
WASTEWATER FACILITIES PLAN FOR THE TOWN OF NORTH KINGSTOWN



PREPARED FOR:

Town of North Kingstown, Rhode Island

80 Boston Neck Road

North Kingstown, Rhode Island 02852



PREPARED BY:

JAMES J. GEREMIA & ASSOCIATES, INC.

272 WEST EXCHANGE STREET, SUITE 201

PROVIDENCE, RHODE ISLAND 02903-1061

DRAFT: November 30, 2011



TABLE OF CONTENTS

<u>CHAPTER</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
1.0	EXECUTIVE SUMMARY.....	1 – 1
1.1	PURPOSE.....	1 – 1
1.2	EXISTING WASTEWATER CONDITIONS.....	1 – 2
1.3	EXISTING WASTEWATER COLLECTION SYSTEM.....	1 – 5
1.3.1	Town of North Kingstown WWCS.....	1 – 5
1.3.2	Quonset Development Corporation (QDC) WWCS.....	1 – 6
1.4	EXISTING WASTEWATER TREATMENT FACILITY.....	1 – 6
1.5	FUTURE LAND USE.....	1 – 10
1.6	FUTURE SEWERED POPULATION AND SERVICE AREA.....	1 – 14
1.6.1	Flows from Existing Units.....	1 – 14
1.6.2	North Kingstown Future Design Flows.....	1 – 15
1.6.3	Quonset Business Park (QBP) Future Design Flows.....	1 – 17
1.7	FUTURE NORTH KINGSTOWN WASTEWATER COLLECTION SYSTEM.....	1 – 19
1.7.1	Post Road South Wastewater Collection System.....	1 – 19
1.7.2	Post Road North Wastewater Collection System.....	1 – 20
1.7.3	Wickford Village/Poplar Point Wastewater Collection System.....	1 – 21
1.7.4	Shore Acres Wastewater Collection System.....	1 – 21
1.7.5	QDC Collection System.....	1 – 22
1.7.6	QDC Wastewater Treatment System.....	1 – 23
1.8	FINANCIAL IMPACT RELATING TO WASTEWATER TREATMENT IMPROVEMENTS.....	1 – 24
2.0	PURPOSE OF STUDY.....	2 – 1
2.1	INTRODUCTION.....	2 – 1
2.2	HISTORICAL PERSPECTIVE.....	2 – 2
2.3	SCOPE OF PROJECT.....	2 – 3
2.4	FACILITIES PLAN PROJECT AREA.....	2 – 3
3.0	EXISTING CONDITIONS.....	3 – 1
3.1	PLANNING AREA DESCRIPTION.....	3 – 1
3.1.1	Organization Context.....	3 – 1
3.1.2	Existing Population.....	3 – 1
3.1.3	Land Use.....	3 – 3
3.1.4	Geophysical Conditions.....	3 – 11
3.1.4.1	Soil Conditions.....	3 – 11
3.1.4.2	Hydrology.....	3 – 14
3.1.4.3	Topography and Drainage.....	3 – 15
3.1.4.4	Geology.....	3 – 15
3.1.5	Environmental Conditions.....	3 – 17
3.1.5.1	Surface Water.....	3 – 17
3.1.5.2	Groundwater.....	3 – 19
3.1.5.3	Air Quality.....	3 – 21
3.1.5.4	Noise Levels.....	3 – 22
3.1.5.5	Historical and Archaeological Features.....	3 – 22
3.1.5.6	Coastal Zones, Wetlands and Floodplains.....	3 – 22
3.1.5.7	Rare and Endangered Species.....	3 – 25
3.1.5.8	Wild and Scenic Rivers.....	3 – 25



TABLE OF CONTENTS

<u>CHAPTER</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
3.0	EXISTING CONDITIONS (Cont'd)	
3.2	EXISTING WASTEWATER CONDITIONS.....	3 – 25
3.2.1	Current Wastewater Disposal Practices.....	3 – 25
3.3	EVALUATION OF UNSEWERED AREAS.....	3 – 31
3.4	EXISTING WASTEWATER COLLECTION SYSTEM.....	3 – 39
3.4.1	Town of North Kingstown WWCS.....	3 – 39
3.4.2	Quonset Development Corporation WWCS.....	3 – 40
3.4.3	Infrastructure Evaluation.....	3 – 44
3.5	EXISTING WASTEWATER TREATMENT FACILITY.....	3 – 46
3.5.1	Existing Wastewater Flow and Organic Loadings.....	3 – 46
3.5.2	Existing Conditions.....	3 – 50
3.5.3	Unit Process Assessment.....	3 – 51
3.5.3.1	Influent Pumping.....	3 – 51
3.5.3.2	Preliminary Treatment.....	3 – 51
3.5.3.3	Preliminary Sedimentation.....	3 – 52
3.5.3.4	Rotating Biological Contactor.....	3 – 52
3.5.3.5	Secondary Clarifiers.....	3 – 53
3.5.3.6	Disinfection System.....	3 – 54
3.5.3.7	Wastewater Treatment Plant Outfall.....	3 – 55
3.5.3.8	Solids Handling Facilities.....	3 – 55
4.0	FUTURE CONDITIONS.....	4 – 1
4.1	FUTURE LAND USE.....	4 – 1
4.2	FUTURE SEWERED POPULATION AND SERVICE AREA.....	4 – 4
4.2.1	Flow From Existing Units.....	4 – 5
4.2.2	Design Flows.....	4 – 6
4.2.2.1	North Kingstown Future Design Flows.....	4 – 6
4.2.2.2	Quonset Business Park (QBP) Future Design Flows.....	4 – 9
4.2.3	Future North Kingstown Wastewater Collection System.....	4 – 10
4.2.3.1	Post Road South WWCS.....	4 – 10
4.2.3.2	Post Road North WWCS.....	4 – 11
4.2.3.3	Wickford Village/Poplar Point WWCS.....	4 – 13
4.2.3.4	Shore Acres WWCS.....	4 – 14
4.2.3.5	Future Improvements to the Existing P.S. Owned by the Town.....	4 – 15
4.2.3.5.1	Wickford Point Pump Station.....	4 – 15
4.3	QDC COLLECTION SYSTEM.....	4 – 19
4.4	EVALUATION OF EXISTING INFRASTRUCTURE.....	4 – 19
4.4.1	QDC Collection System.....	4 – 19
4.4.2	QDC Wastewater Treatment System.....	4 – 23
4.5	FUTURE WASTEWATER TREATMENT FACILITIES.....	4 – 23
4.5.1	Influent Pumping System.....	4 – 23
4.5.2	Preliminary Treatment.....	4 – 24
4.5.3	Primary Clarifiers.....	4 – 24
4.5.4	Rotating Biological Contactors (RBC's).....	4 – 25
4.5.5	Secondary Clarifiers.....	4 – 25
4.5.6	Chlorination System.....	4 – 26



TABLE OF CONTENTS

<u>CHAPTER</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
4.0	FUTURE CONDITIONS (Cont'd)	
	4.5.7 Wastewater Treatment Plant Outfall.....	4 – 27
	4.5.8 Solids Handling.....	4 – 27
5.0	PRELIMINARY IMPLEMENTATION PLAN.....	5 – 1
5.1	WASTEWATER COLLECTION SYSTEM PRELIMINARY DESIGN.....	5 – 1
	5.1.1 Design and Cost Computations.....	5 – 1
5.2	FUTURE SERVICE AREA.....	5 – 2
	5.2.1 Post Road South Wastewater Collection System.....	5 – 2
	5.2.2 Post Road North Wastewater Collection System.....	5 – 8
	5.2.3 Wickford Village/Poplar Point Wastewater Collection System.....	5 – 18
	5.2.4 Shore Acres Wastewater Collection System.....	5 – 25
5.3	EXISTING COLLECTION SYSTEM UPGRADE.....	5 – 29
	5.3.1 A.S.Q.A.H. Road.....	5 – 29
	5.3.2 Newcomb Road.....	5 – 29
6.0	5.3.3 Diversion Structure to D57.....	5 – 30
	5.3.4 Wickford Point Pump Station.....	5 – 30
5.4	WASTEWATER TREATMENT FACILITY PRELIMINARY DESIGN.....	5 – 32
	5.4.1 General.....	5 – 32
	ANTICIPATED ENVIRONMENTAL IMPACTS.....	6 – 1
	RECOMMENDED PLAN.....	6 – 1
6.1	NO CONSTRUCTION ALTERNATIVE.....	6 – 1
6.2	WASTEWATER TREATMENT FACILITY, INTERCEPTORS AND PUMP STATIONS.....	6 – 2
6.3	DIRECT IMPACTS.....	6 – 3
	6.3.1 Traffic and Daily Activities.....	6 – 3
	6.3.2 Historic, Archaeological, Cultural, Recreational.....	6 – 4
	6.3.3 Soils and Hydrology.....	6 – 7
	6.3.4 Erosion Control.....	6 – 7
	6.3.5 Water Quality.....	6 – 8
	6.3.6 Building Displacement.....	6 – 8
	6.3.7 Noise, Air or Visual Pollution.....	6 – 8
	6.3.8 Floodplain.....	6 – 9
6.4	INDIRECT IMPACTS.....	6 – 10
	6.4.1 Urbanization.....	6 – 10
	6.4.2 Local Suppliers.....	6 – 10
	6.4.3 Local Services.....	6 – 10
	6.4.4 Recreation.....	6 – 10
	6.4.5 Land Use.....	6 – 11
	6.4.6 Energy.....	6 – 11
	6.4.7 Economics.....	6 – 11
	6.4.8 Public Safety.....	6 – 11
	6.4.9 Aesthetics.....	6 – 12
	6.4.10 Visual Amenities.....	6 – 12
6.5	SUMMARY.....	6 – 12



TABLE OF CONTENTS

<u>CHAPTER</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
7.0	ARRANGEMENT FOR IMPLEMENTATION.....	7 – 1
7.1	INSTITUTIONAL RESPONSIBILITIES.....	7 – 1
7.2	COLLECTION SYSTEM IMPROVEMENTS.....	7 – 2
7.3	FINANCIAL IMPACT RELATING TO WASTEWATER TREATMENT IMPROVEMENTS....	7 – 4
7.4	IMPLEMENTATION SCHEDULE.....	7 – 5
7.5	SOURCE OF FUNDS.....	7 – 7
7.6	OPERATIONS AND MAINTENANCE COSTS.....	7 – 10
7.7	RECOMMENDED STAFFING.....	7 – 10
8.0	PUBLIC PARTICIPATION	
8.1	PUBLIC PARTICIPATION.....	8 – 1



TABLE OF CONTENTS

LIST OF TABLES

<u>TABLE NO.</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
1-1	Future Land Use.....	1 – 14
1-2	Commercial/Mixed Use Wastewater Projections.....	1 – 15
1-3	Residential Use Wastewater Projections.....	1 – 16
1-4	Projected Average Daily Flow from Proposed Sewered Areas – Design Year 2030.....	1 – 18
1-5	QBP Future Flows.....	1 – 18
1-6	Summary of Future Wastewater Design Flows.....	1 – 23
1-7	Summary of Cost – Town of North Kingstown.....	1 – 24
1-8	Summary of Cost – Existing Collection System.....	1 – 25
1-9	Summary of North Kingstown's Capital Cost.....	1 – 25
1-10	Summary of Anticipated Annualized Cost.....	1 – 25
3-1	Existing Land Use.....	3 – 11
3-2	Adversely Impacted Surface Water Bodies.....	3 – 18
3-3	Existing Water Consumption.....	3 – 30
3-4	Post Road Project Area – OWTS Repairs by Location.....	3 – 33
3-5	Wickford and Poplar Point Area – OWT Repairs by Location.....	3 – 35
3-6	Shore Acres Area – OWTS Repairs by Location.....	3 – 37
3-7	DS-55 Operating Conditions (2006 through 2010).....	3 – 46
3-8	Wastewater Effluent Flows (MGD) – 2006 through 2010.....	3 – 49
3-9	Total Influent BOD ₅ Average (mg/l) – 2006 through 2010.....	3 – 49
3-10	Total Influent TSS Average (mg/l) – 2006 through 2010.....	3 – 49
3-11	Average Septage Loading – 2006 through 2010.....	3 – 49
3-12	Primary Clarifiers Operating Criteria.....	3 – 52
3-13	Rotating Biological Contactor (RBC) Operating Criteria Comparison.....	3 – 53
3-14	Secondary Clarifiers Operating Criteria.....	3 – 54
3-15	Effluent Disinfection.....	3 – 55
4-1	Future Land Use.....	4 – 1
4-2	Commercial/Mixed Use Wastewater Projections.....	4 – 6
4-3	Residential Wastewater Projections.....	4 – 7
4-4	Projected Average Daily Flow from Proposed Sewered Areas – Design Year 2030.....	4 – 8
4-5	QBP Future Flows.....	4 – 9
4-6	Future Capacities of the QDC Sewer System.....	4 – 21
4-7	Summary of Future Wastewater Design Flows.....	4 – 23
4-8	Primary Clarifiers Operating Criteria.....	4 – 24
4-9	Rotating Biological Contactor (RBC) Operating Criteria.....	4 – 25
4-10	Secondary Clarifiers Operating Criteria.....	4 – 26
4-11	Effluent Disinfection.....	4 – 27
5-1	Projected Flows to the S-1 Pump Station.....	5 – 2
5-2	Probable Project Cost for the S-1 Post Road Service Area WWCS	5 – 6
5-3	Projected Flows to the S-2 Pump Station.....	5 – 6



TABLE OF CONTENTS

LIST OF TABLES (Cont'd)

<u>TABLE NO.</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
5-4	Probable Project Cost for the S-2 Post Road Subarea WWCS.....	5 – 7
5-5	Probable Project Cost for the Commercial Component of the S-2 Post Road Subarea WWCS.....	5 – 7
5-6	Probable Project Cost for the Residential Component of the S-2 Post Road Subarea WWCS.....	5 – 8
5-7	Projected Flows to the N-1 Pump Station.....	5 – 10
5-8	Probable Project Cost for the N-1 Post Road Subarea WWCS.....	5 – 10
5-9	Probable Project Cost for the Commercial Component of the N-1 Post Road Subarea WWCS....	5 – 11
5-10	Probable Project Cost for the Residential Component of the N-1 Post Road Subarea WWCS....	5 – 11
5-11	Projected Flows to the N-2 Pump Station (Phase 1).....	5 – 12
5-12	Probable Project Cost for the N-2 Post Road Subarea WWCS.....	5 – 12
5-13	Probable Project Cost for the Commercial Component of the N-2 Post Road Subarea WWCS.....	5 – 13
5-14	Probable Project Cost for the Residential Component of the N-2 Post Road Subarea WWCS.....	5 – 13
5-15	Probable Project Cost for the N-3 Post Road Subarea WWCS.....	5 – 14
5-16	Probable Project Cost for the Pine River Road WWCS.....	5 – 16
5-17	Probable Project Cost for the Mark Drive WWCS.....	5 – 18
5-18	Projected Flows to the Phillips Street Pump Station.....	5 – 22
5-19	Probable Project Cost for the Wickford Village W-1 Subarea WWCS.....	5 – 22
5-20	Probable Project Cost for the Wickford Village W-2 Subarea WWCS.....	5 – 24
5-21	Probable Project Cost for the Wickford Village W-3 Subarea WWCS.....	5 – 25
5-22	Probable Project Cost for the Shore Acres Gravity WWCS.....	5 – 27
5-23	Probable Project Cost for the Shore Acres Low Pressure WWCS.....	5 – 28
5-24	Probable Project Cost for the A.S.Q.A.H. Road Sewer Main Replacement.....	5 – 29
5-25	Probable Project Cost for the Newcomb Road Sewer Main Replacement.....	5 – 29
5-26	Probable Project Cost for the New Diversion Structure to D57.....	5 – 30
5-27	Wickford Point Pump Station.....	5 – 32
5-28	Quonset Point Wastewater Treatment Facility Capital Costs.....	5 – 33
7-1	Summary of Cost to Improve QDC's Infrastructure.....	7 – 4
7-2	Summary of Cost – Existing Collection System.....	7 – 4
7-3	Summary of North Kingstown's Capital Cost.....	7 – 5
7-4	Summary of Anticipated Annualized Cost.....	7 – 5
7-5	North Kingstown Collection System – Probable Maintenance Costs.....	7 – 10



TABLE OF CONTENTS

LIST OF FIGURES

<u>FIGURE NO.</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
1-1	Wastewater Management Districts.....	1 - 4
1-2	Existing QDC Wastewater Collection System.....	1 - 7
1-3	QDC Wastewater Treatment Plant Process Flow Schematic.....	1 - 8
1-4	QDC Wastewater Treatment Plant Site Plan.....	1 - 9
1-5	Future Land Use – Post Road Corridor.....	1 - 11
1-6	Future Land Use – Wickford Village/Poplar Point.....	1 - 12
1-7	Future Land Use – Shore Acres.....	1 - 13
2-1	Town of North Kingstown Organization Chart.....	2 - 4
3-1	Organization Chart.....	3 - 2
3-2	Existing Land Use Project Area.....	3 - 10
3-3	Soils Map.....	3 - 13
3-4	Topographics & Drainage Map.....	3 - 16
3-5	Groundwater Aquifer & Recharge Area.....	3 - 20
3-6	Historical Elements within Project Area.....	3 - 23
3-7	Wetlands & Coastal Areas.....	3 - 24
3-8	Wastewater Management Districts.....	3 - 28
3-9	OWTS Failures & Repairs – Post Road Corridor.....	3 - 34
3-10	OWTS Failures & Repairs – Wickford/Poplar Point.....	3 - 36
3-11	OWTS Failures & Repairs – Shore Acres.....	3 - 38
3-12	Existing QDC Wastewater Collection System.....	3 - 41
3-13	QDC Wastewater Treatment Plant Process Flow Schematic.....	3 - 47
3-14	QDC Wastewater Treatment Plant Site Plan.....	3 - 48
4-1	Future Land Use – Post Road Corridor.....	4 - 2
4-2	Future Land Use – Wickford Village/Poplar Point Area.....	4 - 3
4-3	Future Land Use – Shore Acres.....	4 - 4
4-4	Quonset Development Corporation's WW & Town Tie-In.....	4 - 20
4-5	Future QDC Wastewater Collection System.....	4 - 12
5-1	Post Road South Area.....	5 - 3
5-2	Dana Drive/Oakdale Road.....	5 - 4
5-3	Stony Lane and Sedgefield Road.....	5 - 5
5-4	Post Road North Area.....	5 - 9
5-5	Pine River Road Area.....	5 - 15
5-6	Mark Drive Area.....	5 - 17
5-7	Wickford Village/Poplar Point Area W-1.....	5 - 19
5-8	Wickford Village/Poplar Point Area W-2.....	5 - 20
5-9	Wickford Village/Poplar Point Area W-3.....	5 - 21
5-10	Shore Acres Area.....	5 - 26
7-1	Construction Schedule.....	7 - 6
7-2	Organization Chart.....	7 - 2



LIST OF APPENDICES

- A Wastewater Management Plan
- B. Phase IA Archaeological Reconnaissance Survey for Camp Ave. (October 19, 2011)
- C. North Kingstown/Quonset Development Corporation Agreement (including amendments)
- D. Public Meeting No. 1 – October 24, 2011 (Powerpoint Slides)



1.1 PURPOSE

The purpose of this study is to develop a comprehensive Wastewater Facilities Plan for the Town of North Kingstown. The Wastewater Facilities Plan will provide a twenty-year Comprehensive Plan addressing the wastewater needs for the Town to ensure the proper management of wastewater throughout the planning period.

Through a systematic process, this study will analyze the demographic, topographic, hydrologic and other characteristics of the planning area. The plan will document the need for sewers and provide a preliminary plan establishing the most cost-effective sewer routing. The study will outline financial, legal and institutional requirements necessary to ensure the installation of sewers.

The methodology for the development of this document was tailored for compliance with Rhode Island Comprehensive Planning and Land Use Act – Wastewater Utilities Section and with the financing provisions of the U.S. Clean Water Act relating to the State Revolving Fund Program. Specific guidelines governing the preparation of wastewater facilities plans have been prepared by the Rhode Island Department of Environmental Management-Division of Water Resources, who will act as the primary reviewing authority.

The Town has recognized that, while it is the goal of the Town to focus on on-site wastewater systems with a Wastewater Management Plan, due to the physical constraints in those specific areas of Town where the Comprehensive Plan is looking to increase development, a more conventional approach to sewerage would be more effective.

Efforts are currently underway to create a higher density mixed use for the Post Road District (PRD). The Post Road Corridor Element of the North Kingstown Comprehensive Plan includes a number of actions designed to improve the commercial, residential and affordable housing activities, as well as the visual quality of Post Road. Recommended improvement actions include providing adequate infrastructure and community services to businesses and residents in the PRD without negatively impacting the environment. The Town's projected

development plan recommends establishing two designated growth centers along the Post Road Corridor as these sites are redeveloped in the future. The Town further recognizes that an essential component in the re-development of the Post Road Corridor is to address the wastewater disposal needs of the area by more conventional means.

1.2 EXISTING WASTEWATER CONDITIONS

Approximately 96% of the present population of North Kingstown relies on on-site wastewater treatment systems for their treatment and disposal of wastewater. This method is self-contained underground waste disposal systems typically designed to handle wastewater generated from individual buildings. The useful life for both types of systems is approximately 20 to 25 years. A vast majority of buildings constructed prior to 1964 were serviced by cesspools. These generally consist of a collection tank with singular or multiple discharge points designed to dispose the liquid portion of the waste directly to surrounding soils. Between 1965 and 1979, an increasing number of installed systems were of the *septic tank/leachfield* type. However, with the absence of adequate regulations until 1968, which were not strictly enforced, many of these systems were of sub-standard installation. Since 1979, when new design standards were adopted and enforced by the State, system construction methods and performance has generally improved.

North Kingstown, like most municipalities, relies on individual property owners/managers to maintain their wastewater disposal systems. Failure of a system can be attributed to any or all of the following factors:

- Improper siting
- Inadequate sizing
- Hydraulic overloading
- Introduction of large quantities of non-biodegradable solids
- Failure to pump the system regularly
- Improper installation or substandard construction materials
- Adverse activities around the leaching field (i.e., planting trees)

To ensure the proper performance of on-site wastewater disposal systems in North Kingstown where they will continue to provide an alternative to conventional sewerage, the Town Council has established a wastewater management district. The North Kingstown Wastewater Management District Ordinance went into effect on May 1, 1999.

In 1996, a decision was made by the North Kingstown Town Council to shift the focus away from sewerage to maintenance of OWTS through the drafting of a wastewater management district ordinance. At that time, the Town's Sewer Study Committee was renamed the "Wastewater Management Committee" and their charge was revised to reflect the new focus, which included the drafting of a Wastewater Management District Ordinance and an associated public outreach/education program to garner public support for the ordinance. The Committee membership was also expanded to include representation from other Town committees including the Planning Commission, Groundwater Committee, Harbor Management Committee and Historic District Commission. Aqua Fund grant funds were acquired to help with these tasks.

Chapter 8, Article VII of the Code of Ordinances, Town of North Kingstown, entitled "North Kingstown Wastewater Management District" was adopted at a public hearing held on January 11, 1999. The ordinance requires that all onsite systems in the Town of North Kingstown be inspected and pumped if necessary once every three years.

The Town is divided into four Wastewater Management Districts (as presented on Figure 1-1). The districts are defined as follows:

- **Wastewater District 1** All properties serviced by a private well and OWTS or cesspool;
- **Wastewater District 2** All properties located in Zone 1 Groundwater Protection Areas and all properties located adjacent to poorly flushed coastal areas;
- **Wastewater District 3** All properties located in Zone 2 Groundwater Protection Areas and properties located in densely settled coastal areas; and
- **Wastewater District 4** All other properties in North Kingstown serviced by OWTS or cesspools.

The effective date of the ordinance was delayed until May 1, 1999 so that an implementation strategy could be developed. It was determined that implementation of the ordinance would be the responsibility of the North Kingstown Department of Water supply and an implementation plan for the wastewater management program was presented to the Town Council by the Department of Water Supply in April 1999.

The goals of North Kingstown's Wastewater Management Program include the following:

1. Ensure the proper operation and maintenance of OWTS to prevent malfunctioning systems.

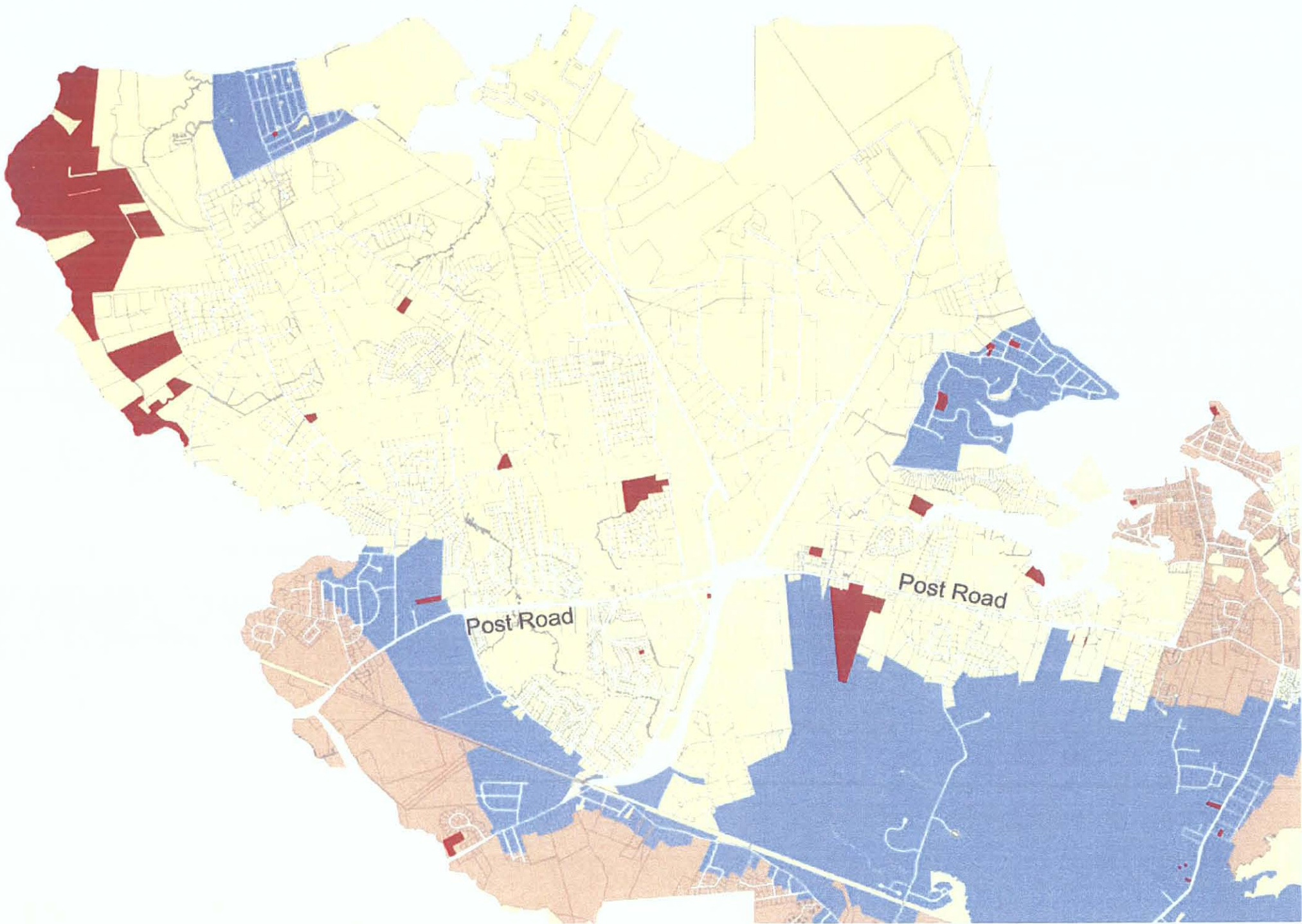
Figure 1-1

North Kingstown Wastewater Facilities Plan

Wastewater Management Districts

Legend

- Wastewater District 1
- Wastewater District 2
- Wastewater District 3
- Wastewater District 4



2. Protection of the public health from risks associated with septic system failures.
3. Protection of surface and groundwater resources, including the Town's drinking water supply from contamination associated with failure of OWTS.
4. Continued reliance on the use of properly functioning OWTS as a viable and cost-effective alternative to municipal sewers.
5. To maintain the hydrological balance in groundwater recharge areas by reducing the transport of water out of these areas.

The Town has a limited municipal wastewater collection system. At this time, approximately 4% (1,532 out of 26,326) of the population is sewered. The sewered area is limited to the area in and around the Quonset Business Park (QBP). Sewers presently service the former Navy personnel housing, several multi-family developments adjacent to Devil's Foot Road and Newcomb Road, the Quidnesset & Fishing Cove Elementary Schools, and several homes along Mark Drive, Kings Grant and Essex Village near Quidnesset School, and ASQAH apartments, Millcreek Drive area and Wickford Point.

1.3 EXISTING WASTEWATER COLLECTION SYSTEM

1.3.1 Town of North Kingstown Wastewater Collection System

The Town's wastewater collection system is limited to two (2) pump stations, 8,300 linear feet of sewer main, 5,000 linear feet of force main, approximately 309 residential units and two (2) schools. Due to the limited extent of the wastewater collection managed by the Town, the supervision of the system is handled through the Water Department. The Director of Water Supply is the individual who coordinates these efforts through a private contractor. The private contractor is responsible for all maintenance parts of the system.

Mark Drive

The Mark Drive collection system is limited to the Quidnesset School and three (3) residential properties. The gravity line from the School and three residential properties connect into a pump station located on the school property.

Wickford Point

The Wickford Point service area is a residential subdivision constructed in the 1990's on former Navy housing land. The subdivision is situated off Camp Ave. south of A.S.Q.A.H. Road. The service area is comprised of ninety-four (94) single family homes and the Fishing Cove Elementary School.

1.3.2 Quonset Development Corporation (QDC) Wastewater Collection System

QBP is served by a gravity wastewater collection system consisting of approximately 20 miles of pipes ranging in diameter from 4 to 24 inches. The system is composed of lateral and collector sewers which generally follow natural ground contours. Wastewater is discharged from individual buildings into sewer lines via service connections. Lateral and collector sewers are equipped with manholes at regular intervals to allow inspection and cleaning. Wastewater flows by gravity in a southerly direction toward the Quonset Wastewater Treatment Facility (WWTF) located on Zarbo Avenue. The system provides wastewater treatment for all parcels within the Quonset Business Park (QBP) as well as several parcels within the Quonset State Airport.

Because of topographic constraints, four pumping stations are included in the QBP collection system. The Davisville Pumping Station (designated as DS-55) is located at the south end of the golf course; the Pier Area Pumping Station is located near Davisville Pier 2; the Commerce Park Pumping Station is located at the eastern end of Commerce Park Road; and the Burlingham Ave. Pumping Station is located at the eastern side of Burlingham Ave. at the intersection of Circuit Drive. These stations lift wastewater from low points in the system to an elevation where wastewater can flow by gravity to the WWTP. Figure 1-2 depicts the existing sanitary sewer collection system and the location of the WWTF outfall.

1.4 EXISTING WASTEWATER TREATMENT FACILITY

The QDC WWTF was originally constructed in the 1940s by the Navy to serve the former naval base. In 1992, the WWTF was upgraded to accommodate an average daily hydraulic flow of 2.6 MGD, a RIDEM permitted average daily flow (based on theoretical organic loading) of 1.78 MGD and a peak of 3.56 MGD from the QBP. A process flow schematic and site plan is shown in Figures 1-3 and 1-4 respectively.

Figure 1-2

North Kingstown Wastewater Facilities Plan

Existing QDC Wastewater
Collection System

Information taken from
Berger/Maguire report prepared
for QDC

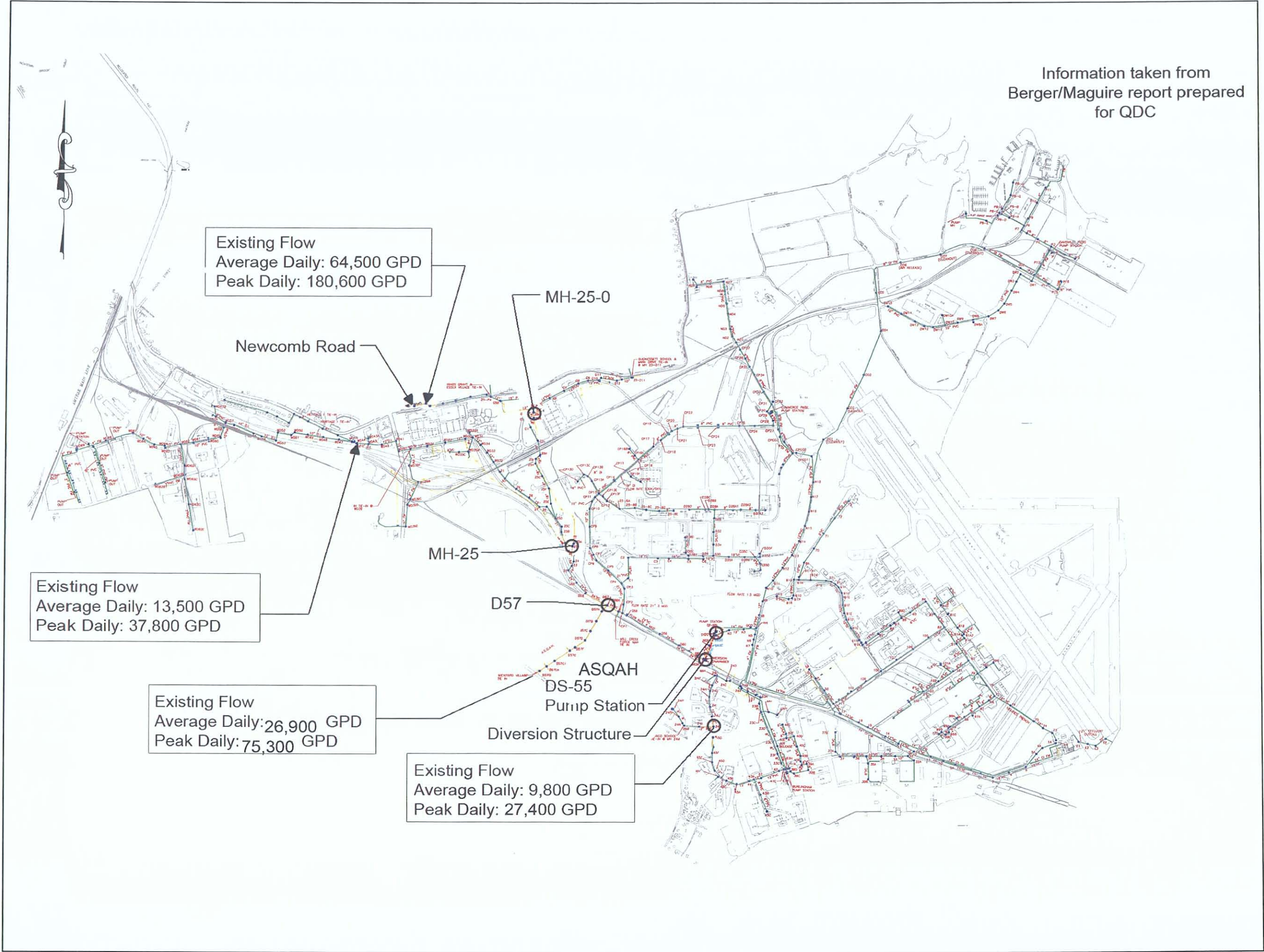
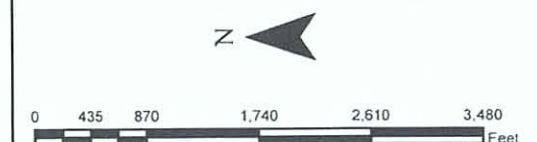
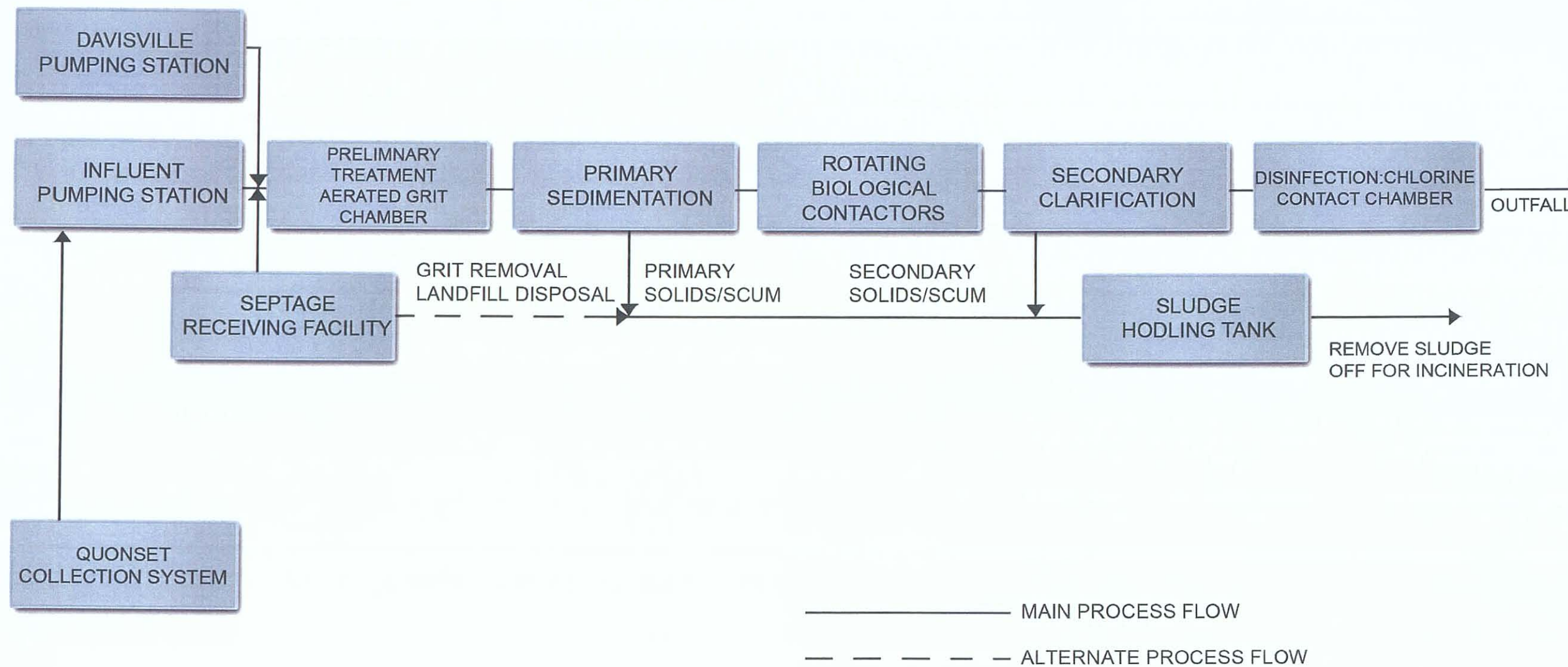


Figure 1-3
**North Kingstown
Wastewater
Facilities Plan**

QDC Wastewater Treatment
Plant Process Flow Schematic



The facility was originally designed for a permitted hydraulic capacity of 2.6 MGD (6.5 MGD peak) and a corresponding organic capacity for BOD and TSS of 6,505 lbs./d. Due to monetary constraints, QDC eliminated one RBC train. This resulted in a reduction in the facility's BOD and TSS loading to 4,454 lbs./d. However, the process equipment remains fixed to meet the 2.6 MGD hydraulic capacity.

1.5 FUTURE LAND USE

The Facilities Plan will focus on the continuing development of the Post Road Corridor element of the Town's Comprehensive Plan (Post Road District) to encourage mixed-use development within existing neighborhoods, revitalizing Wickford Village as the center of the Town, and respond to the request of specific neighbors where there have been chronic on-site treatment system failures. The remainder of the Town will continue following the Wastewater Management Ordinance. To that end, the twenty year planning period for the conventional wastewater needs will focus on:

- Post Road Corridor (Figure 1-5);
- Wickford Village/Poplar Point (Figure 1-6); and
- Shore Acres (Figure 1-7).

The land use information for each of these areas is presented in Table 1-1.

One area identified for a potential growth center is within the Quonset/Davisville vicinity along Post Road. This area is targeted to be oriented towards the creation of economic development opportunities at the Quonset Gateway parcel, and high-density infill redevelopment of aging properties having frontage on Post Road as well as the property to the rear of those parcels. Another area identified is the Reynolds Farm/Oakdale Road Village Center which is oriented towards long term controlled development of vacant and underutilized properties at increased density, as well as the updating of aging public infrastructure and utilities. Planning for the long-term generation of village growth centers will allow for a more consistent placement of retail, office and residential uses that concentrate pedestrian intensive areas together.

The proposed growth centers will also support the growth associated with the Quonset Business Park. According to the 2008 Quonset Master Plan prepared by the Maguire Group, future industrial and commercial development is projected to generate a total 15,157 jobs at the site over the next 20 years. This total includes the over 7,968 existing employees and nearly 7,189 additional employees on the vacant

Figure 1-5 North Kingstown Wastewater Facilities Plan

Future Land Use
Post Road Corridor

Prepared By
James J. Geremia & Associates

- Features**
- Railroad
 - Post Road Corridor
 - Town Boundry
 - Project Area
 - Post Road District(Adopted 8/10)
- Parcels**
- <all other values>
- Land Use**
- General Industrial
 - Heavy Business
 - Heavy Business UL
 - Light Industrial
 - Neighborhood Residential
 - Open Space
 - Public
 - Public Residential
 - Rural Residential
 - Village Residential

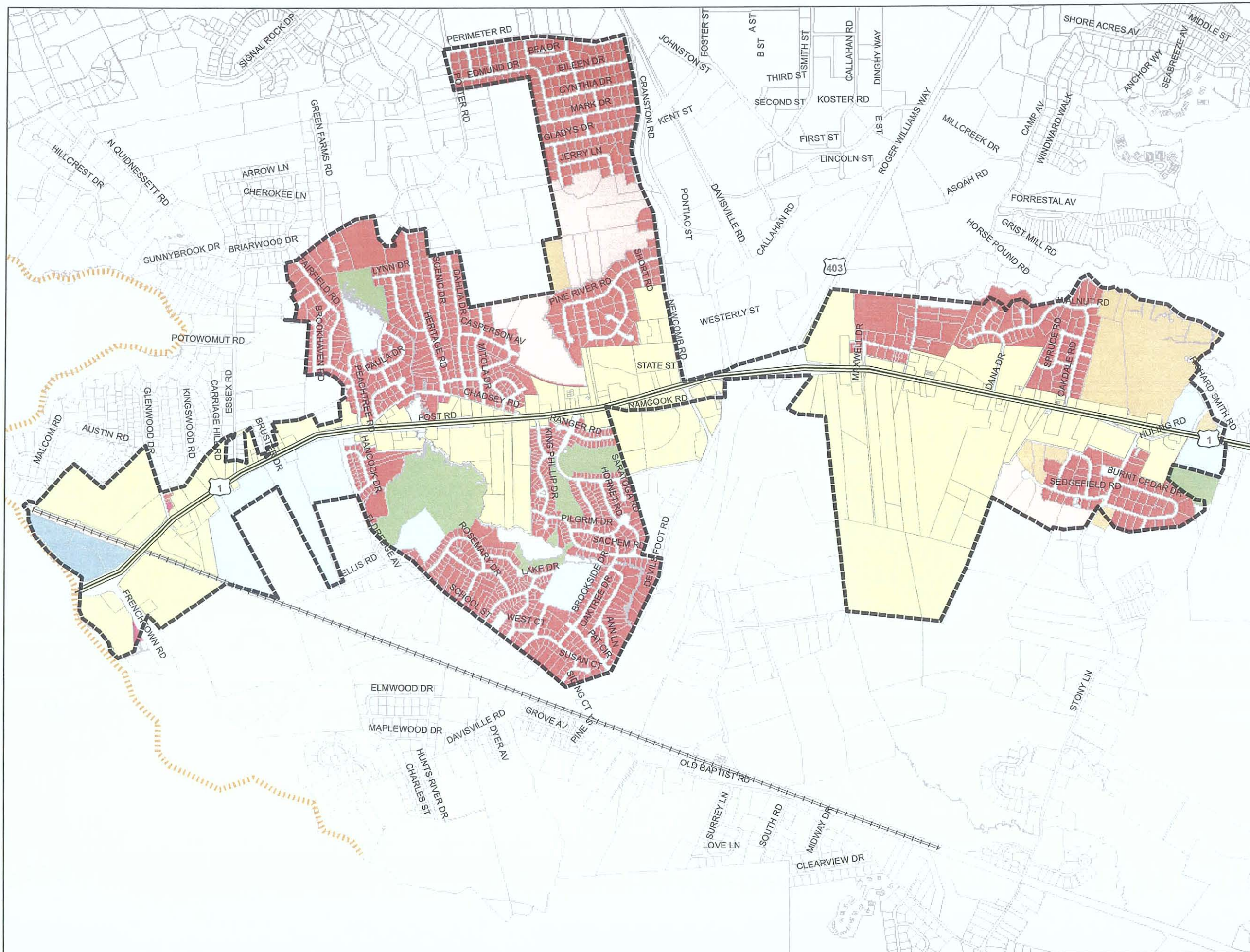


Figure 1-6

North Kingstown Wastewater Facilities Plan

Future Land Use
Wickford Village/Poplar Point

Prepared By
James J. Geremia & Associates



- Features**
- Railroad
 - Post Road Corridor
 - Town Boundary
 - Wickford area
- Parcels**
- Land Use**
- Parcels
 - General Business
 - General Industrial
 - Neighborhood Business
 - Neighborhood Residential
 - Open Space
 - Public
 - Planned Village District
 - Village Residential
 - Waterfront Business
 - Waterfront VC

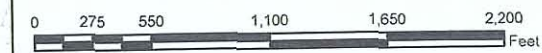
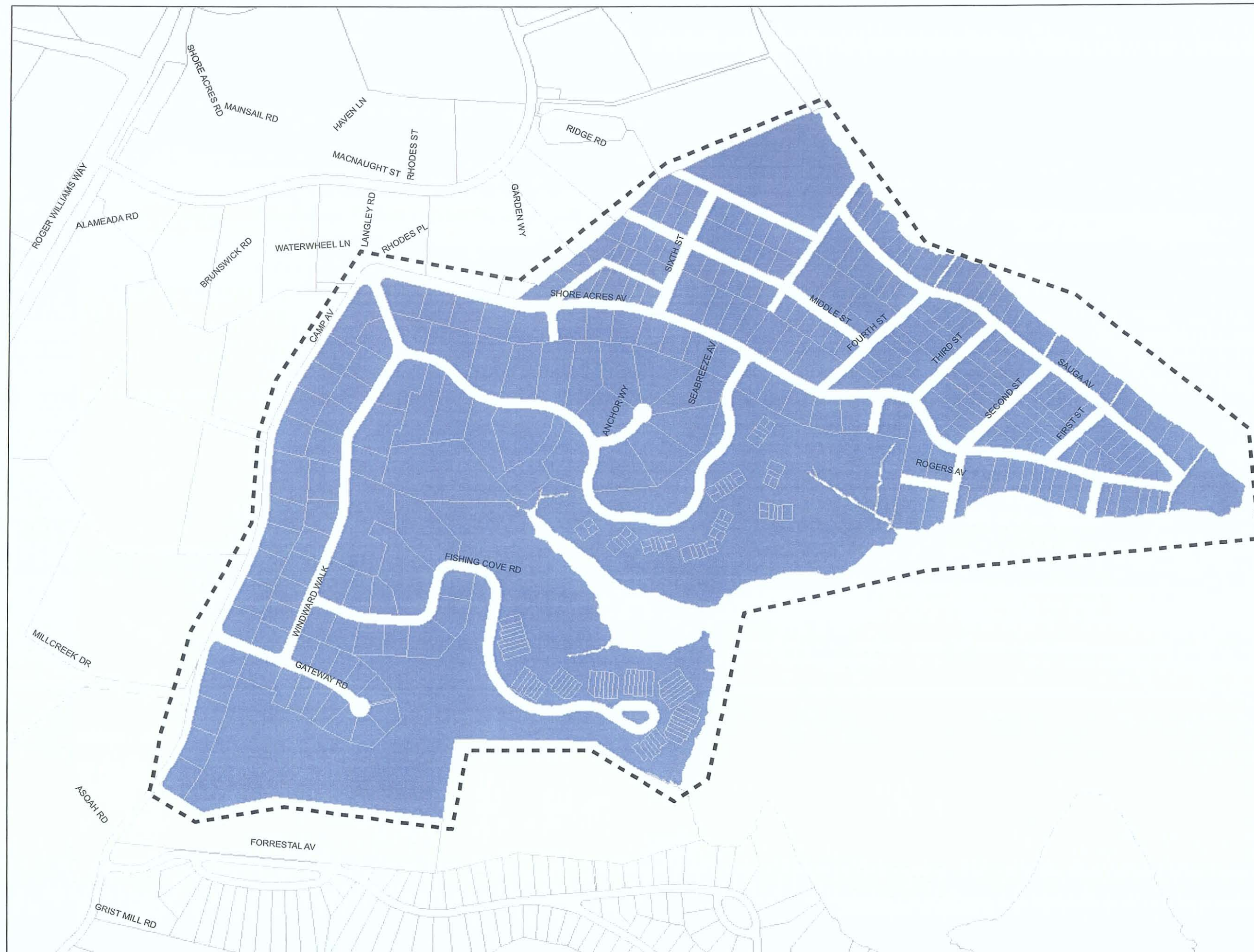


Figure 1-7

North Kingstown Wastewater Facilities Plan

Future Land Use
Shore Acres

Prepared By
James J. Geremia & Associates



- Features**
- Railroad
 - Post Road Corridor
 - Town Boundary
 - Area
- Parcels**
- Land Use**
- Parcels
 - Open Space
 - Village Residential



0 140 280 560 840 1,120 Feet



TABLE 1-1 FUTURE LAND USE					
Type	Acres	Type	Acres	Type	Acres
<u>Post Road Corridor</u>		<u>Wickford Area</u>		<u>Shore Acres Area</u>	
Commercial (Post Rd. District)	510	General Business	18	Village Residential	187
High Density Residential	59	General Industrial	1	Open Space	18
Medium Density Residential	108	Neighborhood Business	14	Institutional/Office	6
Low Density Residential	10	Neighborhood Residential	97		
Parks/Recreation	14	Open Space	180		
Open Space	30	Public	34		
Heavy Business	15	Planned Village District	26		
Gateway	55	Village Residential	280		
Cemetery	63	Waterfront Business	13		
		Wickford Village Commercial	1		
TOTAL	864	TOTAL	664	TOTAL	211

and developable land. It can be reasonably assumed that many of these employees currently utilize the retail and service business located just outside of QBP on Post Road. In order for Post Road to accommodate the future growth at QBP, the development of walkable village centers is crucial for the area's economic and environmental sustainability.

The Town has recently developed guidelines and zoning changes to improve the conditions along the Post Road Corridor. The regulation changes allow for higher density commercial and residential development and provide the opportunity to cultivate walkable village centers that are economically successful and architecturally pleasing.

