, haybales and silt fencing will be used downgradient of work areas and adjacent to stockpiled soils until stabilization and restoration of the impacted area is accomplished.

e. Vegetative Restoration and Stabilization

To stabilize areas impacted by installation of the pipeline before indigenous species become established, the impacted area will be planted with a grass seed mix which will be both compatible with the adjacent existing species and capable of growing on site. It is anticipated that within one or two years, the herbaceous species from adjacent areas and revegetation from live root stock in the top mineral layer of soil will become established within the impacted area restoring species diversity.

To minimize the visual impact of the Scituate pump station and compensate the loss of wildlife habitat, berry producing shrubs, such as flowering dogwood (Cornus florida) and wild cherry (Prunus spp.) should be used to landscape around the station.

f. Monitoring

Periodic visits by qualified personnel, at least annually and one month before the end of the growing season, will be conducted to measure and facilitate the success of the vegetation restoration plan. The U.S. Fish and Wildlife Service will be invited to attend the periodic site visits. Any areas which show unnatural and excess water channeling or ponding or land erosion and/or failure of vegetative growth will be noted and corrective measures taken (i.e. regrading, supplemental planting, additional stabilization measures). This monitoring plan will most likely be the responsibility of the local sponsor.

The restored areas should have at least 75% vegetative cover as compared to adjacent undisturbed areas and there should be no exposed patches of soil (greater than 100 square feet) with less than 25% vegetative cover as compared to adjacent undisturbed areas. If these criteria are meet after a period of three years, this monitoring plan will cease. Any areas which have not meet this criteria after a three year monitoring period will require additional corrective measures and subsequent monitoring.

g. Archaeological Phase I Study

The areas of concern for this study are those alignments in west Cranston that are located off-road or cross-country through previously undisturbed locations. These locations will need to be archaeologically tested at the Phase I intensive survey level, prior to construction. A total of eight areas in west Cranston within the proposed project area will require archaeological investigation (see Table 6 - Areas of Archaeological Investigation). In addition, the proposed Wilbur pump station is to be located within the Oaklawn Village Historic District and will need to be constructed to standards established for building within a National Register Historic District. If Phase I archaeological studies uncover any historic or archaeological resources of potential significance, further studies would be required to determine eligibility of these resources to the National Register of Historic Places, and, possibly, Data Recovery investigations if impacts to these resources cannot be avoided.

I. COORDINATION

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Field Offices
22 Bridge Street, Unit #1
Concord, New Hampshire 03301-4986

November 16, 1993

Joseph L. Ignazio
Planning Directorate
Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254-9149

ATIN: Impact Analysis Division

Dear Mr. Ignazio:

This responds to your letter dated October 18, 1993 requesting information on the presence of Federally listed and proposed endangered or threatened species in relation to the feasibility investigation of management options for transporting contaminated wastewater from sites in Cranston and Johnston, Rhode Island to a facility in Cranston.

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 at 83 Park St., Providence, RI 02903, telephone 401/277-2776, for information on state listed species that may be present.

A list of Federally designated endangered and threatened species in Rhode Island is included for your information. Thank you for your cooperation and please contact Susi von Oettingen of this office at (603) 225-1411 if we can be of further assistance.

Sincerely yours,

William G. Rudenauer

for Gordon E. Beckett
Supervisor
New England Field Offices

Inclosure

FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES IN RHODE ISLAND

Common Name	Scientific Name	Status	Distribution
FISHES:			
Sturgeon, shortnose*	Acipenser brevirostrum	E	Atlantic coastal waters and rivers
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, occasional
Falcon, American peregrine	Falco peregrinus anatum	E	No current nesting; entire state-migratory
Falcon, Arctic peregrine	Falco peregrinus tundrius	T	No nesting; entire state-migratory
Plover, Piping	Charadrius melodus	T	Atlantic coast, Washington and Newport Counties
Roseate Tern	Sterna dougallii dougallii	E	Atlantic coast
MAMMALS:			
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. 11-12-92

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

24 November 1993

Joseph Ignazio
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Rd.
Waltham, MA 02254-9149

RE: Wastewater Options
Cranston/Johnston, RI

Dear Mr. Ignazio,

Thank you for contacting the Rhode Island Natural Heritage Program for information on rare species and ecologically significant natural communities in the vicinity of the proposed wastewater transport facilities in Cranston and Johnston, RI.

At this time, we are not aware of any rare species or noteworthy natural communities in this area.

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
RI Natural Heritage Program

JM/jm

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

HISTORICAL PRESERVATION COMMISSION
Old State House
150 Benefit Street
Providence, Rhode Island 02903
401-277-2678 • FAX 401-277-2968 • TDD 401-277-3700

December 22, 1993

Mr. Joseph Ignazio
Director of Planning
New England Division
U. S. Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

Re: Feasibility Study, Wastewater Conveyance System
Cranston

Dear Mr. Ignazio,

The Rhode Island Historical Preservation Commission staff has reviewed the information you provided on the above-referenced project in your letter of December 7, 1993. We find that the summary of cultural resource issues prepared by Marc Paiva is essentially correct in its assessment of the historic and cultural resources affected by the different alternatives. We do wish to bring to your attention that the Nathan Westcott House, Joy Homestead, Sheldon House, Potter-Remington House and Oak Lawn Village Historic District have all been listed on the National Register of Historic Places.

We concur that Phase I archaeological testing is warranted in the nine areas identified in the assessment where ground disturbance would occur outside of existing roadways in environmentally sensitive areas. In the case of the Wilbur Road pump station, the assessment correctly notes the need to design the structure so that it does not intrude on the setting of the Oak Lawn National Register Historic District. The scale, roof and building forms, door and window pattern, exterior materials and siting should all be selected to harmonize with the setting. Materials such as clapboards for the wall surfaces, a gable or hip roof, and a siting plan that positions the building so that it does not disturb the rhythm of the other elements of the streetscape. If fencing is required, then landscape treatment may be needed as well. As the Oak Lawn District is covered by a local historic district ordinance, we will need to coordinate the station design with the Cranston Historic District Commission.

PRESERVATION 1968 25 1993 PROGRESS

These comments are provided in accordance with Section 106 of the National Historic Preservation Act. If you have any questions or comments, please contact Richard E. Greenwood, Project Review Coordinator for this office.

Very truly yours,

Edward F. Sanderson
Executive Director
Deputy State Historic
Preservation Officer

cc: Lynn Furney, Cranston Planning Dept.

Z75

Rhode Island Department of Transportation

Division of Maintenance
90 Calverley Street
Providence, R.I. 02908
(401) 277-2378
(401) 277-2963 - Fax

STATE OF
RHODE ISLAND
AND PROVIDENCE
PLANTATIONS

December 27, 1993

Mr. Joseph L. Ignazio
Director of Planning
Department of the Army
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254-9149

Dear Mr. Ignazio:

In response to your letter of October 19, 1993, the Rhode Island Department of Transportation has reviewed the feasibility of installing a wastewater pumping station in the area of I-295 at Wilbur Avenue, Cranston. It appears that the median location is better suited to your needs and will not adversely affect the operations of the Department of Transportation. If you are to proceed with your project, the following conditions must be met.

1. Access to the property must be via Wilbur Avenue, you will not be permitted to access the property from the interstate.

2. Final siting must be approved by the department. An easement must be received from the department prior to siting any structure on the freeway right-of-way.

3. If rock removal is required, the method must be approved by the department prior to construction.

Early coordination of this proposal with the department should minimize delays and avert potential problems.

Very truly yours,

Thomas E. Jackvony, Jr.
Assistant Director

TEJ/JN/dd

cc: James R. Capaldi
Edmund T. Parker
John D. Nickelson
File

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Field Offices
22 Bridge Street, Unit #1
Concord, New Hampshire 03301-4986

January 7, 1994

Joseph L. Ignazio, Chief
Planning Directorate
Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254-9149

ATTN: Impact Analysis Division

Dear Mr. Ignazio:

This responds to your letter dated October 19, 1993 requesting comments on the Environmental Assessment (EA) for the feasibility study of wastewater management options for transporting wastewater from several sites in Cranston and Johnston, Rhode Island. The following comments are provided in accordance with the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

1 - We appreciate the opportunity to review the project at the feasibility study stage but the Service will not be able to make substantive comments at this preliminary study stage, general comments will follow. Each service area option needs to be justified in terms of public need. It is important to consider all practicable alternatives for the pump stations and sewer lines. The first step in the design process should be avoidance of streams and wetlands. The sewer lines should avoid alignments adjacent to streams, wherever possible they should be located in the streets. The Alternative Analysis should provide enough information to compare the environmental impacts of the different alternatives and options.