1.6 FUTURE SEWERED POPULATION AND SERVICE AREA

1.6.1 Flows From Existing Units

Sewage flow to the Quonset Wastewater Treatment Facility, from the expansion of sewers into the Town, is based on sewerage the Post Road Corridor (North and South), Wickford Village/Poplar Point Area and Shore Acres Area. The two components which make up the wastewater flow are the commercial and residential areas combined with the existing sewer population. Present development data was used to determine a base wastewater flow. Average daily residential flows are based on the total number of housing units with an assumed occupancy of 2.7 persons per unit and a daily per person wastewater contribution of 67 gallons. This wastewater flow was determined from actual water consumption data and discounting it by 15% to account for outside water usage divided by the number of users (1,532). Due to the changes in the Town's Zoning Ordinance, it has not been determined what impact those changes will have on the commercially-zoned land. Therefore, for the purpose of projecting wastewater flows, this

report will use the commercial standard of 775 gallons per developed acre per day, as utilized by QDC, to determine future commercial flows within Post Road. For the purpose of this report, the commercial component will be composed of land designated as Planned Village District, Neighborhood Commercial and Commercial. The commercial flows within the Wickford Area will be based on actual water consumption, as the area is fully built out. An estimated length of gravity lateral and interceptor sewers in each area was first determined. Being that sewer laterals represent the majority of the installed pipe length, an average pipe diameter of 8-inches was then assumed and a factor of 150 gal/in. dia./mile of sewer was applied for infiltration/inflow.

1.6.2 North Kingstown Future Design Flows

There are 240 acres of commercial/mixed use-zoned land within the Post Road North Segment (excluding areas under agreement with Quonset Development Corporation (QDC), the Gateway and all public land), and 285 acres within the Post Road South Segment. In view of the Town's plans to increase the commercial activities along Post Road and increase the residential development density, the entire 525 acres of commercial/mixed use-zoned land is proposed to be sewered over the next twenty years. There are 34 acres of commercial zoned land and 13 acres of waterfront business zoned land for the Wickford Village/Poplar Point Area. For the purpose of projecting future flows, this report will use 775 gallons per acre, regardless of whether the land contains a structure or not within the Post Road Corridor and the actual water usage for the Wickford Village/Poplar Point. Boat slip flows in the Wickford Village/Poplar Point Area are based on 450 boat slips at 10 gallons per day per boat slip. Table 1-2 provides a breakdown of the commercial flow.

TABLE 1-2 COMMERCIAL/MIXED USE WASTEWATER PROJECTIONS							
Area	Post Road District Acreage	Heavy Business Acreage	Commercial Acreage	Waterfront Business Acreage	Total Acreage	Developable Acreage ³	Project Flow (GPD)
Post Road North ¹	225	15			240	204	158,100
Post Road South ¹	285				285	242	187,550
Sub-Total	510	15			525	446	345,650
Wickford Vil./Poplar Pt. Area ²			34	13	47	40	30,300
TOTAL	510	15	34	13	572	486	375,950

¹ Flow is based on 775 gallons per acre per day

² Flow is based on actual water usage for commercial and 10 gallons per day for 450 boat slips

³ Assumed 15% of land will be utilized for roadways and common land

Source: North Kingstown Planning Department

The Town has identified the residential areas within the Post Road Service Area which abut the commercial properties as a subsequent phase of the sewer plan for the Post Road Corridor. These areas have been defined as:

- North 1:** This area encompasses School Street (to the north and west) and Route 403 (Devil's Foot Road) to the south.
- North 2:** This area is situated between Post Road (to the west), Brookhaven Road (to the north) and Newcomb Road (to the south).
- North 3:** This area is situated between Potter Road (to the south and east), Jerry Lane (to the west) and Cranston Road (to the south).
- South 1:** This area is situated between Post Road (to the east) and Sedgefield Road (to the west).
- South 2:** This area is situated between Post Road (to the west), Dana Road (to the north) and Oakdale Road (to the south)

Traditionally, future design flows consider the increase in population and new development through the planning period to contribute to the future design flows. However, in this situation, when existing neighborhoods are being considered, the approach is slightly different. For the purpose of planning, it is assumed that all of the existing 2,395 residential lots of record either have an existing dwelling unit on it or have the potential to construct one. Based on the occupancy of 2.7 persons per dwelling unit, the future residential sewer population is 6,467 persons. Based upon a wastewater consumption of 67 gallons per person per day, this then translates to a wastewater flow of 433,256 gallons per day. Table 1-3 provides a complete breakdown of the residential flows.

TABLE 1-3 RESIDENTIAL USE WASTEWATER PROJECTIONS			
Area	Parcels ¹	Connected Population	Projected Flow ² (GPD)
Post Road North ³	1,152	3,110	208,397
Post Road South	179	483	32,381
Wickford Village/Poplar Pt. Area	720	1,994	130,248
Shore Acres	344	929	62,230
TOTALS	2,395	6,467	433,256

¹ Parcels provided by North Kingstown Planning Department

² Flow is based on 67 gpcpd x population

³ Includes Pinewood and Mark Drive residential areas

The total projected design year average daily flow is summarized in Table 1-4 as 828,106 gallons per day. Peak sanitary flows from various areas are used to determine the size of collection sewers and the required hydraulic capacity of treatment units. Based on the total estimated design average daily flow of 0.828 MGD, the peak hourly sewage flow from the Town is estimated to be 2.5 times the average flow (or 2.07 MGD).

1.6.3 Quonset Business Park (QBP) Future Design Flows

The QBP has estimated that the remaining 467.8 acres of land yet to be developed will produce a projected employment of 4,678 persons (based on 71 gallons per person of wastewater). The projected wastewater flow will be 332,138 gallons per day. Infiltration for this area is estimated to be approximately 150 gpd/acre. Based on the 467.8 acres, this totals an additional 70,170 gpd of flow. The balance on the contractual wastewater commitment to Tory Plastics of 43,000 gpd, future wastewater flow reserved for high volume commercial users has been identified as 300,000 gpd. Table 1-5 illustrates that QDC will require 1,233,308 gallons per day at full build-out of QBP.

Future Wastewater Flows for the Town of North Kingstown

The total projected average daily flow from the Town of North Kingstown is projected to be 828,106 gpd. Table 1-4 provides a breakdown of this flow by residential and commercial area.

The Town has bond authorization to construct Post Road South sewers for the commercial area.

The future wastewater needs of the QBP is 1.233 MGD. With the addition of the Town's initial requirements of 2.0 MGD, the projected future flow to QDC's Treatment Facility will be 1.433 MGD, which remains below the permitted capacity of the Treatment Facility. At the point the Town requires additional flows, QDC will be required to request a permit change.

The following sections will evaluate the wastewater collection system and treatment facilities for the total future needs of QDC (1.233 MGD) and the Town (0.828 MGD). The minimum future design will be 2.061 MGD, however, based on the original design parameters, the future capacity will be 2.6 MGD.

TABLE 1-4
PROJECTED AVERAGE DAILY FLOW FROM PROPOSED SEWERED AREAS – DESIGN YEAR 2030

Area Name	Number Residential Units	Number Commercial Acres	Est. Length of Sewer (mi.)	Residential Flow (GPD) ¹	Commercial Flow (GPD) ²	Inflow/ Infiltration (MGD) ⁴	Total Flow (GPD)
Post Road North	1,152	204	13	208,397	158,100	3,900	370,397
Post Road South	179	242	4	32,381	187,550	3,000	222,931
Wickford Vil./Poplar Pt. Area ³	720	40 units	7	130,248	30,300	8,000	168,548
Shore Acres	344		4	62,230	0	4,000	66,230
TOTALS	2,395	486	28	433,256	375,950	18,900	828,106

¹ Residential Flow = # units x 2.7 persons per unit @ 67 gpcpd

² Commercial Flow = # acres x 775 gal/acre/day

³ Commercial Flow = based on actual water usage and 450 boat slips x 10 gpd/boat slip

⁴ Infiltration/Inflow = 150 gal/in. dia./mile

TABLE 1-5
QBP FUTURE FLOWS

<i>Existing Wastewater Flow</i>	Total	5-Year Average	488,000 gpd
<i>Projected Wastewater Flow</i>			
Infiltration/Inflow	Unit (gpd/acre)	Developed Land (acres)	I/I Flow (gpd)
	150	467.8	70,170
Projected Employment	Number	Flow/Employee	Flow
	4,678	71	332,138
Future Processing			300,000
Future (Toray Plastics) contractual commitment			43,000
Sub-Total Projected Wastewater Flow			745,308 gpd
Total Wastewater Flow			1,233,308 gpd

1.7 FUTURE NORTH KINGSTOWN WASTEWATER COLLECTION SYSTEM

1.7.1 Post Road South Wastewater Collection System

The Post Road South Wastewater Collection System will serve 285 acres of commercial land and 179 residential dwelling units. The collection system for Post Road South will consist of conventional gravity sewers on Post Road, and two (2) pump stations. The abutting residential neighborhood will consist of conventional gravity sewers, one (1) pump station and low pressure sewers with grinder pumps.

Pump Station S-2 will serve the area from Dana Avenue south to the Rhode Island State Police Barracks, consisting of 49 acres of commercial/mixed use land and 179 residential dwelling units within the Post Road Corridor (Oakdale Rd. and Dana Dr. neighborhood to the east and Stoney Land and Sedgefield Rd. neighborhood to the west of Post Road), including all of the flows from the Wickford Village/Poplar Point Area. The pump station will be located in the vicinity of the State Police Barracks and will be required to accommodate an average flow of 234,529 gpd and a peak daily flow of 586,510 gpd (410 GPM). The location of this station will be designed to accommodate future wastewater flows from the Wickford Village/Poplar Point Area. The 8-inch force main from Pump Station S-2 will traverse along Post Road in a northerly direction to Dana Avenue where it will connect into a gravity interceptor sewer for connection into Pump Station S-1. The total length of the force main is approximately 8,300 linear feet. An 8-inch gravity sewer will be installed along Post Road to convey the wastewater from Dana Avenue south. The sewer will collect commercial wastewater along Post Road. The Stoney Land and Sedgefield Rd. area will be served by pressure sewers and grinder pumps discharging to the Post Road gravity sewer. The Oakdale Rd. and Dana Dr. area will consist of gravity sewers, low pressure sewers and one (1) pump station.

Pump Station S-1 will be sized to service the commercial/mixed use along Post Road from Dana Drive south to Route 403, plus the wastewater flows generated from Post Road S-2 Pump Station. Pump Station S-1 will have a design capacity of 725 gpm. Pump Station S-1 will be located off of Camp Avenue approximately 200 feet east from Post Road on Tully Road and will service 285 acres of commercial/mixed use land along Post Road, 179 residential dwelling units, and the Wickford Village/Poplar Point Area. An 8-inch force main will traverse along Camp Avenue in an easterly direction and terminate at the existing sewer manhole on ASQAH Drive. The total length of the force main is approximately 3,600 linear feet. An 8-inch gravity sewer will be installed along Post Road from Route 403 to Camp Avenue and a 12-inch gravity interceptor sewer will be installed from Camp Avenue to Dana Avenue.

1.7.2 Post Road North Wastewater Collection System

The Post Road North Wastewater Collection System will serve 240 acres of commercial land and 1,152 residential dwelling units. The collection system for Post Road North will consist of conventional gravity sewers on Post Road, three (3) pump stations, and low pressure sewers with grinder pumps in the residential areas.

Pump Station N-3 will serve the commercial land along Post Road from Namcook Road to Newcomb Road, consisting of 14 acres. The pump station will be located in the vicinity of the intersection of Namcook Road, Newcomb Road and Post Road and will be required to accommodate an average flow of 9,300 gpd and a peak daily flow of 31,206 gpd (22 GPM). The 4-inch force main will traverse along Newcomb Road in an easterly direction for approximately 500 linear feet and connect to the existing sewer manhole.

Pump Station N-2 will serve the area from Frenchtown Road to Peachtree Road consisting of 171 acres of commercial land and 170 residential dwelling units within Hancock Drive and Peachtree Road areas. The pump station will be located on Post Road near Peachtree Road. The average sewage flow generated by this area is 146,200 gpd with an associated peak flow of 411,300 gpd. Pump Station N-2 will have a design capacity of 411,300 gpd (285 GPM). An 8-inch force main will traverse along Post Road and terminate at the proposed sewer manhole at the high point on Post Road near Chadsey Road (southerly entrance). The total length of the force main is approximately 2,400 linear feet. The Hancock Drive and Peachtree Road areas will consist of pressure sewers connecting to the gravity sewer on Post Road. A 10-inch gravity sewer will be installed along Post Road.

Pump Station N-1 will serve the area from Frenchtown Road to Yorktown Road, which includes the Pump Station N-2 service area. The residential areas on the east side and west side of Post Road will be served by pressure sewers connecting to the 12-inch gravity sewer on Post Road. Pump Station N-1 will serve 226 acres of commercial land and 1,081 residential dwelling units. The average daily flow for Pump Station N-1 service is 348,250 gpd with an associated peak daily flow of 0.93 MGD. Pump Station N-1 will have a capacity of 0.93 MGD (646 gpm). An 8-inch force main will traverse along Post Road in a southerly direction to Newcomb Road. It will then traverse along Newcomb Road and terminate at the existing sewer manhole. The total length of the force main is 2,200 linear feet.

Pine River Road Area: The Pine River Road area is a residential area bordered to the south by Newcomb Road and Pine River Road to the north. This residential area consists of 71 residential units within the Pine

River Road, Shore Road, Knollwood West and East, and Knollwood Circle. This area will connect to the existing sewer system located on Newcomb Road via pressure sewers.

Mark Drive Area: The Mark Drive area is a residential neighborhood which is bordered to the north by Potter Road, to the south and east by Newcomb Road, and to the west by Jerry Lane. The Mark Drive neighborhood has a history of subsurface sewage disposal system problems due to unsuitable soil conditions. The area includes the Quidnessett Elementary School, which is presently tied into the QPD collector system. The school and three homes along Mark Drive are serviced by a lift station that was designed and built in 1970. The pump station is fitted with two (2) 200 GPM submersible pumps giving the station a peak capacity of 0.29 MGD. The capacity of the station is adequate to service the projected 125 homes in the study area and provide continued service to existing users. However, over the past five years, this station has been plagued with operational problems. The dry pit chamber is built with steel construction and is deteriorating. The age of the station, combined with the lack of alarms, standby power and individual service, leads to the recommendation to completely rebuild the station. Consideration should be given to converting the existing wetwell into a submersible pump station and installing two (2) submersible chopper pumps. The upgrade will also include a new electrical service, pump controls, emergency bypass, standby generator and remote alarms to a central monitoring station. Average daily design year flows from new users are expected to reach 0.023 MGD with peak flows approaching 0.06 MGD.

1.7.3 Wickford Village/Poplar Point Wastewater Collection System

The Wickford Village/Poplar Point Wastewater Collection System will serve 34 acres of developed commercial land, 13 acres of business waterfront, marinas with a total of 450 boat slips, Town Hall, North Kingstown Library, North Kingstown Police Department, the Middle School, the former Wickford Elementary School and 720 residential dwelling units. The collection system will consist of conventional gravity sewers, six (6) pump stations, and low pressure sewers with grinder pumps. The Wickford Village/Poplar Point sewer system will connect to the Post Road South sewer system in the vicinity of the State Police Barracks.

1.7.4 Shore Acres Wastewater Collection System

The Shore Acres Wastewater Collection System will serve 344 residential dwelling units located on Camp Avenue from Wickford Point Road to Shore Acres Avenue, Gateway Road, Fishing Cove Road, Windward Walk, Seabreeze Drive, Anchor Way, Shore Acres Avenue, Kingsley Avenue, Middle Street, Sauga Avenue, First Street, Second Street, Rogers Avenue, Third Street, Fourth Street, Fifth Street and Sixth Street. The collection system for Shore Acres will consist of conventional gravity sewers, four (4) pump

stations and low pressure sewers with grinder pumps. The Shore Acres sewer system will tie into the existing chamber on A.S.Q.A.H. Drive.

1.7.5 QDC Collection System

Based on the wastewater flows generated by the Town, an adequacy analysis was performed on QDC's collection system to determine the components that will need to be upgraded. These components are as follows.

Newcomb Road: The existing 8-inch sewer on Newcomb Road will need to be replaced with a new 12-inch sewer at full build-out. The capacity of the new 12-inch sewer will be 2.26 MGD. The existing 8-inch sewer will be inadequate for Post Road North Phase 1 flows. The peak daily flow with Post Road North Phase 1 will be 1.16 MGD which is greater than the capacity of 0.41 MGD.

MH 25-0 to Newcomb Road: The existing 8-inch and 12-inch sewer mains within the Quonset Business Park (QBC) will need to be replaced from MH 25-0 to MH 25-P3. QDC will be relocating and replacing this sewer as part of the Gateway Project. The new line will be an 18-inch sewer connecting to MH 25. The existing sewer main will be inadequate for Post Road North Phase 1 construction flows. The peak daily flow with Post Road North Phase 1 construction will be 1.16 MGD.

Mark Drive Area: The QDC's existing 10-inch sewer line is within the future Gateway Project and is scheduled to be relocated and upgraded with a new 12-inch sewer. The capacity of the new 12-inch sewer will be 2.22 MGD.

A.S.Q.A.H. Drive: The existing 10-inch sewer along A.S.Q.A.H. will need to be replaced with a new 12-inch sewer that will have a capacity of 1.58 MGD. The existing sewer main will be adequate for the Post Road South Phase 1 sewer project as the peak daily flow is 0.53 MGD, however, with the addition of either Post Road South Phase 2 and/or Shore Acres, the existing sewer will be inadequate.

Diversion Chamber to D57: The existing 24-inch sewer is inadequate to handle the total future flows. A new, larger capacity sewer line will be installed to replace the existing 24-inch sewer. A diversion structure will be installed at D57 which will allow 1.37 MGD to go through the existing 24-inch sewer and 3.02 MGD will flow through a new 18-inch parallel sewer. The capacity of the new 18-inch sewer main will be 3.30 MGD. The existing sewer main will be adequate to handle flows from Post Road South Commercial and Residential and Shore Acres Area which has a projected peak daily flow of 1.07 MGD. The existing sewer

main will not be adequate for any additional flows generated from the Wickford Village/Poplar Point Area and build-out at QDC.

Davisville Pump Station (DS-55): The Davisville Pump Station is responsible to pump approximately 58% (715,318 gpd) of the wastewater flows generated at the Quonset Business Park (QBP) and 100% of the flows generated by the Town of North Kingstown (828,000 gpd). The average daily flow at build-out will be 1.54 MGD (1,070 gpm) and the corresponding peak flow will be 3.85 MGD (2,673 gpm). The current pumping capacity of 1,200 gpm (one pump running / one pump standby) will have the ability to handle wastewater flows from QDC, Post Road South Commercial and Residential and Shore Acres Area with a corresponding flow of 691,200 gpd average and 1,728,000 gpd peak (1,200 gpm). In order to receive flows above the peak daily flow of 1,728,000 gpd, the pump station will have to be upgraded. During the 1999 upgrade, the pumps selected have the ability to be upgraded to 1,800 gpm with provision for a third pump. Based on the projected peak flow at full buildout of 3.86 MGD, the pump station will be upgraded with the pumps rated to handle 1,350 gpm per pump and the installation of a third pump rated at 1,350 gpm to meet the requirements of handling peak flows with one pump as standby. At that point, the station will have the capacity of 5.18 MGD. In addition to the installation of the pumps, a new well must be constructed to allow for sufficient capacity.

1.7.6 QDC Wastewater Treatment System

As previously stated, the Town will initially generate approximately 187,550 gpd for Post Road South Commercial area; this combined with QBP's future need of 1,233,308 gpd will not require expansion of the Treatment Facility until the Town requests permission to connect subsequent phases into the system. As the Town's wastewater needs exceed 200,000 gpd, the Town will become responsible for the expansion of the wastewater treatment facility and the corresponding infrastructures currently owned by QDC. The build-out of all phases of the Town's wastewater program will generate 828,000 gpd over the next twenty years and QBP will generate 1,233,308 gpd. Table 1-6 summarizes the present and future wastewater design flows.

TABLE 1-6 SUMMARY OF FUTURE WASTEWATER DESIGN FLOWS	
Area	Gallons Per Day (GPD)
QBP Present Flows	488,000
QBP Future Flows	745,670
North Kingstown Flows	828,106
TOTAL	2,061,776

Since the build-out capacity would not occur instantaneously (for either the Town or QDC), the expansion to 2.6 MGD will be phased in once the Town reaches its allowable capacity of 0.20 MGD. The phased approach will allow the Town to begin the development of the Post Road South Project without expanding the Treatment Facility. Once the flows exceed the 1.78 MGD, QDC will need to undertake the following upgrades to its collection and treatment system:

1. Construct a new Diversion Structure to D57;
2. Upgrade DS-55 Pump Station; and
3. Treatment Plant Upgrades:
 - a. One (1) RBC train
 - b. Expansion of the chlorine contact tank

1.8 FINANCIAL IMPACT RELATING TO WASTEWATER TREATMENT IMPROVEMENTS

The financial impact to the Town is broken down into two categories. The first relates to the cost to upgrade QDC's existing infrastructure and the second is the cost for the Town's infrastructure.

QDC Infrastructure Cost

In accordance with the intergovernmental agreement, the Town will be responsible for capital costs associated with the upgrades once the Town's flows reach 200,000 gpd from the proposed service area, as presented in Table 1-7.

TABLE 1-7 SUMMARY OF COST - TOWN OF NORTH KINGSTOWN	
	Total Cost
Diversion Structure and Gravity Line	\$ 1,284,000
Upgrade to WWTF (2.6 MGD)	4,965,000
TOTAL	\$ 6,249,000

North Kingstown Infrastructure Cost

Table 1-8 presents the total cost associated with North Kingstown's upgrade of the existing collection system.

TABLE 1-8 SUMMARY OF COST – EXISTING COLLECTION SYSTEM		
Area	Cost	Affected Users
Newcomb Rd. Interceptor	\$ 608,800	Post Rd. North, Pine River & Mark Dr. Area
ASQAH Dr. Interceptor	\$ 567,900	Post Rd. South 1 & 2, Wickford Village/Poplar Pt. & Shore Acres

The total estimated capital cost for the North Kingstown infrastructure has been broken down into six phases (two within the south and four within the north). Table 1-9 provides a summary of the project cost for commercial and residential properties. The commercial assessment has been based on a cost per developable commercial area and the residential assessment has been based upon a cost per linear foot of frontage with a minimum frontage of 100 feet.

TABLE 1-9 SUMMARY OF NORTH KINGSTOWN'S CAPITAL COST						
	Commercial Cost	Residential Cost	Commercial Acreage	Residential L.F.	Commercial Cost/Acre	Residential Cost/L.F.
Post Road South	\$ 9,026,200	\$ 4,830,606	285	39,200	\$31,670	\$123.23
Post Road North	\$10,389,300	\$19,250,500	240	119,600	\$43,288	\$160.96
Pine River		\$ 1,330,800		10,200		\$130.47
Mark Drive		\$ 3,534,000		28,400		\$124.45
W1 Wickford Village / Poplar Pt.		\$15,364,600	*			
W2 Wickford Village / Poplar Pt.		\$11,872,500	*	97,200		\$350.85
W3 Wickford Village / Poplar Pt.		\$ 6,865,500	*			
Shore Acres (gravity)		\$13,207,800		42,800		\$308.60
Shore Acres (low pressure)		\$ 6,034,800		42,800		\$141.00

* Commercial units are included with Residential Units

Table 1-10 presents a summary of the anticipated annualized cost. The annualized cost includes the principal and interest paid over twenty (20) years at an interest rate of 3%.

TABLE 1-10 SUMMARY OF ANTICIPATED ANNUALIZED COST		
	Total Cost Per Unit	20-Year Bond @ 3% Interest
<u>Post Road South</u>		
Commercial	\$ 9,026,200	\$12,014,181
Residential	\$ 4,830,606	\$ 6,429,701
<u>Post Road North</u>		
Commercial	\$10,389,800	\$13,829,179
Residential	\$19,250,500	\$25,623,074
Pine River (Residential)	\$ 1,330,800	\$ 1,771,340
Mark Drive (Residential)	\$ 3,534,000	\$ 4,703,874
Wickford Village/Poplar Pt. (Residential)	\$34,102,600	\$45,391,727
Shore Acres (Residential) – gravity	\$13,207,800	\$17,580,033
Shore Acres (Residential) – low pressure	\$ 6,034,800	\$ 8,032,525

Units for Commercial = 1 Acre

Units for Residential = 1 Dwelling Unit



2.1 INTRODUCTION

The purpose of this study is to develop a comprehensive Wastewater Facilities Plan for the Town of North Kingstown. The Wastewater Facilities Plan will provide the Town with a twenty-year plan addressing the wastewater to ensure the proper management of wastewater throughout the planning period.

Through a systematic process, this study will analyze the demographic, topographic, hydrologic and other characteristics of the planning area. The plan will document the need for sewers and provide a preliminary plan establishing the most cost-effective sewer routing. The study will outline financial, legal and institutional requirements necessary to ensure the installation of sewers.

The methodology for the development of this document was tailored for compliance with Rhode Island Comprehensive Planning and Land Use Act – Wastewater Utilities Section and with the financing provisions of the U.S. Clean Water Act relating to the State Revolving Fund Program. Specific guidelines governing the preparation of wastewater facilities plans have been prepared by the Rhode Island Department of Environmental Management-Division of Water Resources, who will act as the primary reviewing authority.

The Town has recognized that, while it is the goal of the Town to focus on on-site wastewater systems with a Wastewater Management Plan (Appendix A), due to the physical constraints in those specific areas of Town where the Comprehensive Plan is looking to increase development, a more conventional approach to sewerage would be more effective.

Efforts are currently underway to enhance and revitalize Post Road. The Town is focusing its efforts to create a higher density mixed use for the Post Road District (PRD) along this segment from the East Greenwich line to the State Police Barracks of the Post Road Corridor. The Post Road Corridor Element of the North Kingstown Comprehensive Plan includes a number of actions designed to improve the commercial, residential and affordable housing activities, as well as the visual quality of Post Road. Recommended improvement actions include providing adequate infrastructure and community services to businesses and residents in the PRD without negatively impacting the environment. The Town's projected development plan recommends establishing two designated growth centers along the Post Road Corridor

as these sites are redeveloped in the future. The Town further recognizes that an essential component in the re-development of the Post Road Corridor is to address the wastewater disposal needs of the area by more conventional means.

2.2 HISTORICAL PERSPECTIVE

The Town of North Kingstown (population approximately 26,326) is located approximately twenty miles south of Providence. In many respects, it is a typical southern New England coastal community consisting of a mix of residential, commercial, and limited industrial districts. It also has many areas that experience an increase of population during the summer months due to the influx of summer recreational users of Town facilities. One peculiarity of the Town is the existence of an expansive major industrial/commercial complex within its borders, known as Quonset Business Park (QBP).

One area identified for a potential growth center includes the Quonset Business Park vicinity along Post Road (known as the Quonset Gateway Parcel). This area would be targeted to be oriented towards the creation of economic development opportunities along the Post Road Corridor with high-density infill redevelopment of aging properties having frontage on Post Road as well as the property to the rear of the Post Road parcels. The second area identified is the Reynolds Farm/Oakdale Road Village Center which would be oriented towards long term controlled development of vacant and underutilized properties at increased residential density and mixed use, as well as the updating of aging public infrastructure and utilities. Planning for the long-term generation of village growth centers will allow for a more consistent placement of retail, office and residential uses that concentrate pedestrian intensive areas together.

In recent years, the Town's administrative staff has recognized the need to ensure the proper management of wastewater generated throughout the Town. Historically, the Town has relied upon onsite wastewater treatment systems (OWTS). Only limited portions of Town are serviced with conventional sewer systems that are connected for the Wastewater Treatment Facility at Quonset Business Park. The heavy reliance on OWTS's has, in several instances, led to problems of failed systems on lots which do not support OWTS due to either lot size, soil conditions, or the proximity of potable water supply sources. Faulty construction will also lead to premature system failure. Failed OWTS systems are also thought to be a major contributor of bacteriological and nutrient contamination in Wickford Harbor and other surface water bodies.

2.3 SCOPE OF PROJECT

The project scope is concentrated as follows:

The area of increased density will be analyzed and evaluated to determine the most environmentally prudent means of providing an effective measure of wastewater treatment. For those areas where conventional sewers are required, the report will generate a wastewater plan based on population projections through a twenty (20) year planning period. In those areas where it is determined that the OWTS is a more effective means of treatment, this report will review the current Ordinance for its effectiveness in dealing with OWTS.

All future proposed improvements shall consider the improvement and protection of groundwater quality. Located within the Town's boundaries are several public water supply aquifers and watersheds, and the preservation of the integrity of these supplies will most likely impact future actions.

2.4 FACILITIES PLAN PROJECT AREA

The *geographical location of the Facilities Plan Project Area* for the Town of North Kingstown is presented in Figure 2-1.

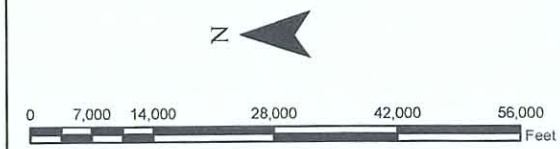
Figure 2-1

North Kingstown Wastewater Facilities Plan

Project Area

Prepared By
James J. Geremia & Associates

towns
 Cities & Towns
 Project Area





3.1 PLANNING AREA DESCRIPTION

The study area for this Facilities Plan is defined as the entire Town of North Kingstown located in Washington County, Rhode Island. The Town is bordered on the east by Narragansett Bay, on the south by the Towns of South Kingstown and Narragansett, to the west by the Town of Exeter, and on the north by the City of Warwick and the Town of East Greenwich (as shown in Chapter 2, Figure 2-1).

3.1.1 Organizational Context

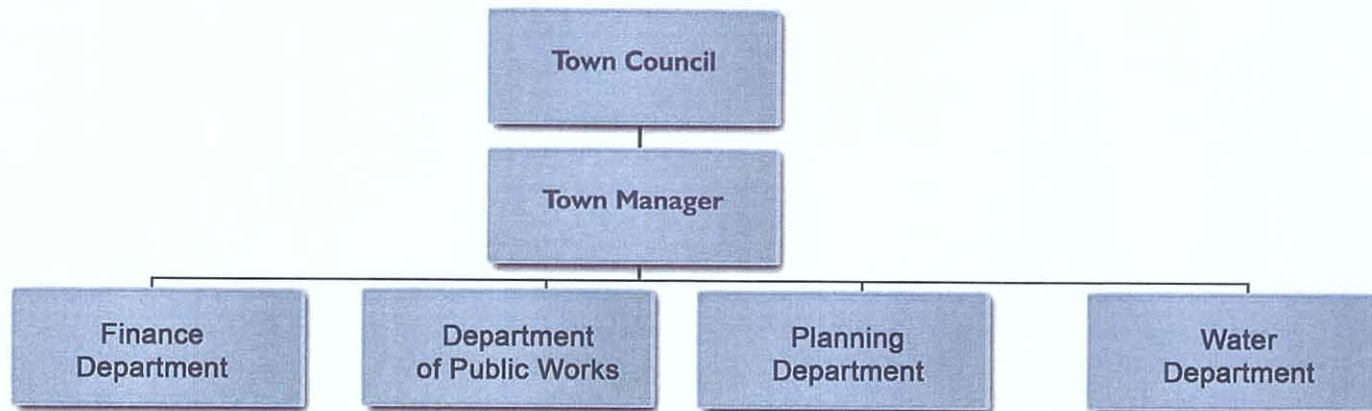
The Town's government consists of a five member elected Town Council with an appointed Town Manager. The Town Manager is responsible for administering the day-to-day activities of the Town and reports directly to the Council. This Facilities Planning effort is being conducted by the North Kingstown Department of Planning and Development and Department of Public Works at the direction of the Town Council. The Rhode Island Department of Environmental Management's Division of Water Resources maintains specific standards and guidelines for facilities plans and will act as the State's reviewing agency. Figure 3-1 provides an organization chart of Town government and the role of various entities involved in the planning process.

3.1.2 Existing Population

Population figures will provide the base for determining wastewater loads from individual sewershed areas. The existing population in North Kingstown (2000 Census)¹ is 26,326 people. A 2000 census count identified 10,743 housing units in the Town. Based on the 2000 population of 26,326, the average household size was determined to be approximately 2.57 persons. The 2000 census, however, identified household size for owner-occupancy as 2.73 persons. This latter figure was adopted by the Town's Comprehensive Plan and will be used for planning purposes throughout the remainder of this report.

¹ At the time of the preparation of this report, the 2010 Census has not been adopted.

Town of North Kingstown Organization Chart



3.1.3 Land Use²

North Kingstown is a community with character and historic heritage that is recognized and valued by its residents. Through a firm community commitment to environmental quality and historic preservation, the Town has preserved and protected its historic character and sensitive natural lands. The town center – Wickford Village – is the cultural center and the focus of government and recreation-based maritime activities. The Town's countryside is composed of preserved farmland and open space, sensitively mixed with recent residential and commercial development and village centers that have evolved from the small crossroads settlements of the eighteenth century.

Major concerns identified in the Comprehensive Plan include taxes, schools and municipal services. The pace of residential and commercial development is not a major concern at this time, but the character and quality of the Town remains very important.

The attractiveness of North Kingstown as a place to live has continued to be a stimulus for growth. Between 1990 and 2000, the number of building permits issued totalled 1,329. Much of this development occurred in rural areas in single-family subdivisions with 42% in the southwest corner of the Town. This trend continued over the next five years, with 566 building permits issued between 2000 and 2005, thereby average 113 permits per year. Most of the new development has been designed to preserve open space and rural character. During that same time period, 46 subdivisions with 851 lots have been constructed. Of these, 64% (552) of lots are located in cluster subdivisions, 24% (196) lots are in conventional subdivisions, and 12% (103) lots are in planned village districts. New commercial development in recent years has been focused on the major highways, Post Road and the area of Routes 2, 102 and 4.

As North Kingstown continues to grow, open land (including agricultural land) will quickly be absorbed by development if preservation mechanisms are not in place. A number of planning programs that are being considered to create incentives for preserving open land include Transfer of Development Rights (TDR), Transit Oriented Development (TOD), and Conservation or Open Space Development. The goal of TOD is to center communities around high quality train systems (in this case, the Wickford Junction Station), thereby reducing the dependence on automobile travel, and allows communities to become compact and walkable. By making the project compact and with enough density to support transit use, lower

² Information taken from the Town's Comprehensive Plan adopted in 2005 and updated in 2008.

density/auto-dependent areas can be preserved. The Planned Unit Development and the Village Center ordinances are currently available to support other types of similar development projects in other situations. TDR is a tool that can be used to facilitate the method of distributing development by facilitating the movement of development from sensitive areas, such as groundwater protection areas, into areas that can accommodate development. The Town has recently implemented Conservation Development Regulations which look at the character of each piece of land proposed for development and determines the best locations for new construction and the means to construct the project to preserve natural features and improve the liveability of the project.

State of Rhode Island Land Use Planning Initiatives: Adopted in April 2006, Land Use 2025: Rhode Island's State Land Use Policies and Plan is the most recent look at Rhode Island's historic land use patterns and possible future development areas. Land Use 2025 examines trends, analyzes projections, and makes recommendations regarding future use of the State's land and resources. The document's major concepts include: sustaining the urban/rural distinction with GIS mapping that designates urban growth boundaries; statewide systems of greenspace, community design and infrastructure; and land capability and suitability analysis. North Kingstown's future land use should be guided by the goals and objectives outlined by the Rhode Island Statewide Planning Program, because the plan outlines a positive process for influencing state investments that support good planning.

A key element of Land Use 2025 is the Future Land Use Map which illustrates the desired patterns of Rhode Island's future development and conservation. The map proposes retaining the distinction between Rhode Island's urban and rural areas. The areas within the urban services boundary are identified as optimal areas for accommodating the majority of the state's development needs through 2025. They are areas where growth (new development or reuse, infill and redevelopment) is encouraged. It is important to note that there are pocket areas of protected greenspace within these boundaries. Most of the land identified outside of the urban services boundary is better suited for conservation or lower density development. In North Kingstown, the urban services boundary covers most land east of Routes 1 and 4. Land to the west of these highways is identified as better suited for future conservation or low density development.

Land Use 2025 presents Goals, Objectives and Strategies for a sustainable Rhode Island, the State's Greenspace System, Community Design, Infrastructure, and Implementation. Suggested municipal

responsibilities to act on the plan are indicated in 25 of the 29 Objectives and 73 of the 92 Strategies, meaning the town has a very significant role in this statewide plan.

Over the last ten years, the Town has taken many actions to maintain the character of the Town. As recommended in the Comprehensive Plan, the Town has:

- Adopted a *Village District Ordinance* to encourage mixed-use development within existing neighborhoods and in the development of new neighborhoods.
- Made an effort to encourage cluster development and the use of Planned Unit Development (PUD) to maintain the historic village character, maximize the use of available infrastructure, conserve open space, protect natural resources, and increase the efficiency of public transit service and other alternative modes of transportation. The Town has also encouraged development of diverse neighborhoods with a variety of housing types that serve varied socio-economic levels and age groups as appropriate.
- Prepared a *Post Road Corridor Plan* that will serve as a guide to enhance and revitalize Post Road as the Town's primary commercial district and improve its commercial activity and visual quality. The plan recommends application of the Growth Centers concept to obtain the type of development desired for this area.
- Identified specific parcels for agricultural preservation and designated agricultural lands for preservation in order of priority. The Town continues to preserve high priority agricultural land by purchasing land in fee simple or by purchasing the development rights. The Town continues to obtain support from local, state and federal programs to fund acquisition or preservation of agricultural land or to fund the purchase of development rights on agricultural land. Through a real estate transfer tax, North Kingstown is committed to supporting the preservation of farms and the use of local farm products to help ensure the viability of farming.
- Adopted the *Affordable Housing Plan* in June 2005. The Town is working cooperatively with profit and non-profit developers to build units for rent or sale to qualified applicants and with Crossroads RI to develop transitional housing units. However, new construction is not the only path to obtain

affordable units and the *Affordable Housing Plan* lays out additional means to create affordable units such as inclusionary land use programs.

- Has identified areas and established boundaries where conventional sewer services and distributive wastewater management systems would permit increased density for multi-family and high-density single-family developments without adversely affecting groundwater quality of the sole source Hunt Aquifer. North Kingstown has also coordinated with the State to allow innovative alternatives to conventional OWTS.
- Developed waterfront zoning that accommodates marine dependent and related uses while protecting the water quality of Narragansett Bay. The Town has also continued to implement the recommendations of the *Harbor Management Plan*. Calf Pasture Point is being developed in a manner consistent with the *Allen Harbor-Calf Pasture Point Master Plan*. North Kingstown worked with the RIDEM on the management of the John H. Chafee Nature Preserve. The Town will continue to secure opportunities for public access to the coast in established areas, and to encourage public access to fresh and saltwater bodies in all new developments.
- Prepared and adopted a *Capital Improvement Ordinance* to help serve residents and businesses.
- Adopted, in a Memorandum of Understanding (MOU), shared development regulations and sewer agreements with the Quonset Development Corp. (QDC).

The community of North Kingstown seeks to protect and enhance its natural beauty and scenic assets, its traditional New England character, and its natural resources within healthy ecosystems. To retain North Kingstown's distinctive suburban, yet charming town character, and to prevent unmanaged growth, historic areas should be preserved, new development should reinforce a sense of place, and remaining open space and farmland should be preserved. High priority will be given to open space planning and sustainability.³ Growth must be managed in a way that respects physical characteristics of the site, protects the surrounding area, and is supported with appropriate municipal services. To avoid suburban sprawl, the Town will encourage an integrated mix of residential and commercial uses in existing village centers, new

³ Open space planning is defined as land use patterns that reflect and respect natural resources, wildlife habitat and rural traditions and provide generous amounts of open space and recreational opportunities between build-up areas. Sustainability is defined as development that maintains or enhances economic opportunity and community well-being while protecting and restoring the natural environment upon which people and economies depend.

Land Use Descriptions

Residential Land Uses

Very Low Density Residential (VLDR): Very Low Density Residential uses permit one dwelling unit per 120,000 to 200,000 square feet of lot area (or approximately 3 to 5 acres). This designation reflects natural and environmental constraints in the Town, as well as areas that lack infrastructure. VLDR uses are also designed for use at Pojac Point, where the existing zone classification requires 5-acre minimum lots.

Low Density Residential (LDR): Low Density Residential uses permit one dwelling unit per 80,000 to 120,000 square feet of lot area (or approximately 2 to 3 acres). This range of density is also used for environmentally sensitive areas and areas that rely on OWTS units for wastewater disposal.

Medium Density Residential (MDR): Medium Density Residential uses permit one dwelling unit per 40,000 to 80,000 square feet of lot area (or approximately 1 to 2 acres). These areas generally include residential subdivisions that have been approved since the 1950's. This designation is predominant in the northern section of Town.

High Density Residential (HDR): High Density Residential uses permit one dwelling unit per 20,000 to 40,000 square feet of lot area (or approximately 0.5 to 1 acre). Most HDR areas consist of older Village Centers, former summer communities and former Navy or mill housing. HDR areas are connected to Town water service and generally located close to major circulation facilities and commercial users. Some HDR areas are on sewers that are connected to the Quonset Business Park Wastewater Treatment Facility. HDR areas include Wickford, Plum Beach/Point, Davisville, Lafayette, and a number of neighbourhoods off of Post Road.

Industrial Land Uses

Light Industrial: The emphasis of the Light Industrial designation is for the development of businesses that do not draw additional retail traffic. It include uses such as research and redevelopment facilities, industrial mini-warehouses, skilled trade businesses, warehouses, "clean" industry, and light manufacturing. It is also intended for industrial sites immediately adjacent to residential neighbourhoods and in environmentally sensitive areas.

General Industrial: The General Industrial designation is for areas serviced by sewers and good transportation access. Uses in this designation include manufacturing, fabrication, assembly, processing, trucking, warehousing and distribution.

Waterfront Industrial: Waterfront Industrial area designations are located within the Quonset Business Park and support water dependent industrial activities

Commercial Land Uses

Commercial: The Commercial designation is intended for intensive commercial activities relating to the daily needs of North Kingstown residents. Typical Commercial areas include supermarkets, drugstores, restaurants, and other convenience goods. Commercial developments along Post Road and Ten Rod Road by the Route 4 interchange are examples of this land use designation.

Neighborhood Commercial: The Neighborhood Commercial designation is to allow a mix of uses in the village center areas of Town. The businesses in this designation serve the needs of neighborhood residents. Small village scale business along Boston Neck Road and Tower Hill Road are examples of this land use designation.

Waterfront Commercial: Waterfront Commercial areas are established for businesses catering to marine activities and for small business operations. Examples of Waterfront Commercial include boatyards, fish or shellfish establishments, marine oriented recreational clubs for boating and swimming, and areas that construct or store boats.

Other Designations

High Density Mixed Use: The High Density Mixed Use designation is to provide a mix of commercial and residential uses at higher densities than what is permitted in most other areas of Town. Better site design practices shall be encouraged to facilitate the development of pedestrian-friendly environments, to leverage environmental improvements, to increase property values, to promote commercial development, and to improve the general aesthetic appeal of the area. The primary area for High Density Mixed Use is along the Post Road Corridor.

Quonset Mixed Use: The Quonset Mixed Use designation is for the development of commercial office, small-scale retail, hotel, and high-density residential housing in certain areas of the Quonset Business

Park. Areas under this classification are located in the Gateway parcels, Davisville Waterfront, West Davisville, Kiefer Park and by the airport. High-density residential housing consisting of multi-family and townhouse units will only be considered in the West Davisville area.

Open Space: The Open Space designation identifies public and private land identified for conservation or recreational use. Open Space includes parks, golf courses, beaches, conservation areas, preserves and buffers around wetlands, streams and coastal features. Open Space in North Kingstown includes several large expanses of undeveloped land, such as Cocumscussoc State Park, Rome Point and Casey Farm.

Public: Uses under the Public designation include federal, State and Town buildings, community facilities, schools, religious institutions and cemeteries.

Airport: The Airport land use designation identifies the area dedicated to the Quonset State Airport. This area is designed for the landing and taking off of aircraft and is to be utilized in the interest of the public for those purposes.

Planned Village District (PVD): The Planned Village District designation is intended to encourage development of harmonious, efficient and environmentally sound neighbourhoods by promoting variety in land use, residential density and site design through the grouping or other configuration of buildings and by the preservation of unique features of the site and may include compatible residential and recreational uses.

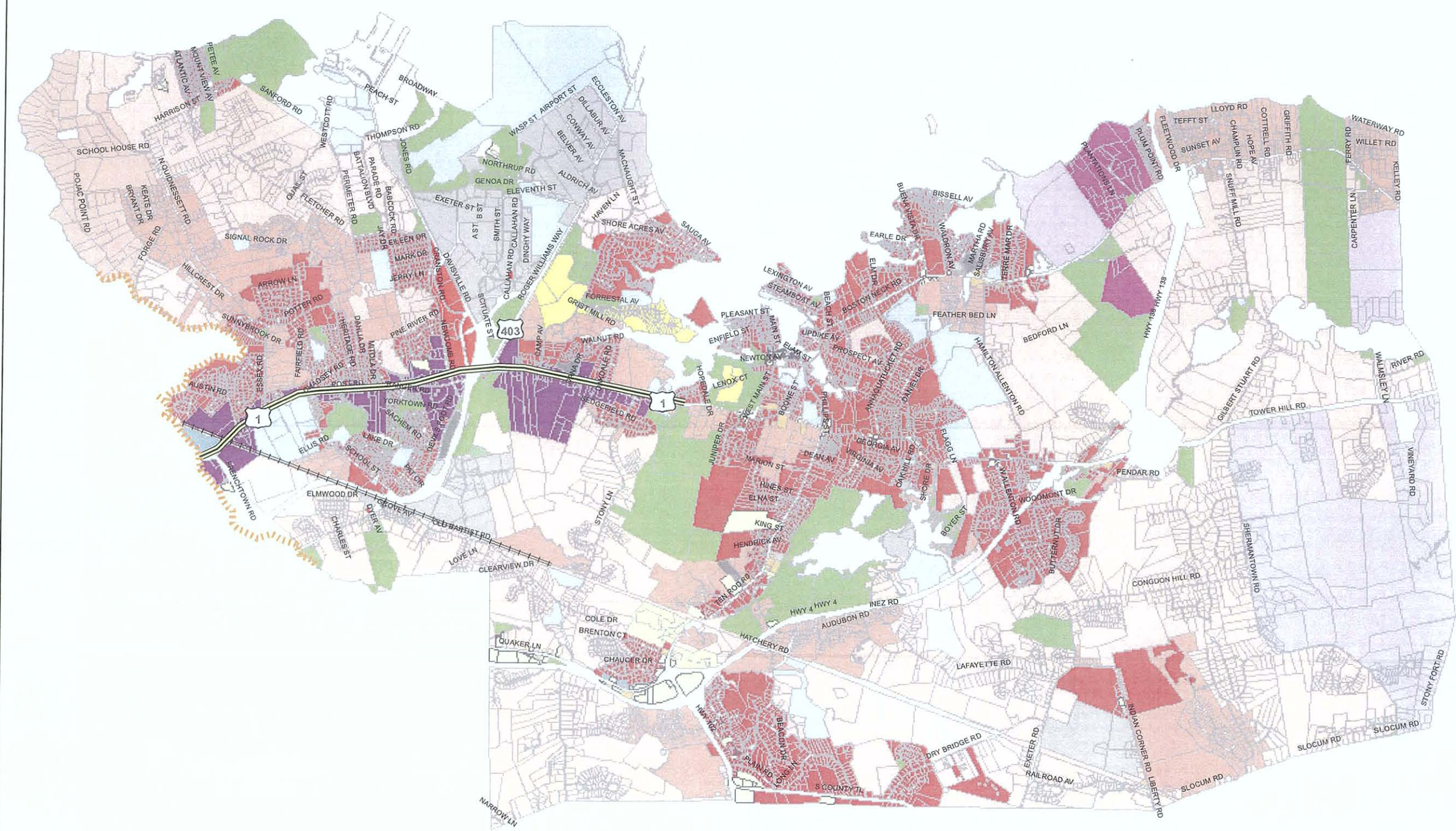
Corporate Compound: The Corporate Compound designation is established for the purpose of allowing corporate headquarters to locate within areas of the Town in which this activity will be compatible with surrounding uses. In residential areas, the Corporate Compound shall be allowed where it can conform to the rural character of the existing area and where it will preserve open space. It is not the intent of this district to allow uses that are prohibited in other districts or that are inconsistent with the master plan. Wherever possible, siting shall preserve prime agricultural or scenic areas.

Information concerning current land use was obtained through a review of Assessor's plats, the Town's Comprehensive Plan and from on-site inspections. Figure 3-2 presents the Land Use Map.

Figure 3-2

North Kingstown Wastewater Facilities Plan

Existing Land Use
Project Area



- Features**
- Railroad
 - Post Road Corridor
 - Town Boundary
- Parcels**
- ZONING**
- Commercial Open Space
 - General Business
 - General Industrial
 - Heavy Business
 - Heavy Business UL
 - IO
 - Light Density Residential
 - Light Industrial
 - Manufacturing
 - Neighborhood Business
 - Neighborhood Residential
 - Open Space
 - Public
 - Planned Business District
 - Poplar Point Residential
 - Public Residential
 - Planned Village District
 - Rural Residential
 - Unnamed
 - Village Light Density Residential
 - Village Residential
 - Waterfront Business
 - Waterfront Industrial
 - Waterfront VC



The Town of North Kingstown encompasses a total area of 28,061 acres. Approximately 6,008 acres (or 21.4% of the total land area) is currently utilized for residential purposes. Other significant land uses include 1,978 acres of agricultural land and 1,639 acres of parks and recreational facilities. There are also 24 sites within the Town (totalling 2,200 acres) that are currently zoned industrial. Of these, 850 acres are currently utilized for industrial purposes, 283 acres are utilized for non-industrial purposes, and 1,065 acres are vacant. The majority of the industrially zoned land is located within the Quonset Business Park. Current land use information is presented in Table 3-1.

TABLE 3-1 EXISTING LAND USE	
Type	Acres
Commercial	624
Industrial	850
Institutional / Public	1,203
Parks / Recreation	1,639
Uncommitted Land	15,369
Agricultural	1,978
Residential Extractive Land	6,008
	390
TOTAL	28,061

3.1.4 Geophysical Conditions

Planning and developing an effective wastewater management program (such as wastewater collection, treatment and disposal systems) requires an adequate knowledge of the physical environment of the area to be served. Additionally, an estimate of long range development within the study area is essential as a basis of planning in view of the long life of facilities which will be involved in the wastewater management system. Physical characteristics, important to a study of this nature, include geography, topography, geology, soil conditions, groundwater conditions, and climate. Knowledge of environmental characteristics makes it possible to develop forecasts of future land use and population growth.

3.1.4.1 Soil Conditions: Data published by the United States Department of Agriculture, Soil Consideration Service was reviewed to determine the types of soil present in the planning area and their appropriate uses and suitability for development. Soil characteristics can limit the extent and intensity of buildings, roads, subsurface wastewater disposal systems, and other improvements. The soil in which a subsurface wastewater disposal system is located, has a major affect on its ability to function. The most important soil characteristic in this regard is permeability.

Soils with extremely low permeability do not allow sufficient volumes of wastewater to infiltrate into the subsurface, causing ponding in the vicinity of the system or system back-ups. Conversely, soils with excessive permeability generally do not provide adequate treatment of effluent and allow pollutants such as nutrients and bacteria to pass directly to groundwater.

For the purpose of this study, soil classifications have been placed into broad categories based on features such as permeability, slope, depth to bedrock, and water table. Figure 3-3 illustrates soil conditions in the planning area as they relate to development constraints. The characteristics of the most frequent soil series found in the Town are discussed below.

Canton and Charlton (CeC) series soils can be found on more than 2,000 acres in level, sloping and steeply sloping disposition. These soils are sandy loams with a surface layer of approximately 3-inches and a substratum to 60-inches, and are usually in parcels ranging from 5 to 200 acres. Available water capacity is moderate and runoff is slow. While the soils are suitable for community development, slopes can be problematic and attention to septic design is important because of the tendency for effluent to seep to the surface. Most of this soil type is found in the central and southeasterly portions of Town. Only a limited quantity is found in the planning area.

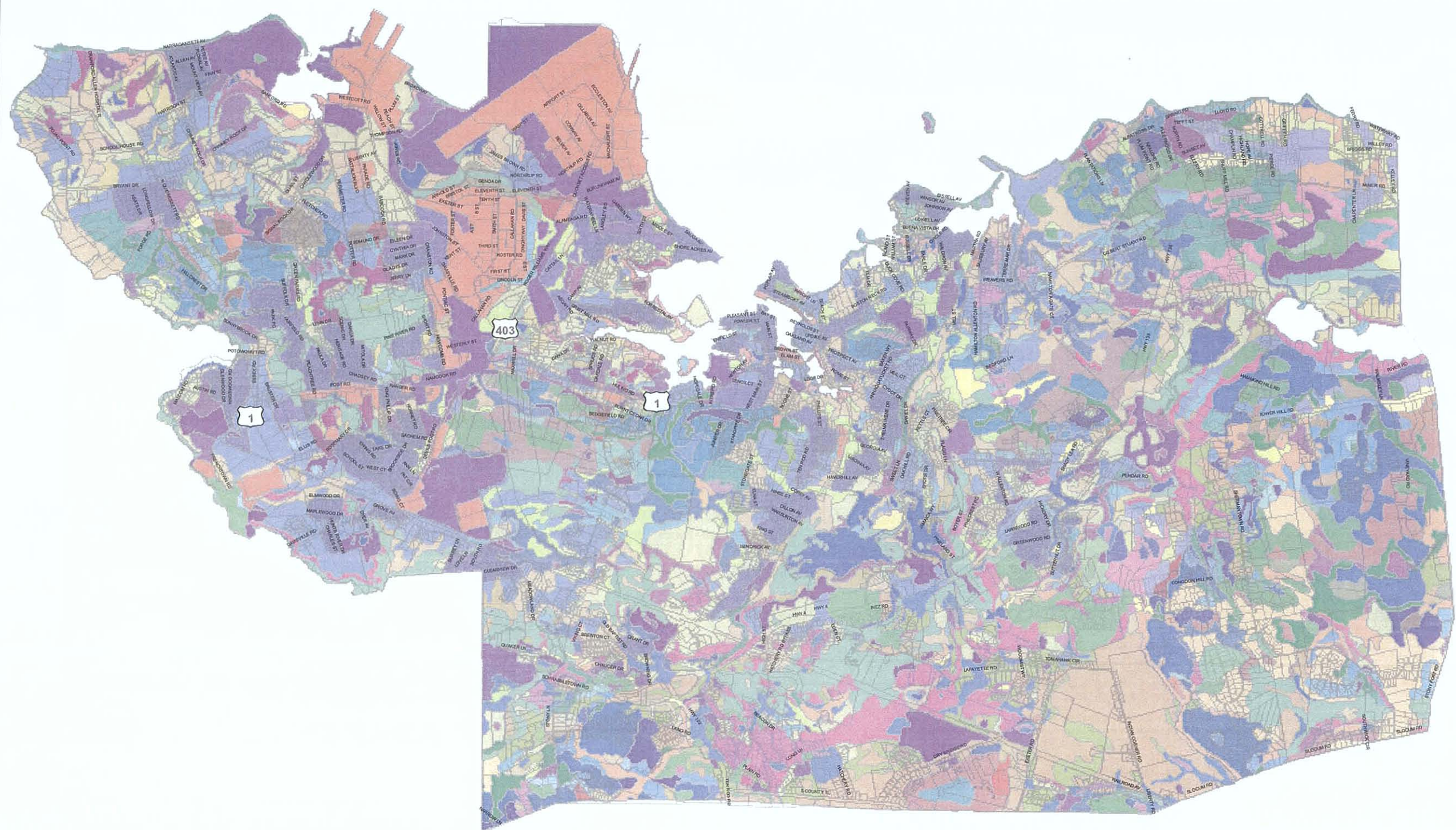
Carlisle Muck (Co) generally is found on level areas ranging in size from 5 to 100 acres. This soil type is found on over 1,450 acres in the planning area. Water capacity is high and runoff is very slow. The water table is near or at the surface for most of the year and subject to ponding. The soil is poorly suited for community development and cannot accommodate septic systems.

Hinckley (HkA) series soils are excessively drained soil and most often found in level areas of irregular shape, in parcels of 5 to 75 acres, with some occurrence in rolling hills. Approximately 1,750 acres are covered by this soil group. Topsoil is approximately 6-inches in depth with about a 12-inch subsoil and 60-inches of substratum. The soil is suitable for community development, but improper septic system design and installation will result in rapid pollution of groundwater. Excavated slopes are typically unstable. Most of this soil type is found in the northwest and central part of the Town.

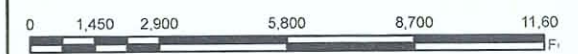
Merrimac Sandy Loam (MmA) is the soil type that occurs in a higher percentage than any other type found in North Kingstown and covers an area greater than 5,300 total acres. Irregular shaped plains, terraces and rolling hills, ranging in size from two to four hundred acres, are typical. This soil type is somewhat excessively drained and suited to community development. However, improper septic system

Figure 3-3
**North Kingstown
Wastewater
Facilities Plan**

Soils Map



soils			
SOIL_NAME			
Aa	BhC	RaA	
Ba	BhD	RaB	
Bc	HnC	RbB	
BhA	MU	Rc	
BhB	Mc	Re	
BmA	Mk	Rf	
BmB	MmA	Rp	
BnB	NP	Ru	
BnC	NaA	Sb	
BoC	NaB	ScA	
BrA	NbB	SdB	
BrB	NbC	Se	
CB	NcC	Sf	
CaC	NeA	Ss	
CaD	NeB	StA	
CdA	NeC	StB	
CdB	NfB	SuB	
CdC	NoC	Tb	
CaC	PD	UD	
ChB	PbB	Ur	
ChC	Pg	W	
ChD	PmA	Wa	
CkC	PmB	WbA	
Co	PnB	WbB	
Dc	Pp	WcB	
Du	PsA	WgA	
EfA	PsB	WgB	
EfB	QoA	WhA	
HkA	QoC	WhB	
		WB	



design and installation will result in rapid pollution of groundwater. Excavated slopes are usually unstable. There is typically 8-inches of topsoil, 17-inches of subsoil and a 60-inch substratum. This soil type is commonly found in the north and central easterly portions of the Town.

Quonset Gravelly Sand Loam (QoC) is an excessively drained soil found on flat plains and hilly areas to 15% grade in parcels ranging from 5 to 75 acres. This soil type is found on more than 2,700 acres of land in North Kingstown. Its potential problems regarding septic systems and erosion are consistent with the other predominant North Kingstown soil types. The largest areas of Quonset Soils also coincide with the locations of significant deposits of stratified drift that overlay the Town's four groundwater aquifers. Such soils are often targeted for earth removal and gravel extraction activities.

3.1.4.2 Hydrology: Soil types have been categorized by the U.S. Soil Conservation Service into four hydrologic groups, which allows estimates to be made of infiltration/percolation rate after the soils have been wetted. Most of the major soils groups previously identified in the planning area are classified as Group A or Group B.

Group A soils have a high infiltration rate when thoroughly wet. These consist mainly of deep well drained sands or gravel. Group A have a high rate of water transmission.

Group B soils have a moderate percolation rate when thoroughly wet and consist of moderately deeper or deep, moderately well drained soils that have a moderately fine to moderately coarse texture. These soils have a moderate rate of water transmission.

Lower lying areas of the planning area and those associated with wetlands and floodplains typically have soil types that are classified as Group C or Group D.

Group C soils have a slow infiltration rate when thoroughly wet and generally have a layer that impedes the downward movement of water. These soils also have a fine texture which results in a slow rate of water transmission.

Group D soils have a slow infiltration rate when thoroughly wet and consist of: clay that has a high shrink/swell potential; soils that have a permanent high water table; soils that have a clay layer at or near the surface; and soils that are shallow over nearly impervious materials. These soils have a very slow rate of water transmission.

Soils classified as Type A, and some of those classified as Type B, have rapid permeability and high transmissivity rates which result in a more direct interaction between surface and ground water. This rapid permeability requires careful design and installation of septic systems to prevent pollution of groundwaters. It also suggests that a significant supply of groundwater may be in the area of these soils. Conversely, soil classified in Group C may also require special septic tank design due to slow infiltration rates. Generally, soils in Group D are unsuitable for septic system usage.

3.1.4.3 Topography and Drainage: Topographical information identifies physical features of the earth which will influence the design, construction, cost and operation of wastewater facilities. As related to ground slope and natural drainage features, topography will determine the size and location of sewers, the area tributary to a common collection point and the necessity for and location of wastewater pump stations. Topography also has a direct influence on population distribution and growth.

The topography of North Kingstown is formed by a series of evenly dispersed ridgelines that create rolling hills, meadows, woodlands and valleys. Resulting from these topographic characteristics are a number of small drainage basins as opposed to one large directional flow. Elevations in the planning area range from sea level along Narragansett Bay to 310-feet above sea level in the northwest corner of the Scrabbletown district. The majority of the densely developed areas in the planning area are within 100-feet of sea level.

Approximately 20% of the Town is drained by the Annaquatucket River which flows through the center of the Town toward Bissell Cove. Another 20% of the land drains to small streams and coves leading to Wickford Harbor. The Hunt-Potowomut River system drains the northeast portion of the planning area, accounting for 17% of the total land area. It is estimated that only 20% of the land area drains to the west or away from Narragansett Bay. Significant drainage patterns are shown in Figure 3-4.

3.1.4.4 Geology: Geologic formations and groundwater levels are important design considerations for onsite wastewater treatment systems. High groundwater elevations can result in contamination of groundwater sources from inadequately treated or filtered effluent. Shallow depths to bedrock or other impervious materials can result in the rapid movement of untreated wastewater along their surfaces potentially causing groundwater and water supply well contamination. Both of these conditions will lead to the premature failure of an OWTS system. In addition, geologic and hydrogeologic conditions encountered in the construction of pipelines and other structures have a direct bearing on their cost.

Figure 3-4

North Kingstown Wastewater Facilities Plan

Topographics & Drainage Map



contours	
ELEVATION	
10 feet	200 feet
100 feet	210 feet
110 feet	220 feet
120 feet	230 feet
130 feet	240 feet
140 feet	250 feet
150 feet	30 feet
160 feet	40 feet
170 feet	50 feet
180 feet	60 feet
190 feet	70 feet
20 feet	80 feet
	90 feet



Geologic data was obtained from the Groundwater Map of the Wickford Quadrangle (1959). More than 50% of the planning area is underlain by glacial outwash deposits. These consist of medium to coarse sand and gravel interbedded with fine sand, silt and clay. The deposits form a relatively thick mantle over the bedrock. Outwash deposits are found primarily in the Quonset Point Davisville Planning district.

Till, consisting of a thin layer of unstratified and unconsolidated boulders, gravel, sand, silt and clay over bedrock, is found primarily in the Slocum and Saunderstown areas and also the region west of Post Road from Victory Highway to Davisville Road. The village of Wickford is primarily underlain by a mixture of till and outwash deposits.

Rock outcrops can be found in the vicinity of the following locations which are underlain by outwash deposits:

- Newcomb Road and Post Road
- South of Bissel Cove

3.1.5 Environmental Conditions

Existing environmental conditions in the Planning Area form a basis of comparison among alternatives and identify unique features which may influence the selection of the recommended plan. Environmental conditions include surface water and groundwater quality, air quality, noise levels, historical features, and coastal and freshwater wetlands.

3.1.5.1 Surface Water: The Town of North Kingstown contains many inland surface water features, primary rivers include the Hunt, Potowomut, Pettaquamscutt, Mettatuxet, Annaquatucket and their tributaries. In addition to rivers and streams, there are ten ponds larger than five acres.

A special area management plan for the Narrow (Pettaquamscutt) River has been developed and implemented by the State's Coastal Resources Management Council. The watershed of the Narrow River lies in the southeast portion of the Town. Major water bodies in this river system include Silver Spring Lake, Shady Lea Pond, Carr Pond, Gilbert Stuart Pond, Upper Pond and the Mettatuxet River. Among the problems that have been identified in the area are a degradation in water quality and high rate and density of OWTS failures. The Narrow River is presently designated as a Type SA water body. However, due to measured coliform bacteria levels which consistently exceed the standard for SA waters, use of the river for

shellfishing and recreational activities has been periodically restricted. Recommended management strategies to protect the environmental quality of the watershed call for identifying and restoring failed OWTS systems and prioritizing areas with high rates of septic system failure for sewerage.

North Kingstown also has 30 miles of saltwater coastline which forms the Town's eastern boundary. Physically, the coastline is comprised of beaches, coves and inlets which attract human and wildlife activity. Pollution problems, particularly in the Wickford Harbor and Mill Cove areas, have been increasing in recent years. Contributing to this is the inability of the soil to handle the large number of OWTS systems serving the area and the construction and placement of systems in areas subject to moderate to severe performance limitations. Regions such as Sauga Point and Wickford Village are subject to tidal influences which may flush cesspools and other disposal systems. This contributes bacteria and nutrients to the harbour.

The 2006 "Report of the State of the State's Waters" from the RIDEM Division of Water Resources identifies several surface water bodies in the Town which are known to have water quality problems. A summary of impacted surface waters, the extent of contamination, and potential pollutant sources is presented in Table 3-2.

Water Body	Impact	Potential Sources
Hunt River	Occasional exceedance of aquatic metal criteria, coliform, and potential VOCs (1,1,1 trichloroethane)	Road runoff, agricultural runoff, gravel washing, contaminated groundwater, unknown other sources
Potowomut River	Potentially high nutrients, dense bottom nuisance sea lettuce (Ulva)	Upstream nutrient sources to Hunt River, road runoff, OWTS's
Allens Harbor	Unknown (potential) impacts from hazardous waste	Former Navy landfill
Mill Creek & Mill Cove	High bacteria levels, dense Ulva growth, possible low oxygen in bottom waters and fish kills in summer	High nutrients and bacteria from failed/inadequate OWTS/Cesspools and road runoff adjacent to area and upstream
Fishing Cove	Occasional high bacteria levels	Inadequate/failing OWTS's, cesspools, boats
Academy Cove, Wickford Cove and Harbor	High bacterial levels, dense Ulva growth and/or algae growth, low oxygen in bottom waters in Summer, fish kills	Inadequate/failing OWTS's, cesspools, boat discharges
Duck Cove	Nuisance algae, possible low oxygen/fish kills	Failing/ inadequate OWTS's, cesspools
Bissel Cove (inner cove)	High bacteria levels, nuisance Ulva, potential low oxygen	Failing/inadequate OWTS's, cesspools
Belleville Pond System	High nutrients, algae blooms and/or bottom vegetation, potential low oxygen (Summer)	Abandoned landfill, OWTS's
Upper Narrow River	High bacteria levels	Road runoff, failing/inadequate OWTS's
Sandhill Brook	High bacteria levels	Failed or inadequate OWTS's

3.1.5.2 Groundwater: The RIDEM has classified the groundwater resources of the State into four categories: GAA, GA, GB, and GC. Groundwater classified GAA are those groundwater resources that are known or presumed to be suitable for drinking water without treatment.

Groundwater classified GA are those groundwaters, like GAA, that are known or presumed to be suitable for drinking water use without treatment. However, groundwater classified GA does not fall within any of the two priority areas described above. Most of the State, approximately 72% (773.5 square miles), overlies groundwater classified GA.

Groundwater classified GB is that groundwater which may not be suitable for drinking without treatment due to known or presumed degradation. Data on groundwater quality is basically limited to known sources of contamination and to groundwater withdrawn from public wells. All of the areas where the groundwater is classified GB are served by public water systems. There is current requirement to restore groundwater classified GB to drinking water quality, however, the intent is to protect it from further degradation.

Groundwater classified GC is, or may be, unsuitable for drinking water use. The most appropriate use for land overlying groundwater classified GC as determined by RIDEM is waste disposal. The areas where the groundwater is classified GC is limited to the RIDEM permitted waste disposal areas at licensed solid waste landfills and areas surrounding these landfills determined by RIDEM to be suitable for waste disposal.

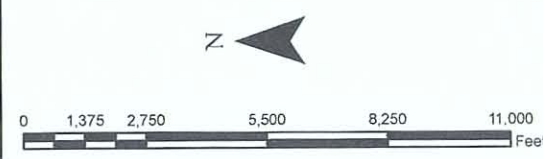
The portion of the planning area identified with GAA water quality includes four groundwater aquifers and their recharge areas, including Annaquatucket, Chipuxet, Hunt and Pettaquanscutt. These areas provide all of the Town's drinking water supply. Concern about the vulnerability of these groundwater resources and limited supply alternatives led to the successful petition to the U.S. EPA for Sole Source Aquifer designation for the Hunt-Annaquatucket-Pettaquanscutt Aquifer system. A portion of the Hunt River Aquifer is located in the planning area. The relationship between the Town's groundwater aquifers and recharge areas and the planning area is shown on Figure 3-5.

The Town has adopted a Groundwater Recharge and Wellhead Protection Overlay Districts (Section 21-186 of the Zoning Ordinance. Permitted uses in the Hunt River groundwater protection area is contingent on the site meeting the following:

Figure 3-5
**North Kingstown
 Wastewater
 Facilities Plan**
 Groundwater Aquifer &
 Recharge Area



- Features**
- Railroad
 - Post Road Corridor
 - Town Boundary
 - Groundwater Recharge Area
 - Parcels



- "1. The average density of any residential development shall not exceed one dwelling unit per two acres and the use is not prohibited in table 1 in subsection (h) of this section. No density bonuses shall be granted in groundwater protection areas.
2. All new commercial and industrial development must show that the nitrate loading standard of five mg/l as set forth in article VI of chapter 8 of this Code, pertaining to groundwater reservoirs and recharge areas, can be met on site using a conventional onsite wastewater treatment system.
3. On residential lots that are nonconforming by area (square footage) and where municipal sewers are not available, for all new construction, alteration, additions, expansions, enlargements or intensifications for which the state department of environmental management determines that an upgrade to the onsite wastewater treatment system is required, the upgraded system must include the installation of a nitrogen reducing septic disposal system for on-site treatment of wastewater approved by the state department of environmental management."

With the exception of the Quonset Business Park, which has a groundwater classification of GB, the remainder of the Town is underlain by groundwater classified as GA. To protect groundwater quality, particularly from nitrate contamination, the Town of North Kingstown has adopted a Groundwater Protection Plan which establishes overlay districts limiting development to one residential unit per two acres. This density was determined necessary to ensure that nitrate concentrations would remain below an adopted goal of 5.0 mg/l. The EPA drinking water standard for nitrates is 10.0 mg/l.

3.1.5.3 Air Quality: According to the RIDEM Division of Air Quality, North Kingstown complies with all of the air quality standards established by the U.S. Clean Air Act, except for ozone. Ozone levels represent a problem which is inherent throughout the surrounding communities, as well as the entire State. The source of the problem is thought to be auto emissions and industry.

Due to the isolated location of the QDC Wastewater Treatment Facility within the Industrial Park, odor complaints are rare. The facility is effectively buffered from sensitive receptors typically found in commercial and residential areas.

3.1.5.4 Noise Levels: Formal noise studies were not conducted in North Kingstown for the purposes of this Wastewater Management Facilities Plan. Existing noise sources in the planning area center around highly commercialized districts such as Post Road, Tower Hill Road and Route 4. Noise in these areas is the result of a high volume of vehicular traffic and the Quonset State Airport. The greatest threat to noise is increased development of the Quonset Business Park, which could have a direct impact on the redevelopment of the Post Road commercial strip. Again, due to the somewhat isolated nature of the Quonset facilities, little overall impact to the Town is anticipated.

3.1.5.5 Historical and Archaeological Features: In North Kingstown's Comprehensive Plan, an inventory of sites, structures and areas within the Town that exhibit cultural or historic significance was developed. Information was obtained from the North Kingstown, Rhode Island Statewide Historical Preservation Report and includes entities listed in the National Register of Historic Places and those recommended for listing. There are two sites identified by the Planning Department: Smith's Castle and Devils Foot Road Cemetery. Figure 3-6 identifies the approximate location of these sites.

3.1.5.6 Coastal Zones, Wetlands and Floodplains: North Kingstown has a network of environmentally sensitive streams, rivers, lakes, and ponds. In addition, the Town has more than 31 miles of coastline. Associated wetland areas, coastal zones and floodplains account for approximately 15% of the total land area. Figure 3-7 identifies the wetlands and coastal zones that are within the project area.

Wetlands generally provide a valuable habitat for a variety of fish and wildlife species and act to improve water quality by filtering nutrients, wastes and sediment from upland runoff. Wetlands also provide flood control and groundwater recharge opportunities. Improper sewage disposal practices and urban run-off, among other factors, continuously threaten wetland areas. Aside from their environmental value, wetlands and floodplains will also indicate areas where high groundwater tables may adversely impact the function of a subsurface sewage disposal system.

The predominant wetland classification in the Town, as defined by the U.S. Fish and Wildlife Service, is the Palustrine System, which includes all non-tidal wetlands dominated by trees, shrubs, emergent mosses or lichens. These areas are generally less than 20 acres with a water depth of less than 2-feet at low water. Palustrine wetlands may be situated shoreward of lakes, river channels and estuaries.

Figure 3-6

North Kingstown Wastewater Facilities Plan

Historical Elements within
Project Area

- Features
- Railroad
 - Post Road Corridor
 - Town Boundary
 - Local Historic Districts
 - Historic Districts
 - Parcels



Figure 3-7

North Kingstown Wastewater Facilities Plan

Wetlands & Coastal Areas

NARRAGANSETT BAY



Estuarine systems comprise the second largest wetland type. These systems are defined as deep water tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land. Estuarine systems extend inland to where ocean derived salt concentrations are less than 0.5%.

Water sources which drain to the coast include Mill Creek, Tibbets Creek, Wannuchecomecut River, Annaquatucket River and the Hunt-Potowomut River. Major coves are identified as Bissel Cove, Duck Cove, Wickford Cove, Mill Cove, and Fishing Cove. Other coastal features of significance include Little Tree Point, Rome Point, Wild Goose Point, Plum Point, Casey Point, Sauga Point, Greene Point, Poplar Point, and Pojac Point.

Freshwater floodplains are valuable resources that provide storage for stormwater when rivers and streams are not capable of carrying flows. The Army Corps of Engineers does not allow changes to the storage capacity of floodplains. In addition, coastal floodplains exist along the coast and are subject to flooding from wave action and tidal surges.

3.1.5.7 Rare and Endangered Species: The Rhode Island Natural Heritage Program was contacted for information regarding the presence of rare and endangered species in the study area. It was reported that there are no rare species or ecologically significant natural communities in the project area.

3.1.5.8 Wild and Scenic Rivers: There are no rivers in the planning area that are classified as wild and scenic by the federal government.

3.2 EXISTING WASTEWATER CONDITIONS

3.2.1 Current Wastewater Disposal Practices

Approximately 96% of the present population of North Kingstown relies on on-site wastewater treatment systems for their treatment and disposal of wastewater. This method is self-contained underground waste disposal systems typically designed to handle wastewater generated from individual buildings. The useful life for both types of systems is approximately 20 to 25 years. A vast majority of buildings constructed prior to 1964 were serviced by cesspools. These generally consist of a collection tank with singular or multiple discharge points designed to dispose the liquid portion of the waste directly to surrounding soils. Between 1965 and 1979, an increasing number of installed systems were of the septic tank/leachfield type. However, with the absence of adequate regulations until 1968, which were not strictly enforced, many of

these systems were of sub-standard installation. Since 1979, when new design standards were adopted and enforced by the State, system construction methods and performance has generally improved.

North Kingstown, like most municipalities, relies on individual property owners/managers to maintain their wastewater disposal systems. Failure of a system can be attributed to any or all of the following factors:

- Improper siting
- Inadequate sizing
- Hydraulic overloading
- Introduction of large quantities of non-biodegradable solids
- Failure to pump the system regularly
- Improper installation or substandard construction materials
- Adverse activities around the leaching field (i.e., planting trees)

To ensure the proper performance of on-site wastewater disposal systems in North Kingstown where they will continue to provide an alternative to conventional sewerage, the Town Council has established a wastewater management district. The North Kingstown Wastewater Management District Ordinance went into effect on May 1, 1999.

In 1996, a decision was made by the North Kingstown Town Council to shift the focus away from sewerage to maintenance of OWTS through the drafting of a wastewater management district ordinance. At that time, the Town's Sewer Study Committee was renamed the "Wastewater Management Committee" and their charge was revised to reflect the new focus, which included the drafting of a Wastewater Management District Ordinance and an associated public outreach/education program to garner public support for the ordinance. The Committee membership was also expanded to include representation from other Town committees including the Planning Commission, Groundwater Committee, Harbor Management Committee and Historic District Commission. Aqua Fund grant funds were acquired to help with these tasks.

Chapter 8, Article VII of the Code of Ordinances, Town of North Kingstown, entitled "North Kingstown Wastewater Management District" was adopted at a public hearing held on January 11, 1999. The ordinance requires that all onsite systems in the Town of North Kingstown be inspected and pumped if necessary once every three years.

The Town is divided into four Wastewater Management Districts (as presented on Figure 3-8). The districts are defined as follows:

- **Wastewater District 1** All properties serviced by a private well and OWTS or cesspool;
- **Wastewater District 2** All properties located in Zone 1 Groundwater Protection Areas and all properties located adjacent to poorly flushed coastal areas;
- **Wastewater District 3** All properties located in Zone 2 Groundwater Protection Areas and properties located in densely settled coastal areas; and
- **Wastewater District 4** All other properties in North Kingstown serviced by OWTS or cesspools.

The effective date of the ordinance was delayed until May 1, 1999 so that an implementation strategy could be developed. It was determined that implementation of the ordinance would be the responsibility of the North Kingstown Department of Water supply and an implementation plan for the wastewater management program was presented to the Town Council by the Department of Water Supply in April 1999.

The goals of North Kingstown's Wastewater Management Program include the following:

1. Ensure the proper operation and maintenance of OWTS to prevent malfunctioning systems.
2. Protection of the public health from risks associated with septic system failures.
3. Protection of surface and groundwater resources, including the Town's drinking water supply from contamination associated with failure of OWTS.
4. Continued reliance on the use of properly functioning OWTS as a viable and cost-effective alternative to municipal sewers.
5. To maintain the hydrological balance in groundwater recharge areas by reducing the transport of water out of these areas.

The Town has a limited municipal wastewater collection system. At this time, approximately 4% (1,532 out of 26,326) of the population is sewered. The sewered area is limited to the area in and around the Quonset Business Park (QBP). Sewers presently service the former Navy personnel housing, several multi-family developments adjacent to Devil's Foot Road and Newcomb Road, the Quidnesset & Fishing Cove Elementary Schools, and several homes along Mark Drive, Kings Grant and Essex Village near Quidnesset

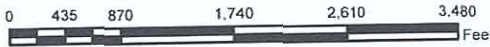
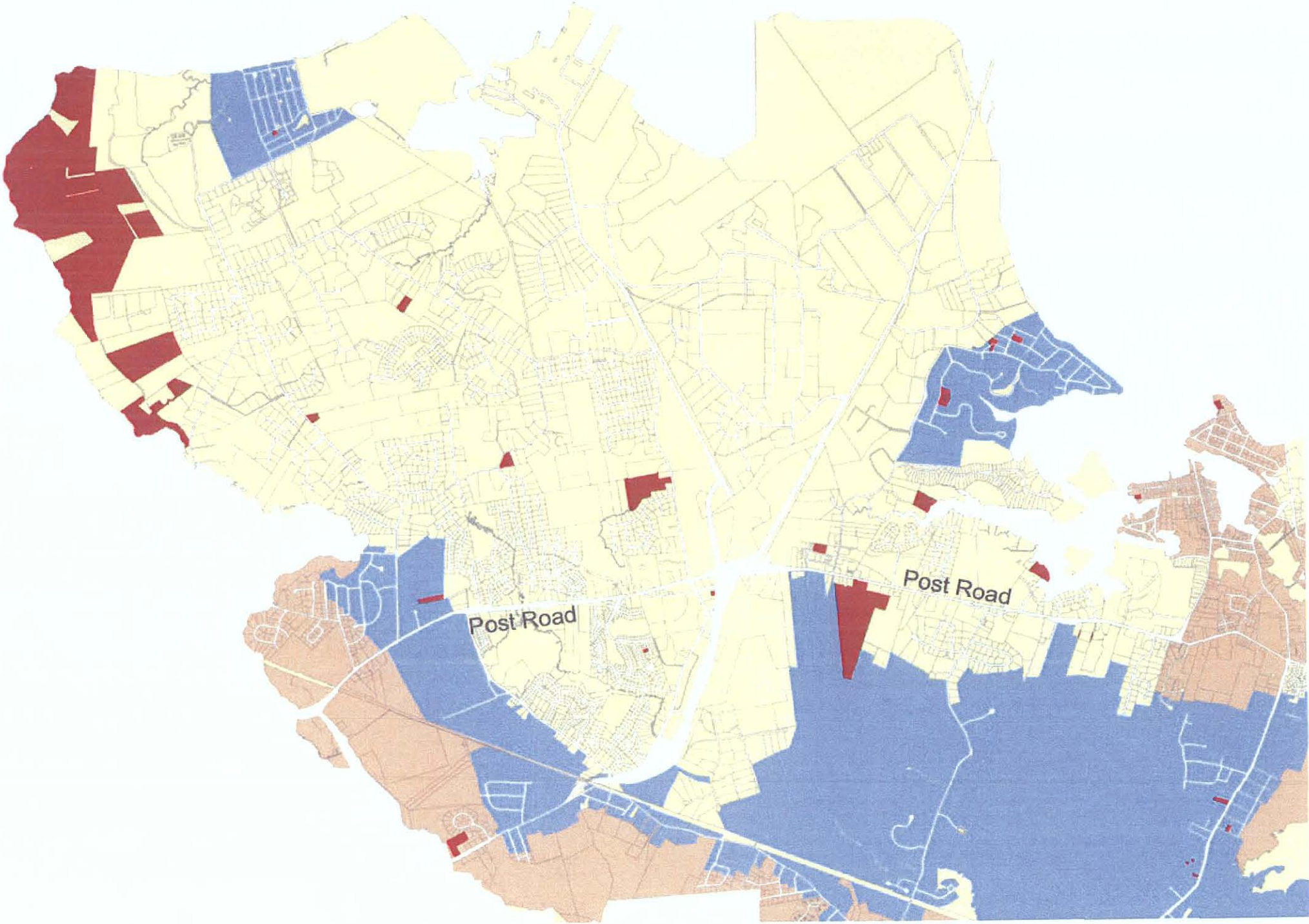
Figure 3-8

North Kingstown Wastewater Facilities Plan

Wastewater Management Districts

Legend

- Wastewater District 1
- Wastewater District 2
- Wastewater District 3
- Wastewater District 4



School, and ASQAH apartments, Millcreek Drive area and Wickford Point. These parcels, sewered by QDC, have done so with a private agreement with QDC. The following properties are connected to QDC's system. In accordance with the Intergovernmental Agreement, the ownership of these sewer lines have been turned over to the Town.

ASQAH	Multi-Unit Apartments on ASQAH Dr., off Camp Ave., with 98 service meters
Essex Village	Multi-Unit Apartments on Newcomb Rd., with 7 service meters
Kings Grant	Multi-Unit Apartments, Newcomb Rd., with 1 service meter
MHRH	Shore Court Housing, off Post Rd., with 1 service meter
Kingstown Heights	Private Homes, 134, 146 and 158 Mark Dr., with 3 service meters
Fishing Cove School	Public School, 110 Wickford Point Rd., with 2 service meters
Quonset School (SOROCO)	Public School, Camp Ave., with 1 service meter
Quidnesset School	Public School at 166 Mark Dr., with 2 service meters
Phoenix Properties (Heritage)	Multi-Unit Apartments, 552 Devils Foot Rd., 580 Devils Foot Rd., 0 Union Dr., 24 Union Dr., 46 Unit Dr., 59 Union Dr., with 8 service meters
Lischio/Moran	Future Multi-Unit development, previous drive-in, Namcock Rd., with a previously purchased capacity flow of 72,000 gallons per day
Travelers Aid	Multi-Unit Housing, Navy Dr. off Devils Foot Rd., with 1 service meter
G. Grossmans	Multi-Unit Apartments on Cattail Ln., Mill Creek Dr., Ripple Ln., Waterwheel Ln., off Camp Ave., with 73 service meters
Wickford Point	Private Homes, Harbor Ct., Lands End Dr., Sea Grass Way, Wickford Point Rd., with 94 service meters
Lischio	Private Home, 165 Namcook Rd., and Multi-Unit Apartments, 620 Devils Foot Rd., 660 Devils Foot Rd., 604 Devils Foot Rd., 604 BD A Devils Foot Rd., 604 BD B Devils Foot Rd., with 6 service meters
North Kingstown Transfer Station	Davisville Rd.

The North Kingstown Water Department provides QDC with the water consumption for each user in order that the QDC can generate a user charge. Table 3-3 presents the 2010 water consumption records.

**TABLE 3-3
EXISTING WATER CONSUMPTION**

# of Units		<u>3/1/2010</u>	<u>6/1/2010</u>	<u>9/1/2010</u>	<u>12/1/2010</u>	<u>Total</u>
8	Brookview Dr.	109,000	90,000	95,000	127,000	421,000
20	Cattail Lane	407,710	224,810	283,980	456,520	1,373,020
11	Millcreek Dr.	115,610	86,000	84,560	147,590	433,760
17	Ripple Lane	243,610	201,010	184,770	323,920	953,310
27	Waterwheel Lane	477,980	390,190	334,750	343,050	1,545,970
98	ASQAH Dr.	1,428,570	1,185,760	1,122,630	1,702,840	5,439,800
1	Camp Ave.	30,000	28,000	20,000	22,000	100,000
7	Devil's Foot Rd.	1,392,700	567,200	1,162,000	1,958,900	5,080,800
4	Fischer Dr.	947,000	433,000	921,000	1,419,000	3,720,000
4	Mark Dr.	74,300	60,430	85,000	82,900	302,630
1	Namcook Rd.	330,000	160,000	410,000	470,000	1,370,000
1	Navy Dr.	1,208,000	1,147,700	1,232,200	1,435,100	5,023,000
1	Newcomb Rd.	1,789,200	1,777,100	1,844,700	1,585,200	6,996,200
1	Post Rd.	81,000	60,000	68,000	83,000	292,000
2	Saw Mill Dr.	185,100	132,000	165,000	194,600	676,700
5	Union Dr.	1,227,100	946,400	890,700	1,179,700	4,243,900
2	Walter Dr.	375,000	197,000	334,000	431,000	1,337,000
94	Wickord Point Rd.	1,121,820	763,260	1,020,550	1,669,600	4,575,230
304	TOTALS	11,543,700	8,449,860	10,258,840	13,631,920	43,884,320

Provided by North Kingstown Water Department

Traditional water use records provide a reliable estimate for wastewater generation rates. Generally, 75% to 85% of the total water measured will enter a sewage collection or wastewater disposal system. The 15% to 25% reduction amounts for uses such as lawn watering, fire fighting and certain manufacturing operations which do not contribute to the flow reaching the wastewater collection systems. For the purpose of this report, a reduction of 15% for water consumption will be used to establish the wastewater flow. This translates to a wastewater value of 37,301,672 MG per year (or approximately 102,200 gpd [or 67 gallons per person per day]).

3.3 EVALUATION OF UNSEWERED AREAS

Traditional type sanitary sewerage in North Kingstown is limited to the area in and around the Quonset Business Park. Sewers presently serve the former Navy personnel housing in A.S.Q.A.H., Wickford Point area, multi-family developments adjacent to Devil's Foot Road and Newcomb Road, the Quidneset and Fishing Cove Elementary Schools, and homes along Mark Drive near the Quidneset School.

Based on the policy adopted by the Town as part of the Town's Wastewater Management Plan, the use of traditional sewerage systems are to be limited to those areas with high needs and are in reasonable proximity to the QDC. These factors combined with the financial commitments of the Town for the next twenty year period the Town has decided to focus on providing sewers to high need areas that are in close proximity to the existing QDC Collection System. Other critical measures utilized by the Town in selecting sewers include high density developments, high incidents of OWTS failures, groundwater and soil conditions prohibiting the effective use of OWTS systems and locations where surface water contamination from failing OWTS's has been documented.

The three areas that are being considered for sewers within the twenty year period include the Post Road Corridor (North and South), Shore Acres and the Wickford Village/Poplar Point areas of Town. Efforts are underway to enhance and revitalize Post Road. The Town is focusing its efforts to create a high density mixed use district along the Post Road Corridor. The Town recognizes that an essential component in the redevelopment of the Post Road Corridor is to address the wastewater disposal needs of the area. In addition, the adjacent residential areas are experiencing a high rate of OWTS disposal failures.

The Shore Acres area of Town is being considered as a result of the property owners requesting that the Town provide sewers because of the high rate of OWTS disposal failures that are a result of the high groundwater table, age of existing systems, soil conditions and the Rhode Island Cesspool Act of 2007 (the

"Act" [RIGL § 23-19.15] which mandates that all cesspools located within 200 feet of the inland edge of a coastal shoreline feature bordering a tidal water area within 200 feet of a public well or drinking water reservoir must cease to be used and abandoned and the home upgraded with a new onsite wastewater treatment system (OWTS, or septic system) or connected to available municipal sewer lines).

The Wickford Village area is the central location for one-of-a-kind shops featuring jewelry, housewares, clothing and more. Also located within the Village are galleries, antique shops, cafes and restaurants, and colonial homes. This area is experiencing OWTS system failures that are in close proximity to the Wickford Harbor. The adjacent residential areas are also experience OWTS system failures. The Collation Circle area is a high density residential development that has a 30 percent (30%) OWTS system failure rate and is subject to the 2007 Cesspool Act.

There are approximately 9,400 on-site wastewater treatment systems in the Town of North Kingstown and 1,509 within the Post Road project area. The Rhode Island Department of Environmental Management Water Resources records were examined for the ten year period between 2000 to 2010 to identify those systems within the planning area needing repairs or systems that were denied. This review revealed that 217 OWTS systems need to be repaired and/or upgraded, while four systems' suitability application had been denied by RIDEM within the Post Road project area. Table 3-4 presents a tabulation of where these systems are located. This represents over 14% of the OWTS systems needed to be upgraded to function correctly. Figure 3-9 illustrates the location of these failures and repairs.

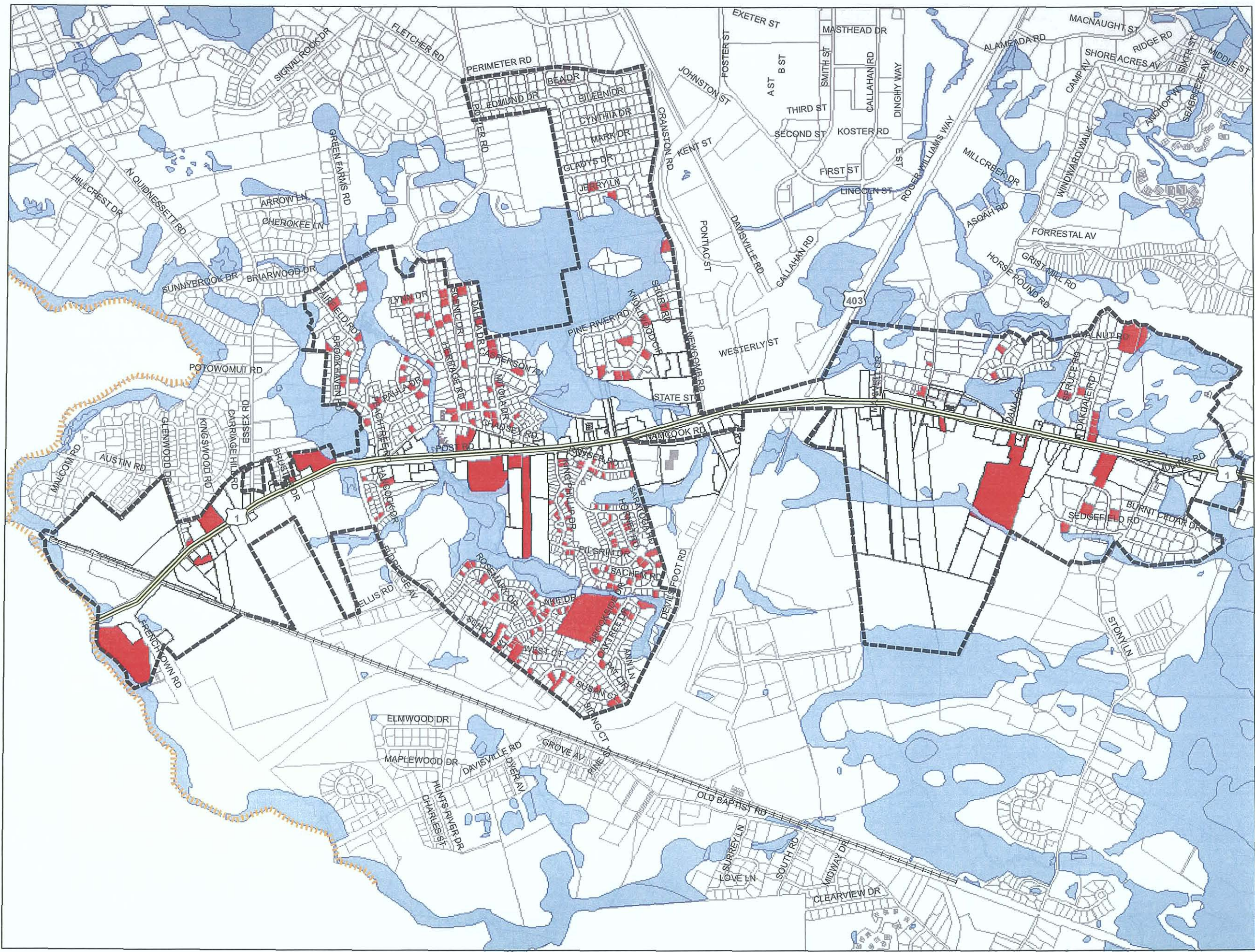
The Wickford area (including Poplar Point) has 550 on-site wastewater treatment systems. The Rhode Island Department of Environmental Management-Water Resources records indicated that between 2000 and 2010 there were 135 OWTS systems that needed to be repaired or upgraded. Table 3-5 presents a tabulation of where these systems are located. This represents 25% of the OWTS's that need to be upgraded to function correctly. Figure 3-10 illustrates the location of these failures and repairs.

The failing systems within the Wickford and Poplar Point areas, along with Shore Acres, are known to be contributing to the contamination in Wickford Harbor. The Harbor area is in need of improved wastewater disposal methods. The Shore Acres area has 213 on-site wastewater treatment systems. The RIDEM-Water Resources records were examined between 2000 and 2010 to identify those systems needing repairs. The review revealed that 34 OWTS systems needed to be repaired which represents 16% of the OWTS systems. Table 3-6 presents a tabulation of where these systems are located.

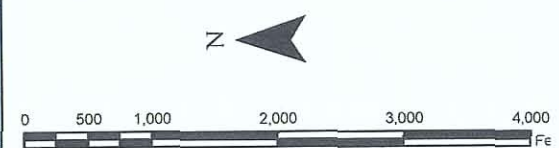
**TABLE 3-4
POST ROAD PROJECT AREA
OWTS REPAIRS BY LOCATION**

Location	Number	Type	Location	Number	Type
Belle Air Drive	2	Repair	Lynn Dr.	1	Repair
Beverly Rd.	1	Repair	Mitola Dr.	4	Repair
Big Oak Drive	2	Repair	New Lexington Rd.	4	Repair
Brookside Dr.	7	Repair	Newcomb Rd.	2	Repair
Camp Ave.	7	Repair	Nichols Rd.	10	Repair
Casperson Ave.	1	Repair	Oak Hill Rd.	1	System Suitability Denial
Chadsey Rd.	4	Repair	Oak Hill Rd.	3	Repair
Charter Oak Ct.	1	Repair	Oak Tree Dr.	3	Repair
Chestnut Rd.	2	Repair	Oakdale Rd.	3	Repair
Dahlia Dr.	5	Repair	Pat Circle	1	Repair
Dana Rd.	1	Repair	Paula Dr.	6	Repair
East Ct.	1	Repair	Peachtree Rd.	3	Repair
Evergreen Rd.	2	Repair	Post Road	17	Repair
Fairfield Dr.	1	System Suitability Denial	Ranger Rd.	5	Repair
Fairfield Dr.	7	Repair	Rosemary Dr.	7	Repair
Green Farms Ln.	1	Repair	Sachem Rd.	9	Repair
Greenmeadow Circle	4	Repair	Sand Hill Dr.	3	Repair
Hancock Dr.	3	Repair	Scenic Dr.	6	Repair
Harrington Rd.	2	Repair	School St.	1	System Suitability Denial
Heritage Rd.	6	Repair	School St.	12	Repair
Hickory Dr. East	1	Repair	Sedgefield Rd.	1	System Suitability Denial
Hornet Rd.	9	Repair	Sedgefield Rd.	1	Repair
Jerry Lane	2	Repair	Short Road	1	Repair
King Philip Drive	13	Repair	Susan Ct.	1	Repair
King St.	1	Repair	Trowbridge Dr.	1	Repair
King St. (rear)	1	Repair	Verdant Circle	1	Repair
Knollwood Circle	5	Repair	Walnut Rd.	2	Repair
Lake Dr.	9	Repair	Wasp Rd.	2	Repair
Lantern Lane East	1	Repair	Yorktown Rd.	7	Repair
Lexington Ave.	1	Repair			

Figure 3-9
**North Kingstown
 Wastewater
 Facilities Plan**
 OWTS Failures & Repairs
 Post Road Corridor



- Features**
- Railroad
 - Post Road Corridor
 - Town Boundry
 - Project Area
 - Wetlands
- Post Road Corridor**
- Post Road Corridor
 - Post Road Failures
- Parcels**
- Project Area
 - Parcels
 - Failures & Repairs



**TABLE 3-5
WICKFORD AND POPLAR POINT AREA
OWTS REPAIRS BY LOCATION**

Location	Number	Type
Bay St.	2	Repair
Beach St.	2	Repair
Boone St.	4	Repair
Boston Neck Rd.	1	Repair
Brown St.	8	Repair
Church Ln.	1	Repair
Collation Cir.	8	Repair
Concord Ave.	4	Repair
Cranston Cir.	2	Repair
Dean Ave.	3	Repair
Elam St.	6	Repair
Enfields Ave.	1	Repair
Esmond Ave.	1	Repair
Fountain St.	1	Repair
Fowler St.	3	Repair
Lawton Ave.	3	Repair
Lexington Ave.	4	Repair
Madison Ave.	2	Repair
Main St.	15	Repair
Newport Ave.	2	Repair
Oakland Ave.	1	Repair
Ocean Ave. & Pond St.	1	Repair
Phillips St.	9	Repair
Pleasant St.	8	Repair
Poplar Ave.	2	Repair
Post Rd.	1	Repair
Preston Dr.	6	Repair
Reynolds St.	2	Repair
Roger Williams Dr.	1	Repair
Spencer Dr.	5	Repair
Steamboat Ave.	3	Repair
Ten Rod Rd.	4	Repair
Thomas St. & Sherman St.	2	Repair
Tower Hill Rd.	3	Repair
Waite Ct.	1	Repair
Washington St.	2	Repair
West Main St.	11	Repair

Figure 3-10

North Kingstown Wastewater Facilities Plan OWTS Failures & Repairs Wickford/Poplar Point

- Features**
- Railroad
 - Post Road Corridor
 - Town Boundary
 - Wetlands
- Parcels**
- Project Area**
- Parcels
 - Repairs & Failures

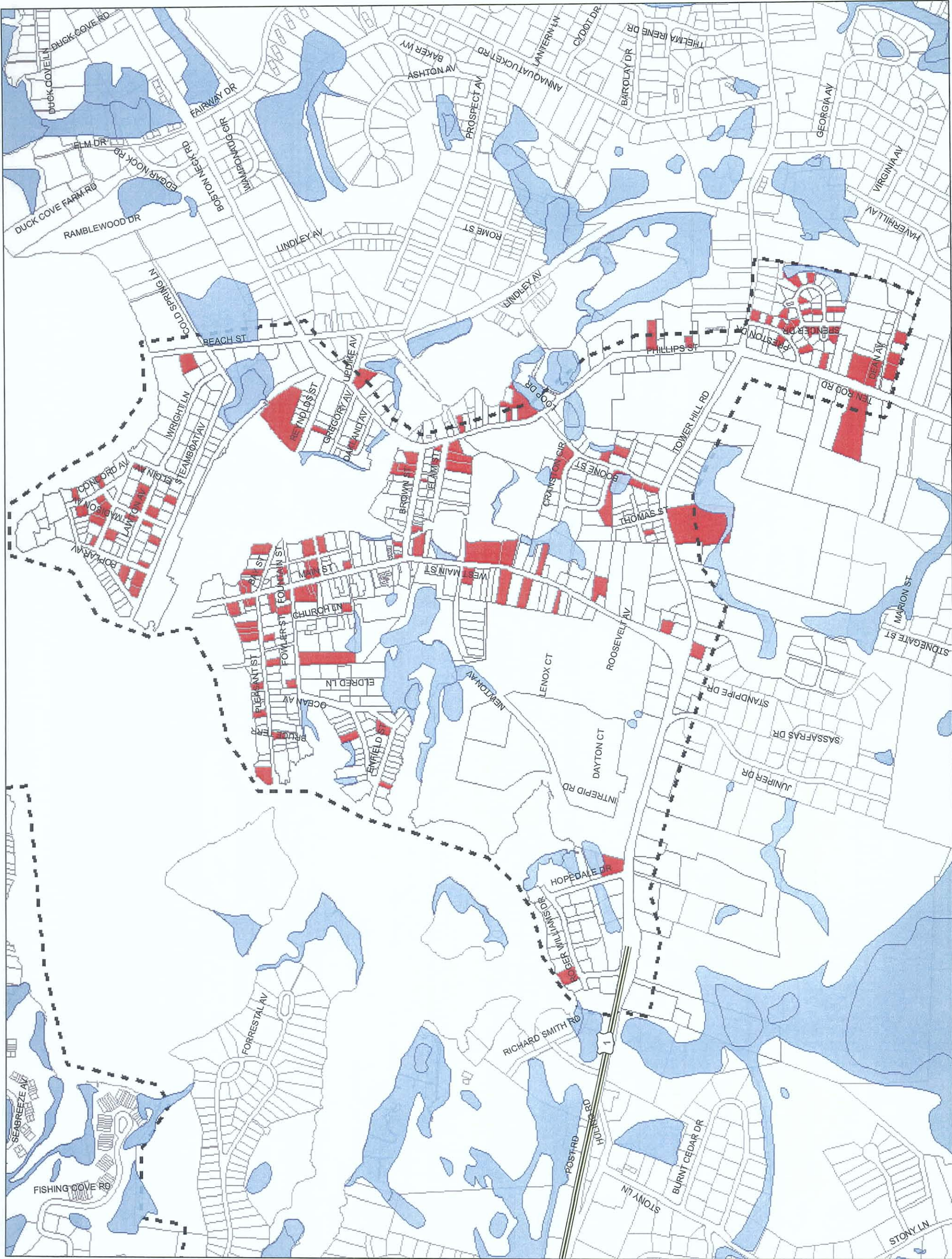


TABLE 3-6 SHORE ACRES AREA OWTS REPAIRS BY LOCATION		
Location	Number	Type
Camp Ave.	4	Repair
Gateway Rd.	2	Repair
Fishing Cove Rd.	2	Repair
Sea Breeze Dr.	2	Repair
Shore Acres Ave.	11	Repair
Fourth St.	3	Repair
Sauga Ave.	6	Repair
Middle St.	4	Repair

Figure 3-11 illustrates the locations of failures and repairs. The Shore Acres area is a densely developed residential neighborhood with poor soils and a high groundwater table. This area also includes substandard on-site wastewater treatment systems.