2 - The EA states that the development of western Cranston with the new sewer lines will have less impact on wildlife than the without project condition (development with individual septic systems). The planned cluster development (with sewers and pump stations) includes the protection of wildlife habitat through the preservation of open space in conjunction with cluster development. In order to maximize wildlife habitat value, the open space should be designed so there are wildlife travel corridors between open spaces. The plan should also minimize the removal of large trees.

3 - The planned cluster development will result in a loss of wildlife habitat. Unavoidable impacts must be mitigated. A potential mitigation plan should be included in the EA. In evaluating compensation alternatives, Cranston should first attempt to find on-site wetlands that have been degraded. The goal should be to restore the degraded wetlands natural functions and values. The Service will assist in evaluating potential mitigation alternatives. A monitoring plan should be included to ensure the goals of the mitigation plan are being achieved.

Thank you for the opportunity to comment. If you have any questions, please contact Gregory Mannesto in our Rhode Island Field Office at (401) 364-9124.

Sincerely yours,

William J. Neuberger

for Gordon E. Beckett
Supervisor
New England Field Offices

Judith Johnson of the Corps of Engineers, Impact Analysis Division responded to the U.S. Fish and Wildlife Service comment letter dated January 7, 1994 in a telephone communication with Gregory Mannesto on January 12, 1994. A summary of that discussion follows:

1. The Federal project is to construct two pumping stations, one force main, one force main/variable grade sewer, proposed improvements to the Sockanosset Interceptor and Influent pumps at the Cranston Wastewater Treatment Facility (WWTF) (after 2015) and selected trunk sewers to provide the framework for a wastewater connector system to service portions of west Cranston. The construction of lateral sewers in west Cranston are the city's responsibility and is not part of the Federal project. In a 1991 study, the City of Cranston through its contractor Tutela Engineering Associates, found that nonpoint source pollution has a significant effect on water quality in the Pawtuxet River and its tributaries. Installation of sewers is expected to contribute to nonpoint source water quality improvements in areas affected by failing septic systems. Sewers were located in streets whenever possible to avoid impacts to streams and wetlands. However, in some cases, topography necessitates alignments which impact wetlands or require stream crossings.

2. We concur with your comment however, development in west Cranston is the city's responsibility and not part of the Federal project. It is anticipated that development would occur in the area with or without the Federal project. The City of Cranston's Open Space and Recreation Plan included in the Comprehensive Plan (1992) recommends tying together existing open space and recreation areas through acquisition and protection of additional open space to create linkages. The technical feasibility of siting cluster developments is improved with installation of sewer lines. The preservation of open space through cluster development is additional to preservation and protection of wetlands. Wetlands are regulated by the Rhode Island Department of Environmental Management pursuant to the Rhode Island Freshwater Wetlands Act.

3. The installation of trunk sewers in west Cranston will result in the temporary loss of wildlife habitat through construction related disturbances to wetland and upland habitat. However, impacts are expected to be temporary and areas affected along the pipeline alignment should recover within a period of one to two years. There will be soil handling requirements to minimize construction impacts (sediment/erosion control plan) and requirements for placement of soils to assure viable root stock remain to revegetate the area. To assure recovery of the habitat following construction, a monitoring plan will be undertaken. This monitoring plan will most likely be the responsibility of the local sponsor and the U.S. Fish and Wildlife Service will be invited to the periodic site visits.

The Federal project will not include a mitigation plan for replacement of wetland habitat which is temporarily lost due to construction. Corps regulations require replacement of wetlands if there is a permanent loss due to dredging or filling. The Federal project will not cause any permanent loss of wetlands.

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Environmental Management
DIVISION OF FISH AND WILDLIFE
Government Center
Tower Hill Road
Wakefield, R.I. 02879
Tel. 401-789-3094

Mr. Joseph L. Ignazio
U.S. Army Corps of Engineers
Impact Analysis Division
424 Trapelo Road
Waltham, MA 02254-9149

24 January 1994

Dear Mr. Ignazio:

Please accept my apologies for not responding to your request for our input on the Cranston Wastewater Conveyance System Project in a more timely manner.

In reviewing the limited information available to us at this time we have the following comments. Obviously we are concerned about any adverse impacts this project may have on the aquatic flora and fauna of streams or rivers in the project area. With the exception of Furnace Hill Brook where we have stock trout, we have little, if any information on the fish fauna of these streams.

1 It is our recommendation that when and where possible steps be taken to avoid any impacts to the aquatic system. However, realizing that this is not always possible, we ask that any instream or streamside activity which may affect the stream ecosystem be limited to time periods when these activities will not adversely impact migration or spawning activities of the fish fauna utilizing the area. In concert with this we also expect state-of-the-art methodology be used to reduce adverse impacts to the aquatic systems involved.

2 Considering the lack of biological data available to assess the impacts of the proposed options for the route of the pipeline, it is our recommendation that the consultant for this project undertake an aquatic biological survey in the area impacted by each option. With this information we can better evaluate the fisheries impact of each option and indicate which option would be most acceptable to this agency.

Thank you for the opportunity to comment on this proposal. If you need additional information regarding the nature of such a biological survey please feel free to contact me.

Sincerely,

John F. O'Brien (CS)

John F. O'Brien
Deputy Chief
Freshwater & Anadromous Fisheries

Judith Johnson of the Corps of Engineers, Impact Analysis Division responded to the Rhode Island Division of Fish and Wildlife letter dated 24 January 1994 in a telephone communication with Chris Powell, Senior Fisheries Biologist, on January 31 and February 2, 1994. A summary of that discussion follows:

1. Proposed sewers are located in streets wherever possible to avoid impacts to streams and wetlands. However, in some cases, topography necessitates alignments which impact wetlands or require stream crossings. Construction activities in or adjacent to streams will be conducted during the low flow season to minimize ecological impacts. This construction window will also limit impacts to spawning activities of the fish utilizing the project area.

2. The Federal project is to construct two pumping stations, one force main, one force main/variable grade sewer, proposed improvements to the Sockanosset Interceptor and Influent pumps at the Cranston Wastewater Treatment Facility (WWTF) (after 2015) and selected trunk sewers to provide the framework for a wastewater connector system to service portions of west Cranston. Project effects were assessed using a multi-disciplinary approach to impact analysis which included impacts to wetlands and streams. These initial findings aided in the selection of the Federal project components.

The Rhode Island Division of Fisheries Resources (RIDFW) was concerned about opening the canopy adjacent to streams which could adversely affect stocked and native trout in Furnace Hill Brook due to increases in stream water temperature. In addition, the brook lamprey (Lampetra appendix), a State endangered species has been documented to occur in the Blackstone watershed. The RIDWF has determined habitat is available for the brook lamprey in the project area however, there are no records of occurence (possibly due to a lack of survey data). Due to limited information concerning fisheries resources in the project area and a lack of knowledge concerning specific sewer alignments (adjacent to streams), it is difficult to determine specific impacts to the aquatic resources as a result of the proposed project. Further coordination with the Rhode Island Division of Fish and Wildlife is necessary to make this determination once sewer alignments are more clearly defined. A biological survey may be necessary at that time.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
JOHN F. KENNEDY FEDERAL BUILDING
ONE CONGRESS STREET
BOSTON, MASSACHUSETTS 02203-2211

February 17, 1994

Mr. Joseph L. Ignazio
Planning Division
U.S. Army Corps of Engineers
New England Division
424 Trapelo Road
Waltham, MA 02254-9149

Dear Mr. Ignazio:

This is in response to a public notice regarding the U.S. Army Corps of Engineers and City of Cranston, Rhode Island feasibility study of wastewater management options for transporting wastewater from several sites in the City of Cranston, Rhode Island.

The proposed study involves the Rhode Island Solid Waste Management Corporation's Central Landfill, Vinagro landfill, potential industrial land in southern Johnston, industrial, commercial and residential lands in western Cranston, the State of Rhode Island's Howard Center, and the Capuano landfill.

Our agency participated in a meeting at the Cranston City Hall with other concerned local, state and federal agencies. The following is only a preliminary response to the feasibility study for the project.

The applicant's project list four different options. Each alternative alignment has definite wetland impact of varing degrees. It is important that the applicant provide a wetland analysis which includes justification for alignment choices. Also, an alternative analysis which includes enough environmental information to answer the concerns of any adverse effects to wetlands including all practicable alternatives. In the event that there are unavoidable impacts, the plan will need to provide a mitigation plan. Finally, the applicant should look at alignments that will cause the least environmental damage.

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Such alternative alignments include running the alignments down city streets and avoid wetlands by using upland with pump stations.

Thank you for the opportunity to comment on this study. In the future, please contact Mr. Melvin Holmes of my staff at (617) 565-4433.

Sincerely,

Douglas A. Thompson, Chief
Wetland Protection Section

cc: NMFS, Gloucester, MA
USF&WS, Concord, NH
DEM, Providence, RI
Ronald G. Manfredonia, Chief, WQB

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Environmental Management
OFFICE OF ENVIRONMENTAL COORDINATION
83 Park Street
Providence, RI 02903-1037
(401) 277-3434
FAX (401) 277-2591
TDD (401) 277-6800

June 9, 1994

Mr. Joseph L. Ignazio, Chief
Planning Directorate
US Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254-9149

Subject: Environmental Assessment, Section 404(b)(1) Evaluation and Finding of No Significant Impact, Section 1170 Cranston, RI Wastewater Conveyance System Feasibility Investigation

Dear Mr. Ignazio:

Thank you for extending the comment deadline on the feasibility study and National Environmental Policy Act (NEPA) documentation on the Cranston wastewater conveyance system investigation to allow the RI Department of Environmental Management (RIDEM) to comment on the subject documents. RIDEM notes that we have not as yet received the usual Intergovernmental Review referral from the State Single Point of Contact on this project. It would appear that the requirements of Presidential Executive Order 12372 and Governor's Executive Order 83-11 apply to this project.

Unfortunately, RIDEM finds that the subject documents are inadequate to serve as a basis for selection of a preferred alternative or option for the Federal project and for a determination of "No Significant Impact". Our concerns are as follows.

On March 21, 1994, the RIDEM Division of Water Resources sent a letter to Ms. Barbara Blumeris, of the Impact Analysis Division of the New England Division, Army Corps of Engineers, reiterating concerns raised by that Division at a Technical Briefing held on March 1, 1994. A copy of this letter is enclosed and the contents of the letter incorporated in these comments by reference. These comments were not addressed in the final feasibility study, Environmental Assessment and Finding of No Significant Impact which

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has been published by the ACOE. A letter of response to our comments, from the ACOE, dated May 31, 1994 was received by the Division of Water Resources on June 2, 1994. This Department is currently reviewing the May 31, 1994 letter to see whether our concerns have been adequately addressed.

In RIDEM's letter of March 21, 1994, we note that the ACOE will consider phasing conveyance components based on projected year 2015 wastewater flows, but that the hydraulic design will be based on build-out conditions (year 2045 flows).

However, based upon the Cranston Community Plan, sewer service will only be provided, in general, for areas in the western part of Cranston where required to eliminate problems with faulty systems.

It seems reasonable to consider the potential for wastewater flows/sewer needs for the western portion of Cranston as part of long-range planning. RIDEM suggests, however, that the hydraulic design be based on current and year 2015 needs initially, while making provisions for the future flows that could develop from failures of ISDS systems, if and when the need arises.

RIDEM suggests that the alternatives proposed and that hydraulic sizing of the system be reconsidered based on firm existing and planned future needs and that possible future needs be considered in phasing and scheduling the project development and construction to allow reasonable options to accommodate additional flows if they develop. These options could include selecting pipe sizes that would possibly accommodate potential future as well as planned flows, replacement of single speed pumps with variable speed drives, leaving room for additional pumps and partitioning wetwells to allow for an increase in pumping capacity in the future, if needed.

Also, any schedule for constructing sewers within the study area or prioritization of overall needs should indicate taking care of the existing needs first, then the planned future needs and lastly, the possible future needs based on the potential for septic system failures in areas not yet developed. Please refer to enclosed correspondence to Barbara Blumeris from Warren Towne, dated March 21, 1994 for further discussion of this matter.

DISCUSSION OF ALTERNATIVES

The preferred alternative (proposed Federal project) is a regional connector system including the the extension of the City's existing sewer system to the proposed "Village Center" with the construction

of a pumping station and force main\ variable grade sewer to the I-295 pumping station. This segment of the project will result in loss of 0.23 acres of river bank wetland and one river crossing for a total of 0.37 acres.

A second pumping station is proposed on the river bank (0.33 acres) for service area 2, and a gravity flow system of trunk sewers to collect sewage from existing and future residential and industrial development. To achieve gravity flow, it would be necessary to impact 7.28 acres of freshwater wetlands.

In general, it should be noted that this assessment referred to the cost analysis comparison between alternatives, but no data is given. This information should be provided since it is partly the basis for selecting the gravity flow alternative over the pump station, force main alternative for trunk sewer alignments (Option 2D).

The alternative to a gravity flow system, or variable grade system, is the construction of additional pump stations/force mains to allow placement of lines along roads. The Environmental Assessment (EA) cursorily dismisses this option with the following discussion, on page 7 of the document.

"The short term impacts associated with pump station construction include noise, dust and the temporary loss of wildlife habitat. The long term impacts associated with pump station construction include possible social\visual\aesthetic impacts (location of a pump station adjacent to homes), permanent loss of wildlife habitat, operational costs, and maintenance costs. The use of additional pump stations (long term impacts) as a means of avoiding temporary impacts to natural resources was not considered prudent."

No further information is presented on pump stations; although one reason for dismissal of the alternative is loss of permanent wildlife habitat, as versus the "temporary" loss of 7.28 acres of wetland/water habitat resulting from implementing the preferred alternative. It is RIDEM's position that insufficient information has been provided to dismiss the use of pump stations on environmental grounds or to determine that the selected alternative is the least environmentally damaging practicable alternative. No description is given of the wildlife habitat that would be permanently lost. Would it be upland, wetland, what type of habitat, how much wil be lost, et cetera? The ACOE document states that social\visual\aesthetic impacts will result from locating pump stations adjacent to homes (see above). If the the wildlife habitat referred to is property adjacent to homes in residential areas, it may be of relatively low value as wildlife habitat. RIDEM also does not find the information provided sufficient to term the impacts to wetland fuctions and values as

temporary.

You should be aware that RIDEM does not consider maintenance of a clear zone over a sewer pipeline through forested wetland or other forested habitat to be temporary in nature. Actually this results in a permanent change to wildlife habitat conditions which may, in some circumstances, have far reaching negative impacts upon some species and some ecosystems.

RIDEM's regulatory programs will also be concerned about any direct and indirect impacts of this project. It is the Department's experience that sewer line projects, unless carefully planned and extensively monitored, result in significant problems before and after construction. RIDEM can expect numerous violations as a result of disposal of unsuitable material from such projects and development of land no longer restricted by the unsuitable conditions for siting individual sewage disposal systems. There are in addition to the direct wetland disturbance, sediment problems et cetera as a result of construction.

RIDEM believes that the above comments **must** be addressed to fulfill the requirements of the National Environmental Policy Act. In addition, we would like to take this opportunity to provide the following information and guidance on the **RIDEM Divison of Frehwater Wetlands** permitting requirements for such a proposal.

- The applicant should be aware that amended Rules and Regulations Governing the Administration and Enforcement of the Freshwater Wetlands Act, April, 1994, are now in effect. Copies of the Rules and Regulations may be obtained from the RIDEM Division of Freshwater Wetlands at 291 Promenade Street, Providence, RI 02908 (telephone 401 277-6820).

- The applicant should become familiar with the application requirements and the rules and regulations prior to submitting the project application. Evaluations, best management practices, monitoring and mitigation strategies should be prepared by qualified professionals.

- The applicant should be aware that a stringent alternatives analysis is now part of the state application requirements. The information developed in the subject EA\Feasibility Study, for example, is not sufficient to meet state requirements and will have to be supplemented for the state's review.

- It is likely that the state will require **far more** in the way of mitigation than that described in the subject NEPA document. This should be kept in mind when estimating the cost of the project.

- The document refers to areas adjacent to swamps, marshes, bogs and ponds as "Wetland Buffer". It should be clearly understood that **all** of the wetland types defined in state law and the Rules and Regulations are regulated areas providing functions and values of concern, including the so called "wetland buffer" referred to.

- The applicant should have all regulated wetlands identified/verified in accordance with state criteria in advance of design of this project. This will help determine sensitive areas and meet the requirements of the Rules and Regulations. Further, should the applicant wish to meet with RIDEM to discuss the proposal, pre-identification of the wetlands will facilitate discussions and recommendations.