They are generally considered to be two ways in which an OWTS system can fail. In the first circumstance, the leaching field does not operate, meaning that water cannot pass through the system. The system eventually surcharges, or backs up into the house. In the second instance, the system drains too freely, causing untreated sewage to percolate to the groundwater. In each case of failure, there may be several factors which contribute to the system not operating properly. For example, soils that drain poorly cannot pass large volumes of water. Conversely, soils which drain excessively may result in poor wastewater treatment and short-circuit to the surface or groundwater table. Population density is another factor. Areas which have a high concentration of residences over a small land area may experience oversaturation of OWTS effluent in the soil, particularly in wetland areas. High groundwater will also restrict a soil's ability to disperse and treat wastewater.

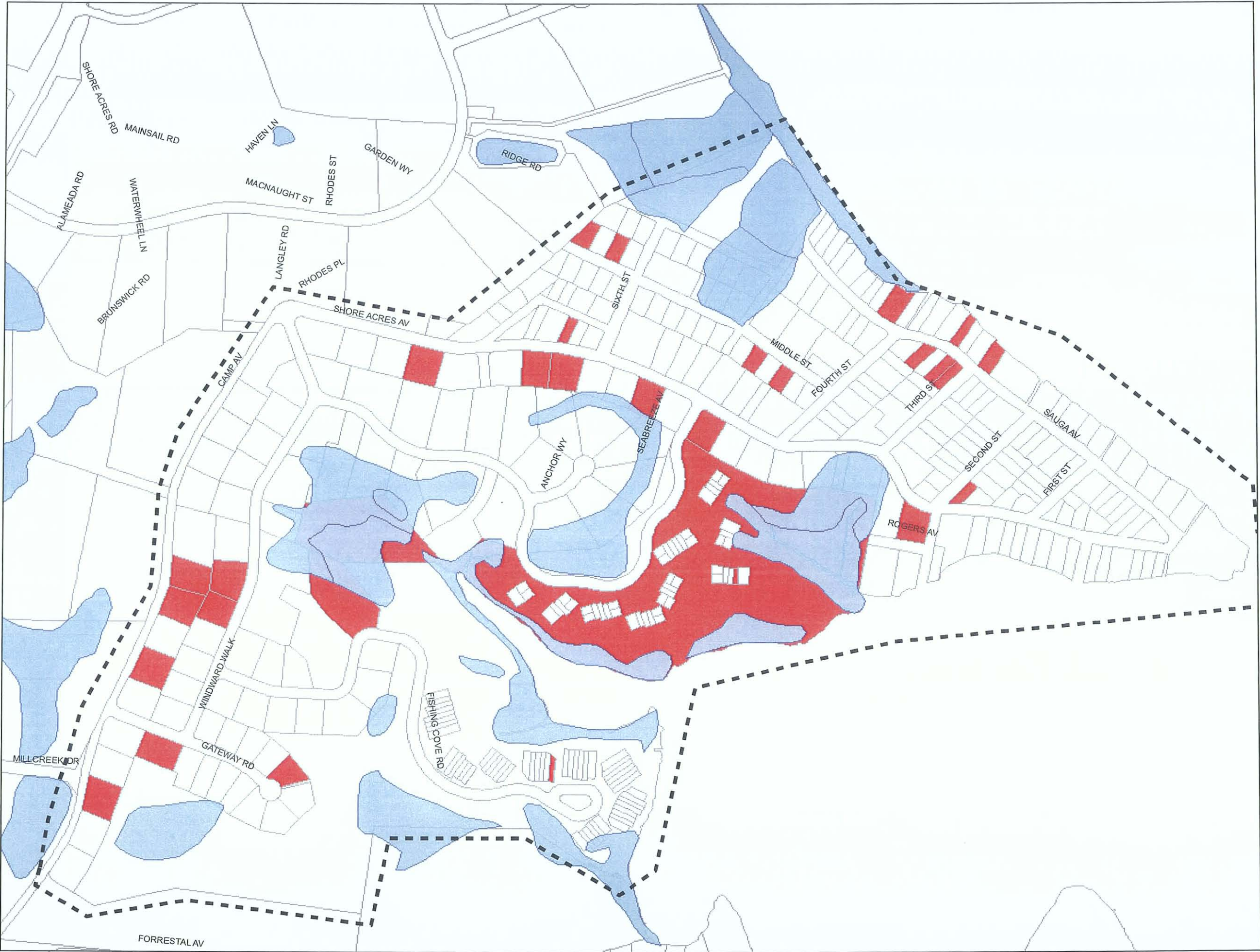
The soils where the failures occur are very permeable soils having a potential for groundwater pollution, slowly permeable soils having a potential for OWTS failures, soils with a seasonally high water table located within 1.5 to 3.5 feet from the surface, and soils consisting of topography with slopes greater than 15 percent and shallow bedrock.

The sewerage of these areas will improve the quality of the reservoir, Wickford Harbor, Fishing Cove, groundwater, and adjacent wetlands with the elimination of leaching field effluent containing pathogenic bacteria and viruses, nitrates, phosphates and synthetic organic chemicals from septic tank additives and

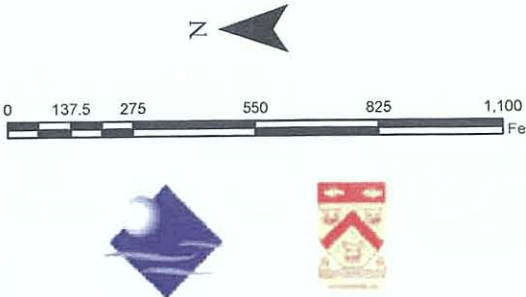
Figure 3-11

North Kingstown Wastewater Facilities Plan

OWTS Failures & Repairs
Shore Acres



- Features**
- Railroad
 - Post Road Corridor
 - Town Boundry
 - Wetlands
- Parcels**
- Project Area**
- Repairs & Failures



household chemicals. The onsite wastewater treatment systems predate state-enforced siting and design standards, and have approached their expected life span.

The Town is aware that there may be other areas that will require sewerage beyond the 20 years of this Facilities Plan document, but as a result of the existing financial capabilities and the time period necessary to sewer these areas of the Town, these areas will not be considered within this twenty year study period.

The remaining sections of Town will remain as part of the Wastewater Management District Ordinance which ensures that the existing OWTS systems are properly maintained and inspected every three (3) years.

3.4 EXISTING WASTEWATER COLLECTION SYSTEM

3.4.1 Town of North Kingstown Wastewater Collection System

The Town's wastewater collection system is limited to two (2) pump stations, 8,300 linear feet of sewer main, 5,000 linear feet of force main, approximately 309 residential units and two (2) schools. Due to the limited extent of the wastewater collection managed by the Town, the supervision of the system is handled through the Water Department. The Director of Water Supply is the individual who coordinates these efforts through a private contractor. The private contractor is responsible for all maintenance parts of the system.

Mark Drive

The Mark Drive collection system is limited to the Quidnesset School and three (3) residential properties. The gravity line from the School and three residential properties connect into a pump station located on the school property. The station is rated at 200 gpm at 21-feet of Total Dynamic Head (TDH). Power to the station is fed from the elementary school. There is no standby power to the station. The alarms do not report to a remote monitoring location. The alarms report locally at the station only with a light and horn. The force main is approximately 2,000 linear feet long, which runs from the school (on school grounds) to QDC's manhole on Newcomb Road.

Wickford Point

The Wickford Point service area is a residential subdivision constructed in the 1990's on former Navy housing land. The subdivision is situated off Camp Ave. south of A.S.Q.A.H. Road. The service area is comprised of ninety-six (96) single family homes and the Fishing Cove Elementary School. The gravity sewer flows to the Wickford Point Pump Station. The station is rated at 310 gpm @ 60 ft. TDH. The 3,000 linear feet of 6" force main runs northerly along Wickford Point Road before crossing Camp Avenue connecting into the A.S.Q.A.H. manhole. From that point, the A.S.Q.A.H. area is serviced by the QDC Wastewater Department. There is approximately 6,300 linear feet of gravity sewers within this area. The pump station alarms do not report to a remote location. The alarms activate a light and a horn mounted to the exterior of the station.

3.4.2 Quonset Development Corporation (QDC) Wastewater Collection System

QBP is served by a gravity wastewater collection system consisting of approximately 20 miles of pipes ranging in diameter from 4 to 24 inches. The system is composed of lateral and collector sewers which generally follow natural ground contours. Wastewater is discharged from individual buildings into sewer lines via service connections. Lateral and collector sewers are equipped with manholes at regular intervals to allow inspection and cleaning. Wastewater flows by gravity in a southerly direction toward the Quonset Wastewater Treatment Facility (WWTF) located on Zarbo Avenue. The system provides wastewater treatment for all parcels within the Quonset Business Park (QBP) as well as several parcels within the Quonset State Airport.

Because of topographic constraints, four pumping stations are included in the QBP collection system. The Davisville Pumping Station (designated as DS-55) is located at the south end of the golf course; the Pier Area Pumping Station is located near Davisville Pier 2; the Commerce Park Pumping Station is located at the eastern end of Commerce Park Road; and the Burlingham Ave. Pumping Station is located at the eastern side of Burlingham Ave. at the intersection of Circuit Drive. These stations lift wastewater from low points in the system to an elevation where wastewater can flow by gravity to the WWTP.

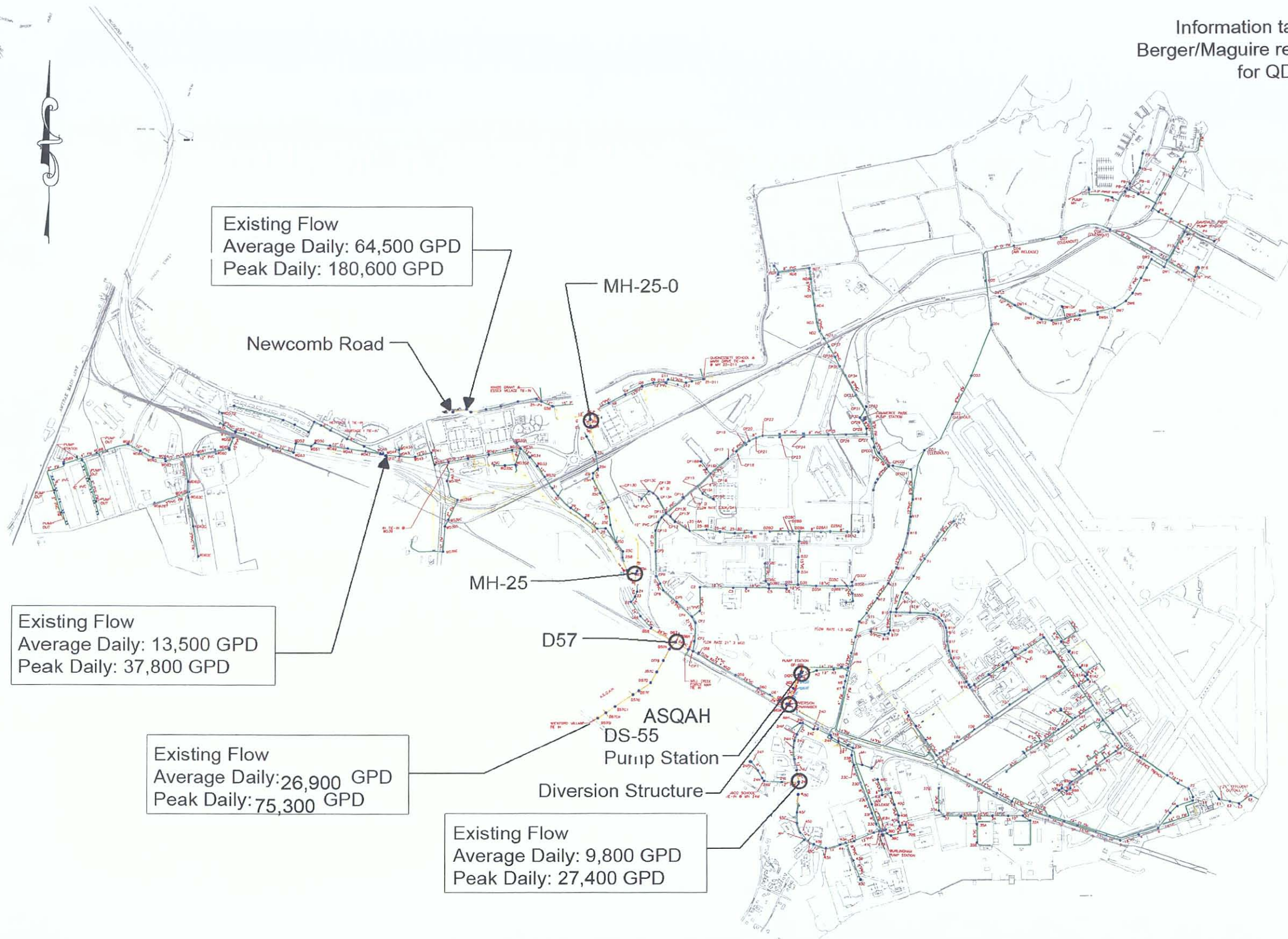
Figure 3-12 depicts the existing sanitary sewer collection system and the location of the WWTF outfall. The QBP can be divided into two primary wastewater collections areas, Davisville and Quonset.

Figure 3-12

North Kingstown Wastewater Facilities Plan

Existing QDC Wastewater
Collection System

Information taken from
Berger/Maguire report prepared
for QDC



0 435 870 1,740 2,610 3,480 Feet



Davisville Collection System

The service area for the Davisville collection system is bounded on the north by Newcomb Road, on the east by Davisville Piers, on the south by Pump Station DS-55 and on the west by Wickford Point. Wastewater generated in the Davisville area is conveyed by gravity to Pump Station DS-55. Wastewater flow from Pump Station DS-55 is pumped through a 14-inch force main about 8,300 linear feet in length to the WWTP. Pump Station DS-55 was originally an influent pump for a wastewater treatment facility that serviced the Davisville area. The treatment facility has been demolished, but the pumping station is needed because of the depth of the sewer mains at the pump station.

The Davisville service area is further subdivided into three other subareas that are created by the Davisville and Commerce Park Pump Stations and the gravity component which flow directly into Pump Station DS-55. The Davisville Pier Pump Station was constructed in 1987 to collect wastewater from the Davisville Waterfront District. The wastewater is pumped through an 8-inch diameter force main that is connected to a 12-inch diameter gravity main located along Northrup Road. The Kiefer Park Pump Station was constructed in 2011 and was designed to collect wastewater from Circuit Drive and Burlingham Ave. section of the Kiefer Park area in the Quonset District. Wastewater is pumped through a 4-inch diameter force main that is connected to the 12-inch diameter gravity main on Mainsail Road. The gravity main conveys the wastewater flow into Pump Station DS-55. The Commerce Park Pump Station was constructed in 2005 and is designed to collect wastewater from the northeastern section of the Commerce Park District and from the North Davisville District. The Commerce Park Pump Station pumps the wastewater into an 8-inch diameter force main that conveys the wastewater into the 12-inch diameter gravity located along Northrup Road. The gravity main conveys the balance of the wastewater flow into Pump Station DS-55.

The West Davisville District is conveyed by a 10-inch diameter gravity main generally located adjacent to the newly constructed Route 403 highway to a 12-inch diameter gravity main located generally along Gate Road to the 24-inch diameter gravity main on Roger Williams Way. The 24-inch diameter main conveys the wastewater to Pump Station DS-55. Wastewater from the Gateway District and from the western and southern sections of the Commerce Park District are collected by a series of gravity sewers ranging in size from 12 to 21 inch diameter pipes into the 24-inch diameter pipe along Roger Williams Way.

Quonset Collection System

The Quonset service area is bounded on the north by Fry's Pond and Northrup Road and Callahan Road, on the east by the Quonset State Airport, on the south by Zarbo Avenue and on the west by Kiefer Park. The eastern section of the Quonset District and the Airport District is gravity fed to the WWTF by an 18-inch diameter sewer main which runs along Airport Street traveling under cross wind runway at the Quonset State Airport to the WWTP. This gravity main continues along Zarbo Avenue and discharges into the WWTF.

North Kingstown

Over the last forty-nine years, the Navy granted permission to individuals from North Kingstown to connect into its wastewater collection system. The sewered area is limited to the area in and around the Quonset Business Park (QBP). Sewers presently service the former Navy personnel housing, several multi-family developments adjacent to Devil's Foot Road and Newcomb Road, the Quidnesset & Fishing Cove Elementary Schools, and several homes along Mark Drive, Kings Grant and Essex Village near Quidnesset School, and ASQAH apartments, Millcreek Drive area and Wickford Point. The properties connected to QDC's system are as follows:

ASQAH	Multi-Unit Apartments on ASQAH Dr., off Camp Ave., with 98 service meters
Essex Village	Multi-Unit Apartments on Newcomb Rd., with 7 service meters
Kings Grant	Multi-Unit Apartments, Newcomb Rd., with 1 service meter
MHRH	Shore Court Housing, off Post Rd., with 1 service meter
Kingstown Heights	Private Homes, 134, 146 and 168 Mark Dr., with 3 service meters
Fishing Cove School	Public School, 110 Wickford Point Rd., with 2 service meters
Quonset School (SOROCO)	Public School, Camp Ave., with 1 service meter
Quidnesset School	Public School at 166 Mark Dr., with 2 service meters

Phoenix Properties (Heritage)	Multi-Unit Apartments, 552 Devils Foot Rd., 580 Devils Foot Rd., 0 Union Dr., 24 Union Dr., 46 Unit Dr., 59 Union Dr., with 8 service meters
Lischio/Moran	Future Multi-Unit development, previous drive-in, Namcock Rd., with a previously purchased capacity flow of 72,000 gallons per day
Travelers Aid	Multi-Unit Housing, Navy Dr. off Devils Foot Rd., with 1 service meter
G. Grossmans	Multi-Unit Apartments on Cattail Ln., Mill Creek Dr., Ripple Ln., Waterwheel Ln., off Camp Ave., with 73 service meters
Wickford Point	Private Homes, Harbor Ct., Lands End Dr., Sea Grass Way, Wickford Point Rd., with 94 service meters
Lischio	Private Home, 165 Namcook Rd., and Multi-Unit Apartments, 620 Devils Foot Rd., 660 Devils Foot Rd., 604 Devils Foot Rd., 604 BD A Devils Foot Rd., 604 BD B Devils Foot Rd., with 6 service meters
North Kingstown Transfer Station	Davisville Rd.

3.4.3 Infrastructure Evaluation

Collection System

In December 2008, QDC undertook an extensive infiltration and inflow CCTV video inspection of their collection system. As a result of that report, QDC has addressed the following areas:

1. Sealed sewer manholes in the areas influenced by groundwater and titles.
2. Installed waterproof manhole covers in flood zones;
3. Lined approximately 10,500 linear feet of sewer mains identified as being in poor structural condition and with a considerable amount of infiltration along Airport Street, Zarbo, Avenue, Roger Williams Way and McNaught Street; and
4. Replaced seriously deteriorated collections systems in Commerce Park and the former Davisville Construction Battalion area with new, and extended sanitary service to the easterly portion of the Commerce Park area, which was formerly serviced by septic systems and cesspools.

Pump Stations

Davisville Pump Station (DS-55)

The Davisville Pump Station (DS-55) is located on the south side of the golf course, north of Toray Plastics. Wastewater from Kiefer Park and the North and West Davisville area north of the pump station and from the Davisville Pier area flows to the wetwell in the Davisville Pump Station. The pump station is a wetwell/drywell design, with two end-suction centrifugal pumps discharging to a 14-inch force main. This force main heads south around the west side of the airport to the treatment plant. Wastewater that is pumped through the force main can be discharged into either the influent wetwell or into the channel just prior to the aerated grit chamber's influent channel of the treatment facility.

Wastewater enters the Davisville Pump Station via gravity from the collection system entering the wetwell's west side of the pump station, where it first flows through either a manually-cleaned bar rack or a comminutor. From the bar rack or comminutor, the wastewater is pumped to the treatment facility.

In 1999, this station was upgraded with the installation of two 1,200 GPM variable speed pumps. The pumps were designed with the ability to be upgraded to 1,800 GPM by changing the *impellers and motors*. The pumps are located in the basement of the pump station on the drywell side. These pumps are vertically mounted end-suction centrifugal type sewage pumps that draw wastewater from a common suction header and discharge into a common discharge header. During the upgrades, provisions were made to accommodate the installation of a third pump.

The Davisville Pump Station is equipped with a radio telemetry system to monitor alarm conditions and transmit them to the wastewater treatment plant's alarm system. The two alarm points that are monitored are the run/off status of the emergency generator wetwell levels, and the presence/absence of incoming utility power. As alarm conditions occur, their status is displayed on the main monitoring panel located in the office of the treatment plant's Operations Building. A 75-kilowatt (kW) standby engine generator provides emergency power in the event of a power failure.

A review of the operating data for calendar years 2006 through 2010 (Table 3-7) finds that flows at DS-55 average 0.288 MGD (200 gpm) over that period.

TABLE 3-7 DS-55 OPERATING CONDITIONS (2006 THROUGH 2010)				
Year	Minimum	Maximum	Total	Average
2006	0.290	0.046	4.471	0.373
2007	0.073	0.468	3.495	0.291
2008	0.250	0.408	3.765	0.314
2009	0.142	0.325	2.942	0.245
2010	0.110	0.433	2.608	0.217
AVERAGE	0.173	0.416	3.456	0.288

Flow data provided by QDC Wastewater Treatment Facility

3.5 EXISTING WASTEWATER TREATMENT FACILITY

The QDC WWTF was originally constructed in the 1940s by the Navy to serve the former naval base. In 1992, the WWTF was upgraded to accommodate an average daily hydraulic flow of 2.6 MGD, a RIDEM permitted average daily flow (based on theoretical organic loading) of 1.78 MGD and a peak of 3.56 MGD from the QBP. A process flow schematic and site plan is shown in Figures 3-13 and 3-14 respectively.

The facility was originally designed for a permitted hydraulic capacity of 2.6 MGD (6.5 MGD peak) and a corresponding organic capacity for BOD and TSS of 6,505 lbs./d. Due to monetary constraints, QDC eliminated one RBC train. This resulted in a reduction in the facility's BOD and TSS loading to 4,454 lbs./d. However, the process equipment remains fixed to meet the 2.6 MGD hydraulic capacity. As the following sections will show, the equipment can handle the higher flow of 2.6 MGD with TR-16 requirements.

3.5.1 Existing Wastewater Flow and Organic Loadings

A review of operating data for the calendar years 2006 through 2010 (Table 3-8) finds that the average daily effluent flow conditions, including infiltration, entering the facility is 0.488 MGD, with a corresponding maximum daily flow of 0.695 MGD.

During that same period, the corresponding influent and effluent BOD₅ and TSS are presented in Table 3-9 and Table 3-10. The average influent for BOD₅ and TSS is 271.8 mg/l and 385.2 mg/l, respectively. The higher than normal concentration is due to the high presence of septage waste received at this facility.

Figure 3-13

North Kingstown Wastewater Facilities Plan

QDC Wastewater Treatment
Plant Process Flow Schematic

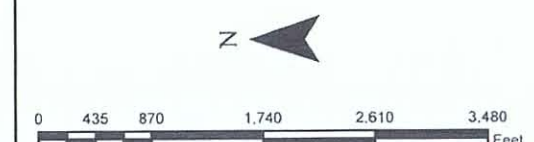
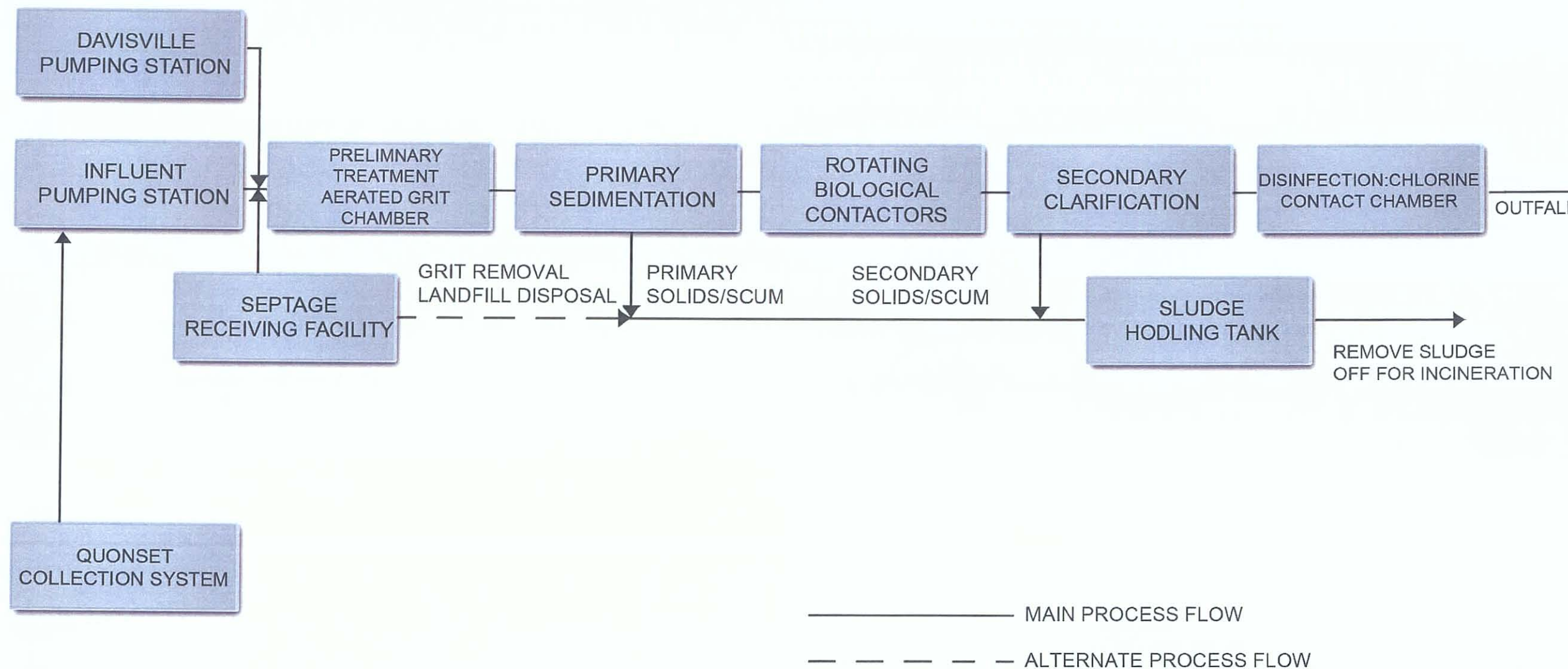
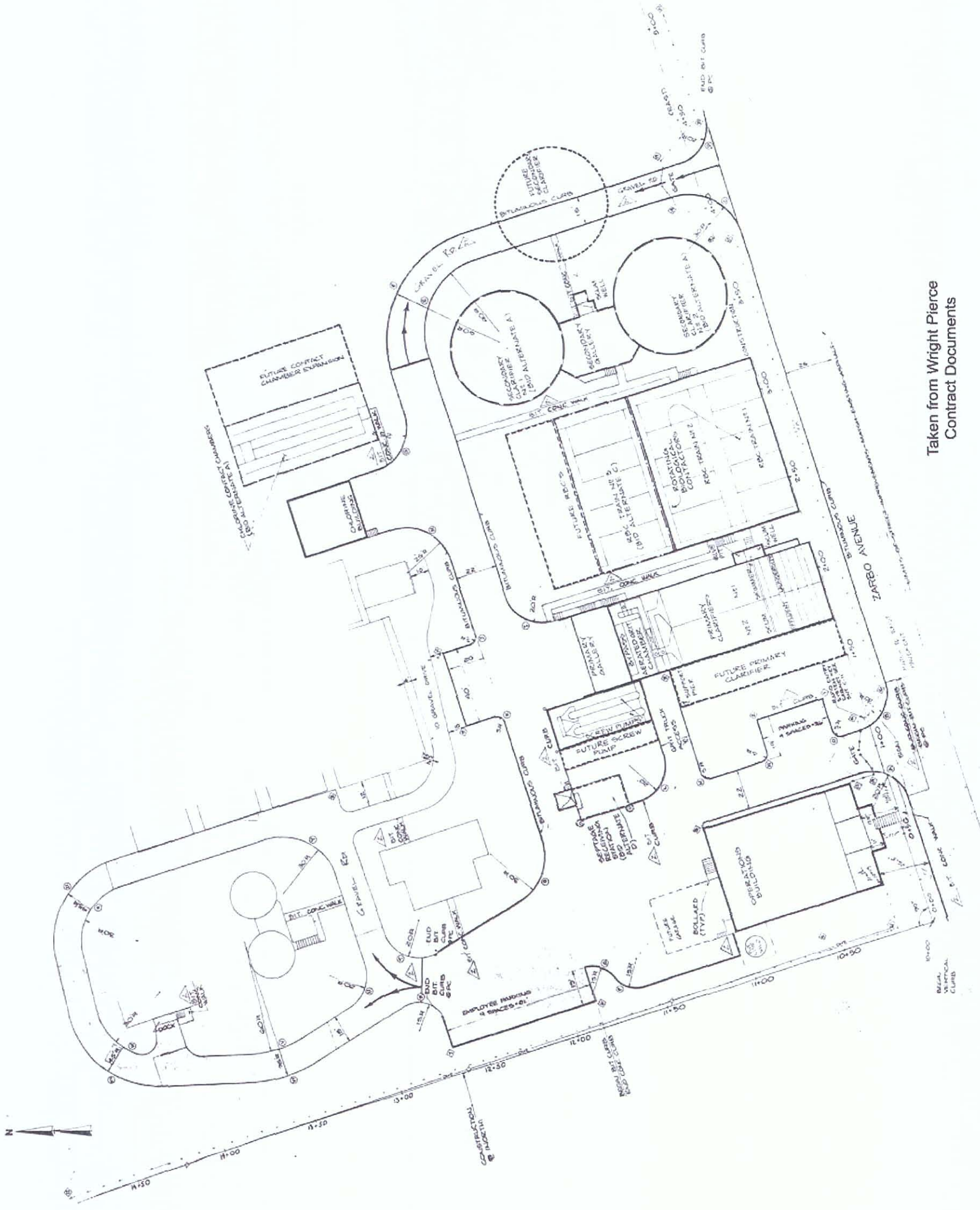


Figure 3-14

North Kingstown Wastewater Facilities Plan

QDC Wastewater Treatment Plant
Site Plan



Taken from Wright Pierce
Contract Documents



TABLE 3-8 WASTEWATER EFFLUENT FLOWS (MGD) - 2006 THROUGH 2010				
Year	Minimum	Maximum	Total	Average
2006	.422	.685	6.581	.548
2007	.343	.747	5.902	.492
2008	.362	.656	5.940	.495
2009	.345	.553	5.493	.458
2010	.297	.837	5.354	.446
AVERAGE	.354	.695	5.855	.488

TABLE 3-9 TOTAL INFLUENT BOD ₅ AVERAGE (mg/l) - 2006 THROUGH 2010			
Year	Minimum	Maximum	Average
2006	190.2	336.3	250.7
2007	164.8	549.8	327.7
2008	177.3	371.5	281.2
2009	168.7	328.8	227.9
2010	167.5	407.9	262.5
AVERAGE	173.7	398.8	270.0

TABLE 3-10 TOTAL INFLUENT TSS AVERAGE (mg/l) - 2006 THROUGH 2010			
Year	Year	Year	Year
2006	226.3	450.9	323.8
2007	260.8	598.8	386.1
2008	202.7	472.2	363.2
2009	229.7	1,201.9	437.7
2010	285.2	600.5	415.4
AVERAGE	240.9	664.8	385.2

Table 3-11 provides a summary of the septage loading for that period. If the septage was removed, the influent loading would be reduced to the following: BOD would be 257 mg/l and TSS would be 113 mg/l.

TABLE 3-11 AVERAGE SEPTAGE LOADING - 2006 THROUGH 2010			
Year	gpd	BOD (mg/l)	TSS (mg/l)
2006	9,283	4,358.9	11,574.4
2007	9,094	4,231.8	11,644.8
2008	9,580	3,705.1	10,184.2
2009	8,032	2,967.4	11,731.7
2010	8,325	2,927.3	11,715.7
AVERAGE	8,862	3,638	11,370

3.5.2 Existing Conditions

As previously indicated, the phased construction of a secondary treatment facility was constructed to service projected flows from the Quonset Business Park and a limited number of North Kingstown residential users. The treatment schematic consists of an aerated grit chamber, comminution and primary sedimentation followed by Rotating Biological Contactors (RBCs), secondary sedimentation and disinfection prior to discharge. Primary and secondary sludge was to be managed through aerated storage and dewatering using a belt filter press. Disposal was planned to be carried out via landfilling at one of the existing solid waste management facilities in the State.

The planned phase construction included an initial upgrade to 2.6 MGD (average) with subsequent expansion to 3.9 MGD (average). Due to a lack of existing flows from the industrial park, as well as financial constraints, the Quonset Development Corporation (QDC) scaled back the 2.6 MGD upgrade to its current capacity of 1.78 MGD. This reduction resulted in the elimination of a third RBC train from the original design plans.

Other final design components that were eliminated as part of the reduced scope included the deletion of the belt press and related sludge processing facilities. As a result of the elimination of the dewatering system, the facility applied for and was granted an Order of Approval to continue using the existing sludge drying beds with onsite land application of the dried sludge. Since the initial Order of Approval, the facility has elected to contract with a private company to haul (off-site) their liquid sludge for incineration. One existing anaerobic digester was converted into a sludge holding tank in 1988 to permit the solids to become concentrated to approximately 5 percent solids.

The WWTF is designed for 85 percent removal of raw BOD₅ and Total Suspended Solids (TSS) at influent loading of 4,154 pounds per day.

The plant design is intended to satisfy the discharge permit that requires a monthly average of daily average effluent BOD₅ and TSS not to exceed a concentration of 30 mg/l each.

3.5.3 Unit Process Assessment

3.5.3.1 Influent Pumping

The QDC Wastewater Treatment Facility receives its influent from two sources. Gravity sewers bring the flow from the Quonset Business Park area to the Plant, where it is lifted by the influent pump station to the preliminary treatment facilities. The balance of the influent is pumped via a 14-inch force main from the Davisville Pump Station (Building DS-55). The force main can either discharge into the Plant at a point just upstream of the aerated grit chamber or a valve can be opened to allow it to discharge into Manhole 302, which will route the flow to the influent pump station. Because of the head available from the Davisville Pump Station, it is not necessary to use the influent pump station to lift the flow. However, routing the force main flow through the influent pump station does allow the pump on/off fluctuations at the Davisville Pump Station to be significantly dampened.

The influent pump station consists of six submersible pumps, four 10HP pumps and two 3.2HP pumps. For isolation purposes, a set of pumps consists of two 10HP pumps and one 3.2HP pump.

The submersible pumps lift the wastewater approximately 32 feet to the aerated grit chamber influent channel. This lift provides the capability to discharge Plant flow through the downstream processes by gravity during a 100-year storm event.

In addition to the influent wastestream flows from the dewatering lines of the primary clarifiers, RBC basins, secondary clarifiers and chlorine contact chambers also enter the pump influent channel.

3.5.3.2 Preliminary Treatment

The preliminary treatment involves passing the raw sewage which enters the plant via screw lift pumps through an existing 20-inch channel sized for capacity of 9 MGD followed by the comminutor and aerated grit chamber. The comminutor shreds larger debris into small pieces that can be carried with the wastewater into the aerated grit chamber. The grit is removed from the system into a container for ultimate disposal. The performance of this system is adequate to meet the current treatment requirements.

3.5.3.3 Preliminary Sedimentation

The primary treatment portion of the WWTF consists of two (2) rectangular primary settling tanks having dimensions of 85-feet long by 20-feet wide and 10.4-feet sidewater depth (SWD) each. The tanks have been designed to provide approximately 55% of suspended solids (SS) and 40% BOD₅ removal. The current operation of the primary settling tanks does not present any problems. The WWTF currently operates satisfactorily within permit limitations with the units on line. The summary of permitted conditions, present operating conditions, original design conditions, and their comparison with the TR-16 design criteria is presented in Table 3-12.

TABLE 3-12 PRIMARY CLARIFIERS OPERATING CRITERIA					
Criteria		Permitted Conditions	Present Conditions	Original Design Conditions	Various Design Guidelines
Flow (MGD)	Average	1.78	0.446	2.6	
	Peak	4.48	1.15	6.5	
No. of Units		2	1	2	
Total Tanks Volume (gals.)		264,000	132,000	264,000	
Total Surface Area (sf)		3,400	1,700	3,400	
Tank Dimensions (each) – L x W (ft.)		85 x 20	85 x 120	85 x 120	
Sidewater Depth (ft.)		10.4	10.4	10.4	>8 ^{1, 2}
Avg. Detention Time (hr.)		3.6	7.1	2.4	1.5 – 2.5 ^{2, 3}
Suspended Solids	Average	3,670	1,616	--	
	Peak	7,339	1,853	--	
Surface Overflow Rate (gal/d/sf)	Average	58	262	765	1,000 ⁴
	Peak	1,318	67689	1,912	2,250 ⁴

¹ ASCE, *Manuals and Records of Engineering Practice – No. 36 – Wastewater Treatment Plant Design*, 1998

² New England Interstate Water Pollution Control Commission, *Guides for the Design of Wastewater Treatment Works*, 1998

³ EPA, *Inspectors Guide for Evaluation of Municipal Wastewater Treatment Plants*, 1979

⁴ Median value of published parameter

3.5.3.4 Rotating Biological Contactor

The RBC process requires the biological growths to accumulate on the surfaces of the RBC media. As this growth continues to remove organics, the thickness of the growth will increase. At some point, the growth will become heavy and slough off of the RBC media. This growth (known as secondary sludge) flows out of the RBC tanks with the wastewater and is removed from the flow in the secondary clarifier.

The RBC has been sized on a maximum hydraulic loading of 1.8 gpd/sf and 7.2 lbs/sf or organic (BOD₅) loading. Each RBC train contains five RBC shafts. The first three shafts each contain 100,000 square feet of media area, while each of the last two shafts contains 150,000 square feet of media area. The basins

are designed so that approximately 40 percent of the media disc diameter is submerged. The existing two trains are adequate to be the design loading 2,890 lbs. per day at a hydraulic loading of 1.78 MGD.

Table 3-13 presents a comparison between the original design parameters to present conditions and TR-16 design criteria.

TABLE 3-13 ROTATING BIOLOGICAL CONTACTOR (RBC) OPERATING CRITERIA COMPARISON				
Criteria		Design Condition	Present Condition	Various Design Guidelines
Flow (MGD) ¹	Average	1.78	0.446	
	Peak	4.48	1.15	
Total Basins Volume (1,000 gal.)		70.4	70.4	
Media Surface Area (1,000 sf)		950	950	
First Stage Surface Area (1,000 sf.)			400	
Detention Times (hrs.)	@ Avg. Flow		1.53	
	@ Peak Flow		1.25	
BOD ₅ Applied (lb/d)	Average	2,211 ⁴	1,659 ⁴	
BOD ₅ Load (lb/d/1,000 sf.)	@ Avg. Flow	7.2	2.7	
				2,400 ^{2,3} 6 – 6.4 ^{2,3}

¹ Without recycle

² ASCE, Manuals and Records of Engineering Practice – No. 76 – Wastewater Treatment Plant Design, 1998

³ New England Interstate Water Pollution Control Commission, Guides for the Design of Wastewater Treatment Works, 1998

⁴ Design BOD = 1.78 MGD x 260 mg/l BOD design concentration less 40% removal in Primary Settling Tanks
Present BOD = 1.275 MGD x 260 mg/l BOD actual (less 40% removal in Primary Settling Tanks)

3.5.3.5 Secondary Clarifiers

The secondary clarifier tanks consist of two (2) circular tanks having dimensions of 60-feet in diameter and sidewater depth (SWD) of 13-feet. The mixed liquor from the RBC flows through Distribution Structure No. 1. This structure can divert the flow to both or one settling tank. The mixed liquor enters the 60-foot unit through a center feedwell.

The current operation of the secondary clarifier tank does not present any problems. The upgrades to the secondary clarifiers have resulted in improved performance, which has resulted in the facility's ability to run one clarifier with the second unit off-line. Only during extreme rain events are both clarifiers on line. With one unit in operation, the WWTF operates within permit limitations. The summary of the present and original design parameters, the permit conditions, and their comparison with the TR-16 design criteria is presented in Table 3-14.

**TABLE 3-14
SECONDARY CLARIFIERS OPERATING CRITERIA**

Criteria		Permitted Conditions	Present Conditions	Original Design Conditions	Various Design Guidelines
Flow (MGD)	Average	1.78	0.446	2.6	
	Peak	4.48	1.15	6.5	
No. of Units		2	1	2	
Total Tanks Volume (gals)		550,375	275,190	550,375	
Total Surface Area (sf)		5,660	2,830	5,660	
Sidewater Depth (ft)		13	13	13	≥ 10 ^{1,2}
Avg. Detention Time (hr.) ¹	Average	8	15	5	400 – 800 ²
	Peak	3	6	2	
Surface Overflow ³		311	158	459	
Rate (gal/d/sf)		792	406	1,148	1,000 – 1,200 ²

¹ ASCE, Manuals and Records of Engineering Practice – No. 76 – Wastewater Treatment Plant Design, 1998

² TR-16, New England Interstate Water Pollution Control Commission, Guides for the Design of Wastewater Treatment Works, 1998

³ One unit on line

Settled sludge is collected from the tank bottom by means of a circular clarifier sludge collection mechanism. The collection mechanism consists of four (two full length, two short) rake arms mounted on and rotating about the center column of the tank at a rate of about one revolution each hour.

Settled sludge, to be wasted from the process, is plowed to a hopper located in the tank bottom near the center column. This plowing action is accomplished by a series of diagonally placed scraper blades mounted on the underside of the rake arms. This sludge is periodically withdrawn by pumping via 6-inch suction lines and wasted to the mixed sludge well.

3.5.3.6 Disinfection System

The original chlorine gas system that provided disinfection was replaced with a sodium hypochlorite (hypo) disinfection system. The hypochlorite is stored in a polyethylene storage tank located in the Chlorine Room. Two chemical metering pumps pump the hypochlorite from the tank to the chlorine contact tank, where the hypochlorite is mixed into the Plant effluent with a mechanical mixture.

Control of Plant effluent disinfection is accomplished with an automatic hypo feed system. This system utilizes chlorine residual analyzer and Plant effluent flow signals to continuously adjust the hypo feed rate. The system includes low and high chlorine alarms that are annunciated on a local alarm panel and at the Main Monitoring Panel.

Sodium Hypochlorite is a solution of sodium hypochlorite in water. The solution is typically 12–15% hypochlorite as available chlorine. At 12.5% available chlorine weights, one gallon of sodium hypochlorite is approximately ten (10) pounds and contains the equivalent of approximately 1.2 pounds of chlorine gas in terms of disinfecting power.

The sodium hypochlorite is stored in a 1,150 gallon polyethylene storage tank.

The contact chambers consist of two tanks having a combined volume of 86,170 gallons. Based upon the required thirty (30) minutes contact time in the chlorine tank, the maximum allowable flow at the plant is currently 4.48 MGD (see Table 3-15).

TABLE 3-15 EFFLUENT DISINFECTION					
Criteria		Design Conditions	Present Condition	Original Design Conditions	Various Design Guidelines
Flow (MGD)	Avg. Daily	1.78	0.446	2.6	
	Peak Hourly	4.48	1.15	6.5	
Total Tank Volume (gal.)		86,170	86,170	172,340	170,000
No. of Units		2	2	4	
Detention Time (min.)	Avg. Daily	71	278	95	
	Peak Flow	28	108	48	30
Chlorine Requirements (gph)		10	3	15	30

3.5.3.7 Wastewater Treatment Plant Outfall

The existing plant outflow consists of a new 200 linear foot section of 30-inch reinforced concrete pipe that joins a 1,100 linear foot section of 21-inch concrete pipe. The 21-inch pipe connects to the adjacent airport stormwater drainage system at a 30-inch concrete pipe along Runway 16-34 of the Quonset State Airport prior to discharging through a headwall into Narragansett Bay. The capacity of the 21-inch pipe section is 6.5 MGD though its carrying capability may be influenced by tidal elevations and stormwater flows.

3.5.3.8 Solids Handling Facilities

As a result of the elimination of the solids handling upgrade in 1992, the existing anaerobic digester was converted into a sludge holding tank under a separate contract. The tank is used to concentrate its sludge to approximately 5% solids. The thickened sludge is then hauled off-site by a private contractor for incineration.



4.1 FUTURE LAND USE

The Facilities Plan will focus on the continuing development of the Post Road Corridor element of the Town's Comprehensive Plan (Village District) to encourage mixed-use development within existing neighborhoods, revitalizing Wickford Village as the center of the Town, and respond to the request of specific neighbors where there have been chronic on-site treatment system failures. The remainder of the Town will continue following the Wastewater Management Ordinance. To that end, the twenty year planning period for the conventional wastewater needs will focus on:

- Post Road Corridor (Figure 4-1);
- Wickford Village/Poplar Point (Figure 4-2); and
- Shore Acres (Figure 4-3).

The land use information for each of these areas is presented in Table 4-1.