RIDEM thanks you for the opportunity to review the subject document. We hope that our comments are of assistance to you; we note that further concerns may be identified during our application processes.

Sincerely,

Janet Keller, Chief

JK\cgw
N:\nonpoint\OEC\ACOE\cranston

cc:w enclosure

D. Thompson, USEPA
M. Annarummo
D. Albro
A. Good
F. Vincent

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254-9149

REPLY TO
ATTENTION OF

June 17, 1994

Planning Directorate
Basin Management Division

Ms. Janet Keller, Chief
Office of Environmental Coordination
Department of Environmental Management
83 Park Street
Providence, Rhode Island 02903-1037

Dear Ms. Keller:

Thank you for your comment letter of June 9, 1994 on the Environmental Assessment, Section 404(b)(1) Evaluation and Finding of No Significant Impact (FONSI) on the Cranston, Rhode Island Wastewater Conveyance System Feasibility Investigation.

As you are aware the Army Corps of Engineers (ACOE) and its cost share partner, the City of Cranston, are conducting a feasibility investigation of options for transporting wastewater from study sites to the Cranston Wastewater Treatment Facility (WWTF). The draft feasibility report is scheduled for completion this summer. The Environmental Assessment (EA), 404(b)(1) Evaluation, and FONSI will be a section in the feasibility report and your comment letter will be included along with this response.

The Environmental Assessment (EA) was prepared in accordance with the ACOE Procedures for Implementing NEPA 33 CFR part 230. An EA is a brief document which identifies information pertinent to the planning process and includes sufficient analysis to determine potential environmental effects of a proposed action. The Corps in preparing the draft EA coordinated with State and Federal environmental agencies to obtain input on the environmental effects of the proposed project. It was determined through this process that the proposed project would not be a major Federal action significantly affecting the quality of the human environment, and a Finding of No Significant Impact was prepared.

During the Public Notice period your office has raised several concerns regarding the proposed project. Our response to these concerns fall into four general areas: wetlands impacts, selection of trunk sewers in West Cranston, design of wastewater conveyance system components, and project permitting requirements.

Wetlands Impacts

During the Environmental Assessment process wetlands were identified as a concern and potential environmental impact of the proposed project. Wetland areas under the jurisdiction of the Rhode Island Department of Environmental Management (RIDEM) Division of Freshwater Wetlands were identified. These areas were considered and avoided wherever possible in the placement of the wastewater conveyance system components. Not all wetland impacts could be practically avoided, however, and therefore a mitigation plan was included in the EA to minimize these impacts.

This office recognizes the value and importance of wetland areas. Wetland impacts cited in the EA include a worst case analysis based on our existing knowledge at that time. Wetland avoidance is a primary consideration as preliminary engineering design continues and more detailed information is developed. In addition, we recognize that the local sponsor would be required to apply for a permit from the RIDEM Division of Freshwater Wetlands. Any outstanding wetland issues requiring detailed information and final plans will be addressed during that permitting process.

West Cranston Trunk Sewer Alignment

The intent of the feasibility study is to provide the framework of a plan for conveying wastewater flows from study sites to the City of Cranston's WWTF. The West Cranston residential area and future industrial development at the Tilcon Gammino site are two of the areas considered in the feasibility study. The plan is that potential wastewater flows from these areas would be collected at the proposed Wilbur pumping station and pumped through a force main located in city streets to the city's existing Sockanosset Interceptor sewer. To convey wastewater flows to the Wilbur Pumping station a system of gravity trunk sewers is proposed. The city would be responsible for the development of all lateral collection sewers and any small local pumping stations that may be necessary to convey wastewater to the trunk sewers.

The trunk sewer system is designed as a gravity flow system. In the initial layout of wastewater conveyance system components as described in the EA, trunk sewers were located in streets wherever possible. However, topography necessitated alignments within the regulated buffer zone (streets in some cases), adjacent to streams or required stream crossings. Where sewerline placement involves wetland impact, construction practices and mitigation measures would be followed in accordance with the Freshwater Wetland permitting requirements. Construction of additional pumping stations and routing of trunk sewers to avoid all wetland areas was not considered a reasonable approach to the design of this system.

Design of Wastewater Conveyance Components

The Corps has completed feasibility level design of several options for transporting wastewater from study sites to the WWTF. These options are identified in the EA. The Corps is in the process of completing more detailed design for the proposed project. The RIDEM Division of Water Resources comments of March 21, 1994 are being considered in this design process.

Permitting Requirements

At this time the Corps' effort is limited to preparation of the Feasibility Report for the proposed project. However, if the Corps were to become involved in the final design and construction of the project, it would be the responsibility of the local sponsor to obtain State permits for the project. The feasibility study will include a list of the identified Federal and State permits required for the project.

This office appreciates your efforts in review of this project. Should you have additional questions, please call Ms. Barbara Blumeris of my staff at (617)647-8737.

Sincerely,

for Joseph L. Ignazio
Director of Planning

CF:

Mr. Peter Alviti, Jr., P.E.
Director of Public Works
City Hall
869 Park Avenue
Cranston, Rhode Island 02190

Mr. Domenic V. Tutela, President
Tutela Engineering Associates
PO Box 817
12 Bay Street
Wilmington, Massachusetts 01887

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K. COMPLIANCE TABLE

COMPLIANCE WITH ENVIRONMENTAL FEDERAL STATUTES AND EXECUTIVE ORDERS

Federal Statutes

1. Preservation of Historic and Archeological Data Act of 1974, as amended, 16 U.S.C. 469 et seq.

Compliance: Consultation with the State Historic Preservation Office and the Advisory Council on Historic Preservation concerning mitigation of historic and/or archaeological resources signifies compliance (see letter dated 22 December 1993).

2. Clean Air Act, as amended, 42 U.S.C. 7401 et seq.

Compliance: Public notice of the availability of this report to the Environmental Protection Agency signifies compliance pursuant to Sections 176c and 309 of the Clean Air Act.

3. Clean Water Act of 1977 (Federal Water Pollution Control Act Amendments of 1972) 33 U.S.C. 1251 et seq.

Compliance: A Section 404(b)(1) Evaluation and Compliance Review have been incorporated into this report. An application shall be filed for State Water Quality Certification pursuant to Section 401 of the Clean Water Act.

4. Coastal Zone Management Act of 1782, as amended, 16 U.S.C. 1451 et seq.

Compliance: Not Applicable; project is not located within the State designated coastal zone.

5. Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq.

Compliance: Coordination with the U.S. Fish and Wildlife Service (FWS) has yielded no formal consultation requirements pursuant to Section 7 of the Endangered Species Act (see letter dated 16 November 1993).

6. Estuarine Areas Act, 16 U.S.C. 1221 et seq.

Compliance: Not Applicable; this report is not being submitted to Congress.

7. Federal Water Project Recreation Act, as amended, 16 U.S.C. 4601-12 et seq.

Compliance: Public notice of availability to this report to the National Park Service (NPS) and Office of Statewide Planning relative to the Federal and State comprehensive outdoor recreation plans signifies compliance with this Act.

8. Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 et seq.

Compliance: Coordination with the FWS, and the Rhode Island Division of Fish and Wildlife signifies compliance with the Fish and Wildlife Coordination Act.

9. Land and Water Conservation Fund Act of 1965, as amended, 16 U.S.C. 4601-4 et seq.

Compliance: Public notice of the availability of this report to the National Park Service (NPS) and the Office of Statewide Planning relative to the Federal and State comprehensive outdoor recreation plans signifies compliance with this Act.

10. Marine Protection, Research, and Sanctuaries Act of 1971, as amended, 33 U.S.C. 1401 et seq.

Compliance: Not Applicable; project does not involve the transportation nor disposal of dredged material in ocean waters pursuant to Sections 102 and 103 of the Act, respectively.

11. National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470 et seq.

Compliance: Coordination with the State Historic Preservation Office determined that no historic or archaeological resources would be affected by the proposed project (see letter dated 22 December 1993).

12. National Environmental Policy Act of 1969, as amended, 42 U.S.C 4321 et seq.

Compliance: Preparation of this report signifies partial compliance with NEPA. Full compliance shall be noted at the time the Finding of No Significant Impact is issued.

13. Rivers and Harbors Act of 1899, as amended, 33 U.S.C. 401 et seq.

Compliance: No requirements for Corps' projects or programs authorized by Congress. The proposed Feasibility Study is pursuant Section 117 of the Water Resources Development Act of 1990.

14. Watershed Protection and Flood Prevention Act as amended, 16 U.S.C 1001 et seq.

Compliance: No requirements for Corps' activities.

15. Wild and Scenic Rivers Act, as amended, 16 U.S.C 1271 et seq.

Compliance: Not Applicable.

Executive Orders

1. Executive Order 11988, Floodplain Management, 24 May 1977 amended by Executive Order 12148, 20 July 1979.

Compliance: Public notice of the availability of this report or public review fulfills the requirements of Executive Order 11988, Section 2(a) (2).

2. Executive Order 11990, Protection of Wetlands, 24 May 1977.

Compliance: Public notice of the availability of this report for public review fulfills the requirements of Executive Order 11990, Section 2 (b).

3. Executive Order 12114, Environmental Effects Abroad of Major Federal Actions, 4 January 1979.

Compliance: Not Applicable; project is located within the United States.

Executive Memorandum

1. Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing NEPA, 11 August 1980.

Compliance: Not Applicable; project does not involve or impact agricultural lands.

II. SECTION 404 (b) (1) EVALUATION

NEW ENGLAND DIVISION
U.S. ARMY CORPS OF ENGINEERS, WALTHAM, MA
SECTION 404(b)(1) EVALUATION

PROJECT: SECTION 117 CRANSTON, RHODE ISLAND
WASTEWATER CONVEYANCE SYSTEM FEASIBILITY INVESTIGATION

PROJECT MANAGER: BARBARA BLUMERIS (617) 647-8737

FORM COMPLETED BY: JUDITH JOHNSON (617) 647-8138

PROJECT DESCRIPTION:

The purpose of the study is to conduct a feasibility investigation of options for transporting wastewater from pollution sites in Cranston to the wastewater treatment facility in Cranston, Rhode Island. Problems and solutions are assessed from a regional perspective and the most effective means of conveying the wastewater to the treatment facility is identified and evaluated.

Selection of the Federal project was based on a multi-disciplinary analysis of feasible options for conveying wastewater to the Cranston WWTF. The final selection of project components involves the construction of two pumping stations, one force main, one force main/variable grade sewer, proposed improvements to the Sockanosset Interceptor and Influent pumps at the Cranston Wastewater Treatment Facility (WWTF) (after 2015) and selected trunk sewers to provide the framework for a wastewater connector system to service portions of west Cranston.

This Environmental Assessment defines all alternatives and areas of wetland fill. In general, the proposed Federal project will temporarily impact 7.28 acres of freshwater wetlands (according to the Rhode Island Division of Freshwater Wetlands definition of wetlands).

NEW ENGLAND DIVISION
U.S. ARMY CORPS OF ENGINEERS, WALTHAM, MA

PROJECT: SECTION 117 CRANSTON, RHODE ISLAND
WASTEWATER CONVEYANCE SYSTEM FEASIBILITY INVESTIGATION

Evaluation of Section 404(b)(1) Guidelines
of the Clean Water Act

1. Review of Compliance (Section 230.10(a)-(d)). Final

a. The discharge represents the least environmentally damaging practicable alternative and if in a special aquatic site, the activity associated with the discharge must have direct access or proximity to, or be located in the aquatic ecosystem to fulfill its basic purpose (if no, see section 2 and information gathered for EA alternative); [X] YES [ ] NO

b. The activity does not appear to: 1) violate applicable state water quality standards or effluent standards prohibited under Section 307 of the CWA; 2) jeopardize the existence of Federally listed threatened and endangered species or their critical habitat; and 3) violate requirements of any Federally designated marine sanctuary (if no, see section 2b and check responses from resource and water quality certifying agencies); [X] YES [ ] NO

c. The activity will not cause or contribute to significant degradation of waters of the U.S. including adverse effects on human health, life stages of organisms dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values (if no, see section 2); [X] YES [ ] NO

d. Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem (if no, see section 5). [X] YES [ ] NO

2. Technical Evaluation Factors (Subparts C-F).

	N/A	Not Signif-icant	Signif-icant*
a. Potential Impacts on Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C).			
1) Substrate.		X	
2) Suspended particulates/turbidity.		X	
3) Water.		X	
4) Current patterns and water circulation.		X	
5) Normal water fluctuations.		X	
6) Salinity gradients.	X		
b. Potential Impacts on Biological Characteristics of the Aquatic Ecosystem (Subpart D).			
1) Threatened and endangered species.	X		
2) Fish, crustaceans, mollusks and other aquatic organisms in the food web.		X	
3) Other wildlife.		X	
c. Potential Impacts on Special Aquatic Sites (Subpart E).			
1) Sanctuaries and refuges.	X		
2) Wetlands.		X	
3) Mud flats.	X		
4) Vegetated shallows.		X	
5) Coral reefs.	X		
6) Riffle and pool complexes.		X	
d. Potential Effects on Human Use Characteristics (Subpart F).			
1) Municipal and private water supplies.		X	
2) Recreational and Commercial fisheries.		X	
3) Water-related recreation.		X	
4) Aesthetics.		X	
5) Parks, national and historic monuments, national seashores, wilderness areas, research sites, and similar preserves.		X	

Remarks: Explanation of identified significant impacts:

3. Evaluation and Testing (Subpart G).

a. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material. (Check only those appropriate.)

1) Physical characteristics..... |X|
2) Hydrography in relation to known or anticipated sources of contaminants..... |X|
3) Results from previous testing of the material or similar material in the vicinity of the project..... |X|
4) Known, significant sources of persistent pesticides from land runoff or percolation..... |X|
5) Spill records for petroleum products or designated hazardous substances (Section 311 of CWA)..... | |
6) Public records of significant introduction of contaminants from industries, municipalities, or other sources..... | |
7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge activities..... |X|
8) Other sources (specify)..... | |

List appropriate references.

Army Corps of Engineers Soil Exploration February-March 1994. Army Corps of Engineers 1994 Environmental Assessment for the Cranston Rhode Island Section 117 Wastewater Conveyance System Feasibility Investigation

b. An evaluation of the appropriate information in 3a above indicates that there is reason to believe the proposed dredge or fill material is not a carrier of contaminants, or that levels of contaminants are substantively similar at extraction and disposal sites and not likely to require constraints. The material meets the testing exclusion criteria. |X| YES | | NO

4. Disposal Site Delineation (Section 230.11(f)).

a. The following factors, as appropriate, have been considered in evaluating the disposal site.

1) Depth of water at disposal site..... [ ]
2) Current velocity, direction, and variability at disposal site..... [ ]
3) Degree of turbulence..... [ ]
4) Water column stratification..... [ ]
5) Discharge vessel speed and direction..... [ ]
6) Rate of discharge..... [ ]
7) Dredged material characteristics (constituents, amount, and type of material, settling velocities)..... [ ]
8) Number of discharges per unit of time..... [ ]
9) Other factors affecting rates and patterns of mixing (specify)..... [X]

Soils will be backfilled into the pipeline trench.

List appropriate references.

Army Corps of Engineers 1994 Environmental Assessment for the Cranston, Rhode Island Section 117 Wastewater Conveyance System Feasibility Investigation

b. An evaluation of the appropriate factors in 4a above indicates that the disposal site and/or size of mixing zone are acceptable..... [X] YES [ ] NO

5. Actions To Minimize Adverse Effects (Subpart H).

All appropriate and practicable steps have been taken, through application of recommendation of Section 230.70-230.77 to ensure minimal adverse effects of the proposed discharge..... [X] YES [ ] NO

List actions taken.

Soils will be removed and placed adjacent to the pipeline corridor to minimize mixing of upland and wetland soils. The top live layer of mineral soil will be separated during construction activities. Soil will be replaced in kind following construction and soils will be stabilized through seeding. A monitoring program will be undertaken to assure adequate revegetation. Construction in and adjacent to streams will be conducted during the low flow season to minimize ecological impacts.

6. Factual Determination (Section 230.11).

A review of appropriate information as identified in items 2 - 5 above indicates that there is minimal potential for short or long term environmental effects of the proposed discharge as related to:

a. Physical substrate (review sections 2a, 3, 4, and 5 above). YES [X] NO [ ]

b. Water circulation, fluctuation and salinity (review sections 2a, 3, 4, and 5). YES [X] NO [ ]

c. Suspended particulates/turbidity (review sections 2a, 3, 4, and 5). YES [X] NO [ ]

d. Contaminant availability (review sections 2a, 3, and 4). YES [X] NO [ ]

e. Aquatic ecosystem structure, function and organisms (review sections 2b and c, 3, and 5) YES [X] NO [ ]

f. Proposed disposal site (review sections 2, 4, and 5). YES [X] NO [ ]

g. Cumulative effects on the aquatic ecosystem. YES [X] NO [ ]

h. Secondary effects on the aquatic ecosystem. YES [X] NO [ ]

7. Findings of Compliance or non-compliance.

The proposed disposal site for discharge of dredged or fill material complies with the Clean Water Act Section 404(b)(1) guidelines.