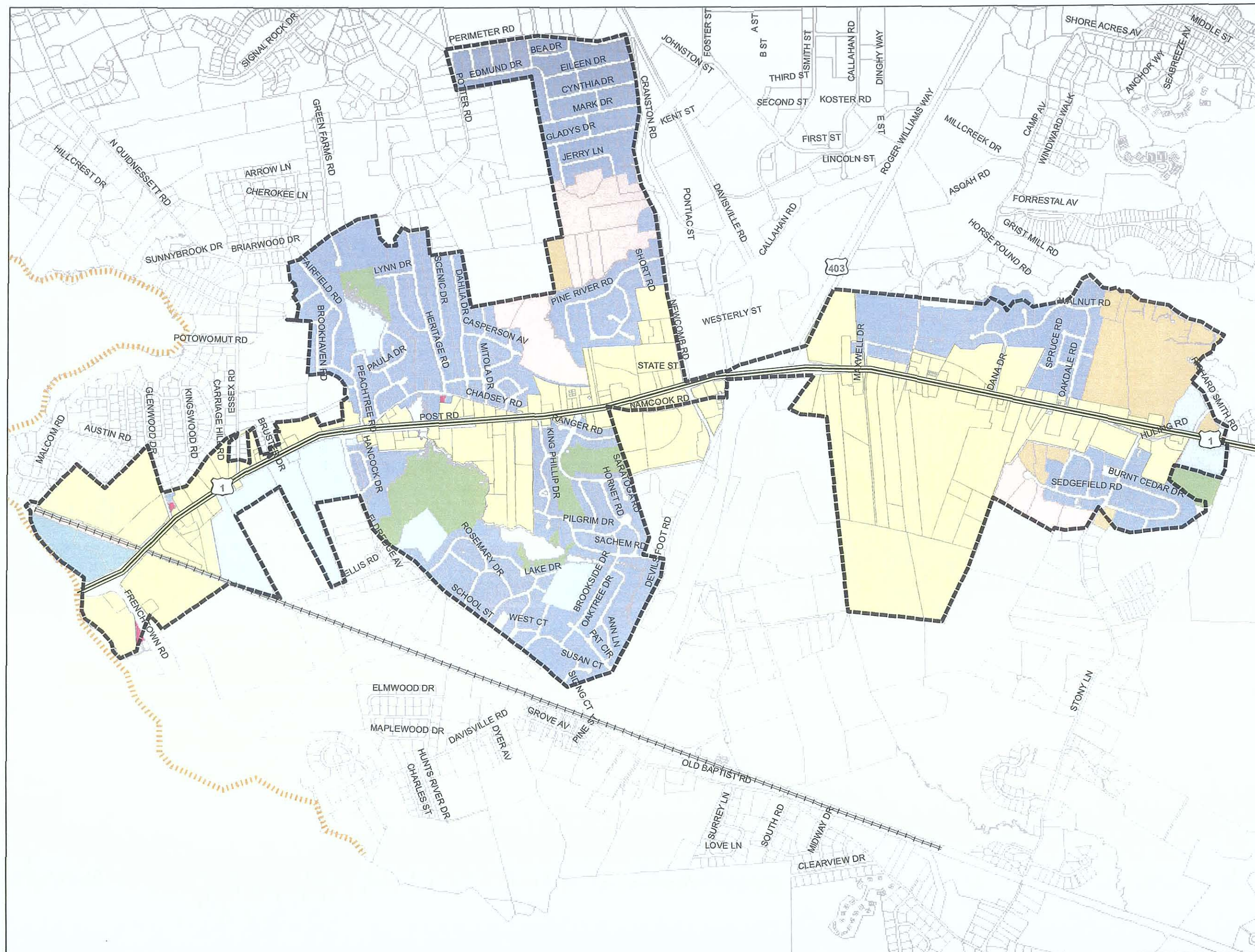
TABLE 4-1 FUTURE LAND USE					
Type	Acres	Type	Acres	Type	Acres
<u>Post Road Corridor</u>		<u>Wickford Area</u>		<u>Shore Acres Area</u>	
Commercial (Post Rd. District)	510	General Business	18	Village Residential	187
High Density Residential	59	General Industrial	1	Open Space	18
Medium Density Residential	108	Neighborhood Business	14	Institutional/Office	6
Low Density Residential	10	Neighborhood Residential	97		
Parks/Recreation	14	Open Space	180		
Open Space	30	Public	34		
Heavy Business	15	Planned Village District	26		
Gateway	55	Village Residential	280		
Cemetery	63	Waterfront Business	13		
		Wickford Village Commercial	1		
TOTAL	864	TOTAL	664	TOTAL	211

One area identified for a potential growth center is within the Quonset/Davisville vicinity along Post Road. This area is targeted to be oriented towards the creation of economic development opportunities at the Quonset Gateway parcel, and high-density infill redevelopment of aging properties having frontage on Post Road as well as the property to the rear of those parcels. Another area identified is the Reynolds Farm/Oakdale Road Village Center which is oriented towards long term controlled development of

Figure 4-1

North Kingstown Wastewater Facilities Plan

Future Land Use
Post Road Corridor



- Features**
- Railroad
 - Post Road Corridor
 - Town Boundry
 - Project Area
 - Post Road District(Adopted 8/10)
- Parcels**
- <all other values>
- Land Use**
- General Industrial
 - Heavy Business
 - Heavy Business UL
 - Light Industrial
 - Neighborhood Residential
 - Open Space
 - Public
 - Public Residential
 - Rural Residential
 - Village Residential

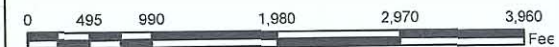


Figure 4-2
**North Kingstown
 Wastewater
 Facilities Plan**
 Future Land Use
 Wickford Village/Poplar Point Area



- Features**
- Railroad
 - Post Road Corridor
 - Town Boundary
 - Wickford/Poplar Point Area
- Parcels**
- <all other values>
- Land Use**
- General Business
 - General Industrial
 - Neighborhood Business
 - Neighborhood Residential
 - Open Space
 - Public
 - Planned Village District
 - Village Residential
 - Waterfront Business
 - Waterfront VC

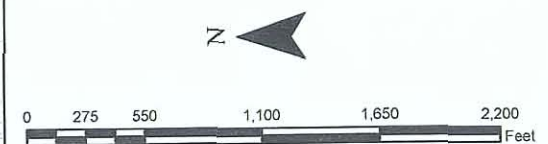
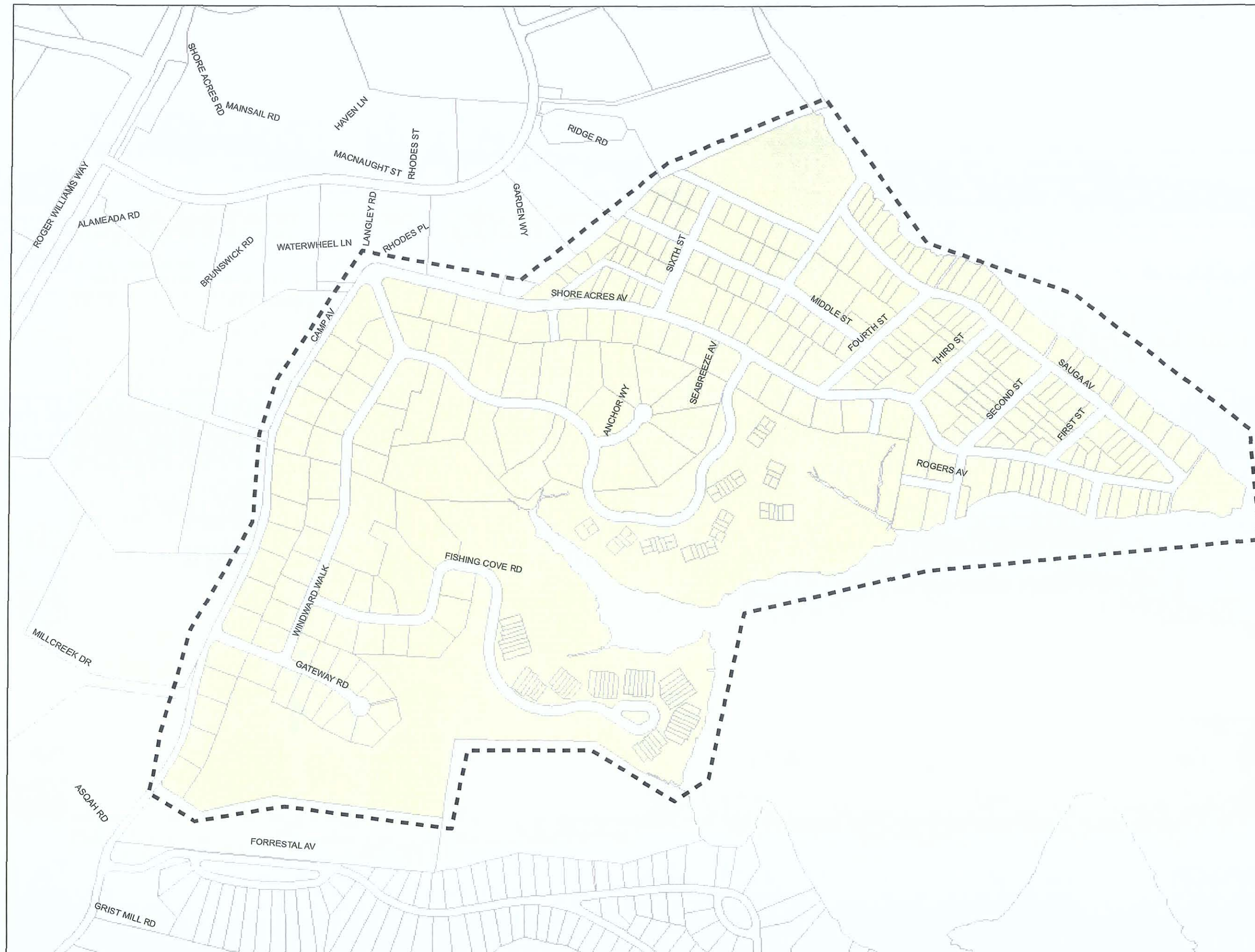


Figure 4-3

North Kingstown Wastewater Facilities Plan

Future Land Use
Shore Acres



- Features**
- Railroad
 - Post Road Corridor
 - Town Boundry
 - wickford area
- Parcels**
- Land Use**
- Open Space
 - Village Residential

Existing land use mapping has been compiled by James J. Geremia & Associates from data provided by the Town of North Kingstown Planning Department



vacant and underutilized properties at increased density, as well as the updating of aging public infrastructure and utilities. Planning for the long-term generation of village growth centers will allow for a more consistent placement of retail, office and residential uses that concentrate pedestrian intensive areas together.

The proposed growth centers will also support the growth associated with the Quonset Business Park. According to the 2008 Quonset Master Plan prepared by the Maguire Group, future industrial and commercial development is projected to generate a total 12,646 jobs at the site over the next 20 years. This total includes the over 7,968 existing employees and nearly 4,678 additional employees on the vacant and developable land. It can be reasonably assumed that many of these employees currently utilize the retail and service business located just outside of QBP on Post Road. In order for Post Road to accommodate the future growth at QBP, the development of walkable village centers is crucial for the area's economic and environmental sustainability.

The Town has recently developed guidelines and zoning changes to improve the conditions along the Post Road Corridor. The regulation changes allow for higher density commercial and residential development and provide the opportunity to cultivate walkable village centers that are economically successful and architecturally pleasing.

4.2 FUTURE SEWERED POPULATION AND SERVICE AREA

4.2.1 Flow From Existing Units

Sewage flow to the Quonset Wastewater Treatment Facility, from the expansion of sewers into the Town, is based on sewerage the Post Road Corridor (North and South), Wickford Village/Poplar Point Area and Shore Acres Area. The two components which make up the wastewater flow are the commercial and residential areas combined with the existing sewer population. Present development data was used to determine a base wastewater flow. Average daily residential flows are based on the total number of housing units with an assumed occupancy of 2.7 persons per unit and a daily per person wastewater contribution of 67 gallons. This wastewater flow was determined from actual water consumption data (Table 3-4) and discounting it by 15% to account for outside water usage divided by the number of users (1,532). Due to the changes in the Town's Zoning Ordinance, it has not been determined what impact those changes will have on the commercially-zoned land. Therefore, for the purpose of projecting wastewater flows, this report will use the industry standard of 775 gallons per developed acre per day, as

utilized by QDC, to determine future commercial flows within Post Road. For the purpose of this report, the commercial component will be composed of land designated as Planned Village District, Neighborhood Commercial and Commercial. The commercial flows within the Wickford Area will be based on actual water consumption, as the area is fully built out. An estimated length of gravity lateral and interceptor sewers in each area was first determined. Being that sewer laterals represent the majority of the installed pipe length, an average pipe diameter of 8-inches was then assumed and a factor of 150 gal/in. dia./mile of sewer was applied for infiltration/inflow.

4.2.2 Design Flows

4.2.2.1 North Kingstown Future Design Flows

There are 240 acres of commercial/mixed use-zoned land within the Post Road North Segment (excluding areas under agreement with Quonset Development Corporation (QDC), the Gateway and all public land), and 285 acres within the Post Road South Segment. In view of the Town's plans to increase the commercial activities along Post Road and increase the residential development density, the entire 525 acres of commercial/mixed use-zoned land is proposed to be sewered over the next twenty years. There are 34 acres of commercial zoned land and 13 acres of waterfront business zoned land for the Wickford Village/Poplar Point Area. For the purpose of projecting future flows, this report will use 775 gallons per acre, regardless of whether the land contains a structure or not within the Post Road Corridor and the actual water usage for the Wickford Village/Poplar Point. Boat slip flows in the Wickford Village/Poplar Point Area are based on 450 boat slips at 10 gallons per day per boat slip. Table 4-2 provides a breakdown of the commercial flow.

TABLE 4-2 COMMERCIAL/MIXED USE WASTEWATER PROJECTIONS							
Area	Post Road District Acreage	Heavy Business Acreage	Commercial Acreage	Waterfront Business Acreage	Total Acreage	Developable Acreage ³	Project Flow (GPD)
Post Road North ¹	225	15			240	204	158,100
Post Road South ¹	285				285	242	187,550
Sub-Total	510	15			525	446	345,650
Wickford Vil./Poplar Pt. Area ²			34	13	47	40	30,300
TOTAL	510	15	34	13	572	486	375,950

¹ Flow is based on 775 gallons per acre per day

² Flow is based on actual water usage for commercial and 10 gallons per day for 450 boat slips

³ Assumed 15% of land will be utilized for roadways and common land

Source: North Kingstown Planning Department

The Town has identified the residential areas within the Post Road Service Area which abut the commercial properties as a subsequent phase of the sewer plan for the Post Road Corridor. These areas have been defined as:

- North 1:** This area encompasses School Street (to the north and west) and Route 403 (Devil's Foot Road) to the south.
- North 2:** This area is situated between Post Road (to the west), Brookhaven Road (to the north) and Newcomb Road (to the south).
- North 3:** This area is situated between Potter Road (to the south and east), Jerry Lane (to the west) and Cranston Road (to the south).
- South 1:** This area is situated between Post Road (to the east) and Sedgefield Road (to the west).
- South 2:** This area is situated between Post Road (to the west), Dana Road (to the north) and Oakdale Road (to the south)

Traditionally, future design flows consider the increase in population and new development through the planning period to contribute to the future design flows. However, in this situation, when existing neighborhoods are being considered, the approach is slightly different. For the purpose of planning, it is assumed that all of the existing 2,395 residential lots of record either have an existing dwelling unit on it or have the potential to construct one. Based on the occupancy of 2.7 persons per dwelling unit, the future residential sewer population is 6,467 persons. Based upon a wastewater consumption of 67 gallons per person per day, this then translates to a wastewater flow of 433,256 gallons per day. Table 4-3 provides a complete breakdown of the residential flows.

TABLE 4-3 RESIDENTIAL USE WASTEWATER PROJECTIONS			
Area	Parcels ¹	Connected Population	Projected Flow ² (GPD)
Post Road North ³	1,152	3,110	208,397
Post Road South	179	483	32,381
Wickford Vil./Poplar Pt. Area	720	1,994	130,248
Shore Acres	344	929	62,230
TOTALS	2,395	6,467	433,256

¹ Parcels provided by North Kingstown Planning Department

² Flow is based on 67 gpcpd x population

³ Includes Pinewood and Mark Drive residential areas

The total projected design year average daily flow is summarized in Table 4-4 as 828,106 gallons per day. Peak sanitary flows from various areas are used to determine the size of collection sewers and the required

TABLE 4-4 PROJECTED AVERAGE DAILY FLOW FROM PROPOSED SEWERED AREAS – DESIGN YEAR 2030							
Area Name	Number Residential Units	Number Commercial Acres	Est. Length of Sewer (mi.)	Residential Flow (GPD) ¹	Commercial Flow (GPD) ²	Inflow/ Infiltration (MGD) ⁴	Total Flow (GPD)
Post Road North	1,152	204	13	208,397	158,100	3,900	370,397
Post Road South	179	242	4	32,381	187,550	3,000	222,931
Wickford Vil./Poplar Pt. Area ³	720	40 units	7	130,248	30,300	8,000	168,548
Shore Acres	344		4	62,230	0	4,000	66,230
TOTALS	2,395	486	28	433,256	375,950	18,900	828,106

¹ Residential Flow = # units x 2.7 persons per unit @ 67 gpcpd

² Commercial Flow = # acres x 775 gal/acre/day

³ Commercial Flow = based on actual water usage and 450 boat slips x 10 gpd/boat slip

⁴ Infiltration/Inflow = 150 gal/in. dia./mile

hydraulic capacity of treatment units. Based on the total estimated design average daily flow of 0.828 MGD, the peak hourly sewage flow from the Town is estimated to be 2.5 times the average flow (or 2.07 MGD).

4.2.2.2 Quonset Business Park (QBP) Future Design Flows

The QBP has estimated that the remaining 467.8 acres of land yet to be developed will produce a projected employment of 4,678 persons (based on 71 gallons per person of wastewater). The projected wastewater flow will be 332,138 gallons per day. Infiltration for this area is estimated to be approximately 150 gpd/acre. Based on the 467.8 acres, this totals an additional 70,170 gpd of flow. The balance on the contractual wastewater commitment to Toray Plastics of 43,000 gpd, future wastewater flow reserved for high volume commercial users has been identified as 300,000 gpd. Table 4-5 illustrates that QDC will require 1,233,308 gallons per day at full build-out of QBP.

**TABLE 4-5
QBP FUTURE FLOWS**

Existing Wastewater Flow Total 5-Year Average 488,000 gpd

Projected Wastewater Flow

Infiltration/Inflow	Unit (gpd/acre)	Developed Land (acres)	I/I Flow (gpd)
	150	467.8	70,170
Projected Employment	Number	Flow/Employee	Flow
	4,678	71	332,138
Future Processing			300,000
Future (Toray Plastics) contractual commitment			43,000

Sub-Total Projected Wastewater Flow 745,308 gpd
Total Wastewater Flow **1,233,308 gpd**

Future Wastewater Flows for the Town of North Kingstown

The total projected average daily flow from the Town of North Kingstown is projected to be 828,106 gpd. Table 4-4 provides a breakdown of this flow by residential and commercial area.

The Town has bond authorization to construct Post Road South sewers for the commercial area.

The future wastewater needs of the QBP of 1.233 MGD is within the current permitted flow. As the Town considers additional flow above the 0.20 MGD, that will require QDC requesting permit modifications. RIDEM would be required to consider a hydraulic and organic loading *from the treatment facility*.

Based upon these conditions, QDC projects future flows will be 1.433 MGD, which remains below the permitted capacity of the Treatment Facility.

The following sections will evaluate the wastewater collection system and treatment facilities for the total future needs of QDC (1.233 MGD) and the Town (0.828 MGD). The minimum future design will be 2.061 MGD, however, due to the incremental design conditions of the original plan, a future capacity of 2.6 MGD will be used as the new design capacity.

4.2.3 Future North Kingstown Wastewater Collection System

4.2.3.1 Post Road South Wastewater Collection System

The Post Road South Wastewater Collection System will serve 285 acres of commercial land and 179 residential dwelling units. The collection system for Post Road South will consist of conventional gravity sewers on Post Road, and two (2) pump stations. The abutting residential neighborhood will consist of conventional gravity sewers, one (1) pump station and low pressure sewers with grinder pumps.

Pump Station S-2 will serve the area from Dana Avenue south to the Rhode Island State Police Barracks, consisting of 49 acres of commercial/mixed use land and 179 residential dwelling units within the Post Road Corridor (Oakdale Rd. and Dana Dr. neighborhood to the east and Stoney Land and Sedgefield Rd. neighborhood to the west of Post Road), including all of the flows from the Wickford Village/Poplar Point Area. The pump station will be located in the vicinity of the State Police Barracks and will be required to accommodate an average flow of 234,529 gpd and a peak daily flow of 586,510 gpd (410 GPM). The location of this station will be designed to accommodate future wastewater flows from the Wickford Village/Poplar Point Area. The 8-inch force main from Pump Station S-2 will traverse along Post Road in a northerly direction to Dana Avenue where it will connect into a gravity interceptor sewer for connection into Pump Station S-1. The total length of the force main is approximately 8,300 linear feet. An 8-inch gravity sewer will be installed along Post Road to convey the wastewater from Dana Avenue south. The sewer will collect commercial wastewater along Post Road. The Stoney Land and Sedgefield Rd. area will be served by pressure sewers and grinder pumps discharging to the Post Road gravity sewer. The Oakdale Rd. and Dana Dr. area will consist of gravity sewers, low pressure sewers and one (1) pump station.

Pump Station S-1 will be sized to service the commercial/mixed use along Post Road from Dana Drive south to Route 403, plus the wastewater flows generated from Post Road S-2 Pump Station. Pump Station S-1 will have a design capacity of 725 gpm. Pump Station S-1 will be located off of Camp Avenue approximately 200 feet east from Post Road on Tully Road and will service 285 acres of commercial/mixed use land along Post Road, 179 residential dwelling units, and the Wickford Village/Poplar Point Area. An 8-inch force main will traverse along Camp Avenue in an easterly direction and terminate at the existing sewer manhole on ASQAH Drive. The total length of the force main is approximately 3,600 linear feet. An 8-inch gravity sewer will be installed along Post Road from Route 403 to Camp Avenue and a 12-inch gravity interceptor sewer will be installed from Camp Avenue to Dana Avenue.

4.2.3.2 Post Road North Wastewater Collection System

The Post Road North Wastewater Collection System will serve 240 acres of commercial land and 1,152 residential dwelling units. The collection system for Post Road North will consist of conventional gravity sewers on Post Road, three (3) pump stations, and low pressure sewers with grinder pumps in the residential areas.

Pump Station N-3 will serve the commercial land along Post Road from Namcook Road to Newcomb Road, consisting of 14 acres. The pump station will be located in the vicinity of the intersection of Namcook Road, Newcomb Road and Post Road and will be required to accommodate an average flow of 9,300 gpd and a peak daily flow of 31,206 gpd (22 GPM). The 4-inch force main will traverse along Newcomb Road in an easterly direction for approximately 500 linear feet and connect to the existing sewer manhole.

Pump Station N-2 will serve the area from Frenchtown Road to Peachtree Road consisting of 171 acres of commercial land and 170 residential dwelling units within Hancock Drive and Peachtree Road areas. The pump station will be located on Post Road near Peachtree Road. The average sewage flow generated by this area is 146,200 gpd with an associated peak flow of 411,300 gpd. Pump Station N-2 will have a design capacity of 411,300 gpd (285 GPM). An 8-inch force main will traverse along Post Road and terminate at the proposed sewer manhole at the high point on Post Road near Chadsey Road (southerly entrance). The total length of the force main is approximately 2,400 linear feet. The Hancock Drive and Peachtree Road areas will consist of pressure sewers connecting to the gravity sewer on Post Road. A 10-inch gravity sewer will be installed along Post Road.

Pump Station N-1 will serve the area from Frenchtown Road to Yorktown Road, which includes the Pump Station N-2 service area. The residential areas on the east side and west side of Post Road will be served by pressure sewers connecting to the 12-inch gravity sewer on Post Road. Pump Station N-1 will serve 226 acres of commercial land and 1,081 residential dwelling units. The average daily flow for Pump Station N-1 service is 0.348 MGD with an associated peak daily flow of 0.93 MGD. Pump Station N-1 will have a capacity of 0.93 MGD (646 gpm). An 8-inch force main will traverse along Post Road in a southerly direction to Newcomb Road. It will then traverse along Newcomb Road and terminate at the existing sewer manhole. The total length of the force main is 2,200 linear feet.

Pine River Road Area: The Pine River Road area is a residential area bordered to the south by Newcomb Road and Pine River Road to the north. This residential area consists of 71 residential units within the Pine River Road, Shore Road, Knollwood West and East, and Knollwood Circle. This area will connect to the existing sewer system located on Newcomb Road via pressure sewers.

Mark Drive Area: The Mark Drive area is a residential neighborhood which is bordered to the north by Potter Road, to the south and east by Newcomb Road, and to the west by Jerry Lane. The Mark Drive neighborhood has a history of subsurface sewage disposal system problems due to unsuitable soil conditions. The area includes the Quidnessett Elementary School, which is presently tied into the QPD collector system. The school and three homes along Mark Drive are serviced by a lift station that was designed and built in 1970. The pump station is fitted with two (2) 200 GPM submersible pumps giving the station a peak capacity of 0.29 MGD. The capacity of the station is adequate to service the projected 125 homes in the study area and provide continued service to existing users. However, over the past five years, this station has been plagued with operational problems. The dry pit chamber has deteriorated over time. The age of the station, combined with the lack of alarms and standby power, leads to the recommendation to completely rebuild the station. Consideration should be given to converting the existing wetwell into a submersible pump station and installing two (2) submersible chopper pumps. The upgrade will also include a new electrical service, pump controls, emergency bypass, standby generator and remote alarms to a central monitoring station. Average daily design year flows from new users are expected to reach 0.023 MGD with peak flows approaching 0.06 MGD.

4.2.3.3 Wickford Village/Poplar Point Wastewater Collection System

The Wickford Village/Poplar Point Wastewater Collection System will serve 34 acres of developed commercial land, 13 acres of business waterfront, marinas with a total of 450 boat slips, Town Hall, North Kingstown Library, North Kingstown Police Department, the Middle School, the former Wickford Elementary School and 720 residential dwelling units. The collection system will consist of conventional gravity sewers, six (6) pump stations, and low pressure sewers with grinder pumps. The Wickford Village/Poplar Point sewer system will connect to the Post Road South sewer system in the vicinity of the State Police Barracks.

The Brown Street Pump Station (North) will serve commercial establishments on Brown Street from the Wickford Cove Crossing to Franklin Street. The pump station will be located on Town property. The 2-inch force main will traverse along Brown Street in a southerly direction to the Brown Street Pump Station (South).

The Brown Street Pump Station (South) will serve the Brown Street Pump Station (South) service area as well as commercial establishments on Brown Street (from Franklin Street to Phillips Street) and residential units on Franklin Street, Elan Street and Phillips Street (from Boone Street to Brown Street). The Brown Street Pump Station (South) will have a design capacity of 30 GPM. The pump station will be located on Brown Street near Phillips Street. The 2-inch force main will traverse along Phillips Street to a sewer manhole located near Boone Street. The total length of the force main is approximately 1,100 linear feet.

The Beach Street Pump Station will serve the Poplar Point area consisting of 155 residential units and the Wickford Shipyard with 168 boat slips. The Poplar Point area will consist of gravity sewers that will discharge to the Beach Street Pump Station located in the vicinity of Beach Street and Steamboat Avenue. The 3-inch force main will traverse along Beach Street to a sewer manhole on Boston Neck Road. The approximate length of the force main is 1,500 linear feet. The Beach Street Pump Station will have a design capacity of 62 GPM.

The Boston Neck Road Pump Station will serve residential units along Boston Neck Road, Oakland Avenue, Matteson Street, Gregory Avenue, Reynolds Street, Town Hall, a marina at the end of Reynolds Street, as well as the Beach Street Pump Station service area. The Boston Neck Road Pump Station will have a capacity of 40,000 gpd (80 GPM). The pump station will be located on Town property. The 4-inch force main will cross Wickford Cove attached to the existing bridge. The force main will then traverse along

Phillips Street to a sewer manhole near Boone Street. The approximate length of the force main will be 1,900 linear feet.

The Phillips Street Pump Station will serve the Boston Neck Road Pump Station and Brown Street South Pump Station service area, as well as an area consisting of Dean Avenue, Collation Drive area, Tower Hill Road, Phillips Street, Boone Street and Cranston Circle. The Phillips Street Pump Station will have a capacity of 263,043 gpd (183 GPM). The 4-inch force main will traverse along Boone Street to Tower Hill Road and then along Tower Hill Road northerly for approximately 1,000 linear feet to a gravity sewer manhole. The total length of the force main is approximately 2,400 linear feet.

The Main Street Pump Station will serve 9 acres of commercial land, marinas with 131 boat slips, and 166 residential dwelling units. The service area consists of West Main Street, Main Street, Church Lane, Washington Street area, Fowler Street/Pleasant Street area, and the Enfield Drive/Ocean Avenue area. The service area will consist of a gravity sewer system and a low pressure sewer system within the Enfield Drive/Ocean Avenue area. The pump station will be located at the end of Main Street. The 4-inch force main will traverse along Main Street and West Main Street to Tower Hill Road. The total length of the force main is 4,500 linear feet. The average daily flow for the Main Street Pump Station is 38,400 gpd with an associated peak daily flow of 111,700 gpd. The Main Street Pump Station will have a capacity of 111,700 gpd (78 GPM).

4.2.3.4 Shore Acres Wastewater Collection System

The Shore Acres Wastewater Collection System will serve 344 residential dwelling units located on Camp Avenue from Wickford Point Road to Shore Acres Avenue, Gateway Road, Fishing Cove Road, Windward Walk, Seabreeze Drive, Anchor Way, Shore Acres Avenue, Kingsley Avenue, Middle Street, Sauga Avenue, First Street, Second Street, Rogers Avenue, Third Street, Fourth Street, Fifth Street and Sixth Street. The collection system for Shore Acres will consist of conventional gravity sewers, four (4) pump stations and low pressure sewers with grinder pumps. The Shore Acres sewer system will tie into the existing chamber on A.S.Q.A.H. Drive.

The Fishing Cove Pump Station will serve 63 residential units along Fishing Cove Road which includes 53 Cedar Hurst Condominium units. The pump station will have a capacity of 46,300 gpd (32 GPM). The Fishing Cove Pump Station will be located at the end of Fishing Cove Road. The 2-inch force main will

traverse along Fishing Cove Road to Windward Walk. It will then traverse along Windward Walk to Gateway Road. The total length of the force main is 2,800 linear feet.

The Seabreeze Pump Station will serve 50 units of the Cedar Hurst Condominiums and an additional 31 residential dwelling units. The pump station will be located on Seabreeze Drive near Landing Lane. The capacity of the Seabreeze Pump Station will be 59,300 gpm (41 GPM). The 2-inch force main will traverse easterly along Seabreeze Drive to Shore Acres Road. The approximate length of the force main is 400 linear feet.

The Sauga Drive Pump Station will serve the Seabreeze Pump Station service area including the Shore Acres Avenue/Sauga Avenue area. The services are 280 residential dwelling units. The average daily flow generated by this area will be 53,900 gpd with an associated peak daily flow of 153,300 gpd. The Sauga Drive Pump Station will have a design capacity of 155,300 gpd (110 GPM). The 4-inch force main will traverse along Fourth Street to Shore Acres Avenue. On Shore Acres Avenue, the force main will traverse northerly to its point of termination at Camp Avenue. The approximate length of the force main is 3,100 linear feet.

The Camp Avenue Pump Station will serve the Shore Acres wastewater collection system consisting of 344 residential dwelling units. The Camp Avenue Pump Station will be located on Gateway Road. The 4-inch force main will traverse along Camp Avenue to A.S.Q.A.H. Drive and connect to the existing chamber. The average daily flow to the pump station will be 66,800 gpd with an associated peak daily flow of 191,200 gpd. The Camp Avenue Pump Station will have a capacity of 191,200 gpd (135 GPM).

4.2.3.5 Future Improvements to the Existing Pump Station owned by the Town

4.2.3.5.1 Wickford Point Pump Station

The Wickford Point Pump Station is located south of Route 403 and connects to QDC's wastewater system at A.S.Q.A.H. Road. This pump station services the Wickford Point neighborhood that is comprised of ninety-six (96) single family homes and the Fishing Cove Elementary School. The pump station, which was installed by the Navy in the mid-1960's, was updated in the 1990's to service the newly developed housing subdivision. Currently, the station is rated at 310 gpm @ 60 ft. TDH. The station discharges through a 6-inch force main which runs 3,000 linear feet northerly along Wickford Point Road before crossing Camp Avenue connecting into the A.S.Q.A.H. manhole.

The approved plans retrieved from QDC did not reflect the actual improvements that were made to the pump station during the 1990's upgrade. The two significant deviations from the approved plans were the type of pump and generator replacement.

The plans indicated that the new pump set would be a submersible style pump (15 HP, 480 volt, 3-phase with a TDH of 66.5 feet), and the generator was to be placed inside the existing structure.

Pump Assessment

The two pump sets currently in use at this station are dry pit submersible type pumps, each rated at approximately 300 gpm. Each pump motor is 7.5 HP, 1704 gpm, 208 volt, 3-phase. Based on the serial number, the manufacturer was able to identify that the pumps were sold in 1989.

In general, the pumps appear to be in fair condition. The access to the pumps is limited to a 2' x3' grate in the floor of the Control Room. The Pump Room is located ten-feet (10') below the control room. The constraints to access the Pump Room make the maintenance of the pumps very difficult. There is a sump pump located in the Pump Room that discharges into the wetwell.

When inspected, there were several inches of water on the floor. While checking the sump pump, we were unable to activate the sump pump with the floats.

Control Room

The Control Room is partially below grade. During the 1990 upgrades, a bulkhead-type entrance door was installed. The bulkhead shows signs of corrosion (several of the steps had corroded through).

The Control Room has a small unit heater to maintain minimal temperatures during the winter season. The unit heater is in poor condition and shows sign of corrosion. At the time of the inspection, the heater was unable to be run.

The ventilation system located in the Control Room provides ventilation for the Pump Room and Control Room. The system's intake and exhaust louvers are located on the north and south sides of the structure. During the inspection, the ventilation system was inoperable. The exterior sides of the louvers are less than one-foot (1') above finish grade. This has allowed rodents to enter the station.

Access Hatches (Roof)

The access hatches are located over each compartment (Control Room, Wetwell and Comminutor Pit). The hatches are extremely difficult to operate due to their weight and the hydraulic hinges that should assist with opening the hatches have failed. Once open, the hatch openings contain no safety features, such as safety grates or railings (as required by OSHA).

Wetwell

The wetwell is fed by two (2) 8-inch AC gravity lines which enter the chamber from the north and south sides. Access to the floats was inaccessible because the placement of the grating platform is located below the invert of the influent sewer. This configuration makes it impossible to work within the wetwell without being covered with sewage. The plans indicate that there are four (4) level sensors with internal mercury switches to control the operation of the pumps and alarms. The four sensors were not visible and have not been tested, but the pumps do operate in an apparent response to the sensor. The alarms are local only and neighbors have heard it sounding.

Comminutor Pit

The comminutor pit was taken out of service during the 1990 upgrade.

Site

The pump station is located within the sewer easement for this development. The station is secured with a chain link fence with material woven through the fence to block the view of the station. Surrounding the fence, there is heavy vegetation to further block the view of the station. Inside the fenced area, access is limited to a 3-foot (3') walking path around the structure. The limited access around the station makes it extremely difficult to properly maintain the site. The site, as currently configured, will not permit access to the wetwell by a vactor truck. If access is required to maintain the pump station, the fence and shrubs will have to be cleared.

The site does not have perimeter lighting. The lack of perimeter lighting is hazardous if emergency work needs to be performed during the nighttime.

Electrical

Power Assessment: A 120/208 Volt 3-phase, 4-wire main service is derived from a pad-mounted utility transformer located just outside of the pump station's fence. The service runs underground from the transformer pole into the pump station and to a 400A automatic transfer switch. From the automatic transfer switch, the service feeds into 200A panelboard with a 200A main circuit breaker.

The panelboard has a 30A, 3-pole circuit breaker that provides power to the pump control panel and has 1-pole branch circuit breakers that provide power to lighting, receptacles, unit heaters, and a ventilation fan.

In general, the entire electrical equipment appears to be in good to fair condition, but the environment inside the pump chamber is damp and is not suitable for the type of electrical equipment enclosures mounted within it. Currently, there are no major signs of corrosion on the equipment but, over time, with this type of environment, one can anticipate that corrosion will emerge.

Lighting Assessment: The Control Room lighting system consists of linear fluorescent light fixtures that are in fair condition. The station does not have site lighting, lighting in the wetwell, or emergency egress lighting.

The Pump Room light fixtures are in poor condition and show signs of corrosion. During the inspection, the lights in the Pump Room were unable to be turned on.

Generator Assessment: The pump station is equipped with a 40KW outdoor diesel engine generator located behind the pump station. The generator provides power to the entire pump station through the automatic transfer switch via underground conduit/cable. The diesel fuel is stored in a 30 gallon single-wall tank located on the unit.

The generator is in absolute poor condition and cannot be considered reliable. The generator enclosure is currently not weatherproof and does not have any sound attenuation to prevent a nuisance to neighbors when running.

Raceways and Miscellaneous Items Assessment: The pump station raceway system consists mostly of electric metallic tubing conduit which appears to be in fair condition with some signs of corrosion. Receptacles and switches are in fair condition.

Instrumentation Assessment: A pump control panel has a main disconnect switch and two motor starters to provide power to each of the sewage pumps. Float switches located in the wetwell are wired back to the pump control panel to start/stop the pumps. The alarm functions at the station are only local indicators. The operators are unaware of any problems with the station until a resident calls alerting them to the condition.

The pump control panel appears to be in fair condition.

4.3 QDC COLLECTION SYSTEM

All of the wastewater collected in the QDC's West Davisville, North Davisville, Davisville Waterfront, Commerce Park and Executive Park and the existing flows from the Town is conveyed to the Wastewater Treatment Facility through the Davisville Pump Station (DS-55), which is located off Roger Williams Way, adjacent to the North Kingstown Golf Course. DS-55 is presently fed by a 3,400 foot section of 24-inch interceptor in Roger Williams Way and an 8-inch force main extending from the Davisville Pier Pump Station. Wastewater is conveyed to the Treatment Facility via a 14-inch force main. The 24-inch interceptor and 14-inch force main have maximum design capacities of approximately 3.6 MGD.

The Town's flow will enter the QDC collection system from one of two points (Figure 4-4). Flows from the north will be introduced into the QDC system on Newcomb Rd. where it will flow through Commerce and Executive Parks, ultimately entering Roger Williams Way at Manhole No. D-56. Flows from the south will be introduced into QDC's system at A.S.Q.A.H. Dr. through a 10-inch gravity line, which enters Roger Williams Way at Manhole D-57. The flow combines at Manhole No. D-57 before entering the Davisville Pump Station (DS-55).

4.4 EVALUATION OF EXISTING INFRASTRUCTURE

4.4.1 QDC Collection System

The Quonset Development Corporation's (QDC) wastewater collection system has been analyzed to determine its adequacy to transport the existing and future flows from QDC along with North Kingstown's future flows.

The capacity of the pipe sections was computed using Manning's equation for circular pipes flow full and was used in the formula.

Figure 4-4

North Kingstown Wastewater Facilities Plan

Quonset Development
Corporation's Wastewater
Collection System & Town
Tie-In

Prepared By
James J. Geremia & Associates

Legend

Features

- RailRoad
- Town Boundry
- Post Road Corridor
- Wetlands
- wastewater
 - <all other values>
- fm
 - Gravity
 - Force Main



Plan



0 435 870 1,740 2,610 3,480 Feet



$$Q = (1.49 A/n) R^{2/3} S^{1/2}$$

Where:

- Q = discharge (cfs)
- A = cross section area (ft²)
- n = Manning roughness coefficient (dimensionless)
- R = hydraulic radius (ft), pipe diameter/4 for pipes flowing full
- S = slope of the pipe (ft/ft), assumed parallel to the hydraulic grade line

The roughness coefficient used in this analysis was 0.013 and is a standard design value. All pipe diameters and slopes were obtained from the QDC wastewater collection plans. Table 4-6 compares the future peak flows to the design capacities for each sewer segment. Each sewer segment consists of various sizes and slopes, resulting in a variation in capacities with each segment. The capacities shown in Table 12 represent the lowest capacities.

TABLE 4-6 FUTURE CAPACITIES OF THE QUONSET DEVELOPMENT CORPORATION'S SEWER SYSTEM				
Location	Size	Future Flows (MGD)	Capacity ¹ (MGD)	Total Build-Out
MH 25-0 to Newcomb Rd.	8" and 12"	1.16	0.53 and 1.16	Inadequate
MH 25 to MH 25-0	18"	1.28	1.97	Adequate
MH D57 to MH 25	24"	1.80	4.06	Adequate
Diversion Chamber to D57	24"	3.69	2.12	Inadequate
DS 55 to Diversion Chamber	24"	3.69	5.47	Adequate

¹ Capacity of 8" – 12" pipe based on 60 percent pipe flow and pipes greater than 12" are based on 70 percent pipe flow.

The Town of North Kingstown has available bonding in place for Post Road South Commercial and Shore Acres Area. Therefore, additional priorities were given to determine when the existing sewer mains would become inadequate.

Newcomb Road: The existing 8-inch sewer on Newcomb Road will need to be replaced with a new 12-inch sewer at full build-out. The capacity of the new 12-inch sewer will be 2.26 MGD. The existing 8-inch sewer will be inadequate for Post Road North Phase 1 flows. The peak daily flow with Post Road North Phase 1 will be 1.16 MGD which is greater than the capacity of 0.41 MGD.

MH 25-0 to Newcomb Road: The existing 8-inch and 12-inch sewer mains within the Quonset Business Park (QBC) will need to be replaced from MH 25-0 to MH 25-P3. QDC will be relocating and replacing this sewer as part of the Gateway Project. The new line will be an 18-inch sewer connecting to MH 25. The

existing sewer main will be inadequate for Post Road North Phase 1 construction flows. The peak daily flow with Post Road North Phase 1 construction will be 1.16 MGD.

Mark Drive Area: The QDC's existing 10-inch sewer line is within the future Gateway Project and is scheduled to be relocated and upgraded with a new 12-inch sewer. The capacity of the new 12-inch sewer will be 2.22 MGD.

A.S.Q.A.H. Drive: The existing 10-inch sewer along A.S.Q.A.H. will need to be replaced with a new 12-inch sewer that will have a capacity of 1.58 MGD. The existing sewer main will be adequate for the Post Road South Phase 1 sewer project as the peak daily flow is 0.53 MGD, however, with the addition of either Post Road South Phase 2 and/or Shore Acres, the existing sewer will be inadequate.

Diversion Chamber to D57: The existing 24-inch sewer is inadequate to handle the total future flows. A new, larger capacity sewer line will be installed to replace the existing 24-inch sewer. A diversion structure will be installed at D57 which will allow 1.37 MGD to go through the existing 24-inch sewer and 3.02 MGD will flow through a new 18-inch parallel sewer. The capacity of the new 18-inch sewer main will be 3.30 MGD. The existing sewer main will be adequate to handle flows from Post Road South Commercial and Residential and Shore Acres Area which has a projected peak daily flow of 1.07 MGD. The existing sewer main will not be adequate for any additional flows generated from the Wickford Village/Poplar Point Area and build-out at QDC.

Davisville Pump Station (DS-55): The Davisville Pump Station is responsible to pump approximately 58% (715,318 gpd) of the wastewater flows generated at the Quonset Business Park (QBP) and 100% of the flows generated by the Town of North Kingstown (828,000 gpd). The average daily flow at build-out will be 1,540,000 gpd (1,070 gpm) and the corresponding peak flow will be 3.85 MGD (2,673 gpm). The current pumping capacity of 1,200 gpm (one pump running / one pump standby) will have the ability to handle wastewater flows from QDC, Post Road South Commercial and Residential and Shore Acres Area with a corresponding flow of 691,200 gpd average and 1,728,000 gpd peak (1,200 gpm). In order to receive flows above the peak daily flow of 1,728,000 gpd, the pump station will have to be upgraded. During the 1999 upgrade, the pumps selected have the ability to be upgraded to 1,800 gpm with provision for a third pump. Based on the projected peak flow at full buildout of 3.86 MGD, the pump station will be upgraded with the pumps rated to handle 1,350 gpm per pump and the installation of a third pump rated at 1,350 gpm to meet the requirements of handling peak flows with one pump as standby. At that point, the station will have the

capacity of 5.18 MGD. In addition to the installation of the pumps, a new well must be constructed to allow for sufficient capacity.

4.4.2 QDC Wastewater Treatment System

As previously stated, the Town will initially generate approximately 187,550 gpd for Post Road South Commercial area; this combined with QBP's future need of 1,233,308 gpd will not require expansion of the Treatment Facility until the Town requests permission to connect subsequent phases into the system. As the Town's wastewater needs exceed 200,000 gpd, the Town will become responsible for the expansion of the wastewater treatment facility and the corresponding infrastructures owned by QDC. The build-out of all phases of the Town's wastewater program will generate 0.828 MGD over the next twenty years and QBP will generate 1.233 MGD. Table 4-7 summarizes the present and future wastewater design flows.

TABLE 4-7 SUMMARY OF FUTURE WASTEWATER DESIGN FLOWS	
Area	Gallons Per Day (GPD)
QBP Present Flows	488,000
QBP Future Flows	745,670
North Kingstown Flows	828,106
TOTAL	2,061,776

Since the build-out capacity would not occur instantaneously (for either the Town or QDC), the expansion to 2.6 MGD will be phased in once North Kingstown reaches its allowable capacity of 0.20 MGD. The phased approach will allow the Town to begin the development of the Post Road South Project without expanding the Treatment Facility.

4.5 FUTURE WASTEWATER TREATMENT FACILITIES

4.5.1 Influent Pumping System

The influent pumping system consists of submersible pumps rated for a total capacity at 4.11 MGD each. The addition of flows from the Town will not affect the sizing of these facilities because 95% of the flow will pass through DS-55 which will bypass the influent pump chambers. Due to the sizing of the submersible pumps, they are not affected by the additional flows from the Town and were not included in the upgrade scenarios presented herein.

4.5.2 Preliminary Treatment

Aerated Grit Chamber: The initial design report prepared by Wright Pierce states that the existing aerated grit chamber will handle a peak flow of 9 MGD, which translates to a detention time of three (3) minutes. This falls within the TR-16 recommended range of 2 to 5 minutes. Based upon TR-16 criteria, the existing volume of 18,500 gallons and the corresponding future peak flow of 13.2 MGD will result in a detention time of 2.02 minutes, which also is within the operating range. The 13.2 MGD coincides with the maximum peak flow. Based upon this assessment, the grit chamber does not need to be increased in size to accept the additional flows.

Comminutor / Influent Channel: The existing 20-inch primary channels are sized for 9 MGD peak flows.

4.5.3 Primary Clarifiers

The two existing primary clarifiers are designed to handle flows up to a 2.6 MGD average daily flow and a 6.5 MGD peak flow with corresponding overflow rates of 765 and 1,912 gpd/sf respectively. TR-16 allows settling rates, for plants of design flow above 1 MGD, up to 1,000 gpd based upon average daily flow and up to 2,250 gpd based upon peak flow. Table 4-8 summarizes the primary clarifiers' operating criteria for the future expansion.

Criteria		Design Conditions	Present Condition	Upgrade	Various Design Guidelines
Flow (MGD)	Average	1.76	0.488	2.6	
	Peak	4.48	1.15	6.5	
No. of Units		2	1	2	
Total Tanks Volume (gals.)		264,000	132,000	264,000	
Total Surface Area (sf)		3,400	1,700	3,400	
Tank Dimensions (each) – L x W (ft.)		85 x 20	85 x 120	85 x 120	
Sidewater Depth (ft.)		10.4	10.4	10.4	>8 ^{1,2}
Avg. Detention Time (hr.)		3.6	7.1	2.4	1.5 – 2.5 ^{2,3}
Suspended Solids Applied (lb/d)	Average	3,670	1,616	--	
	Peak	7,339	1,853	--	
Surface Overflow Rate (gal/d/sf)	Average	58	262	765	1,000 ⁴
	Peak	1,318	67689	1,912	2,250 ⁴

¹ ASCE, Manuals and Records of Engineering Practice – No. 36 – Wastewater Treatment Plant Design, 1998

² New England Interstate Water Pollution Control Commission, Guides for the Design of Wastewater Treatment Works, 1998

³ EPA, Inspectors Guide for Evaluation of Municipal Wastewater Treatment Plants, 1979

⁴ Median value of published parameter

4.5.4 Rotating Biological Contactors (RBC's)

The RBC sizing was based on a maximum hydraulic loading of 1.8 gpd/sf and a first stage BOD₅ loading of 6 lbs/day/1,000 sf which resulted in the following RBC design.

<u>Flow</u>	<u>No. Trains</u>	<u>No. Shafts/Train</u>	<u>Stages/Train</u>	<u>Shafts in First Stage</u>	<u>Surface Area</u>
1.78	2	5	4	2	1,200,000 sf
2.6	3	5	4	2	1,800,000 sf

A third train will need to be added to accommodate the increase in hydraulic capacity.

Table 4-9 summarizes the operating criteria to achieve an expansion of 2.6 MGD.

TABLE 4-9 ROTATING BIOLOGICAL CONTACTOR (RBC) OPERATING CRITERIA					
Criteria		Design Conditions	Present Condition	Upgrade	Various Design Guidelines
Flow (MGD) ¹	Average	1.78	0.446	2.6	
	Peak	4.48	1.15	6.5	
Total Basins Volume (1,000 gal.)		70.4	70.4	105.6	
Media Surface Area (1,000 sf)		950	950	1,425	
First Stage Surface Area (1,000 sf.)		400	400	600	
Detention Times (hrs.)	@ Avg. Flow		1.53		
	@ Peak Flow		1.25		
BOD ₅ Applied (lb/d)		1,781 ⁴	377 ⁴	2,602	6 – 6.4 ^{2,3}
BOD ₅ Load (lb/d/1,000 sf.)		4.4	2.7	4.33	

¹ Without recycle

² ASCE, *Manuals and Records of Engineering Practice – No. 76 – Wastewater Treatment Plant Design*, 1998

³ New England Interstate Water Pollution Control Commission, *Guides for the Design of Wastewater Treatment Works*, 1998

⁴ Design BOD = 1.78 MGD x 200 mg/l BOD design concentration less 40% removal in Primary Settling Tanks
Present BOD = 1.275 MGD x 169 mg/l BOD actual less 40% removal in Primary Settling Tanks

4.5.5 Secondary Clarifiers

The two existing secondary clarifiers are designed to handle flows up to 2.6 MGD average daily flow and a 6.5 MGD peak flow. This results in overflow rates of 460 and 1,148 gpd/sf for average and peak flows, respectively. This is consistent with overflow rates of 400–800 and 1,000–1,200 gpd/sf as stated in TR-16. Table 4-10 summarizes the operating criteria for the future expansion.

TABLE 4-10
SECONDARY CLARIFIERS OPERATING CRITERIA

Criteria		Design Condition	Present Condition	Upgrade	Various Design Guidelines
Flow (MGD)	Average	1.78	0.446	2.6	
	Peak	4.48	1.15	6.5	
No. of Units		2	1	2	
Total Tanks Volume (gals)		550,375	275,190	550,375	
Total Surface Area (sf)		5,660	2,830	5,660	
Sidewater Depth (ft)		13	13	13	
Avg. Detention Time (hr.) ¹	Average	8	15	5	≥ 10 ^{1, 2}
	Peak	3	6	2	
Surface Overflow ³	Average	311	158	459	400 – 800 ²
Rate (gal/d/sf)	Peak	792	406	1,148	1,000 – 1,200 ²

¹ ASCE, Manuals and Records of Engineering Practice – No. 76 – Wastewater Treatment Plant Design, 1998

² TR-16, New England Interstate Water Pollution Control Commission, Guides for the Design of Wastewater Treatment Works, 1998

³ One unit on line

4.5.6 Chlorination System

The disinfection system uses sodium hypochlorite to meet the effluent limits. The hypochlorite is stored in a polyethylene storage tank located in the Chlorine Room. Two chemical metering pumps pump the hypochlorite from the tank to the chlorine contact tank, where the hypochlorite is mixed into the Plant effluent with a mechanical mixture.

The sodium hypochlorite solution is typically 12-15% hypochlorite as available chlorine. At 12.5% available chlorine weights, one gallon of sodium hypochlorite is approximately ten (10) pounds and contains the equivalent of approximately 1.2 pounds of chlorine gas in terms of disinfecting power.

The feed system has a maximum capacity of 2,000 lbs/day which is adequate to meet maximum flow conditions. There is no concern regarding the size of the feed equipment with the additional flows from the Town.

The Chlorine Contact Chambers, on the other hand, are a limiting factor for flow capacity at the plant. RIDEM-Division of Water Resources has designated the area outside of the plant's outfall as an area suitable for shellfishing and has imposed a 30 minute chlorine contact time for the plant at peak flow. The current contact chambers consist of two (2) tanks having a combined volume of 86,170 gallons. Based upon the RIDEM contact time, the maximum allowable flow at the plant is currently 4.1 MGD. Based upon a peak flow of 6.5 MGD and tanks of similar size as those existing on site (43,085 gallons each), a total of

one (1) additional contact tank (having a volume of 50,000 gallons) would be required. Table 4-11 summarizes the operating criteria for the future expansion.

TABLE 4-11 EFFLUENT DISINFECTION					
Criteria		Design Condition	Present Condition	Upgrade	Various Design Guidelines
Flow (MGD)	Avg. Daily	1.78	0.446	2.6	
	Peak Hourly	4.48	1.15	6.5	
Total Tank Volume (gal.)		86,170	86,170	136,170	136,000
No. of Units		2	2	3	
Detention Time (min.)	Avg. Daily	71	278	72	
	Peak Flow	28	108	30	30
Chlorine Requirements (gph)		10	3	15	30

4.5.7 Wastewater Treatment Plant Outfall

The existing plant outflow consists of a new 200 linear foot section of 30-inch reinforced concrete pipe that joins a 1,100 linear foot section of 21-inch concrete pipe. The 21-inch pipe connects to the adjacent airport stormwater drainage system at a 30-inch concrete pipe along runway 16-34 of the Quonset State Airport prior to discharging through a headwall into Narragansett Bay. The Conceptual Design Report states that the capacity of the 21-inch pipe section is 6.5 MGD, though its carrying capacity may be influenced by tidal elevations and stormwater flows. The upgrade of this outfall is recommended if the plant is to exceed peak flows of 6.5 MGD. This pipe will not need to be replaced as part of the upgrade.