29 Jun 94
DATE

DWIGHT S. DURHAM
Lieutenant Colonel, Corps of Engineers
Division Engineer

III. FINDING OF NO SIGNIFICANT IMPACT

The purpose of the study is to conduct a feasibility investigation of options for transporting wastewater from pollution sites in Cranston to the wastewater treatment facility (WWTF) in Cranston, Rhode Island. Problems and solutions are assessed from a regional perspective and the most effective means of conveying the wastewater to the treatment facility is identified and evaluated.

Selection of the Federal project was based on a multi-disciplinary analysis of feasible options for conveying wastewater to the Cranston WWTF. The final selection of project components involves the construction of two pumping stations, one force main, one force main/variable grade sewer, proposed improvements to the Sockanosset Interceptor and Influent pumps at the WWTF (after 2015) and selected trunk sewers to provide the framework for a wastewater connector system to service portions of west Cranston.

There will be minor water quality impacts during construction, mainly increases in turbidity and sedimentation from erosion during excavation activities. However, these will be temporary and can be controlled by proper construction and erosion control techniques, including silt fences, hay bales, and other means to control runoff from construction sites; covering stockpiled soil to limit erosion; and other similar activities.

The majority of sewers are located in streets which minimize impacts to wildlife habitat, however to achieve a gravity flow system, the sewers traverse terrestrial and wetland habitat in some cases. Four (4) acres of terrestrial habitat and 7.28 acres of freshwater wetlands (according to the Rhode Island Department of Environmental Management definition of wetlands) will be temporarily impacted by construction of the proposed Federal project. Wildlife will move from the area during construction but will reutilize the habitat once construction is complete. Limited information is available concerning fisheries resources in the project area. Further coordination is necessary with the Rhode Island Division of Fish and Wildlife once sewer alignments are defined to assure minimal impact on fisheries in the project area.

No impacts will occur to Federal or State endangered or threatened species as a result of the proposed project. In addition, the Rhode Island Natural Heritage Program (NHP) provided information regarding rare species and ecologically significant natural communities in the project area. At this time, the NHP is not aware of any rare species or noteworthy natural communities in the study area.

The construction of sewers within existing roadways will not impact cultural resources, as these areas have been previously modified. The areas of concern for this study are those alignments in west Cranston that are located off-road or cross-country through previously undisturbed locations. These locations will need to be archaeologically tested at the Phase I intensive survey level, prior to construction. A total of eight areas in western Cranston within the proposed project area will require archaeological

investigation. In addition, the proposed Wilbur pump station is to be located within the Oaklawn Village Historic District and will need to be constructed to standards established for building within a National Register Historic District. If Phase I archaeological studies uncover any historic or archaeological resources of potential significance, further studies would be required to determine eligibility of these resources to the National Register of Historic Places, and, possibly, Data Recovery investigations if impacts to these resources cannot be avoided.

Continued development is expected to occur in the west Cranston area with or without the proposed Federal project. However, providing a framework for a sewer system may facilitate the establishment of the proposed Village Center and proposed cluster residential development by providing an alternative to on-site septic systems. By clustering residential and commercial development in west Cranston, approximately 494 acres of open space could be preserved.

The Federal project would allow for economic development at the Tilcon-Gammino site. An estimated 1,800 jobs would be created by 2015 and 2,700 by 2045. The total effect on income in Providence County is estimated to be $66,443,000 in 2015 and $99,664,000 in 2045. The total impact on sales in Providence County is estimated to be $109,889,000 by 2015 and $164,834,000 by 2045. The proposed project will not have a negative effect on socio-economic resources in the project area.

To minimize environmental impacts as a result of the proposed project, construction activities in or adjacent to streams will be conducted during the low flow season to minimize ecological impacts such as turbidity and sedimentation. This timing will also protect fisheries resources during spawning. Soil handling techniques will be utilized to minimize erosion potential and assure restoration of endemic vegetation and hydrologic regime. The pipeline corridor will be initially seeded to stabilize the area however, it is anticipated that within one or two years endemic species will revegetate through natural process. To minimize the visual impact of the Scituate pumping station and compensate the loss of wildlife habitat, berry producing shrubs should be used for landscaping. A monitoring plan will be undertaken to assure recovery of the area.

Based on my review and evaluation of the environmental effects as presented in the Environmental Assessment, I have determined that the proposed wastewater conveyance system project in Cranston, Rhode Island will not be a major Federal action significantly affecting the quality of the human environment. Therefore, this project is exempt from the requirement to prepare an Environmental Impact Statement.

28 Jan 94
Date

DWIGHT S. DURHAM
Lieutenant Colonel, Corps of Engineers
Division Engineer

ENVIRONMENTAL ASSESSMENT

SECTION 404 (b)(1) EVALUATION

FINDING OF NO SIGNIFICANT IMPACT

APPENDIX A
FEASIBILITY STUDY OPTIONS

Service Area 1

Option 1A. This option provides for conveyance of projected wastewater flows from Service Area 1 to the WWTF through modification to the existing sewerage system.

Under this option wastewater flows from Service Area 1 would be pumped from the I-295 pumping station (designed and scheduled for construction by the city in 1994) into the existing 14-inch force main/variable grade sewer which discharges to the gravity sewer in Cranston Street. Wastewater would flow by gravity through sewers in Cranston Street, Park Avenue, and the Pocasset Interceptor to the Pontiac pumping station. Flows at the Pontiac pumping station would be pumped to the WWTF.

In addition, a new pumping station is required to collect flows from Service Area 1 in the area of Pipin Orchard Road and the Village Center. The city's facility plan proposes a new pumping station, the "Scituate Pumping Station", and a new force main/variable grade sewer from the pumping station to the I-295 pumping station.

Option 1B. This option is similar to Option 1A. However, projected wastewater flows for the Vinagro Landfill and the proposed Johnston industrial area are not included.

Option 1C. This option includes only the new "Scituate Pumping Station", and a force main/variable grade sewer to collect flows from the proposed Village Center.

New lateral sewers would also be required in Service Area 1 to collect future wastewater flows from currently unsewered areas. However, the design and cost of these are not included in this feasibility study.

Service Area 2

Option 2A. This option provides a connector system to convey projected wastewater flows from Service Area 2 to the WWTF. Wastewater would be pumped from a proposed Wilbur pumping station located near I-295 and Wilbur Avenue through the proposed "Garden Hills" force main/variable grade sewer to the WWTF.

Option 2B. This option is considered as an alternative to Option 2A. The proposed Garden Hills force main/variable grade sewer of Option 2A is replaced with a proposed "Garden Hills" force main/gravity sewer.

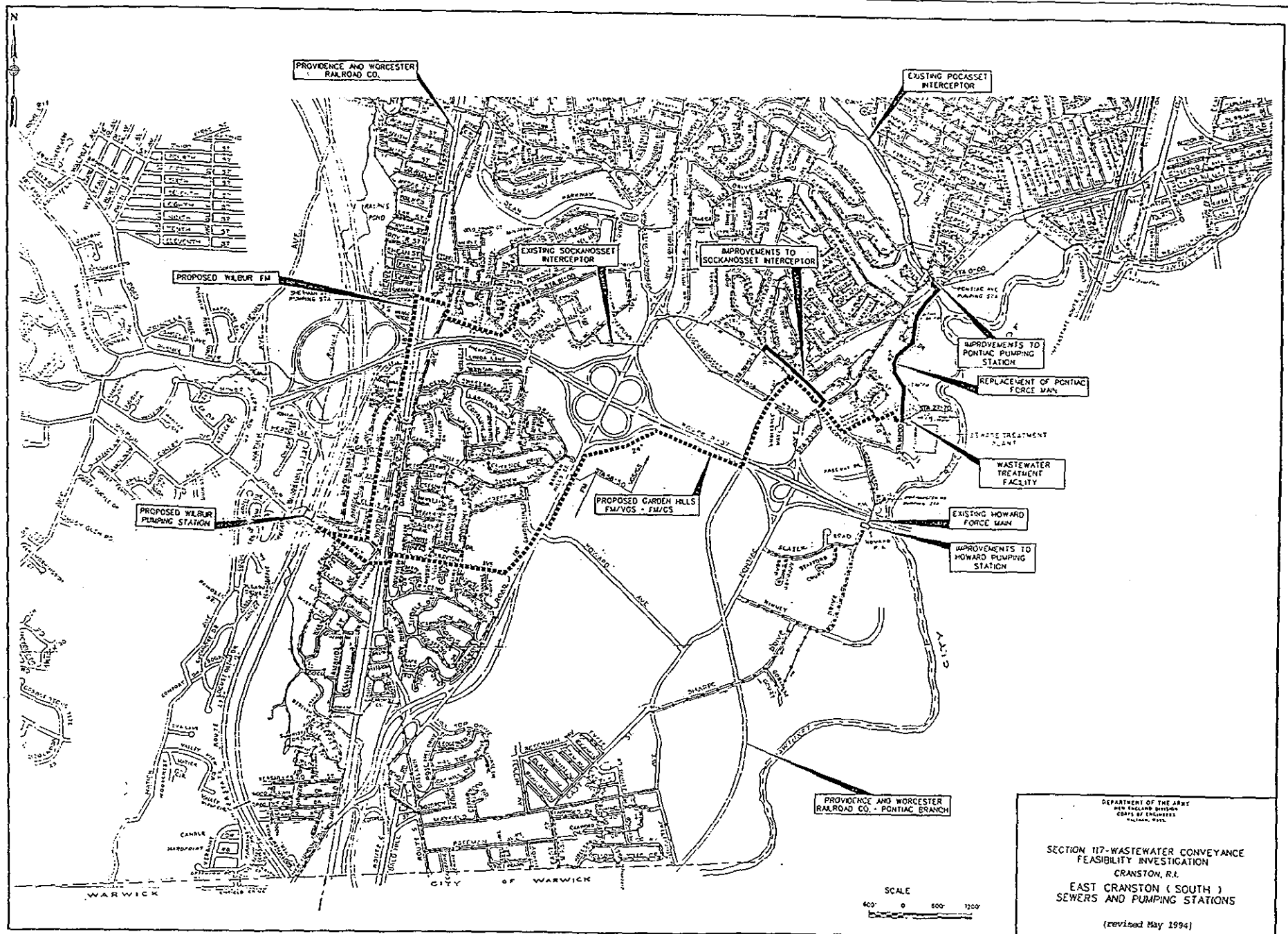
Option 2C. This option is considered as an alternative alignment to Option 2A/2B. The proposed "Turner" force main replaces the Garden Hills sewer and would discharge to the existing Sockanosset Interceptor on Belvedere Drive. Wastewater would flow by gravity through the interceptor to the "siphon" in Webb Street and into the influent screw pumps at the WWTF.

Option 2D. This option considers the location and cost of trunk sewers in Service Area 2 (west Cranston area). Flows from this area would flow to the proposed Wilbur pumping station. Trunk sewers considered include; the proposed Brookdale, Tilcon, Comstock, and Natick/Phenix gravity sewer. Also, a pumping station and force main are proposed near the intersection of Phenix Avenue and Burlingame Road. However, the pumping station and force main are not required until after 2015.

Lateral sewer lines would also be required to collect existing and future wastewater flows from Service Area 2. However, design and cost of these are not included in this feasibility study.

Service Area 3

Option 3A. This option provides for conveyance of projected wastewater flows from Service Area 3 to the WWTF through modifications to the existing sewerage system. Wastewater flows would be conveyed by gravity through the existing main sewers in Kenny Drive, Ross-Simmons Drive, and Sharpe Drive to the Howard pumping station. Flows would be pumped through the Howard force main to the "siphon" in Webb Street into the influent screw pumps at the WWTF.



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

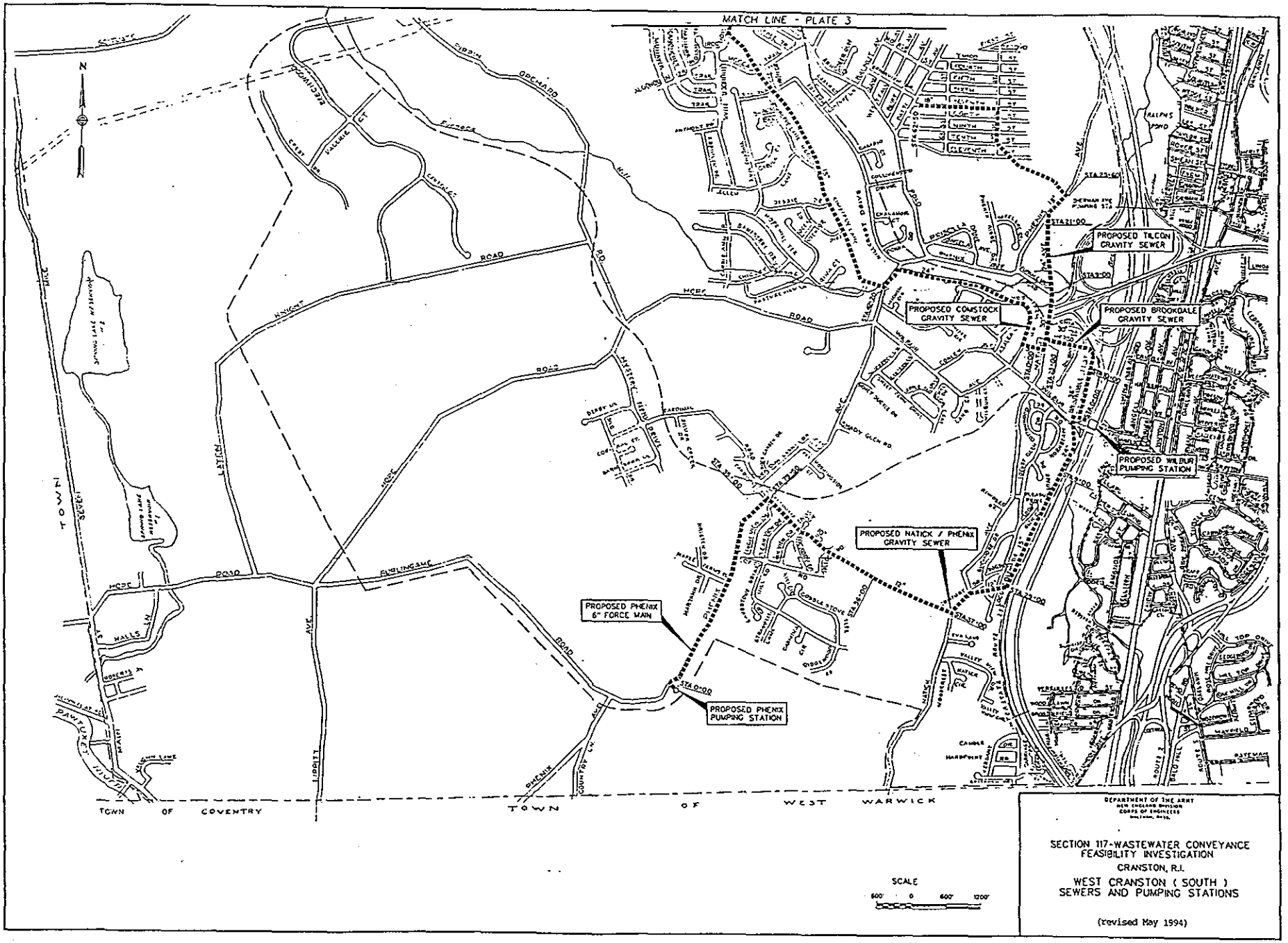
SECTION 117-WASTEWATER CONVEYANCE FEASIBILITY INVESTIGATION

CRANSTON, R.I.