4.5.8 Solids Handling

As previously described, the Conceptual Design Report recommended the use of belt presses for sludge dewatering and disposal at solid waste management facilities within the State. During construction of the most recent plant upgrade, the entire system, with the exception of the Aerated Sludge Holding Tank, was deleted from the project. Because of these deletions, the use of the existing sand bed was continued in conjunction with the new aerated sludge holding tank and existing digester tanks on site for additional sludge storage.

With the reinstatement of the original upgrade, the facility would have the ability to meet the future solids handling needs and continue to use a private hauling company as an alternative means for sludge disposal.

In summary, QDC will need to undertake the following upgrades to its collection and treatment system before accepting flows which will exceed its 1.78 MGD permit condition.

1. Construct a new Diversion Structure to D57;
2. Upgrade DS-55 Pump Station; and
3. Treatment Plant Upgrades:
 - a. One (1) RBC train
 - b. Expansion of the chlorine contact tank



5.1 WASTEWATER COLLECTION SYSTEM PRELIMINARY DESIGN

5.1.1 Design and Cost Computations

The estimate of probable project construction costs have been prepared including labor, materials, and administrative expenses likely to be incurred by the Town of North Kingstown. Actual recent bid prices for similar work in the area supplemented, as appropriate, by equipment suppliers, materials suppliers, and by standard cost estimating guides to prepare the estimate of probable cost were used. The construction costs are based on 2011 costs and a corresponding Construction Cost Index of 9080.15 (as published in the Engineering News-Record). The pipe in place cost includes trench excavation and backfill, cost of pipe installation, diverting, sheeting, stone bedding, sedimentation and erosion control, pavement removal, temporary pavement, and traffic control. Rock excavation was assumed to be five percent (5%) of all excavation, and bank run gravel was assumed to be twenty percent (20%) of all excavation.

An allowance of twenty-five percent (25%) has been provided for construction contingencies. The magnitude of this contingency factor directly reflects design and construction uncertainties attributable to the lack of detailed subsurface information and planimetric and topographic mapping at this stage of the project design development.

Above-Ground Pump Stations

The above-ground pump stations will consist of a separate drywell and wetwell conforming to the Town's and the Department of Environmental Management's requirements. The pump stations have been designed to provide for telemetering of wastewater flow, alarms, etc. Each pump station will be equipped with an emergency generator for standby power and with a pump connection to be used for a portable sewage pump.

The drywell will consist of a minimum of two (2) pumps capable of passing spheres three-inches in diameter, with running meters and pressure gauges on suction and discharge piping, and a sump pump capable of passing 1½-inch solids discharging to the wetwell. Check valves will be installed on discharge piping, plug valves on suction and discharge piping. A connection will be provided on the discharge piping,

including valves and piping to be used to drain the force main. A dehumidifier, heating system, aluminum railing and ladders will be installed. A control system will be provided for the on/off control of pump operation, as well as for high and low water alarms.

5.2 FUTURE SERVICE AREA

5.2.1 Post Road South Wastewater Collection System

The Post Road South Wastewater Collection System has been divided into two (2) subareas to allow for phased construction. Figure 5-1 presents a plan of the two subareas. Figure 5-2 presents a plan for the Dana Drive and Oakdale Road Area. Figure 5-3 presents a plan for the Stoney Lane and Sedgefield Road Area.

Post Road South-1 (S-1)

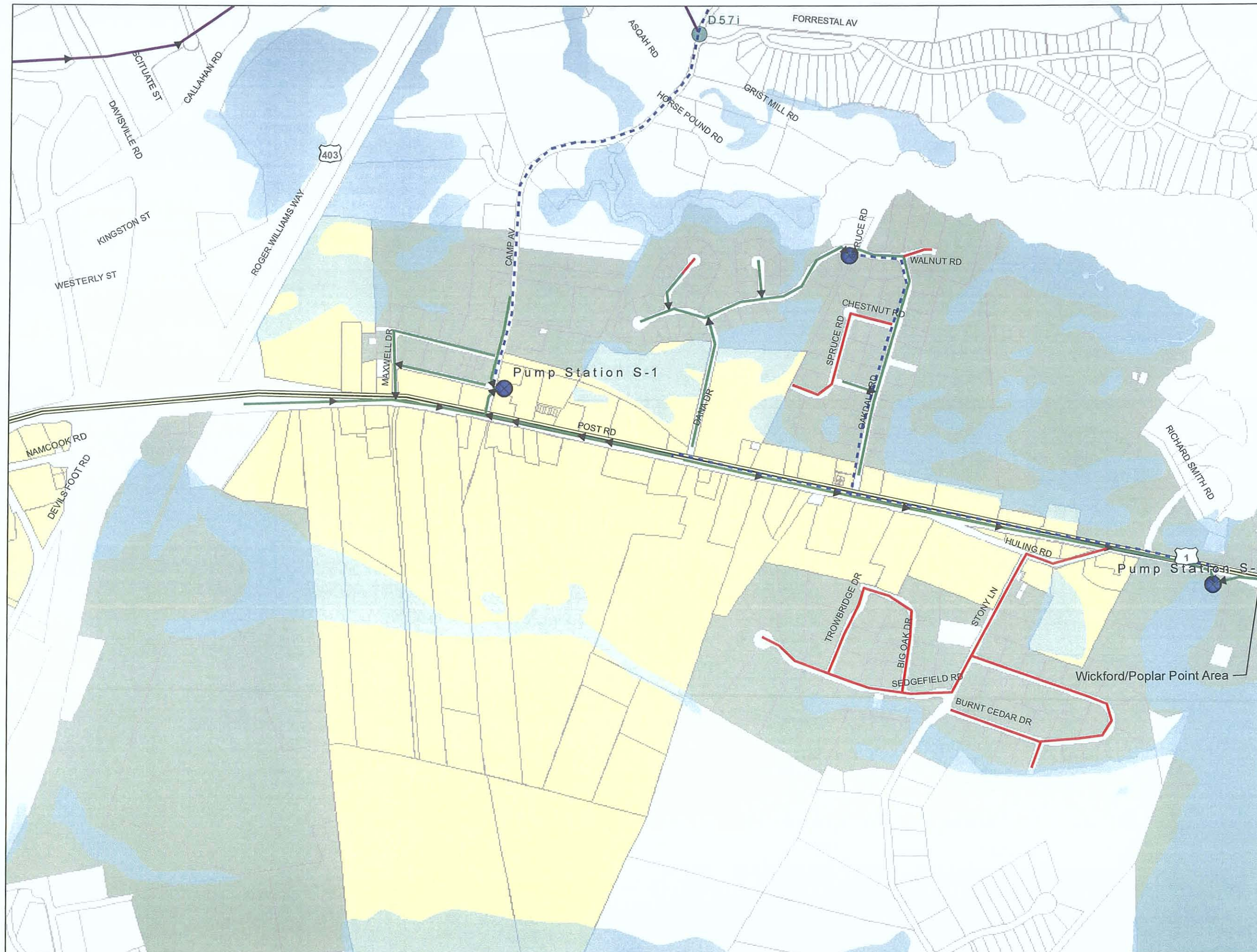
The S-1 Post Road subarea will consist of approximately 1,900 linear feet of 12-inch conventional gravity sewer along Post Road (from Camp Avenue to Dana Avenue), 2,200 linear feet of 8-inch gravity sewer along Post Road (from Route 403 to Camp Avenue), a pump station located on Tulley Way off of Camp Avenue, and approximately 3,600 linear feet of 8-inch force main that will connect to the existing sewer manhole in the vicinity of Camp Avenue and Wickford Point Rd. The S-1 Pump Station will service all of the Post Road South Corridor consisting of 285 commercial acres, 179 residential units, and the total flow from the Wickford Point area, and have a capacity of 1,045,385 gpd (725 GPM). Table 5-1 summarizes the flow components of the S-1 Pump Station.

TABLE 5-1 PROJECTED FLOWS TO THE S-1 PUMP STATION					
	Commercial (gpd)	Residential (gpd)	Infiltration / Inflow (gpd)	Average Daily Flow (gpd)	Peak Daily Flow (gpd)
Post Road South Phase 1	155,800	1,800	2,000	159,600	463,375
Post Road South Phase 2	32,600	30,581	1,000	64,181	172,640
Wickford Village/Poplar Point	30,300	130,248	8,000	168,548	409,370
TOTALS	218,700	162,629	11,000	392,329	1,045,385

The total estimated cost for the S-1 Post Road Service Area Wastewater Collection System is \$4,830,800 as summarized in Table 5-2.

Figure 5-1
**North Kingstown
Wastewater
Facilities Plan**

Post Road South Area

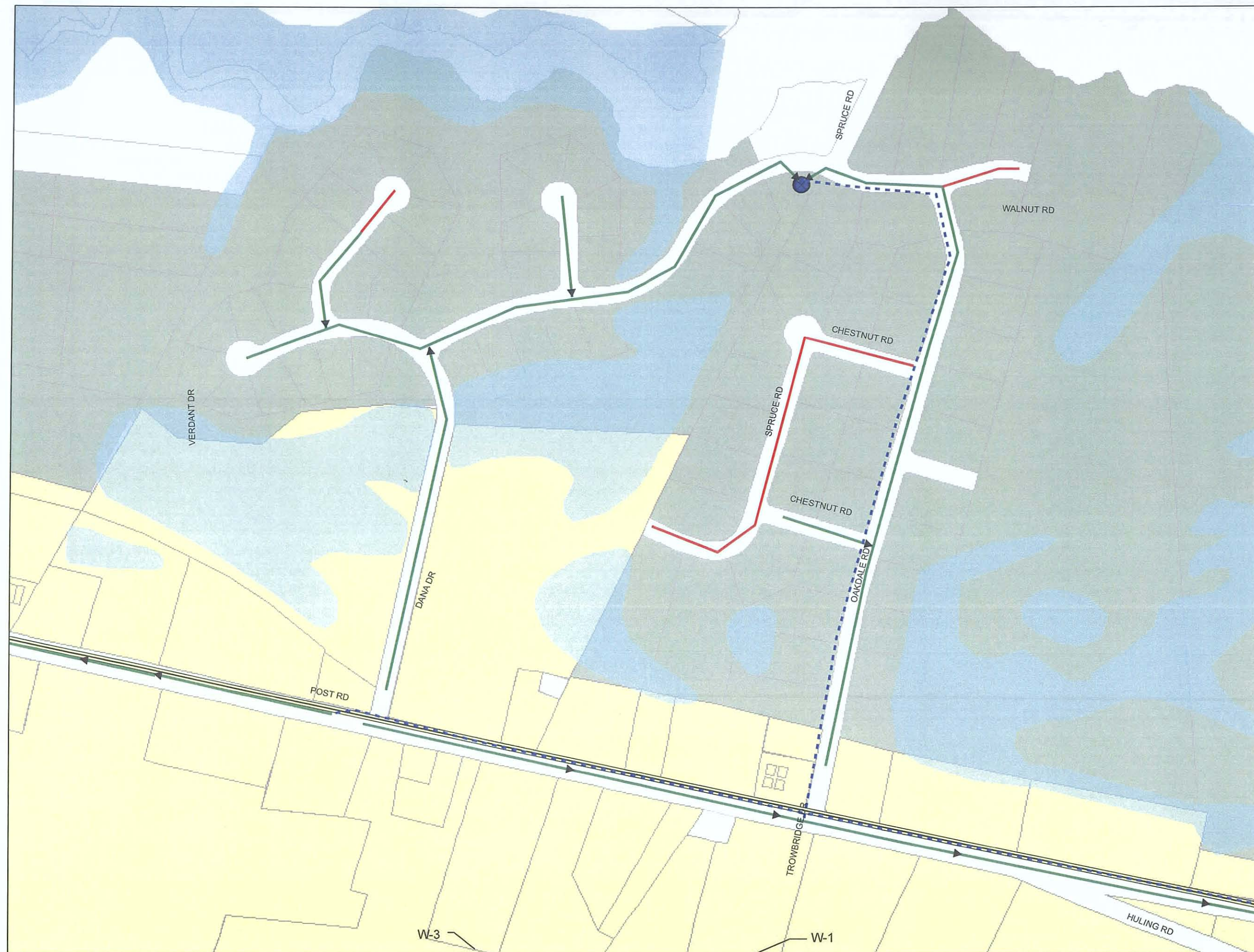


- Proposed Sewer**
 <all other values>
- Sewer_Type**
 Existing Gravity(Approx Location)
 Force Main
 Gravity
 Low Pressure
- Existing Manholes
 Proposed Pump Station
- Features**
 Railroad
 Post Road Corridor
 Town Boundary
 Wetlands
 Post Road District(Adopted 8/10)
- Parcels**
 <all other values>
 parcels_11.PROJECTAREA, ZONING
 Project Area



Figure 5-2
**North Kingstown
Wastewater
Facilities Plan**

Dana Drive/Oakdale Road



- Proposed Sewer**
<all other values>
- Sewer_Type**
 Existing Gravity (Approx Location)
 Force Main
 Gravity
 Low Pressure
- Existing Manholes
 Proposed Pump Station
- Features**
 Railroad
 Post Road Corridor
 Town Boundary
 Wetlands
 Post Road District (Adopted 8/10)
- Parcels**
<all other values>
 parcels_11.PROJECTAREA, ZONING
 Project Area



Figure 5-3

North Kingstown Wastewater Facilities Plan

Stony Lane and Sedgefield Road



- Proposed Sewer**
 <all other values>
- Sewer_Type**
 Existing Gravity (Approx Location)
 Force Main
 Gravity
 Low Pressure
- Existing Manholes
 Proposed Pump Station
- Features**
 Railroad
 Post Road Corridor
 Town Boundary
 Wetlands
 Post Road District (Adopted 8/10)
- Parcels**
 <all other values>
 parcels_11.PROJECTAREA, ZONING
 Project Area



TABLE 5-2 PROBABLE PROJECT COST FOR THE S-1 POST ROAD SERVICE AREA WASTEWATER COLLECTION SYSTEM	
Gravity Sewer	\$ 822,600
Sewer Manholes	71,000
Gravel Refill	24,000
Rock Excavation	38,000
Traffic Control	200,000
Pavement Restoration	1,095,000
8-Inch Force Main	210,000
Pump Station	900,000
Sub-Total	\$ 3,360,600
Contingencies (25%)	840,200
Sub-Total	\$ 4,200,800
Engineering Design Services	210,000
Construction Administration and Residential Inspection	420,000
TOTAL	\$ 4,830,800

Post Road South-2 (S-2)

The S-2 Post Road subarea wastewater collection system will consist of approximately 4,700 linear feet of 8-inch gravity sewer along Post Road (from Dana Drive to the State Police Headquarters), approximately 8,800 linear feet of low pressure sewers in the residential areas of Stoney Lane/Sedgefield Road Area, 4500 linear feet of gravity sewers, 1,500 linear feet of low pressure sewers, 2,300 linear feet of 4" force main, and one (1) pump station within the Dana Drive and Oakdale Road Area, and a pump station in the vicinity of the State Police Headquarters, and approximately 4,700 linear feet of 8-inch force main along Post Road to Dana Avenue. The S-2 Pump Station will service the subarea with a capacity of 582,010 gpd (404 GPM). The Walnut Drive Pump Station will have a capacity of 73,700 gpd (51 GPM). Table 5-3 summarizes the flow components of the S-2 Pump Station. The pump station will serve the incremental flows along Post Road and the Wickford Village/Poplar Point Area.

TABLE 5-3 PROJECTED FLOWS TO THE S-2 PUMP STATION					
	Commercial (gpd)	Residential (gpd)	Infiltration / Inflow (gpd)	Average Daily Flow (gpd)	Peak Daily Flow (gpd)
Post Road South Phase 2	32,600	32,381	1,000	65,981	172,640
Wickford Village/Poplar Point	30,300	130,248	8,000	168,548	409,370
TOTALS	62,900	162,629	9,000	234,529	582,010

The total estimated cost for the S-2 Post Road subarea wastewater collection system is \$9,026,300 as summarized in Table 5-4. The S-2 Post Road Service Area was further subdivided into the commercial component along Post Road and the residential areas to the east and west of Post Road.

TABLE 5-4 PROBABLE PROJECT COST FOR THE S-2 POST ROAD SUBAREA WASTEWATER COLLECTION SYSTEM		
Gravity Sewer	\$	920,000
Sewer Manholes		126,000
Low Pressure Sewers		832,000
Grinder Pumps		572,000
8" Force Main		277,500
4" Force Main		172,500
Pump Station		800,000
Walnut Dr. Pump Station		300,000
Gravel Refill		126,000
Rock Excavation		164,000
Pavement Restoration		2,057,300
Traffic Control		100,000
Sub-Total	\$	6,447,300
Contingencies (25%)		1,611,800
Sub-Total	\$	8,059,100
Engineering Design Services		322,400
Construction Administration and Residential Inspection		644,800
TOTAL	\$	9,026,300

Table 5-5 summarizes the estimated cost of \$4,195,400 to provide a sewer system for the commercial properties along Post Road.

TABLE 5-5 PROBABLE PROJECT COST FOR THE COMMERCIAL COMPONENT OF THE S-2 POST ROAD SUBAREA WASTEWATER COLLECTION SYSTEM		
Gravity Sewer	\$	370,000
Sewer Manholes		60,000
8" Force Main		277,500
Pump Station		800,000
Gravel Refill		58,000
Rock Excavation		102,500
Pavement Restoration		1,278,800
Traffic Control		50,000
Sub-Total	\$	2,996,800
Contingencies (25%)		749,200
Sub-Total	\$	3,746,000
Engineering Design Services		149,800
Construction Administration and Residential Inspection		299,600
TOTAL	\$	4,195,400

Table 5-6 summarizes the estimated cost of \$4,830,600 to provide the residential areas with a sewer system.

TABLE 5-6 PROBABLE PROJECT COST FOR THE RESIDENTIAL COMPONENT OF THE S-2 POST ROAD SUBAREA WASTEWATER COLLECTION SYSTEM	
Gravity Sewer	\$ 550,000
Sewer Manholes	66,000
Low Pressure Sewers	832,000
Grinder Pumps	572,000
4" Force Main	172,500
Walnut Dr. Pump Station	300,000
Gravel Refill	68,000
Rock Excavation	61,500
Pavement Restoration	778,500
Traffic Control	50,000
Sub-Total	\$ 3,450,500
Contingencies (25%)	862,600
Sub-Total	\$ 4,313,100
Engineering Design Services	172,500
Construction Administration and Residential Inspection	345,000
TOTAL	\$ 4,830,600

5.2.2 Post Road North Wastewater Collection System

The Post Road North Wastewater Collection System has been divided into four (4) subareas to allow for phased construction. Figure 5-4 presents a plan depicting the proposed subareas for Post Road North which consists of the N-1 Pump Station Service Area, the N-2 Pump Station Service Area, the N-3 Pump Station Service Area and the Pine River Road Service Area.

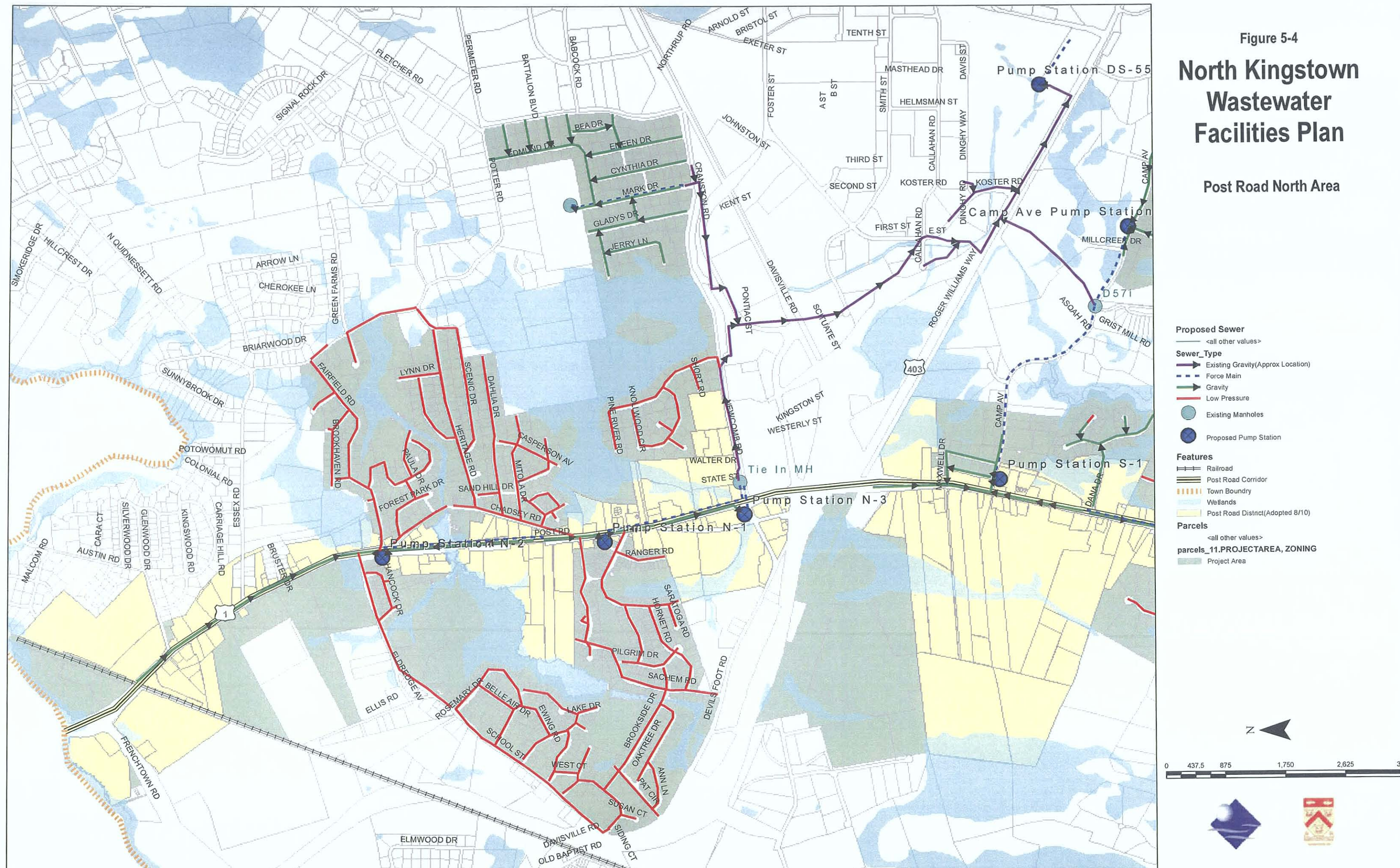
Post Road North-1 (N-1)

The N-1 Pump Station subarea will consist of approximately 2,700 linear feet of 12-inch gravity sewer along Post Road from the high point between Forest Park Drive and Chadsey Road to Namcook Road, and approximately 2,200 linear feet of force main along Post Road to its point of termination at the gravity sewer on Newcomb Road. The residential areas along Heritage Road and Yorktown Road will serve 964 residential units with approximately 48,000 linear feet of low pressure sewers.

Figure 5-4

**North Kingstown
Wastewater
Facilities Plan**

Post Road North Area



The N-1 Pump Station will serve the area from Frenchtown Road to Yorktown Road and the flows generated from the N-2 Pump Station subarea. The N-1 Pump Station will have a capacity of 930,658 gpd (646 GPM). Table 5-7 summarizes the flow components of the N-1 Pump Station.

TABLE 5-7 PROJECTED FLOWS TO THE N-1 PUMP STATION					
	Commercial (gpd)	Residential (gpd)	Infiltration / Inflow (gpd)	Average Daily Flow (gpd)	Peak Daily Flow (gpd)
Post Road North Phase 1	112,400	30,800	3,000	146,200	411,250
Post Road North Phase 2	36,400	164,753	900	202,053	519,408
TOTALS	148,800	195,553	3,900	348,253	930,658

The total estimated cost for the N-1 Post Road subarea wastewater collection system is \$20,498,300 as summarized in Table 5-8. The N-1 Pump Station subarea was subdivided into the commercial component along Post Road and the residential area.

TABLE 5-8 PROBABLE PROJECT COST FOR THE N-1 POST ROAD SUBAREA WASTEWATER COLLECTION SYSTEM	
12-inch Gravity Sewer	\$ 297,000
Sewer Manholes	36,000
Low Pressure Sewers	3,840,000
Grinder Pumps	3,556,000
10" Force Main	198,000
Pump Station	1,500,000
Gravel Refill	440,000
Rock Excavation	1,127,500
Pavement Restoration	3,347,300
Traffic Control	300,000
Sub-Total	\$ 14,641,800
Contingencies (25%)	3,660,500
Sub-Total	\$ 18,302,300
Engineering Design Services	732,000
Construction Administration and Residential Inspection	1,464,000
TOTAL	\$ 20,498,300

Table 5-9 summarizes the estimated cost of \$5,069,300 to provide a sewer system for the commercial establishments along Post Road.

TABLE 5-9 PROBABLE PROJECT COST FOR THE COMMERCIAL COMPONENT OF THE N-1 POST ROAD SUBAREA WASTEWATER COLLECTION SYSTEM		
12-inch Gravity Sewer	\$	297,000
Sewer Manholes		36,000
10" Force Main		198,000
Pump Station		1,500,000
Gravel Refill		40,000
Rock Excavation		20,500
Pavement Restoration		1,479,500
Traffic Control		50,000
Sub-Total	\$	3,621,000
Contingencies (25%)		905,300
Sub-Total	\$	4,526,300
Engineering Design Services		181,000
Construction Administration and Residential Inspection		362,000
TOTAL	\$	5,069,300

Table 5-10 summarizes the estimated cost of \$15,429,000 to provide the residential areas with a sewer system.

TABLE 5-10 PROBABLE PROJECT COST FOR THE RESIDENTIAL COMPONENT OF THE N-1 POST ROAD SUBAREA WASTEWATER COLLECTION SYSTEM		
Low Pressure Sewers	\$	3,840,000
Grinder Pumps		3,556,000
Gravel Refill		400,000
Rock Excavation		1,107,000
Pavement Restoration		1,867,800
Traffic Control		250,000
Sub-Total	\$	11,020,800
Contingencies (25%)		2,755,200
Sub-Total	\$	13,776,000
Engineering Design Services		551,000
Construction Administration and Residential Inspection		1,102,000
TOTAL	\$	15,429,000

Post Road North-2 (N-2)

The N-2 Post Road subarea will consist of approximately 4,300 linear feet of 10-inch gravity sewer along Post Road from Frenchtown Road to Peachtown Road, approximately 2,200 linear feet of 8-inch force main

from N-2 Pump Station to the high point on Post Road toward N-1 Pump Station, N-2 Pump Station, and approximately 11,800 linear feet of low pressure sewers.

The N-2 Pump Station will service the commercial properties along Post Road from Frenchtown Road to Yorktown Road and 170 residential dwellings located within the Brookhaven Road and Hancock Drive areas. The N-2 Pump Station will have a capacity of 411,300 gpd (285 GPM) as summarized in Table 5-11.

TABLE 5-11 PROJECTED FLOWS TO THE N-2 PUMP STATION (PHASE 1)		
	Average Daily Flows (gpd)	Peak Daily Flows (gpd)
Residential	30,800	77,000
Commercial	112,400	331,300
Infiltration/Inflow	3,000	3,000
Total	146,200	411,300

The total estimated cost for the N-2 Post Road subarea is \$8,433,200 as summarized in Table 5-12.

TABLE 5-12 PROBABLE PROJECT COST FOR THE N-2 POST ROAD SUBAREA WASTEWATER COLLECTION SYSTEM	
10-inch Gravity Sewer	\$ 430,000
Sewer Manholes	60,000
8-Inch Force Main	176,000
Pump Station	900,000
Low Pressure Sewer	944,000
Grinder Pumps	680,000
Gravel Refill	200,000
Rock Excavation	500,000
Pavement Restoration	2,033,700
Traffic Control	100,000
Sub-Total	\$ 6,023,700
Contingencies (25%)	1,505,900
Sub-Total	\$ 7,529,600
Engineering Design Services	301,200
Construction Administration and Residential Inspection	602,400
TOTAL	\$ 8,433,200

Table 5-13 summarizes the estimated cost of \$4,611,700 to provide commercial properties with a sewer system along Post Road.

TABLE 5-13 PROBABLE PROJECT COST FOR THE COMMERCIAL COMPONENT OF THE N-2 POST ROAD SUBAREA WASTEWATER COLLECTION SYSTEM		
10-inch Gravity Sewer	\$	430,000
Sewer Manholes		60,000
8" Force Main		176,000
Pump Station		900,000
Gravel Refill		44,000
Rock Excavation		75,000
Pavement Restoration		1,559,000
Traffic Control		50,000
Sub-Total	\$	3,294,100
Contingencies (25%)		823,500
Sub-Total	\$	4,117,600
Engineering Design Services		164,700
Construction Administration and Residential Inspection		329,400
TOTAL	\$	4,611,700

Table 5-14 summarizes the estimated cost of \$3,821,500 to provide the two residential areas with a sewer system.

TABLE 5-14 PROBABLE PROJECT COST FOR THE RESIDENTIAL COMPONENT OF THE N-2 POST ROAD SUBAREA WASTEWATER COLLECTION SYSTEM		
Low Pressure Sewers	\$	944,000
Grinder Pumps		680,000
Gravel Refill		156,000
Rock Excavation		425,000
Pavement Restoration		474,600
Traffic Control		50,000
Sub-Total	\$	2,729,600
Contingencies (25%)		682,400
Sub-Total	\$	3,412,000
Engineering Design Services		136,500
Construction Administration and Residential Inspection		273,000
TOTAL	\$	3,821,500

Post Road North-3 (N-3)

The N-3 Post Road subarea will serve commercial properties along Post Road from Namcook Road to Newcomb Road. The N-3 Post Road subarea will consist of approximately 1,200 linear feet of 8-inch gravity sewer along Post Road, N-3 Pump Station and approximately 500 linear feet of 4-inch force main. The force main will traverse along Newcomb Road to the existing sewer manhole located on Newcomb Rd. The capacity of the N-3 Pump Station will be 31,200 gpd (22 GPM) servicing 14 acres of commercial properties. The estimated cost for the N-3 Post Road subarea is \$708,800 as summarized in Table 5-15.

TABLE 5-15 PROBABLE PROJECT COST FOR THE N-3 POST ROAD SUBAREA WASTEWATER COLLECTION SYSTEM	
8-inch Gravity Sewer	\$ 120,000
Sewer Manholes	18,000
4-Inch Force Main	35,000
Pump Station	200,000
Gravel Refill	10,000
Rock Excavation	22,500
Pavement Restoration	62,600
Traffic Control	25,000
Sub-Total	\$ 493,100
Contingencies (25%)	123,300
Sub-Total	\$ 616,400
Engineering Design Services	30,800
Construction Administration and Residential Inspection	61,600
TOTAL	\$ 708,800

Pine River Road Subarea

The Pine River Road Wastewater Collection System will serve 71 residential dwellings with an associated average daily flow of 11,400 gpd. Figure 5-5 presents a plan for the Pine River Road Area. The Wastewater Collection System will consist of approximately 5,100 linear feet of low pressure sewers connecting to the existing sewers on Newcomb Road. The total estimated cost for the Pine River Road wastewater collection system is \$1,330,800 as summarized in Table 5-16.

Figure 5-5
**North Kingstown
 Wastewater
 Facilities Plan**

Pine River Road Area



- Proposed Sewer**
 <all other values>
- Sewer_Type**
 Existing Gravity(Approx Location)
 Force Main
 Gravity
 Low Pressure
- Existing Manholes**
 Existing Manholes
- Features**
 Railroad
 Post Road Corridor
 Town Boundry
 Wetlands
- Parcels**
 <all other values>
 parcels_11.PROJECTAREA, ZONING
 Project Area

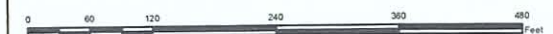


TABLE 5-16 PROBABLE PROJECT COST FOR THE PINE RIVER ROAD WASTEWATER COLLECTION SYSTEM	
Low Pressure Sewers	\$ 408,000
Grinder Pumps	252,000
Gravel Refill	22,000
Rock Excavation	45,000
Pavement Restoration	198,600
Traffic Control	25,000
Sub-Total	\$ 950,600
Contingencies (25%)	237,700
Sub-Total	\$ 1,188,300
Engineering Design Services	47,500
Construction Administration and Residential Inspection	95,000
TOTAL	\$ 1,330,800

Mark Drive Subarea

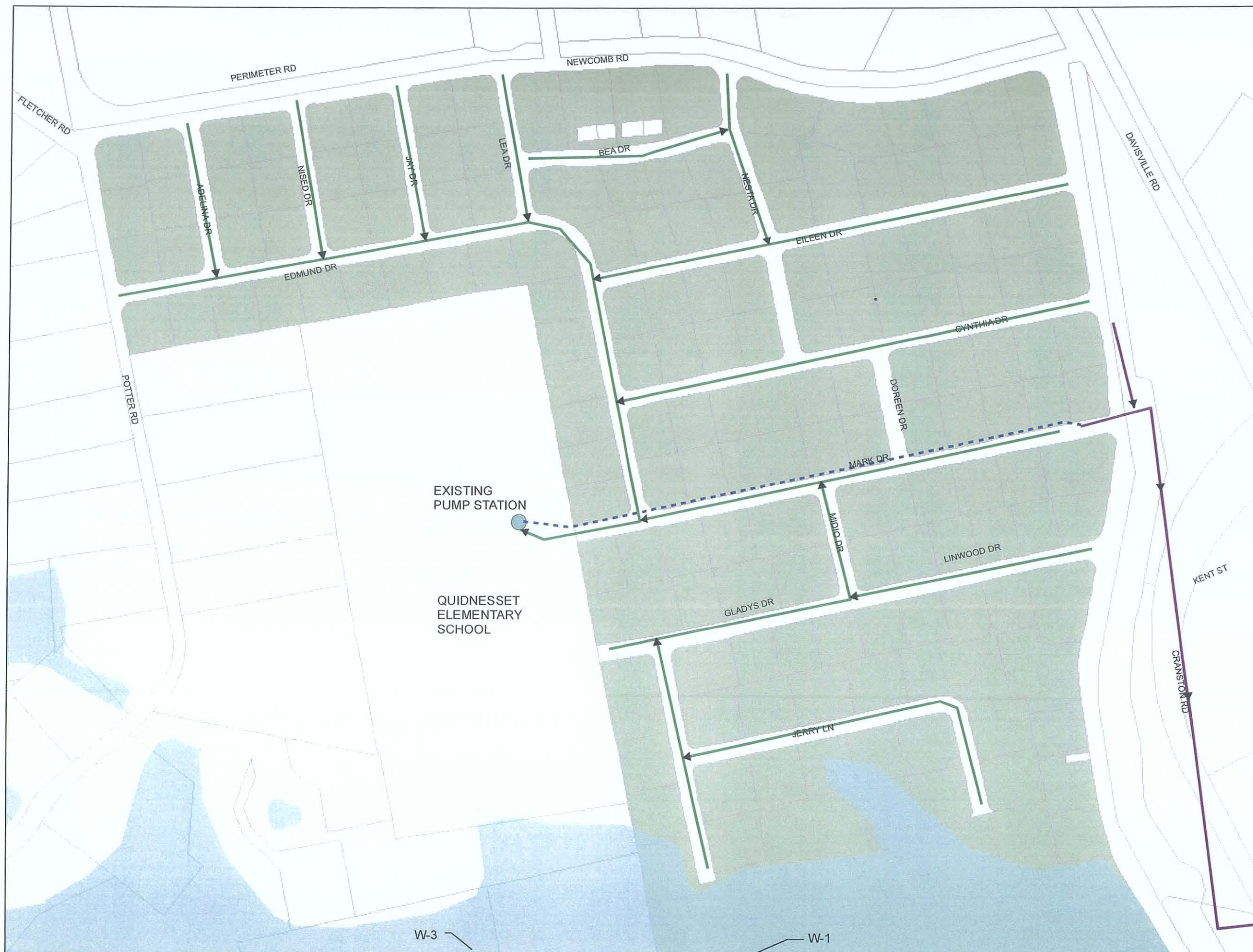
The Mark Drive Wastewater Collection System will serve 125 residential dwellings with an associated average daily flow of 22,612 gpd. The Wastewater Collection System will consist of approximately 14,200 linear feet of 8-inch gravity sewer connecting into the existing pump station on Mark Drive. Figure 5-6 presents a plan for the Mark Drive Area. Due to the age of the existing pump station, it must be completely upgraded. The new pump station will consist of the conversion of the existing wet pit to a submersible pump chamber, including the installation of two (2) chopper pumps (rated at 200 gpm). Additional upgrades will include new electrical service, pump controls and instrumentation, standby generator, and remote alarms.

The total estimated cost for the Mark Drive Wastewater Collection System and pump station is \$3,534,000 as summarized in Table 5-17.

Figure 5-6

North Kingstown Wastewater Facilities Plan

Mark Drive Area



- Proposed Sewer**
- <all other values>
- Sewer_Type**
- Existing Gravity (Approx Location)
 - Force Main
 - Gravity
 - Low Pressure
- Existing Manholes**
- Features**
- Railroad
 - Post Road Corridor
 - Town Boundary
 - Wetlands
- Parcels**
- <all other values>
- parcels_11.PROJECTAREA, ZONING**
- Project Area



TABLE 5-17 PROBABLE PROJECT COST FOR THE MARK DRIVE WASTEWATER COLLECTION SYSTEM		
8-Inch Gravity Sewers	\$	1,420,000
Pump Station Upgrade		150,000
Gravel Refill		75,000
Rock Excavation		250,000
Pavement Restoration		575,000
Traffic Control		55,000
Sub-Total	\$	2,525,000
Contingencies (25%)		631,000
Sub-Total	\$	3,156,000
Engineering Design Services		126,000
Construction Administration and Residential Inspection		252,000
TOTAL	\$	3,534,000

5.2.3 Wickford Village/Poplar Point Wastewater Collection System

The Wickford Village/Poplar Point Wastewater Collection System has been divided into three (3) subareas consisting of Phillips Street Pump Station Area (W-1), Main Street Pump Station (W-2) and the Beach Street Pump Station (W-3) as shown in Figures 5-7, 5-8 and 5-9.

Wickford Village (W-1) Subarea

The W-1 Wickford Village Subarea will consist of approximately 17,400 linear feet of 8-inch gravity sewer, 2,000 linear feet of low pressure sewers, the Phillip Street Pump Station, and approximately 2,400 linear feet of force main along Boone Street and Tower Hill Road. The W-1 subarea consists of 338 residential units, 7 commercial units, North Kingstown Library, the Middle School and the former Wickford Elementary School.

The Phillip Street Pump Station will serve the W-1 service area as well as flows generated by the Brown (South) Pump Station and Boston Neck Pump Station. The Phillips Street Pump Station will have a capacity of 263,043 gpd (187 GPM). Table 5-18 summarizes the flow components of the Phillips Street Pump Station.

Figure 5-7
**North Kingstown
Wastewater
Facilities Plan**
Wickford Village/
Poplar Point Area W-1

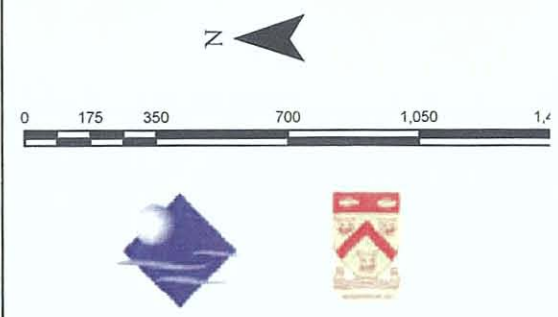


Figure 5-8
**North Kingstown
Wastewater
Facilities Plan**
Wickford Village/
Poplar Point Area W-2



- Proposed Sewer**
<all other values>
- Sewer_Type**
Existing Gravity (Approx. Location)
Force Main
Gravity
Low Pressure
- Existing Manholes
Proposed Pump Station
- Features**
Railroad
Post Road Corridor
Town Boundary
Wetlands
Post Road District (Adopted 8/10)
- Parcels**
<all other values>
parcels_11.PROJECTAREA, ZONING
Project Area

Figure 5-9
**North Kingstown
 Wastewater
 Facilities Plan**

Wickford Village/
 Poplar Point Area W-3



- Proposed Sewer**
 <all other values>
- Sewer_Type**
 Existing Gravity (Approx Location)
 Force Main
 Gravity
 Low Pressure
- Existing Manholes**
 Proposed Pump Station
- Features**
 Railroad
 Post Road Corridor
 Town Boundary
 Wetlands
 Post Road District (Adopted 8/10)
- Parcels**
 <all other values>
 parcels_11.PROJECTAREA, ZONING
 Project Area

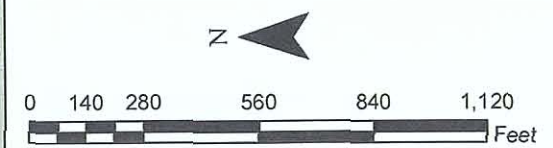


TABLE 5-18 PROJECTED FLOWS TO THE PHILLIPS STREET PUMP STATION		
	Average Daily Flows (gpd)	Peak Daily Flows (gpd)
Residential ¹	65,848	197,543
Commercial ¹	19,200	57,600
Infiltration/Inflow	7,900	7,900
Total	92,948	263,043

¹ Includes flows from Brown Street (South) Pump Station and Boston Neck Pump Station

The total estimated cost for the W-1 subarea wastewater collection system is \$15,364,600 as summarized in Table 5-19.

TABLE 5-19 PROBABLE PROJECT COST FOR THE WICKFORD VILLAGE W-1 SUBAREA WASTEWATER COLLECTION SYSTEM	
8-Inch Gravity Sewers	\$ 2,137,200
Sewer Manholes	261,000
Low Pressure Sewers	187,000
Grinder Pumps	96,000
4" Force Main	132,000
Pump Station	600,000
Gravel Refill	396,000
Rock Excavation	1,089,000
Pavement Restoration	5,676,600
Traffic Control	400,000
Sub-Total	\$ 10,974,800
Contingencies (25%)	2,743,700
Sub-Total	\$ 13,718,500
Engineering Design Services	548,700
Construction Administration and Residential Inspection	1,097,400
TOTAL	\$ 15,364,600

Wickford Village (W-2) Subarea

The W-2 Wickford Village Subarea will serve 38 commercial properties and 216 residential properties along Phillips Street, Brown Street, Boston Neck Road, Oakland Avenue area and the Poplar Area, including 319 boat slips. The W-2 Wickford Village Subarea will consist of approximately 17,200 linear feet of 8-inch gravity sewers, Brown Street (North) Pump Station, Brown Street (South) Pump Station, Boston Neck Road Pump Station, Beach Street Pump Station, and 5,300 linear feet of force mains. The Brown Street (North) Pump Station will serve commercial units along Brown Street (from Wickford Cove Crossing to Franklin Street) and will be located prior to the Wickford Cove Crossing. The Brown Street (North) Pump Station will

be the below-grade grinder pump station. The capacity of the station will be 6,600 gpd (5 GPM) serving 11 commercial units.

The Brown Street (South) Pump Station will serve commercial properties along Brown Street (from Franklin Street to Phillips Street), including the Brown Street (North) Pump Station service area. The station will serve 27 commercial establishments and 26 residential units. The below-grade grinder pump station will be located in the vicinity of Brown Street and Phillips Street on the Wickford Cove side. The 2-inch force main will traverse along Phillips Street for approximately 1,100 linear feet in a westerly direction to a proposed sewer manhole located near the Wickford Elementary School. The capacity of the Brown Street (South) Pump Station will be 39,900 gpd (30 GPM).

The Beach Street Pump Station will have a capacity of 30,400 gpd (62 GPM) serving the Poplar Area consisting of residential parcels and a marina. The 3-inch force main will traverse along Beach Street and discharge to the gravity sewer on Boston Neck Road.

The Boston Neck Road Pump Station will serve parcels along Boston Neck Road, Oakland Avenue, Gregory Avenue, Reynolds Street, the Town Hall, marina and the Beach Street Pump Station service area. The capacity of the Boston Neck Road Pump Station will be 115,100 gpd (80 GPM). The station will be located on Town property. The 4-inch force main will traverse along Boston Neck Road crossing Wickford Cove on the existing bridge and then traversing along Phillips Street in a westerly direction to its points of termination in the vicinity of the Wickford Elementary school. The total length of the force main will be approximately 1,900 linear feet.

The estimated cost for the W-2 Wickford Village Subarea is \$11,872,500 as summarized in Table 5-20.

TABLE 5-20 PROBABLE PROJECT COST FOR THE WICKFORD VILLAGE W-2 SUBAREA WASTEWATER COLLECTION SYSTEM	
8-Inch Gravity Sewers	\$ 2,313,600
Sewer Manholes	258,000
4-inch Force Main	114,000
3-inch Force Main	90,000
2-inch Force Main	66,000
1½-inch Force Main	48,000
Wickford Cove Bridge Crossing	250,000
Brown Street (North) Pump Station	50,000
Brown Street (South) Pump Station	100,000
Beach Street pump Station	250,000
Boston Neck Road Pump Station	250,000
Gravel Refill	1,564,000
Rock Excavation	1,419,000
Pavement Restoration	1,418,500
Traffic Control	289,300
Sub-Total	\$ 8,480,400
Contingencies (25%)	2,120,100
Sub-Total	\$ 10,600,500
Engineering Design Services	424,000
Construction Administration and Residential Inspection	848,000
TOTAL	\$ 11,872,500

Wickford Village (W-3) Subarea

The Wickford Village (W-3) Subarea will consist of approximately 8,500 linear feet of 8-inch gravity sewer, 3,500 linear feet of low pressure sewers, Main Street Pump Station, and approximately 4,500 linear feet of 4-inch force main. The W-3 Subarea consists of 20 commercial units, one marina, and 166 residential parcels. The Main Street Pump Station will service the Wickford Village (W-3) service area. The Main Street Pump Station will have a capacity of 111,700 gpd (78 GPM).

The total estimated cost for the W-3 Subarea Wastewater Collection System is \$6,865,000 as summarized in Table 5-21.

TABLE 5-21 PROBABLE PROJECT COST FOR THE WICKFORD VILLAGE W-3 SUBAREA WASTEWATER COLLECTION SYSTEM	
8-Inch Gravity Sewers	\$ 1,226,300
Sewer Manholes	150,000
Low Pressure Sewers	377,500
Grinder Pumps	240,000
4" Force Main	290,000
Pump Station	300,000
Gravel Refill	324,000
Rock Excavation	891,000
Pavement Restoration	885,100
Traffic Control	220,000
Sub-Total	\$ 4,903,900
Contingencies (25%)	1,226,000
Sub-Total	\$ 6,129,900
Engineering Design Services	245,200
Construction Administration and Residential Inspection	490,400
TOTAL	\$ 6,865,500

5.2.4 Shore Acres Wastewater Collection System

Alternate 1 – Gravity System

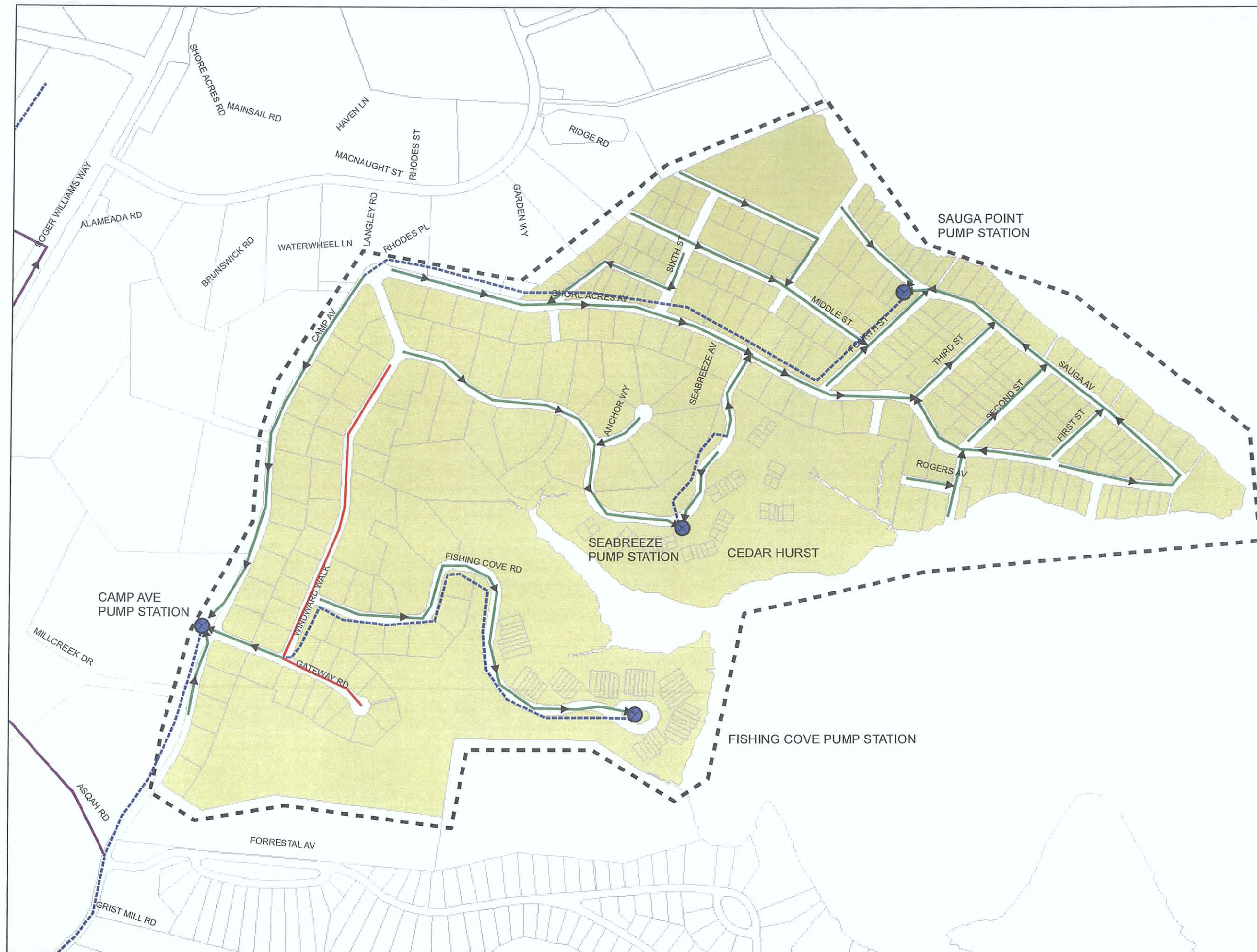
The Shore Acres Wastewater Collection System will consist of approximately 19,500 linear feet of 8-inch gravity sewers, 1,900 linear feet of low pressure sewers, 4 pump stations, and 7,600 linear feet of force main as shown in Figure 5-10.

The Fishing Cove Pump Station will serve 63 residential units which includes 53 units of the Cedar Hurst Condominiums. The pump station will be located at the end of Fishing Cove Road. The 2-inch force main from the pump station will traverse along Fishing Cove Road to Windward Walk and then to its points of termination at the intersection of Gateway Road and Windward Walk. The Fishing Cove Pump Station will have a capacity of 46,400 gpd (32 GPM).