EAST CRANSTON (SOUTH)
SEWERS AND PUMPING STATIONS

(revised May 1994)

PLATE 1



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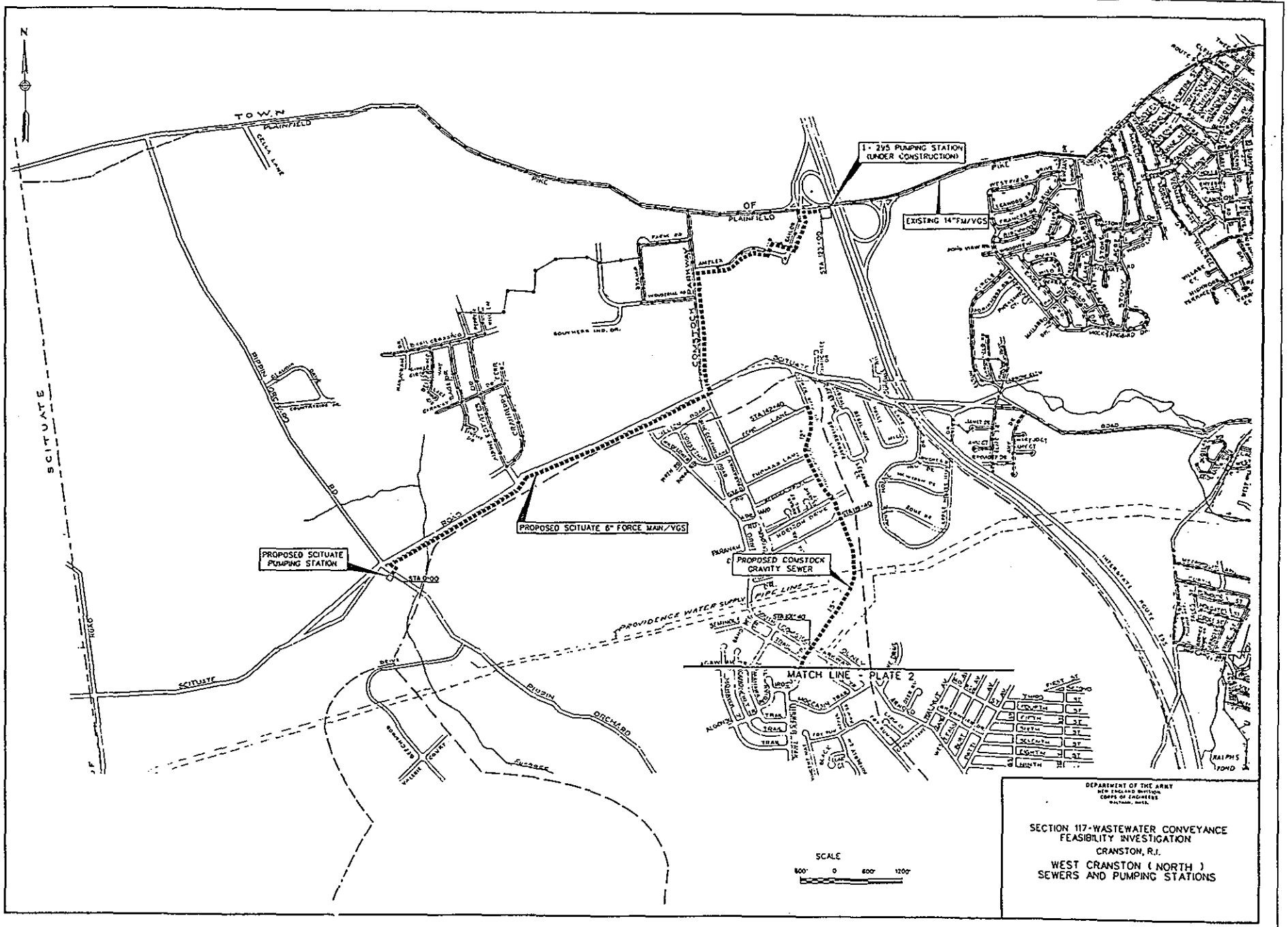
SECTION 117-WASTEWATER CONVEYANCE FEASIBILITY INVESTIGATION

CRANSTON, R.I.

WEST CRANSTON (SOUTH)
SEWERS AND PUMPING STATIONS

(revised May 1994)

PLATE 2



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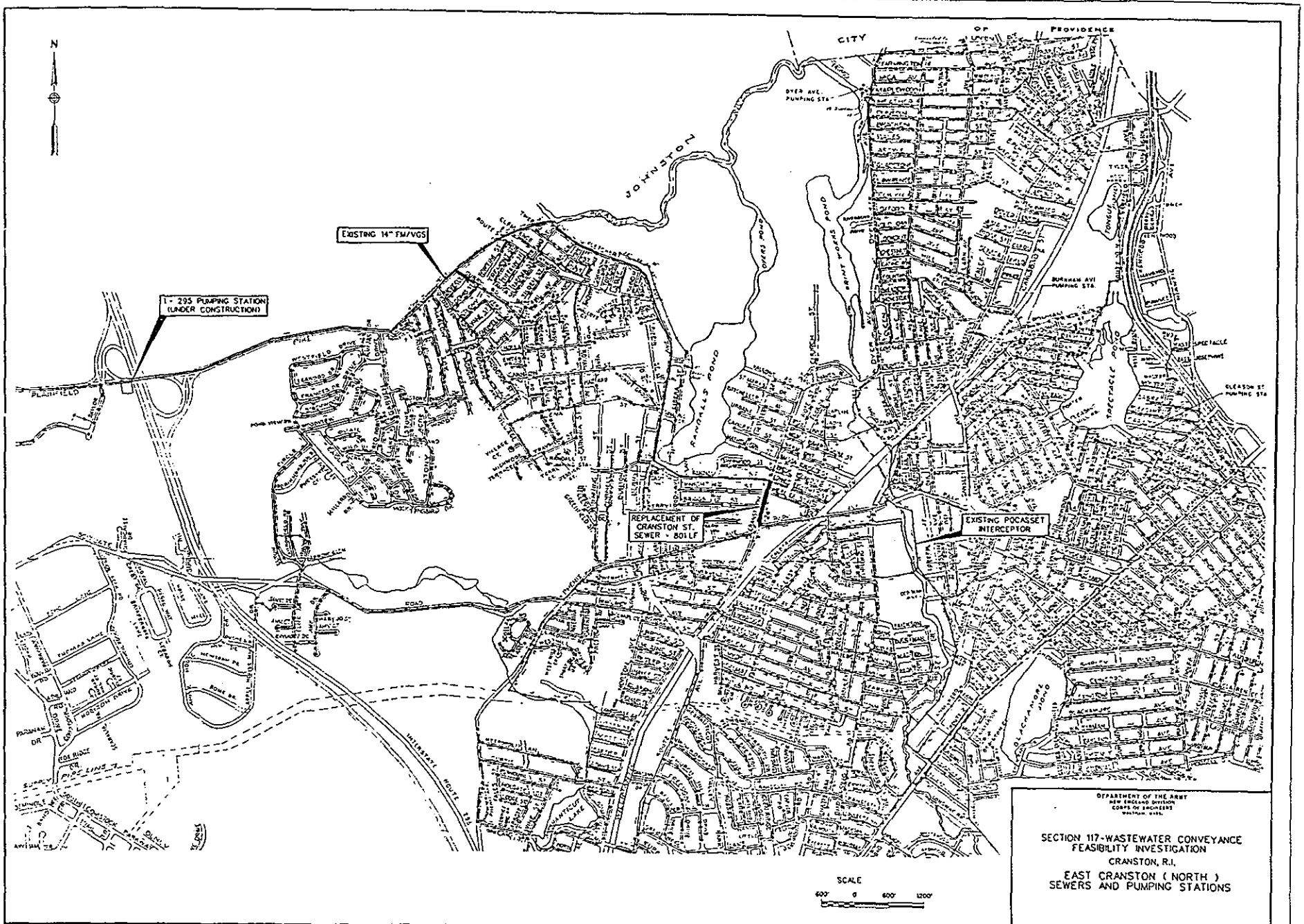
SECTION 117-WASTEWATER CONVEYANCE
FEASIBILITY INVESTIGATION
CRANSTON, R.I.
WEST CRANSTON (NORTH)
SEWERS AND PUMPING STATIONS

PLATE 3


N
CITY OF PROVIDENCE
JOHNSTON
EXISTING 14" FM/VGS
I - 295 PUMPING STATION (UNDER CONSTRUCTION)
PLAINFIELD
REPLACEMENT OF CRANSTON ST. SEWER - 801 LF
EXISTING POCASSET INTERCEPTOR
DYER AVE. PUMPING STA.
BURNHAM AVE PUMPING STA.
GLEASON ST. PUMPING STA.
FANEUIL POND
SPECTACLE POND
INTERSTATE ROUTE 295
SCALE
600' 0 600' 1200'
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FEASIBILITY INVESTIGATION
CRANSTON, R.I.
EAST CRANSTON (NORTH)
SEWERS AND PUMPING STATIONS

PLATE 4