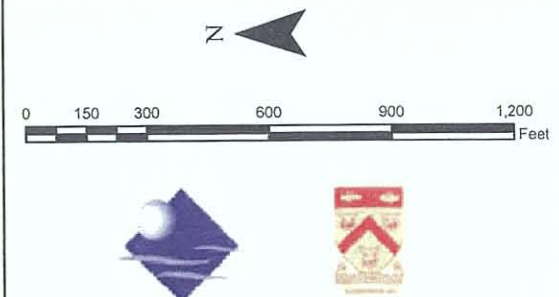
The Seabreeze Drive Pump Station will have a capacity of 59,300 gpd (41 GPM). The pump station will serve 81 residential units which includes 50 units of the Cedar Hurst Condominiums. The pump station will be on Seabreeze Drive west of Landing Lane. The force main from the Seabreeze Drive Pump Station will traverse easterly along Seabreeze Drive to a gravity sewer manhole located in the vicinity of Landing Lane.

Figure 5-10
**North Kingstown
 Wastewater
 Facilities Plan**

Shore Acres Area



- Proposed Sewer**
- Sewer_Type**
- exgrav-al
 - fm
 - gravity
 - lp
- Features**
- Railroad
 - Post Road Corridor
 - Town Boundry
 - Proposed Pump Station
 - Shore Acres
- Parcels**
- Land Use**
- Open Space
 - Village Residential



The Sauga Avenue Pump Station will serve 280 residential units which includes the Seabreeze Drive Pump Station service area. The pump station will be located in the vicinity of Sauga Drive and Fourth Street. The force main will traverse along Fourth Street to Shore Acres Drive. On Shore Acres Drive the force main will traverse northerly to Camp Avenue. The length of the 4-inch force main is approximately 3,100 linear feet. The capacity of the Seabreeze Pump Station will be 155,300 gpd (110 GPM).

The Camp Avenue Pump Station will serve the Shore Acres service area and will be located on Camp Avenue in the vicinity of Gateway Road. The 4-inch force main will traverse along Camp Avenue in a westerly direction to its point of termination at the existing chamber on A.S.Q.A.H. Drive. The Camp Avenue Pump Station will serve 344 residential units. The capacity of the pump station will be 191,200 gpd (135 GPM).

The total estimated cost for Alternate 1 – Gravity System for the Shore Acres area is \$13,207,800 as summarized in Table 5-22.

TABLE 5-22 PROBABLE PROJECT COST FOR THE SHORE ACRES GRAVITY WASTEWATER COLLECTION SYSTEM	
Gravity Sewer	\$ 2,678,000
Sewer Manholes	306,000
Low Pressure Sewers	173,100
Grinder Pumps	100,000
4-inch Force Main	264,000
2-inch Force Main	100,000
Fishing Cove Pump Station	100,000
Seabreeze Drive Pump Station	100,000
Sauga Avenue Pump Station	800,000
Camp Avenue Pump Station	800,000
Gravel Refill	435,600
Rock Excavation	1,188,000
Pavement Restoration	1,579,500
Traffic Control	810,000
Sub-Total	\$ 9,434,200
Contingencies (25%)	2,358,500
Sub-Total	\$ 11,792,700
Engineering Design Services	471,700
Construction Administration and Residential Inspection	943,400
TOTAL	\$ 13,207,800

An option to the gravity sewer option is a pressure sewer system that is powered by grinder pumps. A pressure system uses small diameter pipes and grinder pumps which are installed at each home. The grinder pump station collects all of the wastewater from the home and grinds it into slurry. The wastewater is then pumped to a larger sewer main located at the entrance of A.S.Q.H.A.

Due to the flat terrain, the installation of a conventional gravity sewer in the Shore Acres Area would require four (4) pumps located at Fishing Cove Road, Seabreeze Avenue, Sauga Avenue and Camp Avenue. The installation of a pressure sewer system would eliminate the four pump stations and reduce the installation cost of the sewer line in the road.

The greatest disadvantage to the pressure sewers is the homeowner will be responsible for the annual electric cost (approximately \$250 to \$350 per year) and the maintenance and repair of the systems as may be necessary through the life of the system. The homeowner will be responsible for the installation cost of the grinder pump. During a power outage, the system will not operate. However, each system is equipped with an emergency receptacle to plug in a small emergency generator.

Table 5-23 provides a cost estimate for a pressure sewer system. The total cost for this alternative is \$6,034,800 which is approximately 46% less than the conventional sewer alternative. Besides the installation of 21,400 linear feet of low pressure sewer pipe, the cost also includes the Town purchasing the grinder and providing it to the homeowner for installation by them.

TABLE 5-23 PROBABLE PROJECT COST FOR THE SHORE ACRES LOW PRESSURE WASTEWATER COLLECTION SYSTEM	
Low Pressure Sewers	\$ 1,701,000
Flushing Manholes	30,000
Grinder Pumps	1,376,000
Gravel Refill	170,000
Rock Excavation	174,300
Traffic Control	200,000
Pavement Restoration	1,484,700
Sub-Total	\$ 5,136,000
Contingencies (25%)	128,400
Sub-Total	\$ 5,264,400
Engineering Design Services	256,800
Construction Administration and Residential Inspection	513,600
TOTAL	\$ 6,034,800

5.3 EXISTING COLLECTION SYSTEM UPGRADE

5.3.1 A.S.Q.A.H. Road

The existing 10-inch sewer main from D57-01 to D57 will need to be upgraded to a new 12-inch sewer main along the same alignment for approximately 1,800 linear feet. The estimated cost for the replacement sewer is \$567,900 as summarized in Table 5-24.

TABLE 5-24 PROBABLE PROJECT COST FOR THE A.S.Q.A.H. ROAD SEWER MAIN REPLACEMENT		
12-inch Gravity Sewer	\$	216,000
Sewer Manholes		30,000
Gravel Refill		15,000
Rock Excavation		41,000
Pavement Restoration		28,600
Traffic Control		25,000
By-Pass Sewage Pumping		50,000
Sub-Total	\$	405,600
Contingencies (25%)		101,400
Sub-Total	\$	507,000
Engineering Design Services		20,300
Construction Administration and Residential Inspection		40,600
TOTAL	\$	567,900

5.3.2 Newcomb Road

The Town of North Kingstown's existing sewer main on Newcomb Road will need to be upgraded to a new 12-inch sewer along the same alignment for approximately 1,550 linear feet within Newcomb Road. Table 5-25 summarizes the estimated cost of \$608,800.

TABLE 5-25 PROBABLE PROJECT COST FOR THE NEWCOMB ROAD SEWER MAIN REPLACEMENT		
12-inch Gravity Sewer	\$	186,000
Sewer Manholes		21,000
Gravel Refill		13,000
Rock Excavation		37,800
Pavement Restoration		77,100
Traffic Control		50,000
By-Pass Sewage Pumping		50,000
Sub-Total	\$	434,900
Contingencies (25%)		108,800
Sub-Total	\$	543,700
Engineering Design Services		21,700
Construction Administration and Residential Inspection		43,400
TOTAL	\$	608,800

5.3.3 Diversion Structure to D57

A new 18-inch relief sewer will need to be constructed parallel to the existing 24-inch sewer main for approximately 2,200 linear feet. A new diversion structure will be installed at D57. This structure will be designed to divert approximately 3 MGD of flow into the existing 24-inch sewer main and 2.19 MGD into the new 18-inch sewer main. The estimated cost for the 18-inch relief sewer is \$1,284,000 as summarized in Table 5-26.

TABLE 5-26 PROBABLE PROJECT COST FOR THE NEW DIVERSION STRUCTURE TO D57	
18-inch Gravity Sewer	\$ 600,000
Sewer Manholes	44,000
Gravel Refill	66,000
Rock Excavation	82,000
Pavement Restoration	25,000
By-Pass Sewage Pumping	50,000
Diversion Structure	50,000
Sub-Total	\$ 917,000
Contingencies (25%)	229,300
Sub-Total	\$ 1,146,300
Engineering Design Services	45,900
Construction Administration and Residential Inspection	91,800
TOTAL	\$ 1,284,000

5.3.4 Wickford Point Pump Station

As a result of the assessment, the following upgrades have been recommended.

Mechanical Recommendation

A preliminary assessment to change the style of the pumps from dry pit submersible to suction lift finds that the change would permit the pumps to be moved from the lower level to the Control Room. The cost to replace the pumps, in kind, is \$19,800 plus \$10,000 for new controls (for a total of \$29,800). The suction lift pumps, including controls, would be \$120,000 plus \$21,000 for piping modifications for a total of \$141,000. Because of the significant differential, we recommend replacing the pumps in kind. It is also recommended that a new sump pumps be installed in the lower level.

Site Recommendation

The site constraints limit access to the station. The vegetation, shrubs and overhanging tree branches should be removed from the area. A new chain link fence (with privacy slats) should be installed. The placement of the fence should be designed to allow access for a vector truck for the purpose of cleaning the wetwell. The shrubs should be replaced with new plantings to add additional screening for the adjoining property owners.

Exterior Pump Station Recommendation

The exterior station should be cleaned. The exterior hatch should be replaced with an aluminum Bilco type hatch with the appropriate safety grating. The exterior louvers should be removed and the opening bricked in. New intake and exhaust louvers with an integrated fan should be installed on the roof of the structure. The bulkhead opening should be modified to prevent the groundwater from entering through the structure.

Electrical Recommendation

The power distribution equipment within the Control Room should be located in a controlled environment. A proper means of accomplishing both would be to house all the electrical equipment in a new galvanized steel, pad mounted weatherproof electrical enclosure. This enclosure would contain a new utility meter, new main circuit breaker, new automatic transfer switch, new panelboard, and new pump control panel. All existing power distribution equipment within the pump station should be demolished. Lighting, unit heater, exhaust fan, associated controls and associated conduit within the Control Room and Pump Room should be replaced.

The generator should be replaced with an outdoor weatherproof, sound attenuated, gas driven 40KW generator. The conversion to a gas generator will eliminate the potential environmental hazards of fueling the oil tank. The output of the generator will be connected to the transfer switch within the new electrical enclosure.

The existing pump control panel and float switch level control should be replaced with a new control panel that utilizes a microprocessor, or PLC based control system, along with a submersible pressure type level sensor, motor starters and a small door mounted HMI that will allow for complete operator level and pump control.

A Hi-Hi, Hi, Pump Shutoff, and Low Level float switches should be installed in the wetwell. The float switches will be wired into the pump control panel via intrinsically safe relays and shall be hard wired directly to each pump motor starter to act as backup control in case of a level sensor or RTU failure.

All alarm functions, pump run times, generator run times and intrusion alarms are to be reported to the new PLC. The PLC will send the signal (via radio) to a central location where the Town can remotely monitor the condition of the Pump Station.

The estimated cost is \$413,500 as summarized in Table 5-27.

TABLE 5-27 WICKFORD POINT PUMP STATION		
Mechanical	\$	34,800
Electrical		93,200
Instrumentation		21,000
Site Improvements		31,500
Exterior Building Improvements		87,000
Engineering Design		27,800
Sub-Total	\$	295,300
Contingencies (25%)		73,900
Sub-Total	\$	369,200
Construction Administration and Residential Inspection		44,300
TOTAL	\$	413,500

5.4 WASTEWATER TREATMENT FACILITY PRELIMINARY DESIGN

5.4.1 General

The project schedule for expansion of the QDC Wastewater Treatment Facility will depend upon the anticipated growth within the Town's future sewer area. The current agreement between the Town and QDC allows the Town to extend their future sewer system into the future service areas up to 200,000 gpd without requiring the necessary upgraded to the wastewater treatment facility. Once the Town reaches the 200,000 gpd or QDC's wastewater requirements change, the Town will be obligated to pay all of the associated costs for the design and construction to bring the plant to the capacity of 2.6 MGD.

Estimated overall capital costs associated with the project are shown in Table 5-28. In most instances, the cost for the installed component were taken directly from the previous plant upgrade costs and adjusted for inflation, utilizing the appropriate Engineering News Record (ENR) indexing factors. In cases where new

components are proposed, costs for construction were developed through vendor interviews or through EPA cost estimating guidelines for wastewater treatment facilities.

TABLE 5-28 QUONSET POINT WASTEWATER TREATMENT FACILITY CAPITAL COSTS	
Description	Cost
RBC Equipment - Piles	\$ 570,000
RBC Tanks	500,000
Chlorine Contact Tanks	550,000
Site Piping, Grading, Piles and Dewatering	900,000
DS-55 Pump Station Upgrade	800,000
Engineering	660,000
Sub-Total	\$ 3,980,000
Contingency	995,000
TOTAL	\$ 4,965,000



CHAPTER 6.0 ANTICIPATED ENVIRONMENTAL IMPACTS

RECOMMENDED PLAN

In this chapter of the Facilities Plan, a brief abstract of each portion of the selected plan is presented, along with a discussion of the environmental impacts that may result from implementation of the plan.

It is beyond the scope of this Facilities Plan to recommend which alternative should be implemented. That discussion rests with the citizens and the Town Council of North Kingstown and Quonset Development Corporation (QDC). Wastewater collections systems were evaluated for the Town along with upgrades to QDC's treatment systems with respect to its ability to meet established effluent limitations and water quality objectives at both present and future wastewater needs of the community. The alternative proposal this is the most environmentally sound and cost-effective will be selected. Preliminary plans and cost estimates will be prepared for proposed system upgrades.

6.1 NO CONSTRUCTION ALTERNATIVE

The No Build Alternative is for the Town of North Kingstown not to provide new wastewater collection systems in the future service areas. The No Build Alternative will continue to degrade the groundwater quality. Surface waters where high bacteria counts have been found include Mill Creek and Mill Cove, Fishing Cove, Wickford Harbor, Bissel Cove, and Academy Cove. In addition, high nutrient levels attributed to inadequate disposal systems have caused algal blooms and other incidents of increased plant growth in several water bodies. Failing sewage disposal systems will continue to impact water quality, create odors, and cause public health nuisances. The situation may become progressively more severe as the age of existing systems increases.

It is in the best interest of the Town to have a wastewater collection system that is adequate to handle the service area. A "no build alternative" will result in the non-point source pollutants migrating into surrounding surface water. Construction of pump stations for these projects will occur on land which may need to be purchased by the Town. Force mains and gravity sewers will be installed in the highway and will flow the existing alignments in the highway.

6.2 WASTEWATER TREATMENT FACILITY, INTERCEPTORS AND PUMP STATIONS

The preliminary design of the QDC Wastewater Treatment Facility, as discussed in Chapter 5, consists of hydraulic upgrades to 2.6 MGD / 6.5 MGD once the Town's wastewater flow reaches 200,000 gpd. The preliminary design of individual unit operations and processes is based on material balances throughout the entire system and takes into account recycle and return flows.

Existing Wastewater Treatment Facility

DS-55 Pump Station
RBC Equipment
RBC Tanks
Chlorine Contact Tanks

The interceptor and pump station recommendations are based on the adequacy analysis of each interceptor, pump station, and the transportation of wastewater from the future service areas. The pump station and interceptor are reviewed to determine the ability to accommodate present and future wastewater flows. The future wastewater flows generated by the service areas established the new interceptors and pump stations that are required. Based on this analysis, the residential and commercial flows will require a series of pump stations and interceptor sewers to carry the wastewater flow generated in these areas to QDC's system.

The *Post Road South Wastewater Collection System* will serve 285 acres of commercial land and 179 residential dwelling units. The collection system for Post Road South will consist of conventional gravity, lateral and interceptor sewers on Post Road, two (2) major pump stations, one (1) smaller pump station, and low pressure sewers with grinder pumps in the residential areas.

The *Post Road North Wastewater Collection System* will serve 240 acres of commercial land and 1,152 residential dwelling units. The collection system for Post Road North will consist of conventional gravity, lateral interceptor sewers on Post Road, three (3) pump stations, and low pressure sewers with grinder pumps in the residential areas.

The *Wickford Village/Poplar Point Wastewater Collection System* will serve 34 acres of commercial land, 13 acres of business waterfront, and 720 residential dwelling units. The collection system will consist of conventional gravity sewers, six (6) pump stations and low pressure sewers with grinder pumps.

The *Shore Acres Wastewater Collection System* will serve 344 residential dwelling units. The collection system will consist of conventional gravity sewers, four (4) pump stations and low pressure sewers with grinder pumps.

Existing Collection System: During different stages of wastewater flows from the Town's system, there will be sections of interceptor sewers that will need to be upgraded. This will involve the A.S.Q.A.H. interceptor and Newcomb Road interceptor. The Mark Drive Pump Station and Wickford Point Pump Station will also have to be upgraded due to their age.

The *DS-55 Pump Station* will be renovated to accommodate projected future flows. The pump station service area services the Town of North Kingstown and QDC. The existing station has provisions for a third pump system. It is recommended that the existing pumps be upgraded to achieve 1,800 gpm and a third pump be installed. The station is adequate for the existing flows.

6.3 DIRECT IMPACTS

6.3.1 Traffic and Daily Activities

Traffic impacts will result from construction operations. Police details can minimize these temporary traffic impacts. The impacts will be confined to the localized area of installation. Traffic control measures that comply with MUTAPS will be instituted prior to the construction and maintained during construction.

Existing Wastewater Treatment Facility: The construction will occur within the treatment facility property. Traffic to and from the facility will not be impacted by the construction. No impact to traffic in the surrounding roads will occur because the construction traffic is minimal.

Wastewater Collection Systems: Construction will occur in the existing street. Construction may require closing of the street for a portion of time due to the narrow configuration of the street and the need to install laterals across the road. The installation of the neighborhood collection system would have an impact on the residents who live there. This impact can be mitigated by supplying each residence with proper notification of the upcoming construction and potential for road closure.

DS-55 Pump Station: Upgrading the pump station will occur at the existing pump station (off the road) and will not impact the flow of traffic during construction.

6.3.2 Historic, Archaeological, Cultural, Recreational

Existing Wastewater Treatment Facility, Wastewater South Collection Systems, DS-55 Pump Station:

All the lands involved for gravity sewers and force mains are along the existing highway. Therefore, no archaeological, historical, cultural or recreational area will be lost by these projects.

The proposed pump stations are on land that was previously disturbed. Therefore, no archaeological, historical, cultural or recreational area will be lost by these projects.

The existing wastewater treatment facility is well developed and further improvements will have no impact on historical, archaeological, cultural or recreational resources.

Post Road South

During the preparation of the design plans, which are being developed concurrently with this report, the Rhode Island Historic & Preservation Commission has required a Phase IA Archaeological Reconnaissance Survey of Camp Avenue.

The field reconnaissance was conducted on June 3, 2011 by Gray & Pape, Inc. The project area along Camp Avenue was observed to be lined by both mixed commercial and residential properties. Commercial enterprises are located at the west end of the avenue, at its intersection with Post Road with single family homes, subdivisions, and apartment complexes located to the east.

The landform along Camp Avenue is composed of an elevated plateau near Post Road that meets a series of stream terraces to the east. These terraces run generally north south and are related to the Late Pleistocene and early Holocene down cutting of Mill Creek. From its intersection with Post Road Camp Avenue runs along the elevated plateau for 300 m (984 ft) to Station 5 (Plate 2). The landform then slopes down moderately at 10-15 degrees for 60 m (197 ft) between stations 5 and 9 before running along a level terrace for 185 m (607 ft) between stations 9 and 15 near Robin Drive (Plate 3). Near Station 15 Camp Avenue curves southward along level terrain for 250 m (820 ft) until the roadway crosses Mill Creek near Station 23 (Plate 4). The roadway then runs along a level landform to its intersection with ASQAH Drive, where the project terminates.

The following summarizes the findings and recommendations. For the complete report, refer to Appendix B.

Prehistoric Sensitivity: The Bay Area Coastal Context (see above; RIHPHC 1986) is analogous to the Salt Pond Region, where salt ponds are replaced by small bays and estuaries (McDonough and Bennet 1989). These locations provide access to both fresh water and the rich and varied food sources associated with the coastal zone, i.e. anadromous fish runs, shell fish, and mammals accessing wetland areas, and are typically associated with a diverse range of prehistoric activities. In addition, portions of this area also display the micro-environmental setting (level, elevated landforms with well drained soils and access to a diverse resource base) that is typically associated with prehistoric habitation.

Not only does the environmental setting along Camp Avenue fulfill the criteria of both the large and small scale models of prehistoric land use, but it is also a setting where numerous prehistoric sites have been previously discovered. Most significant in its proximity to the Project is the Fuller Site (RI 142), which was discovered adjacent to Camp Avenue just west of its crossing of Mill Creek. Although only studied at the Phase I level, RI 142 was interpreted as the site of either long term or repeated short term occupation. It should also be noted that a burial site was reportedly excavated near the intersection of Post Road and Camp Avenue in the late 19th century (Hebert 1983). These sites may fit within a larger network including large habitation sites in the area such as Cocumscussoc/Smith's Castle (RI 294) and South Wind (RI 1006).

Based on this evidence, the level and elevated portions of Camp Avenue within 150 m (492 ft) of Mill Creek, its associated estuary, or brackish wetlands, are considered highly sensitive for prehistoric archaeological resources except where urban activity has disturbed the natural stratigraphy. In addition, the area within 100 m (328 ft.) of the intersection of Post Road and Camp Avenue is considered moderately sensitive for prehistoric remains based on the presence of burials nearby. This area is not considered highly sensitive, because it is reported to have been previously excavated and was likely subsequently disturbed by the 20th century construction of a service station. The remainder of Camp Avenue within the project area is considered to have low sensitivity for prehistoric archaeological resources, based on prehistoric land use patterns (see above), a lack of reported sites, or contemporary disturbance.

Historic Sensitivity: The area of Camp Avenue was first deeded to Europeans in 1659 as part of the Atherton Purchase. The Smith's Castle Plantation retained ownership of the property until the late 17th century, when maps show Camp Avenue as the border between the Smith's Castle Plantation and the farms of Benjamin Reynolds and Joshua Pearce. The Camp Avenue area appears to have undergone little development through the 19th century, remaining a locale of dispersed estates and few recorded structures.

Both residences and commercial activity appear to have been concentrated near the intersection of Camp Avenue and Post Road. This intersection continues to be the center of commercial activity today, and as such, has likely undergone extensive modern disturbance. The exception to this pattern is a grist mill erected by John Tenant in the late 18th century.

This mill remained in operation through the 19th century and was expanded by George Tourgee, one of its later owners. In addition, the mill is reported to be collocated with a private toll bridge in operation during the 18th century (Simister 1974). The mill fell into a state of disrepair in the 20th century and was destroyed by a hurricane in 1938.

Based on this evidence, the area of Camp Avenue within 100 m (328.083 ft) of Post Road is considered to be moderately sensitive for archaeological resources. In addition, the location where Camp Avenue crosses Mill Creek is considered to be highly sensitive for archaeological resources related to the historic grist and saw mills that may have been present at this location. While these resources were reportedly destroyed in the hurricane of 1938, portions of the extensive stone foundations and water control features associated with the mill may remain extent below the surface. The remainder of Camp Avenue within the project area is considered to have low sensitivity for historic archaeological resources, based on the lack of historic evidence for structures in the area. Because of the agricultural nature of this land, the possibility remains that unmapped farm outbuildings may have been present in the area.

Recommendations

Because portions of the project area along Camp Avenue are considered to have high or moderate sensitivity for both prehistoric and historic archaeological resources a Phase IB survey including controlled subsurface testing is recommended. Subsurface testing is recommended below the road deck along the proposed route of the sewer main at 15 m (49 ft.) intervals in areas of moderate sensitivity and at 10 m (33 ft.) in areas of high sensitivity. Given this sensitivity, it is recommended that fieldwork be completed as soon as possible in order to ensure that the discovery of significant resources will not impact the proposed construction schedule.

Because the coastal zone in this area was intensively utilized prehistorically, i.e. burials and large habitation, and many types of historic structures, i.e. farm outbuildings and paupers graves, are not recorded on historic maps it is recommended that an archaeological monitor with stop work authority be present during construction activities along Camp Avenue.

6.3.3 Soils and Hydrology

Agricultural Land

There are no agricultural lands within all of the project areas that could be affected by the project work. The sewer line installations will occur along the Post Road Corridor and the existing residential neighborhood which abuts Post Road, Wickford Village/Poplar Point, or Shore Acres.

Soils

Existing Wastewater Treatment Facility (DS-55 Pump Station):

The existing facility is classified as Urban Complex ^{1 2}, that is land that is well developed and changed by previous construction.

Wastewater Collection Systems:

The underlying soils of this area are the Broadbrook Silt Loam, Rainbow Silt Loam and Bridgehampton – Charlton Very Stony Complex. These soils have moderate permeability in the surface, but slow to very slow permeability in the substratum. The Rainbow soil has a seasonal high water table at twenty (20") inches below the surface. Slow permeability can lead to failed Individual Sewer Disposal Systems and surface flow of the wastewater.

Hydrology

Impacts of the proposed facilities on the hydrology of the area will be negligible. Construction of sewer lines in the high water table areas will act as a drain when the groundwater reaches the layer of stone around the pipe. However, normal construction practices tend to prevent this water from moving horizontally.

6.3.4 Erosion Control

It is anticipated that (during construction of all the proposed projects) actions are needed to prevent exposed soils from migrating off-site either by wind or rain. This will require dust control and erosion

¹ Soil Survey of Rhode Island, USDA, Soil Conservation Service and Rhode Island Agricultural Experiment Station, July 1981

² Soil Hydrology, RIGIS, University of Rhode Island

control measures to be instituted by way of stacked hay bales, silt fence, and covering of stockpiled materials.

6.3.5 Water Quality

Non-point pollution is obvious in many of the areas where these projects are proposed. Drainage and runoff from the land areas of the project area are significant sources of non-point source pollution. All of the proposed projects are designed to improve the water quality of the adjoining coastal waters by removing the septic waste leaching from inadequate systems into soils that promote non-point source pollution. Improved water quality of the adjoin areas may benefit aquatic life through the reduction of bacteria and nutrient loading.

6.3.6 Building Displacement

No buildings, residences, or commercial structures will be displaced during any of these projects.

6.3.7 Noise, Air or Visual Pollution

Wastewater Collection Systems: During construction, there will be noise from the operation of heavy equipment when preparing the trench for the sewer mains and construction of the pump stations. After construction, the new facilities will not produce noise because all operations occur within the buildings and consist of the operation of pumps. The building areas are minimal in size and designed to be similar to the surrounding structures. Air quality effects during construction are principally related to suspended dust particles due to trench excavation, stockpiling material, and vehicular solids breakdown and transport. These effects are obviously local and of short duration, although potentially aggravating and annoying. Other effects on air quality during construction will be increased emissions of carbon monoxide and hydrocarbons from heavy duty vehicles and gasoline-driven pumps and generators. These effects will not significantly change the areas' atmosphere and are considered inconsequential. After construction, the force mains are completely enclosed and will not cause air, noise or visual impact. The pump stations are constructed in such a way to blend with the surround areas and operate with no impact to noise or air quality.

6.3.8 Floodplain

Floodplain areas are traversed by segments of the Post Road North in the areas of Chadsey and School Street sewers. Pipe trenches will range from a width of 3 to 5 feet and a depth of 10 to 15 feet. Floodplain impacts will be linear and temporary in nature, except where occasional trees have to be removed. Much of the corridor is within the existing roadway and has been previously disturbed. The sewer installation will have no affect on the floodplain storage areas.

Suitable alternatives to avoid wetland and floodplain areas are not available due to topographic limitations and the need to collect point sources immediately adjacent to water courses. No significant permanent effects to any floodplain (i.e., storage, aesthetics, habitat, human health, and welfare) are being compromised by adoption of the selected plan. Some minor alterations to floodplains will likely be required to expand the QDC sewage collection system. These projects will require approvals from the Rhode Island Department of Environmental Management (RIDEM). No net reduction in flood storage capacity will be required.

Freshwater and Coastal Wetlands: In general, reduced bacteria and nutrient levels may result from the expansion of the wastewater collection system by eliminating problematic OWTS areas. Reduced nutrients may reduce the eutrophication rate of surface water bodies in the area.

Primary adverse impacts associated with the expansion of sewers involve construction activity and temporary disturbances. A list of major wetland area and the portion of the collection system that will affect construction-related impacts is presented below:

<u>Wetland Area</u>	<u>Collection System Section</u>
Sand Hill Brook	Chadsey
Saw Mill Pond	School Street Sewers
Pine River	

Construction impacts to wetlands are primarily in the form of erosion and sedimentation. The washout of soil excavated from trenches could severely affect local storm drainage structures and private property, increasing maintenance costs, reducing water quality, and possibly causing localized flooding problems. These impacts will be regulated by the RIDEM.

6.4 INDIRECT IMPACTS

6.4.1 Urbanization

These areas are residential with some vacant lots that may be developed once the sewer line is installed. The effect of the sewer line is to improve the water quality of the adjacent water bodies. The need for pump stations is to most efficiently and economically remove the wastewater from the service areas. The inadequacy of the DS-55 Pump Station is the result of all the new stations installed by the Town that feed DS-55 Pump Station. Without the upgrade of the pump station, additional development will overtax the station and cause overflow.

6.4.2 Local Suppliers

Improvements to the collection system obviously have the potential to provide short-term benefits to local skilled and unskilled workers with jobs in the construction trades. The project will require the skills of excavating contractors, pipe installers and paving companies. Construction will create a demand for materials such as pipe, soils, pumps and asphalt, plus the work will promote local economic benefits due to worker needs for food, beverage and personal equipment.

6.4.3 Local Services

Local vendors will receive minimal increase in business during construction. The work crew will be less than fifteen (15) people and will not increase demand for local services. No businesses will be impacted during the construction of the collection system within the residential neighborhood. During the construction along Post Road, local businesses may experience a minor disruption in their business with the detouring of traffic. The construction will be set up to ensure that the consumers will have access to the local businesses.

6.4.4 Recreation

The primary beneficiary of the installation of sewer lines is the improvement to the coastal waters that abut the projects. Recreational opportunities are limited because of the non-point pollution from Individual Sewer Disposal Systems. Overall, recreation and improved water quality are a secondary benefit and two of the main reasons for the construction of these projects.

6.4.5 Land Use

Impacts to land use are predominantly construction related short-term impacts associated with pavement breaking, sewer trench excavating, pipe placement, trench backfilling and paving of the existing street. Nearly all of the construction occurs within existing roads and on properties already occupied by pump stations. The installation of sewers along Post Road will allow the Town to promote its Post Road District.

The Post Road District designation is intended to encourage development of harmonious, efficient and environmentally sound neighborhoods by promoting variety in land use, residential density and site design through the grouping or other configuration of buildings and by the preservation of unique features of the site and may include compatible residential and recreational uses. It will also allow a mix of uses in the village center areas of Town. The businesses in this designation serve the needs of neighborhood residents. Small village scale business along Boston Neck Road and Tower Hill Road are examples of this land use designation.

Increased use of the surrounding lands may occur after the installation of sewer lines due to the ability to develop vacant lots that can be served by a sewer line.

6.4.6 Energy

Energy consumption during construction will be in the form of gasoline and diesel engines, electricity for small hand tools and potable water for testing, cleaning and drinking. After construction, the pump stations will have pumps in constant operation. A small electric heater, an exhaust fan, fluorescent lighting and receptacles will operate in the pump stations

6.4.7 Economics

There will be minimal impact to the local economy during construction. After construction, the sewer will provide an economic benefit to the Town by allowing them to develop the land use in conformance with the Comprehensive Plan.

6.4.8 Public Safety

Care is needed with flaggers, signs and warning devices. Traffic control is needed to permit the traffic access to residential homes.

Existing Wastewater Treatment Facility (DS-55 Pump Station):

The work at the Treatment Facility will consist of construction within the complex, thus having no impact on traffic.

Wastewater Collection Systems:

Traffic control will be critical on the narrow roads in this area, and the opportunities for detours are minimal. Flaggers and traffic control will be necessary for this work. Warning devices and signs will be critical during the preconstruction and construction phases to give adequate warning to the residents.

6.4.9 Aesthetics

For all of the projects, the paving of the roads will improve the surface and appearance of the road once the sewer lines are installed. The installation of gravity sewer lines and manholes will not change the view from the current view. When completed, the sewer line is underground and only the manhole covers are exposed as a flush unit in the roadway.

The pump station buildings are to be constructed of materials similar to those in surrounding buildings and blend with the adjoining facilities.

6.4.10 Visual Amenities

There will be no change to the visual impact of these areas over the present conditions.

6.5 SUMMARY

Primary adverse impacts associated with the project to install the pump stations, force mains and interceptors are construction activity and temporary disruption of traffic. All wetland, coastal features and stormwater catch basins need protection with soil erosion methods, including silt fence and hay bales. The potential for soil erosion exists where the soils are so permeable.

The project will provide increased sewer capacity in the QDC Wastewater Treatment Facility. Installation of sewer lines in the critical land areas will improve water quality by collecting wastewater before it leaches into the soil.



7.1 INSTITUTIONAL RESPONSIBILITIES

In July 2010, the Quonset Development Corporation entered into an agreement with the Town of North Kingstown to allow 200,000 gallons per day (gpd) wastewater to enter QDC's collection and treatment system. The 200,000 gpd of flow granted by North Kingstown has allowed the Town to begin the sewerage of Post Road South without being required to undertake major upgrades to QDC's infrastructure. Currently, this agreement is under consideration to be modified to increase the flow to 828,106 gpd.

Comments:

- Acknowledge that for any wastewater flows from North Kingstown beyond the 200,000 gpd, QDC will be required to seek a permit change. This permit change may affect the discharge concentrations of BOD₅ and TSS, as well as the hydraulic conditions
- Acknowledge that they (QDC) will accept the projected future flows from North Kingstown of 828,106 gpd per day, but will not accept more than the 200,000 gpd without expansion of the infrastructure and permit modification. The cost associated with any upgrade directly related to North Kingstown's request for wastewater flow and permit reduction in BOD and TSS will be the responsibility of the Town.

The agreement and amendments can be found in Appendix D.

The following are key elements of the agreement which both parties have agreed to:

- a. North Kingstown will install a suitable flow metering device to record sewage flow from the Town to the QDC facility. North Kingstown will be responsible for the maintenance and operation of the meter. Ultimately, the meter will be used for billing purposes. QDC will invoice the Town for costs of service based on the meter reading. North Kingstown will be responsible to invoice the individual users.
- b. The Town must adopt QDC's industrial pretreatment standards in order to maintain the integrity of treatment process.

c. The Town has agreed to accept responsibility for all current sewer use connections of properties located outside Quonset Business Park ("Additional Service Areas") which include the following:

- ASQAH – Multi-Unit Apartments on Asqah Dr., off Camp Ave.
- Essex Village – Multi-Unit Apartments on Newcomb Rd.
- G. Grossmans – Multi-Unit Apartments on Cattail La., Mill Creek Dr., Ripple La., Waterwheel La., off Camp Ave.
- Kings Grant – Multi-Unit Apartments, Newcomb Rd.
- MHRH – Shore Court Housing, off Post Rd.
- Kingstown Heights – Private homes, 134, 146 and 168 Mark Dr.
- Fishing Cove School – public school at 11 Wickford Point Rd.
- Quonset School (SOROCO) - Private school, Camp Ave.
- Quidnesset School – public school at 166 Mark Dr.
- Phoenix Properties (Heritage) – Multi-Unit Apartments, 552 Devils Foot Rd., 580 Devils Foot Rd., 0 Union Dr., 24 Union Dr., 46 Unit Dr., 59 Union Dr.
- Lischio – Private Home, 165 Namcook Rd., and Multi-Unit Apartments, 620 Devils Foot Rd., 660 Devils Foot Rd., 604 Devils Foot Rd., 604 BD A Devils Foot Rd., 604BD B Devils Foot Rd.
- Lischio/Moran – Future Multi-Unit development, previous Drive-in, Namcook Rd.
- Travelers Aid – Multi-Unit Housing, Navy Dr. off Devils Food Rd.
- Wickford Point – Private Homes, Harbor Ct., Lands End Dr., Sea Grass Way, Wickford Point Rd.
- North Kingstown Transfer Station – Davisville Rd.

d. In the event that treatment facility is required to reduce the plant's effluent loadings to the receiving waters from its current treatment levels (for example, BOD, nutrient removal, etc.), as directed by RIDEM during the term of the contract, North Kingstown must agree to pay a flow proportionate share of the cost.

e. The evaluation of future flows must be examined to, first, meet the needs of the Quonset Business Park (QBP), second, to accommodate the Post Road South Commercial, and third, to accommodate the Town of North Kingstown's request for the balance of the 828,153 gpd.

7.2 COLLECTION SYSTEM IMPROVEMENTS

The Town of North Kingstown will need to institute a procedure that will allow an existing developed neighborhood and/or commercial establishment to be considered for sanitary sewers:

1. The area in question must be recognized by the Town of North Kingstown (Town Council) as being part of the future sewered area, and

2. Sufficient capacity must exist in the conveyance and treatment systems for the proposed additional flow, and
3. A petition (of at least the simple majority of the property owners) must be presented to the Town Council for consideration, then
4. The Town Council would then authorize the development of a preliminary plan and construction cost estimate for the neighborhood in question, then
5. The Town would convey this information to the petitioners; if the petitioners are still in agreement with the project, the Town would include same in the annual Capital Improvement Program (CIP) budget request for the next fiscal year. Projects whose value exceeds a certain financial threshold (that is tied to the Town's debt issuance limit each year) would have to be submitted to the General Assembly for approval of a voter referendum.
6. The Department of Public Works would present an assessment plan to the Town Council for adoption. The costs are to be amortized over twenty (20) years, with the interest rate directly tied to the rate that the Town borrows the money at.
7. A Town-wide voter referendum would be held on the subject of borrowing the necessary funding for the project. Although the repayment will be made by the benefitted users, the State Revolving Loan requires the Town to pledge its credit to the borrowing, hence the Town-wide bond referendum.
8. Should the referendum pass, the Town would begin the process for the design and construction of the sewers in question.
9. At the completion of construction, when all actual project costs have been tabulated, the assessment program amounts would be recalculated. Property owners are then given the choice to pay the assessment in a lump sum, or over twenty (20) years with interest. The assessment runs with the land; any outstanding balance when the property is transferred (by any means) is disclosed to the buyer, and he\she would either retire said balance in a lump sum, or assume the annual payments for the duration of the twenty (20) years. The loan can be repaid in full at any time by the property owner, without any pre-payment penalty.

10. The Town must include a fixed "time for connection" wherein every developed property has to connect to the new sewers within one (1) year of availability.

7.3 FINANCIAL IMPACT RELATING TO WASTEWATER TREATMENT IMPROVEMENTS

The financial impact to the Town is broken down into two categories. The first relates to the cost to upgrade QDC's existing infrastructure and the second is the cost for the Town's infrastructure.

QDC Infrastructure Cost

In accordance with the intergovernmental agreement, the Town will be responsible for capital costs associated with the upgrades once the Town's flows reach 200,000 gpd from the proposed service area, as presented in Table 7-1.

TABLE 7-1 SUMMARY OF COST TO IMPROVE QDC'S INFRASTRUCTURE	
	Total Cost
Diversion Structure and Gravity Line Upgrade to WWTF (2.6 MGD)	\$ 1,284,000
	4,965,000
TOTAL	\$ 6,249,000

North Kingstown Infrastructure Cost

Table 7-2 presents the total cost associated with North Kingstown's upgrade of the existing collection system.

TABLE 7-2 SUMMARY OF COST – EXISTING COLLECTION SYSTEM		
Area	Cost	Affected Users
Newcomb Rd. Interceptor	\$ 608,800	Post Rd. North, Pine River & Mark Dr. Area
ASQAH Dr. Interceptor	\$ 567,900	Post Rd. South 1 & 2, Wickford Village/Poplar Pt. & Shore Acres

The total estimated capital cost for the North Kingstown infrastructure has been broken down into six phases (two within the south and four within the north). Table 7-3 provides a summary of the project cost for commercial and residential properties. The commercial assessment has been based on a cost per developable commercial area and the residential assessment has been based upon a cost per linear foot of frontage with a minimum frontage of 100 feet.

TABLE 7-3 SUMMARY OF NORTH KINGSTOWN'S CAPITAL COST						
	Commercial Cost	Residential Cost	Commercial Acreage	Residential L.F.	Commercial Cost/Acre	Residential Cost/L.F.
Post Road South	\$ 9,026,200	\$ 4,830,606	285	39,200	\$31,670	\$123.23
Post Road North	\$10,389,300	\$19,250,500	240	119,600	\$43,228	\$160.96
Pine River		\$ 1,330,800		10,200		\$130.47
Mark Drive		\$ 3,534,000		28,400		\$124.45
W1 Wickford Village / Poplar Pt.		\$15,364,600	*			
W2 Wickford Village / Poplar Pt.		\$11,872,500	*	97,200		\$350.85
W3 Wickford Village / Poplar Pt.		\$ 6,865,500	*			
Shore Acres (gravity)		\$13,207,800		42,800		\$308.60
Shore Acres (low pressure)		\$ 6,034,800		42,800		\$141.00

* Commercial units are included with Residential units

Table 7-4 presents a summary of the anticipated annualized cost. The annualized cost includes the principal and interest paid over twenty (20) years at an interest rate of 3%.

TABLE 7-4 SUMMARY OF ANTICIPATED ANNUALIZED COST		
	Total Cost Per Unit	20-Year Bond @ 3% Interest
<u>Post Road South</u>		
Commercial	\$ 9,026,200	\$12,014,181
Residential	\$ 4,830,606	\$ 6,429,701
<u>Post Road North</u>		
Commercial	\$10,389,800	\$13,829,179
Residential	\$19,250,500	\$25,623,074
Pine River (Residential)	\$ 1,330,800	\$ 1,771,340
Mark Drive (Residential)	\$ 3,534,000	\$ 4,703,874
Wickford Village/Poplar Pt. (Residential)	\$34,102,600	\$45,391,727
Shore Acres (Residential) – gravity	\$13,207,800	\$17,580,033
Shore Acres (Residential) – low pressure	\$ 6,034,800	\$ 8,032,525

Units for Commercial = 1 Acre
Units for Residential = 1 Dwelling Unit

7.4 IMPLEMENTATION SCHEDULE

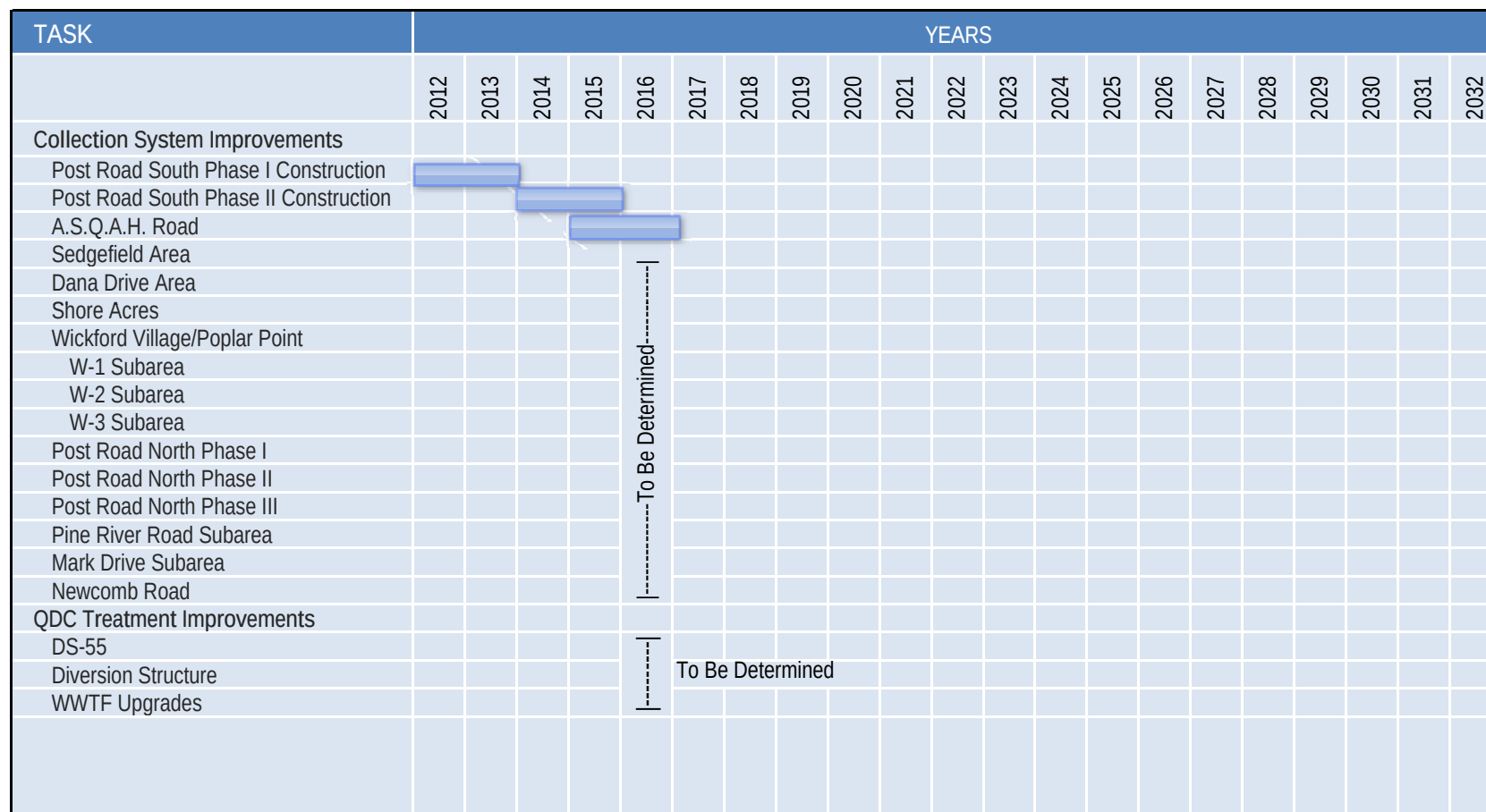
As discussed in the previous sections, implementation of the proposed collection and treatment system improvements should be approached as phased activities based on the financial resources available to the Town and the overall need of the improvements at the particular time. Figure 7-1 provides a bar graph depicting the general schedule for implementation and the projected flow corresponding to the improvement.



Construction Schedule

Figure 7-1

Town of North Kingstown



7.5 SOURCE OF FUNDS

Funds for financing the construction of wastewater treatment and collection facilities are commonly derived from a combination of four principal sources:

State Revolving Fund (SRF) low-interest loans;

1. General Obligation Bonds;
2. Betterment Assessments upon properties which abut the new sewers; and
3. Sewer Service Charges to sewer users.

The first three items, or in some cases a combination of the three (SRF low-interest loans, general obligation bonds and betterment assessments), are commonly used to finance capital improvement costs for sewer systems. The fourth item (sewer service charges) is paid strictly by the users of the sewer system as customers and is typically set annually by the Town based on the budgetary projections of those costs that are required to operate, maintain and improve the existing wastewater collection and treatment system throughout a particular fiscal year.

1. State Revolving Fund

The State Revolving Fund is a loan program established by the U.S. EPA that allows individual states to make low-interest loans to cover the cost of wastewater improvement projects. The SRF is administered by the Rhode Island Clean Water Finance Agency and the RIDEM. Based on demonstrated project need, loans are made available to finance up to 100% of engineering and construction costs. Loans have a payback period of twenty (20) years and carry an interest rate of $\frac{1}{3}$ less than the current market value. For the purposes of this report, an interest rate of 3.0% is used in future repayment schedules. These low-interest loans that are used for town-wide capital improvement projects are repaid with proceeds from betterment assessments received from those parties or individuals benefitting from the sewer system; ad valorem property taxes assessed town wide, through the Town's general fund; or a combination of both. Ad valorem taxes may be levied by the Town on real estate, personal property, or both. That portion of the tax rate applicable to the wastewater related capital improvements should, however, be specified and tracked exclusively with separate accounts.

In those qualifying cases where SRF low-interest loans are borrowed by the Town for improving the existing wastewater treatment and collection system under which such improvements are directly related to improving overall service to its customers and therefore, unrelated to developing and/or otherwise increase the overall design capacity of the system for future use and/or expansion, the repayment of the loan typically remains a component of the O&M budget and paid for by the customers of the system under the revenues collected from the annual sewer service charges.

These methods of repayment are similar to the methods used for the repayment of general obligation bonds. However, due to the specifics of the SRF funding program, the interest rate is typically significantly lower than those available for general obligation bonds thereby making the SRF program a more attractive and cost effective means of financing qualifying wastewater type projects. Funded projects usually include treatment facilities, interceptors, force mains, pump stations and sewer extensions.

2. General Obligation Bonds

General obligation bonds are full faith and credit certificates of debt issued by the Town guaranteeing payment of the principal amount borrowed plus interest. Since general obligation bonds essentially constitute liens on certain municipal assets, they tend to be more attractive to buyers and generally bear lower rates of interest than other types of bonds. Their use does not require the accrual of reserves, nor is there a need to demonstrate a history of collections other than the normal sources of municipal revenue. General obligation bonds issued for purposes of financing the construction of wastewater treatment and collection facilities are repaid with proceeds from betterment assessments received from those parties or individuals benefitting from the sewer system; ad valorem property taxes assessed town wide, through the Town's general fund; or a combination of both. Ad valorem taxes may be levied by the Town on real estate, personal property, or both. That portion of the tax rate applicable to the wastewater related capital improvements should, however, be specified and tracked exclusively with separate accounts.

In those cases where general obligation bonds are secured by the Town for improving the existing wastewater treatment and collection system under which such improvements are directly related to improving overall service to its customers and therefore, unrelated to developing and/or otherwise

increase the overall design capacity of the system for future use and/or expansion, the repayment of the bond typically remains a component of the Operations & Maintenance (O&M) budget and paid for by the customers of the system under the revenues collected from the annual sewer service charges.

3. Betterment Assessments

Betterment assessments are fees placed upon properties that either abut or directly benefit from construction of a sewer extension. The means and methods for formulating better assessments for communities can vary considerably based on locality and established elements of practice. Typically, betterment assessments are collected as revenue and applied directly to defray all or a portion of the overall cost for constructing and financing lateral sewer projects, including any associated pump stations and force mains throughout a particular community and/or the applicable portions of interceptor sewers that provide a direct benefit to a particular property. When using betterment assessments to fully fund treatment facility improvements and interceptor sewers, relief sewers, large pump stations and force main construction, it is important to take into consideration all future users of the system.

In some cases, especially in newer wastewater systems that are in their infancy of operation, the betterment assessments are retained by the Town and applied to help defray the costs for operating and maintaining the new system during the initial years. Under these circumstances, ad valorem taxes are typically the sole source of revenue for the repayment of debt associated with the sewer program. This practice is sometimes used as a means of controlling the user fee charges to individual property owners when the O&M costs far exceed a reasonable allocation of costs upon the individual users based on the limited number of users utilizing the overall system during the initial years. Once a system reasonably establishes itself with a sufficient number of users, the O&M costs incurred should then be allocated solely to those users using that system. At that time, any and all betterment assessments assessed and collected should be directed towards the reduction in the overall debt for improving the system being utilized as previously discussed.

4. Sewer Service Charges

A sewer service charge, or user fee, is assessed against those properties that are actually connected to the Town's sewer system and is generally used to pay for operations, maintenance

and general improvements associated with the existing wastewater treatment and collection facilities.

Given the available sources of funding, it is recommended that the Town pursue funding for all of the town-wide wastewater related capital improvements under the SRF program. This recommendation is based on the Town's eligibility under the SRF program to borrow principal amounts at a much lower rate of interest than those available under the issuance of general obligation bonds.

7.6 OPERATIONS AND MAINTENANCE COSTS

The estimated maintenance costs for the proposed North Kingstown Collection System are presented in Table 7-5. These costs are in 2010 dollars and were computed from data obtained from Construction Cost Indices and the Operation, Maintenance and Repair Costs, U.S. EPA Office of Municipal Pollution Control. In addition to these costs, the Town will be assessed an annual fee from QDC associated with their cost to treat the Town's wastewater.

TABLE 7-5 NORTH KINGSTOWN COLLECTION SYSTEM PROBABLE MAINTENANCE COSTS	
Expenditure Category	Annual Cost
Salaries (including taxes and overhead) Superintendent and 2 Part-Time (Technical Support & Clerical)	\$ 130,000
Insurance	15,000
Legal Engineering	5,000
Insurance	19,000
Supplies	2,000
Utilities	24,000
Pump Station Supplies	2,000
Repair/Maintenance	10,000
Renewal/Replacement Equipment	5,000
TOTAL	\$ 212,000

Note: Total Cost does not reflect Operational Charges assessed by QDC

7.7 RECOMMENDED STAFFING

A great deal of time, effort, and money will go into the design and introduction of the additions to the Wastewater Collection System. In support of this initial investment, plus the annual operating costs, it is important for the collection system to be staffed by qualified, competent personnel.

At the present time, the management of the collection system and pump stations is supervised by the Water Department. The Director of Water Supply is the individual who coordinates the efforts of a private contractor (who is responsible for all maintenance of the system). This organization structure should be modified. The responsibility of the Wastewater Collection System and the Wastewater Management Plan should be under the supervision of the Director of Public Works. A proposed Organization Chart is presented in Figure 7-2.

The anticipated initial staffing is projected to include one full-time Superintendent and two part-time employees (a maintenance technician and a clerical person).

The staffing requirements are based on an employee normal payroll year consisting of 52 weeks at 40 hours per week and a 5 day per week (Monday to Friday), 8 hours per day.

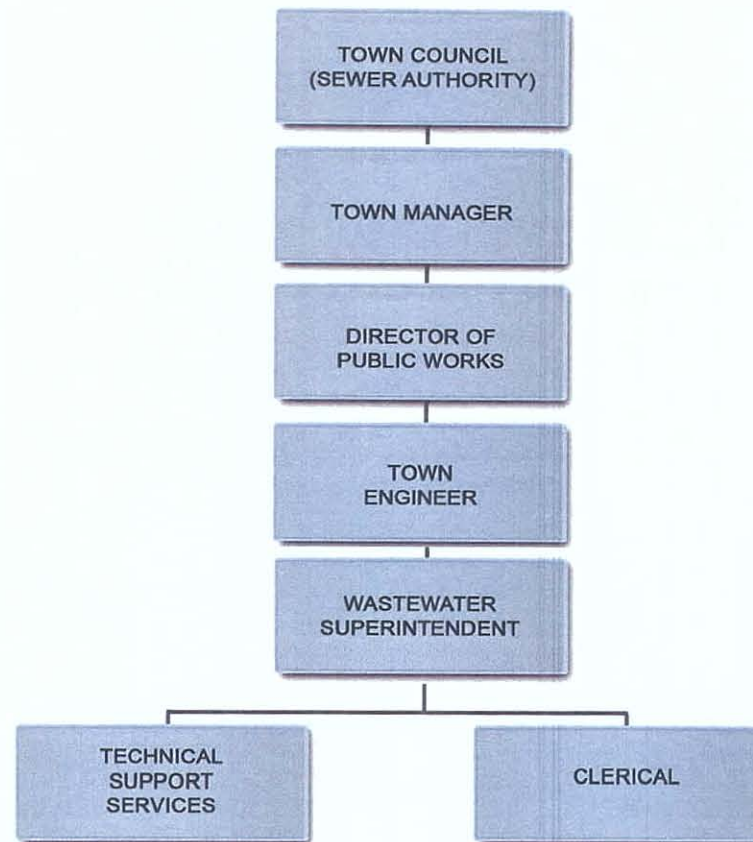
The Superintendent shall have a direct responsibility for the administration, operation, and maintenance of the wastewater collection system, including enforcement of safety regulations and, as otherwise required. He will be responsible for all budgetary requirements.

The maintenance technician will assist the Superintendent in performing all the prevention and corrective maintenance required in the collection system.

The Superintendent and maintenance technician will be responsible to perform inspections at regular intervals, consisting of surveillance of the condition of the collection system, performance of flow measurements and pumping stations. Inspections will reduce the amount of repairs needed and minimize emergency work. Routine maintenance shall include tasks that are required to maintain the collection system in operation and are performed on a periodic basis. The tasks include cleaning and removal of obstructions from sewer lines, maintaining pumping stations, and other operating or monitoring equipment associated with the collection system.

The clerical person will be responsible to issue permits, prepare sewer user bills, maintain the sewer assessment role and as-built drawings.

Figure 7-2
Town of North Kingstown
Organization Chart





8.1 PUBLIC PARTICIPATION

A public participation program is underway as part of this project. The purpose of the public participation program is to keep citizens informed and provide them the opportunity to assist in the decision making process.

A public meeting was held before the Town Council on 24 October 2011 at the Senior Center in North Kingstown. A presentation was made to describe an overview of the project and the tasks involved in completing the project. The key objective was to describe the planning area, the impact the plan will have on the Town, the necessary upgrades at QDC's facility and proposed sewer extensions, along with an explanation of the criteria used in establishing the wastewater flows. The meeting was opened for questions and comments. The handout material for this meeting was Chapter 1.0 (Executive Summary). The Powerpoint slides are included in Appendix D.

APPENDIX A

WASTEWATER MANAGEMENT PLAN

ARTICLE VIII. NORTH KINGSTOWN WASTEWATER MANAGEMENT DISTRICT*

*Cross references: Utilities, ch. 20.

Sec. 8-140. Authority.

This article has been drafted in accordance and under the authority of G.L. 1956, § 45-24.5-1 et seq., entitled "Waste Water Management Districts." The authorizing state chapter shall be known and cited as the "Rhode Island Septic System Maintenance Act of 1987."

(Ord. No. 99-3, § 1, 1-11-1999)

Sec. 8-141. Findings.

(a) The legislative findings set forth in G.L. 1956, § 45-24.5-2 are incorporated in this article by reference.

(b) The town council finds that, without proper operation and maintenance, individual sewage disposal systems (ISDS) or septic systems are prone to failure. Failure poses a risk to public health and a potential contamination source to the town surface waters and groundwaters.

(c) Two groundwater aquifer systems underlie the town. In 1988, the Hunt Annaquatucket Pettaquamscutt (HAP) Aquifer received federal designation as a Sole Source Aquifer (SSA) under the authority of the Safe Drinking Water Act. The Chipuxet Aquifer is a part of the Wood-Pawcatuck Sole Source Aquifer and underlies the southwestern portion of town. The town is entirely dependent on these groundwater resources for its water supply needs. In addition, the town is a coastal community with 31 miles of coastal and estuarine waters including enclosed bays and coves.

(d) When properly designed, installed, used and maintained, individual sewage disposal systems provide a viable and cost-effective alternative to municipal sewers. Furthermore, within groundwater recharge areas, individual sewage disposal systems help maintain the hydrological balance by reducing the transport of water out of the recharge area.

(Ord. No. 99-3, § 1, 1-11-1999)

Sec. 8-142. Purpose.

The declaration of purpose set forth in G.L. 1956, § 45-24.5-3 is incorporated in this article by reference. The purpose of this article is to establish the North Kingstown Wastewater Management District (NKWWMD) to ensure that individual sewage disposal systems are properly operated, regularly inspected and routinely maintained to prevent malfunctioning systems.

(Ord. No. 99-3, § 1, 1-11-1999)

Sec. 8-143. Applicability.

This article shall be applicable to every owner of premises that have an individual sewage disposal system within the North Kingstown Wastewater Management District.

(Ord. No. 99-3, § 1, 1-11-1999)

Sec. 8-144. Boundaries.

The North Kingstown Wastewater Management District will encompass the town.

(Ord. No. 99-3, § 1, 1-11-1999)

Sec. 8-145. Individual sewage disposal system inspections and pumping of systems.

Every individual sewage disposal system owner within the North Kingstown Wastewater Management District shall be required to have a first maintenance inspection of such individual's septic tank/cesspool which shall be conducted as defined in the Rhode Island Handbook for Inspection of Operating Septic Systems. Such inspection shall be performed within three years of the effective date of the ordinance from which this article derives by a town-approved wastewater professional, and proof of the inspection shall be submitted to the town within 30 days of the inspection. Town-authorized forms shall be provided by the North Kingstown Wastewater Management District. All costs of inspection, maintenance and pumping shall be the responsibility of the individual sewage disposal system owner. The town, through this article, maintains the right of entry onto private property if noncompliance occurs.

(Ord. No. 99-3, § 1, 1-11-1999)

Sec. 8-146. Inspection frequency.

After the first maintenance inspection as provided in section 8-145, routine maintenance inspections as described in table 1.1 of the Rhode Island Handbook for Inspection of Operating Septic Systems shall be conducted once every three years. More frequent or less frequent inspections may be required if deemed appropriate by the North Kingstown Wastewater Management District. All individual sewage disposal system owners shall be notified of inspection schedules.

(Ord. No. 99-3, § 1, 1-11-1999)

Sec. 8-147. Inspection records.

The North Kingstown Wastewater Management District shall maintain a record of each septic tank/cesspool initially inspected including but not limited to the following:

- (1) Owner's name.
- (2) Street address or utility pole number.
- (3) Plat and lot numbers.
- (4) Telephone number.
- (5) Septic tank/cesspool location, and sketch if possible.
- (6) Dates and description of previous maintenance.
- (7) Notes on the individual sewage disposal system condition.
- (8) Site features such as water bodies, wetlands or location within groundwater areas.
- (9) Other information about system maintenance, if applicable.

(Ord. No. 99-3, § 1, 1-11-1999)

Sec. 8-148. Inspection reports.

A maintenance inspection report form detailing the results of the inspection shall be kept on file with the North Kingstown Wastewater Management District. Town-authorized forms shall be provided by the wastewater management district. If the inspection reveals that pumping is necessary, the owner shall be required to have the system pumped and shall submit proof of such pumping to the town within 30 days. A receipt from the pumper shall constitute adequate proof.

(Ord. No. 99-3, § 1, 1-11-1999)

Sec. 8-149. Septic tank additives and improper discharges to individual sewage disposal systems.

(a) The use of any septic tank additives, which contain acids and/or organic chemicals, in an individual sewage disposal system is prohibited. To date, there is no scientific information available that indicates that such individual sewage disposal system additives are beneficial. The disposal of any hazardous materials, which include corrosive, explosive or flammable materials, or materials that contain toxic chemicals into an individual sewage disposal system is prohibited.

(b) The discharge of rainspouts, basement sumps or any other drains to an individual sewage disposal system, with the exception of household washing machines, is prohibited.

(Ord. No. 99-3, § 1, 1-11-1999)

Sec. 8-150. Miscellaneous considerations.

(a) *Garbage disposal.* Garbage disposals produce excess solids which can reduce the efficient functioning of a septic system. Garbage disposal discharges to an individual sewage disposal system shall be discouraged.

(b) *Trees and shrubs.* Trees and shrubs shall not be planted over the leaching area. The owner shall keep trees and shrubs at a minimum of ten feet from the leaching area to keep roots from clogging or disturbing the individual sewage disposal system.

(c) *Water saving devices.* Water saving devices, including but not limited to low-flow toilets or toilet dams, faucet aerators and low-flow shower heads, shall be required on appropriate fixtures for new construction or renovations.

(d) *Impervious surfaces.* The location of swimming pools, patios, driveways or other impervious surfaces over leaching areas is prohibited without the approval of the department of environmental management.

(e) *Outlet effluent filters.* The use or retrofitting of outlet effluent filters with access manholes for individual sewage disposal systems shall be encouraged.

(Ord. No. 99-3, § 1, 1-11-1999)

Sec. 8-151. Administration.

This article shall be administered by the town director of water supply or a designated representative, and the director of water supply shall be the administrative officer of the North Kingstown Wastewater Management District.

(Ord. No. 99-3, § 1, 1-11-1999)

Cross references: Administration, ch. 2.

Sec. 8-152. Public education.

A public education program shall be established and overseen by the North Kingstown Wastewater Management District, with technical assistance from the conservation commission, the groundwater committee, the University of Rhode Island On-site Wastewater Training Program, and other appropriate sources, to inform people about the benefits and goals of the town's wastewater management program. The educational program shall include but not be limited to the following:

- (1) Proper operation and maintenance of septic systems.
- (2) Proper disposal of hazardous waste, including household hazardous waste.
- (3) Water conservation and the development of water conservation programs.
- (4) Protection of the town's natural resources.
- (5) Use of environmentally sensitive products.
- (6) How garbage disposals and other household equipment and products may affect individual sewage disposal systems.

(Ord. No. 99-3, § 1, 1-11-1999)

Sec. 8-153. Financing.

The town council shall have the authority to raise funds for the administration, operation, contractual obligations and services required under this article.

(Ord. No. 99-3, § 1, 1-11-1999)

Sec. 8-154. Grant/loan program.

The town, under the authority of the state legislature, shall have the authority to issue bonds or notes, to receive grants or assess property owners for the purpose of establishing a revolving fund, to make low-interest loans or grants available to qualified property owners for the improvement, correction or replacement of a failed individual sewage disposal system. The town shall establish specific criteria to define eligibility for grants or loans.

(Ord. No. 99-3, § 1, 1-11-1999)

Sec. 8-155. Enforcement responsibility.

The building official or designated official of the North Kingstown Wastewater Management District shall be responsible for enforcing this article.

(Ord. No. 99-3, § 1, 1-11-1999)

Sec. 8-156. Notice of violation.

Any owner of an individual sewage disposal system determined to be in violation of this article will be issued a written notice explaining the nature of the violation, required actions, a 30-day timeframe for compliance and the possible consequences for noncompliance.

(Ord. No. 99-3, § 1, 1-11-1999)

Sec. 8-157. Appeals.

(a) Any party aggrieved by a decision of the administrative officer made pursuant to this article shall have the right to appeal that decision to the building code board of appeals by the following procedure:

(1) The appeal must be taken within 20 days of the day the decision is recorded in the office of the town clerk.

(2) The appeal shall be in writing, on a form provided by the department of water supply, and shall state clearly and unambiguously the factual and legal issue or decision that is being appealed, the reason for the appeal and the relief sought.

(3) The appeal shall either be sent by certified mail, return receipt requested, or shall be hand delivered to the office of the town clerk.

(4) Upon receipt of an appeal, the building code board of appeals shall require the administrative officer to transmit forthwith to the building code board of appeals all papers, documents and plans, or a certified copy thereof, constituting the record of the action which is being appealed.

(b) An appeal shall stay all proceedings in furtherance of the action being appealed.

(Ord. No. 99-3, § 1, 1-11-1999)

Sec. 8-158. Building code board of appeals standards of review.

(a) The building code board of appeals shall render a decision of the appeal made pursuant to this article in the manner provided in subsection (b) of this section.

(b) The building code board of appeals shall not substitute its judgment for that of the administrative officer, but shall consider the issue upon the findings and the record of the administrative officer. The building code board of appeals shall not reverse a decision of the administrative officer except on a finding of prejudicial procedural error, clear error or lack of support by the weight of the evidence in the record.

(Ord. No. 99-3, § 1, 1-11-1999)

Cross references: Buildings and building regulations, ch. 4.

Sec. 8-159. Appeals to district court.

Appeals of decisions of the building code board of appeals made pursuant to this article shall be made as follows:

(1) An aggrieved party may appeal a decision of the building code board of appeals to the district court by filing a complaint setting forth the reasons of appeal within 30 days after the decision has been recorded in the town clerk's office.

(2) Within 30 days after being served with a copy of the complaint, the building code board of appeals shall file certified copies of the building code documents acted upon by it and constituting the record of the case appealed from, together with such other materials as may be pertinent, with the clerk of the court.

(3) The court shall review the matter in accordance with the provisions of G.L. 1956, § 42-35-15.

(Ord. No. 99-3, § 1, 1-11-1999)

Sec. 8-160. Penalties.

Any person neglecting or refusing to comply with a written notice of violation issued under this article shall be fined not more than \$500.00 per violation. Each day of a continuing violation shall constitute a separate and distinct violation.

(Ord. No. 99-3, § 1, 1-11-1999)

Sec. 8-161. Definitions.

The definition of terms used in this article shall be consistent with those defined in the State of Rhode Island and Providence Plantations, Department of Environmental Management Rules Establishing Minimum Standards Relating to Location, Design, Construction, and Maintenance of Individual Sewage Disposal Systems, as amended. Terms not defined in the state regulations are underlined. The following words, terms and phrases, when used in this article, shall have the meanings ascribed to them in this section, except where the context clearly indicates a different meaning:

Alteration refers to any modernization, modification or change in the size or type of an existing individual sewage disposal system, including but not limited to any and all work performed in relation to a building renovation and/or change of use, or work performed to accommodate any increase in sewage flow to the system.

Effluent means sewage, water or other liquid, partially or completely treated or in its natural state, flowing out of any component of an individual sewage disposal system flowing over the ground's surface or beneath the ground in groundwater.

Failed system means any sewage disposal system that does not adequately treat and dispose of sewage so as to create a public or private nuisance or threat to public health and/or environmental quality, as evidenced by but not limited to one or more of the following conditions:

- (1) Failure to accept sanitary sewage into the building sewer.
- (2) Discharge of sanitary sewage to a basement, subsurface drain, surface drain or surface water unless expressly permitted by the department.
- (3) Sanitary sewage rising to the surface of the ground over or near any part of an individual sewage disposal system or seeping down the gradient from the absorption area at any change in grade, bank or road cut.
- (4) Any deterioration or damage to an individual sewage disposal system that would preclude adequate treatment and disposal of wastewater. (For example, contact between the bottom of the individual sewage disposal system and the water table.)

Groundwater protection areas means those areas defined in chapter 21 of this Code entitled "Zoning."

Hazardous waste means wastes that include but are not limited to those which are toxic, corrosive, flammable or reactive, or wastes such as are defined under section 3.25 of the Rhode Island Department of Environmental Management Rules and Regulations for Hazardous Waste Generation, Transportation, Treatment, Storage and Disposal.

Individual sewage disposal system (ISDS) means any system of piping, tanks, disposal areas, alternative toilets or other facilities designed to function as a unit to convey, store, treat and/or dispose of sanitary sewage by means other than discharge into a public sewer system.

Leach field means a group of one or more disposal chambers, trenches or beds designed for the final disposal of a septic tank or equivalent effluent in the underlying soil. The leach field shall be the horizontal and vertical lines circumscribing the outermost edges including the area between the chambers or trenches and the depth to the bottom of stone.

Maintenance means the regular inspection or cleaning of any leaching chamber, cesspool, septic tank, building sewer, distribution lines or any other component of an individual sewage disposal system for the purpose of removing any accumulated liquid, scum and/or sludge. The term "maintenance" shall also be held to include any regularly required servicing or replacement of any related mechanical, electrical or other equipment. Innovative and alternative individual sewage

disposal systems or other systems will require a maintenance plan approved by the North Kingstown Wastewater Management District.

Owner means any person who alone or jointly or severally with others (i) has a legal title to any real property, or (ii) has possession of or control of any real property through any agent, executor, executrix, administrator, administratrix, trustee, lessee or guardian of the estate of a holder of a legal title or who has possession or control through any lease or purchase and sales agreement. Each such person is bound to comply with this article.

Package treatment plant means a modular treatment facility of the extended aeration type, which design shall be consistent with criteria set forth for the activated sludge process in "Guides for the Design of Wastewater Treatment Works" (NEIWPCC, TR-16, latest edition), or other acceptable design standards. The effluent shall normally be disposed of into the soil through a surface sand filter.

Person includes any individual; group of individuals; firm; corporation; association; partnership; or any federal, state or municipal governmental entity.

Repair means work performed on an individual sewage disposal system in order to mend or remedy a specific defect or deficiency after the failure, injury, deterioration or partial destruction of a previously existing individual sewage disposal system or component thereof. A repair shall not include any work performed on an existing individual sewage disposal system, which increases the flow capacity of the system.

Sanitary sewage means any human or animal excremental liquid or substance, any putrescible animal or vegetable matter, and/or any garbage and filth, including but not limited to any gray water or black water discharged from toilets, laundry tubs, washing machines, sinks and dishwashers as well as the contents of septic tanks, cesspools or privies.

Septage means solid or liquid materials which are pumped from an individual sewage disposal system. Any human and/or animal excremental liquid or substance, any putrescible animal or vegetable matter, and any garbage and filth, including the discharge of water closets, laundry tubs, washing machines, sinks, dishwashers and the contents of septic tanks, cesspools and privies.

Septic system means an individual sewage disposal system.

Septic tank means a watertight receptacle which receives the discharge of sewage from a building sewer and is designed and constructed to permit the deposition of settled solids, the digestion of the matter deposited and the discharge of the liquid portion into a leaching system.

Violation means failure to comply with and adhere to the rules and regulations set forth in this article or state regulations and/or the improper discharge of sanitary sewage from a failed individual sewage disposal system.

Wastewater. See *Sanitary sewage*.

Wastewater management district constitutes all areas within the town, which utilize individual sewage disposal systems as a means of treating sanitary sewage. The proper operation and maintenance of individual sewage disposal systems will be required townwide.

Wellhead protection area means the critical portion of a three-dimensional zone surrounding a public well or well field, through which water will move toward and reach such well or well field as adopted by the town or the Rhode Island Department of Environmental Management (21-186).

(Ord. No. 99-3, § 1, 1-11-1999)

Cross references: Definitions generally, § 1-2.

Secs. 8-162--8-200. Reserved.

APPENDIX B

PHASE 1A ARCHAEOLOGICAL RECONNAISSANCE SURVEY (CAMP AVENUE)



GRAY & PAPE, INC.

ARCHAEOLOGY · HISTORY · HISTORIC PRESERVATION

October 19, 2011

Ms. Charlotte Taylor
Archaeology Division
Rhode Island Historical Preservation and Heritage Commission
Old State House
150 Benefit Street
Providence, Rhode Island 02903

Re: Ph IA Archaeological Reconnaissance Survey for the Camp Avenue Component of the Comprehensive Wastewater Facilities Plan for the Post Road Corridor, North Kingstown, Rhode Island

Dear Charlotte,

This Letter Report presents the results of Gray & Pape, Inc.'s (Gray & Pape) Phase IA Archaeological Reconnaissance Survey for the Camp Avenue Component of the Comprehensive Wastewater Facilities Plan for the Post Road Corridor (The Project). The Project, which will address the wastewater needs of the corridor and adjacent residential areas, is located along Camp Avenue between Post Road and Asquah Drive in Washington County, North Kingstown, Rhode Island (Figure 1). The reconnaissance survey was conducted by Gray & Pape under contract from James J. Geremia & Associates, Inc. (Geremia & Associates) on behalf of the Town of North Kingstown. In accordance with Section 106 of National Historic Preservation Act, Geremia & Associates informed the Rhode Island Historic Preservation and Heritage Commission (RIHPHC) of the Project in 2008. RIHPHC responded with letters in August 2008 and December 2009 recommending that a Phase IA Archaeological Disturbance Assessment be performed for proposed Pump Stations N-1, N-2, N-3, S-1, S-2, and the Camp Avenue portion of the Project. This report addresses only the Camp Avenue portion of the Project which includes Pump Station S-1. Phase IA investigations of the 4 remaining pump stations will be reported on separately.

PROJECT METHODS AND RESEARCH DESIGN

Background Research

Gray & Pape conducted background research to establish the level of sensitivity for prehistoric and historic archaeological remains along Camp Avenue and at the proposed pump station. Materials at the RIHPHC and on file at Gray & Pape were consulted during this effort. Contextual research was undertaken to understand the environmental and cultural development

of the Northeast, Rhode Island, and North Kingstown. Environmental research was aimed at understanding when conditions could have supported human settlement and subsistence activities. Gray & Pape gathered information on previously reported sites to identify the size, data contents, and cultural affiliation of reported resources and to predict the locations and cultural affiliations of analogous, unreported sites. Although there are numerous sites recorded in North Kingstown, for the purpose of this investigation Gray & Pape most closely examined recorded prehistoric sites within a 2.4 km (1.5 mi) radius of Camp Avenue.

Tribal Consultation

A copy of this report will be provided to Mr. John Brown, the Narragansett Indian Tribal Historic Preservation Officer (NITHPO), via. Certified Mail. In addition, if work requiring a permit is required from the RIHPHC, the NITHPO will be provided with a copy of the permit and an opportunity to comment on related archaeological investigations. It should be noted that these efforts do not fulfill the duty of federal agencies to consult with the Narragansett Indian Tribe but do represent a good faith effort to keep the tribe informed of archaeological activities related to the project.

Archaeological Reconnaissance Methods

Archaeological reconnaissance was conducted through a walkover of the APE. This visit was documented by the collection of field notes and photographs of the area.

ENVIRONMENTAL CONTEXT

Camp Avenue lies astride Mill Creek, where the creek transitions from a freshwater stream to a brackish marshlands area that meets Wickford Harbor and Narragansett Bay as part of the Lower Bay Drainage (Figure 1).

Narragansett Bay is located in Eastern Rhode Island and southeastern Massachusetts, is a north-south trending estuary, and is approximately 30 km (19 mi.) long and 15 km (9.5 mi.) wide. Three large islands, Conanicut, Prudence, and Aquidneck divide the bay into the west, east, and Sakonnet passages. The Bay is fed by three major rivers: in the northwest, the Providence and Seekonk rivers; and in the northeast, the Taunton River.

Pleistocene and Recent sedimentary deposits consist of glacial drift and post-glacial sediments overlying bedrock. Approximately 15 m (50 ft.) of Holocene estuarine deposits overlie the glacial drift (McMaster 1960). A southward flowing drainage system existed during pre-glacial times, but glacial and post-glacial deposition altered the valleys into deep channels filled with Quaternary sediments (McMaster 1984). Post-glacial deposition began about 15,500 B.P. when pro-glacial Lake Narragansett formed in the bay. After approximately 500 years, the lake drained and a river flowed along the axis of the lake into Long Island Sound (Peck and McMaster 1991).

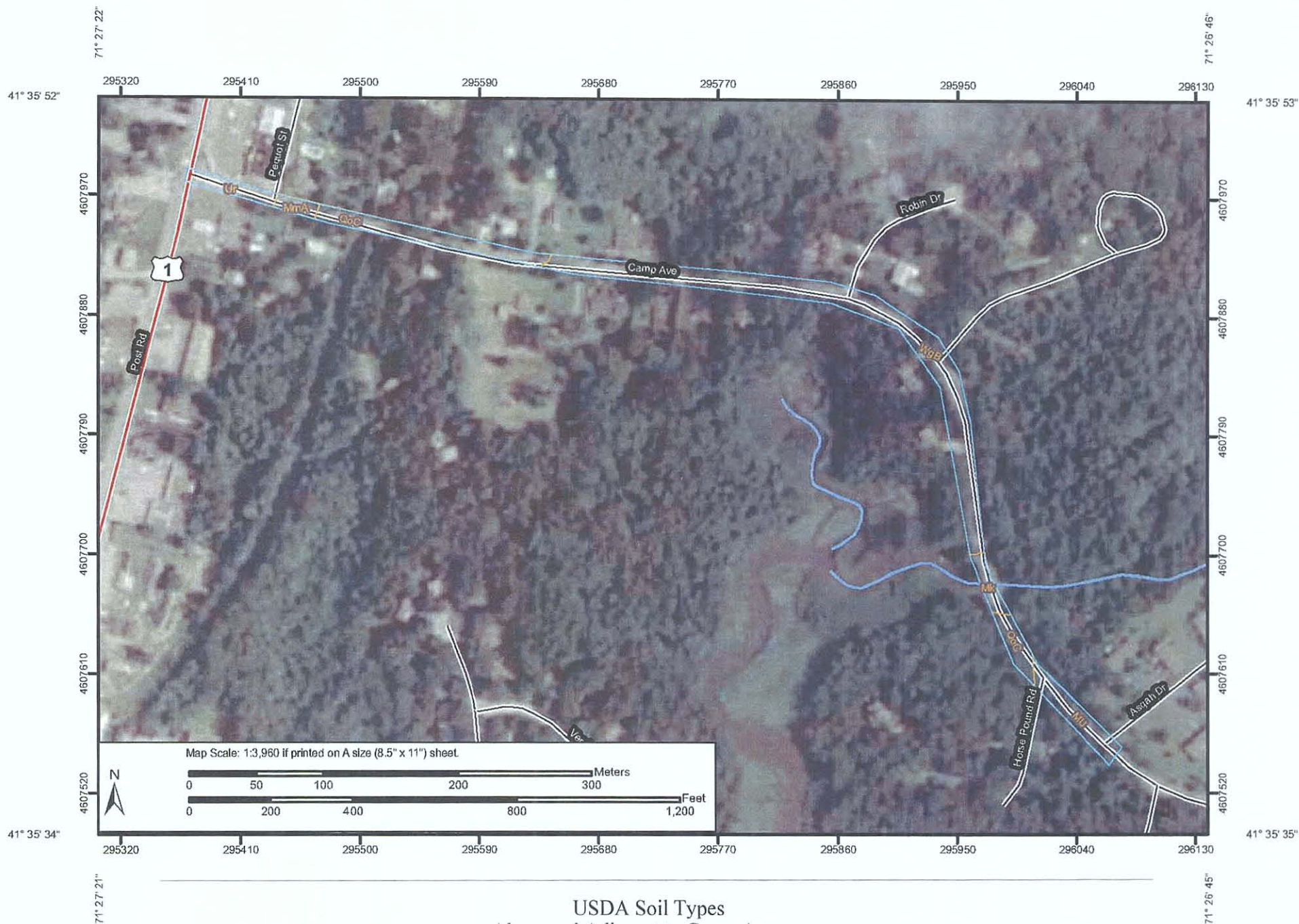
This Early Holocene surface was inundated by the sea in the East Passage trunk valley about 9,000 B.P. The sea subsequently inundated northward via this trunk valley and its branches. Silt and clay sediments associated with estuarine deposition circulation are lens-like in shape and 12

m (39 ft.) or more, thick. These were deposited in the upper Narragansett Bay and around Hope Island by 7,500 B.P. and in Mt. Hope Bay by 6,250 B.P. (McMaster 1984).

The post-glacial environment in and around Wickford Harbor transitioned from glacial lake to a freshwater riverine system before beginning estuarine development. During the late Pleistocene and early Holocene the harbor area would have been a glacial lake as meltwaters combined with lower sea levels and isostatic rebound to impound large amounts of fresh water (Schafer 1961). As the glacial lake receded a river drainage system that encompassed all of present day Narragansett Bay would have developed (McMaster 1984). Beginning around 9000 years before present (B.P.) sea level rise would have begun to turn this river system into the contemporary bay (McMaster 1983). This rise in sea level likely inundated many Paleo-Indian and Early Archaic period sites before sea level rise stabilized around 6000 years B.P. (Olsen 1980).

Table 1. Project Area Soils		
Symbol	Soil Series Name	%APE
Mk	Matunuck mucky peat	3.9
MmA	Merrimac sandy loam	2.8
MU	Merrimac-Urban land	10.4
QoC	Qonset gravelly sandy loam	21.3
Ur	Urban Land	5.4
WgB	Windsor loamy sand	56.1

Soils within and immediately adjacent to the project area (Figure 2; Table 1) are primarily (80.2%) mapped as Windsor loamy sand (WgB; Table 1), Quonset gravelly sandy loam (QoA; Table 1), and Merrimac sandy loam (MmA; Table 1; USDA 2011). Windsor loamy sands are found on glacial outwash plains, kames, and terraces and are typically composed of eolian sands over sandy glaciolfluvial deposits. Similarly, Quonset gravelly sandy loam soils are also found on glacial outwash plains, outwash terraces, terraces, and eskers and are composed of sandy and gravelly glaciolfluvial deposits. Merrimac sandy loams are found on kames and glacial outwash plains and terraces and are typically composed of sandy and gravelly glaciolfluvial deposits. These sandy soil types are excessively well drained and present on slopes from 0-15%, factors attractive for both prehistoric and historic habitation. Other mapped soil types are Matunuck mucky peat (Mk), Merrimac-Urban Land complex (MU), and Urban Land (UR; Table 1). These soil types are present in tidal marshes (Mk) or as a result of filling for modern human use (MU, Ur). These soil types are not considered sensitive for archaeological resources because of their poorly drained (Mk) or disturbed nature (MU, Ur). This soil map and associated data are discussed here as a general planning tool and cannot be used to stratify an archaeological testing strategy because these observations were made at a scale beyond which the soils data was recorded.



USDA Soil Types
 Along and Adjacent to Camp Avenue
 Washington County, North Kingstown, Rhode Island,

CULTURAL OVERVIEW OF THE STUDY AREA

Prehistoric Overview

Narragansett Bay has drawn people to what is now the Rhode Island coastline and its associated estuaries for thousands of years. In the Wickford Bay area the presence of Native Americans has been documented to extend from at least 9000 years before present (B.P.) through the contact period. The archaeological record of human habitation becomes richer approximately 6,000 years B.P. when rates of sea level rise became generally stable. This indicates that the bias in the archaeological record in and around the Study Area is a function of environmental change and not an absence of human occupation. Each of the environmental settings glacial lake, riverine, and estuarine (see above) would have provided attractive ecological conditions for human habitation.

Paleoindian Period (ca. 12,000–9,000 B.P.)

The earliest recognized period of Holocene human occupation in the northeast is the Paleoindian Period, beginning approximately 11000 to 12000 years ago. Although recent research indicates that people may have been in the Americas as early as 25,000 to 50,000 years ago, the presence of Pleistocene glaciers throughout New England would have obliterated any evidence of their presence from the contemporary landscape (Snow 1980:101). The early post-glacial environment has been characterized as tundra—a treeless plain with permanently frozen subsoil and low growing vegetation, such as moss and lichens (Funk 1978). The evidence suggests that tundra flora had occupied the Northeast by 13000 B.P. and provided a food source for grazing animals, such as caribou, mammoth, and mastodon (Snow 1980). Some researchers speculate that Paleoindian subsistence strategies were based on a focal adaptation to these tundra-grazing animals (e.g. Snow 1980:151), while others believe that the Paleoindian diet would have been supplemented with plants, small animals, and fish (Funk 1978:18). The Paleoindian artifact assemblage is comprised primarily of stone hide and fur scrapers, knives, stone and bone graters and drills, and fluted spear points appropriate for hunting large mammals. Use wear analysis of Paleoindian tools indicates that they were used to cut meat, to work hides, and to split bones (Snow 1980).

To date, the oldest known human occupation in southern New England comes from the Wamsutta/Neponset/Signal Hill site in Canton, which has been radiocarbon dated to 10,250±70 B.P. (Hoffman 2005). Recent archaeology at Annasnappet Pond, within the Taunton River drainage in Carver, has produced evidence of a Paleoindian occupation (Doucette 2005). New information on a number of Paleoindian sites is available from northern New England, particularly Maine (Bourque 1992; Gramley 1982, 1990; Doyle et al 1985), and recent fieldwork and reanalysis of old collections reveals that Paleoindian people can be identified in sites all along the Merrimac River between 13,000 and 10,000 years ago (Bradley 2007). Researchers suggest that the evidence reveals “repeated, possibly continuous, use of (the river drainage area) throughout the Paleoindian period” (Bradley 2007). A single Paleoindian site (RI 1006; South Wind) was discovered within the Wickford Harbor area along Calf Neck on the eastern shore of tidal Mill Creek. This site produced a single fluted Eastern Clovis point diagnostic of the Paleoindian period (Leveillee and Van Coughyen 1990). During this time period, Wickford Bay

and the project area were part of a glacial lake (Schafer 1961) or fresh water drainage system (McMaster 1984).

Early Archaic Period (ca. 9,000–7500 B.P.)

Bunker (2002) summarizes the Early Archaic period as a time when early cultures in the Northeast made a “transition to settling.” This concept is embedded in most regional discussions of what differentiates the Early Archaic period from the Paleoindian period beyond the appearance of the bifurcate-base projectile point. Settlement pattern studies generally have correlated bifurcate-base point locations across the region with what appeared to be a wider range of environmental contexts than those recorded for older, Paleoindian site locations. Site distribution was interpreted as evidence of a shift to a broad-based subsistence regime, but this concept must be reconsidered as information about Paleoindian cultures continues to grow, particularly in northern New England.

Defining characteristics of the tradition included a core, uniface, and flake lithic technology, a relatively minor technological role for bifaces and projectile points, and the early development of a diverse ground stone tool assemblage (Robinson 1992: 96). Beginning in the Early Archaic and extending through the Middle Archaic, the observed pattern of occupation corresponds with an environmental zone marked by interior lakes and riverine settings which represent transportation corridors to and from the coastal zone (Robinson 1992: 106). Regional palynological data link the beginning of the Archaic with an overall decline in the open spruce parkland and evolution of the deciduous forest. Data indicate environmental instability throughout the tenth millennium B.P., and generally warmer and drier conditions triggering lower water tables by about 9000 B.P. (McWeeney and Kellogg 2001).

In addition to bifurcate-base projectile points, site assemblages attributed to this period may contain formalized ground stone tools, drills, scrapers, anvil stones, and choppers (Snow 1980). In northern and southern New England, evidence for the use of quartz in the production of unifacial tools and cores is prevalent (Bunker 2002; Robinson 1992), and bifacial tools are conspicuously absent. In particular, Robinson (1992) noted the consistent presence of high-quality quartz, crystal quartz cores and edge tools in northern New England assemblages of the period.

There is some potential for Early Archaic activity areas and sites within the project area, based on the presence of an Early Archaic component at the South Wind Site (Leveillee and Van Coughyen 1990; RI 1006) along Calf Neck on the eastern shore of tidal Mill Creek, south of the project area.

Middle Archaic Period (ca. 7500–6000 B.P.)

The Middle Archaic Period in New England is generally viewed as a time of regional population growth, subsistence diversification, and the evolution of increasingly complex social organization and settlement systems (Dincauze and Mulholland 1977; Robinson 1992). Middle Archaic studies throughout the northeast continue to draw upon the pioneering work of Dena Dincauze at the Neville Site situated along the Merrimack River in Manchester, New Hampshire. The study noted an apparent increase in the resident population of the time (based on an increasing number of sites), well-established core areas located along communication routes (rivers), and an annual round involving large territories (Dincauze and Mulholland 1977).

Analysis of the Neville Site artifact assemblages resulted in the formal classification of 3 projectile point styles in a sequence of Middle Archaic technology, including Neville, Stark, and Merrimack points (Dincauze 1971, MHC 1984). These tools were found in association with perforators made from reworked Neville points, large and thin ovate bifaces, crystal quartz flake end-scrapers, drilled atlatl weights, coarse flake end-scrapers, full-grooved axes and bipolar pebble hammers (Dincauze 1971). To date, the Middle Archaic period remains largely defined as a widespread and long-term cultural adaptation to mid-Holocene climatic fluctuations, also referred to as the Hypsithermal climate interval (Jones 1999). Elevated seasonal temperature extremes and widespread aridity during this period are factors believed to have influenced local biotic communities and, in turn, the behavior of human populations dependent upon them (Anderson 200; McWeeney and Kellogg 2001).

Known sites from this time period near the project area include Green Point (RI 139) and Gravel Pit (RI 57). The Green Point site was positioned above a stream that drained into a lake below Conanicut Island (McMaster 1983), and the Gravel Pit site was positioned near a freshwater stream on Prudence Island (Leveillee 1979). Both sites were situated adjacent to water bodies that allowed the Native population to exploit their runs of anadromous fish. During this period, rising sea levels inundated most coastal/shoreline sites as the Wickford Harbor Area transitioned from a riverine to a tidal, salt water environment (McMaster 1983).

Late and Transitional Archaic Periods (ca. 6000–3000 B.P.)

The Late Archaic Period is characterized by the appearance of distinct tools and assemblages attributed to the Laurentian, Small Stemmed, and Susquehanna traditions (Bunker 2002). The Late Archaic is by far the most archaeologically visible, and the most controversial in the published literature. A defining characteristic of the tradition is the development and persistence of a cobble quartz industry, well developed circa 4000 B.P., and extending into the Early Woodland Period. The Laurentian Tradition is the oldest of the Late Archaic phases and is defined by the presence of Brewerton and Otter Creek-like projectile points. Many Laurentian Tradition sites are found in uplands regions, perhaps indicating a preference for interior or riverine adaptations (Dincauze 1977; Ritchie 1971). Small Stemmed projectile points are commonly distributed throughout New England and often were manufactured from locally available lithics, such as quartzite. Several sites containing Small Stemmed points are found near the project area, including the Crookfall Brook No. 1 Site in Lincoln, Rhode Island, located in an upland swamp along the upper part of a brook, west of the Blackstone River. Archaeologists also identified a small lithic workshop at Albion, Rhode Island, where Native Americans produced bifacial performs made from quartz (Leveillee et al. 1993).

The Susquehanna Tradition that appears in the Terminal Late Archaic, or Transitional Period, generally is associated with mortuary activities and ceremonial sites, particularly those found in a coastal zone (Dincauze 1968). In the Connecticut River drainage, archaeologists observed a cultural distinction between the Small Stemmed and Susquehanna Traditions. The Susquehanna Tradition is more than a mortuary complex, however mortuary practices are viewed as a sociological development that evolved in southern New England from the earlier Laurentian Tradition (Pfeiffer 1990). However, recently identified sites in the Blackstone drainage indicate the presence of Susquehanna sites that are non-ceremonial and not associated with burials. The Horn Hill Steatite Quarry in Millbury, Massachusetts, the Mill River site in Hopedale,

Massachusetts and the Purgatory II site in Purgatory, Massachusetts are all examples of non-ceremonial, non-burial Susquehanna sites in interior upland environments..

Orient style projectile points have been interpreted as a technological merging of Susquehanna and Small Stemmed Tradition tool forms and are most commonly recovered and interpreted within a Transitional Archaic period, Susquehanna Tradition cultural framework (Leveillee and Waller 1999). The Narragansett Bay area near Camp Avenue has yielded many both Late and Transitional Archaic sites. These include Hoskins Park (RI 1007), Greenwich Cove (RI 193), West Ferry (RI 84), Green Point (RI 139), and Scrabbletown (RI 670).

Bernstein's (1993) monograph on the Greenwich Cove Site (RI 193) provides the basis for our current understanding of estuarine formation, human coastal adaptations to that environment, and related shell midden deposition. Bernstein found two components – a Late Archaic assemblage, not related to the shell midden, located on top of a terrace overlooking the cove, and a Terminal Late Archaic to late Woodland shell midden that was the main subject of his study.

The first evidence for shellfish exploitation, at Greenwich Cove is in the Terminal Late Archaic where Bernstein reports a radiocarbon date of 2720 $\pm$ 120 B.P. Also associated are fish and deer bones. No shellfish remains are found at pre-3000 B.P. portions of the site and the radiocarbon date must signify the start for shell fishing in Greenwich cove (Bernstein 1993). Presumably, this date also signifies the formation of estuarine conditions that made such subsistence activities viable here.

The Greenwich Cove shell midden is not the oldest in the Narragansett Bay drainage. Bernstein notes that the earliest reported shell midden dates to 4000 $\pm$ 110 B.P. at the Peckham Site, on the Sakonnet River, in Tiverton, (Leveille and Thorbahn 1984). Other dates include 3850 $\pm$ 120 B.P., at the Minto Site, on Cananicut Island (Wilber Smith Associates 1985), and 2320 $\pm$ 90 B.P. on Potowomut Neck nearby to Greenwich Cove (Kerber 1984). Radiocarbon dates of cores from Potowomut Neck (Kerber 1984) indicate a mature marine estuary ecosystem existed by 2000 to 3000 B.P. in the Greenwich Cove area and Bernstein (1993) notes that this is consistent with his data from Greenwich Cove.

Bernstein argues that Greenwich Cove represents a year-round utilization of coastal estuarine resources during the Woodland Period. He also suspects that pattern existed in Terminal Late Archaic times. Echoing Dunford's (1992) conditional sedentism scheme, Bernstein thinks that settlement involved movements from one coastal site to another, rather than from coastal to inland locations, and that some coastal sites with diverse resources may have been settled much of the year.

Early Woodland Period (ca. 3000–1600 B.P.)

The Early Woodland Period generally is recognized by the presence of distinctive chipped-stone tool styles and certain ceramic types. Regional Woodland Period settlement models have considered the meaning of broad scale coastal, estuarine adaptation, and an apparent shift from strict reliance on foraging to subsistence strategies that also include some domestic plant cultivation. Regional sites are noted in coastal or estuarine zones, rather than along major rivers or lakes and archaeologists note their presence on sites used earlier in the Archaic Period.

Diagnostic points from the Early Woodland period include Meadowood and Rossville types, as well as Small Stemmed points that continue to be used from the Late Archaic (MHC 1984).

The Early Woodland Period is not fully understood in southern New England and its apparent lack of manifestations may be a consequence of incomplete interpretations. Artifact types such as Small-Stemmed Points and Susquehanna BROADSPEARS from the Late/Transitional Archaic, for example, may overlap with types found in Early Woodland sites, thus blurring the boundaries between the 2 periods. The presence of these types also might suggest cultural affinity when in fact similarities might be assumed on the basis of tool morphology and not cultural behavior (see for example, Ritchie 1985 in Leveillee et al. 1993).

Diagnostic artifacts include ceramic vessels and suggest an entire suite of cultural behavioral change from earlier periods. Ceramic manufacture requiring the presence of appropriate soils, are easily broken and not readily transported. These limitations, however, are outweighed by the benefits, such as durable containers for food storage and preparation. Also diagnostic of the Early Woodland Period are Meadowood and Rossville projectile points. A black chert Meadowood project point is known from Grafton, Massachusetts, but there is no evidence of Early Woodland occupations within the Blackstone River drainage. Researchers remain aware that sites such as steatite quarries, rockshelters and temporary campsites thought to be Late Archaic could in fact be associated with Early Woodland Period culture.

Recorded Early Woodland sites near the project include Joyner (RI 706), Greenwich Cove (RI 193), Scrabbletown (RI 670), and Hoskins Park (RI 1007).

Middle Woodland Period (ca. 1600 – 1000 B.P.)

Middle Woodland Period sites most often are distinguished by the presence of Jack's Reef and Fox Creek projectile points, distinctive ceramic types, and the presence of lithic materials such as hornfels. On a regional scale, there is a clear pattern of extra-regional lithic materials in the archaeological record of this period (Luedtke 1987). As a result, the combination of chert, jasper, chalcedony, and hornfels in a lithic deposit typically is recognized as an indicator of a Middle Woodland Period activity area. Undoubtedly, an extra-regional relationship developed between people and places could be explained in many ways. The apparent emphasis on securing and using these rare materials could relate to socioeconomic issues (trading networks, limitations on local resource availability), artistic expression, or symbolism in the context of intensified ideological values, or perhaps the preservation and protection of extra-regional kinship ties. Hoffman (2005) notes intensified trade in lithic raw materials and a diversity of pottery styles during the Middle Woodland.

Elsewhere in the region, researchers have noted a Middle Woodland trend in the diversification of ceramic surface treatments and decoration that remained relatively unchanged through the Late Woodland (Fowler 1966; Ritchie 1969). Another characteristic is the introduction of tropical cultigens from southern regions (Bendremer and Dewar 1993). Reports of cultigens from archaeological contexts in northern New England are rare, although there is evidence of maize in both New Hampshire and Maine (Bendremer et al. 1991; Bendremer and Dewar 1993). More secure evidence of maize horticulture in southern Rhode Island has been reported for the Late Woodland (Largy and Morenon 2008).

Middle Woodland sites are reported from many of the same areas as early woodland sites near the project area, as well as Wickford Cove and the Pettaquamscutt River (Leveillee and Van Coughyen 1990).

Late Woodland Period (ca. 1000–450 B.P.)

New England's Late Woodland Period has been characterized as a time of population growth, increased sedentism, and village formation supported by maize horticulture. Archaeological evidence indicates that while maize might have been introduced into southern New England during the Middle to Late Woodland Period (ca. 1000 B.P.), it had relatively little impact on the Native American subsistence economy until about 1500 A.D. (McBride and Dewar 1987). The sparse evidence for maize indicates that horticulture did not manifest itself uniformly through time or across the greater New England region (Bendremer et al. 1991). Diagnostic artifacts include Levanna and Jack's Reef Corner-Notched, and Jack's Reef Pentagonal projectile points.

Recent research into the presence of maize agriculture in coastal settings suggests that Native people were farming intensively before the contact period (Largy and Morenon 2008). Radiocarbon dates range from about 1000 to 1400 A.D. (Largy and Morenon 2008) from sites in coastal settings. No similar sites are documented from the interior uplands, but that might be because of lack of study, not lack of presence.

The failure of archaeologists to find Late Woodland village sites in southern New England has long been a problem. The ethnohistoric literature clearly reports villages even if it does not describe them. Late 19th and 20th century archaeologists tended to define large areas that yielded artifacts to surface collectors as villages. Test excavations tend to show that these sites often lack deep stratigraphic sequences and tend to be overlapping, low density artifact concentrations. Lynn Ceci's (1990) work on radiocarbon dates from museum curated "village site" collections in coastal New York indicates that these "large" sites accumulated over centuries of short-term use and reuse. She interpreted this to show that there were no apparent densely occupied permanent prehistoric or contact villages. She suggested a new paradigm of diversity among coastal settlements. Dincauze (1991) has noted this appears to fit the picture for coastal New England as well.

What is emerging is a picture of diversity in coastal Woodland Period settlement patterns. Year-round permanent coastal settlement may have taken place at sites where a stable year-round food supply, combined with a protected aspect, made relocation unnecessary. At other places, settlement was more "conditional" depending on the need to move short distances to take advantage of sheltered aspects and locally available food resources. In other areas, seasonal movement may have involved abandoning unprotected coastal sites for more sheltered seasonal inland or upland sites.

Leveillee and Harrison (1996) state that many coastal Rhode Island Woodland sites, show evidence of seasonal movement and re-occupation along with evidence for many special activity logistical sites. Many of these logistical sites, sacred areas, and economic resource locations are located within a day's walk of settlement areas. They suggest these patterns could best be understood by a landscape model. Such models examine how sites may interrelate rather than considering isolated individual sites by themselves. A landscape approach better fits our

growing understanding of how individual sites, land-use, in general, and seasonal movement within a given coastal zone interrelate.

Leveillee et al. (2006) use landscape analysis to understand the Late Woodland archaeological record from Point Judith (RI 110) and the southern coastal salt pond region (RI 2280) of Rhode Island. They present evidence for the cultivation of maize and beans by peoples presumed to be Late Woodland ancestors of the Narragansett and Eastern Niantic Indians. They also identify the nature of associated semi-permanent settlement patterns which they characterize as “dispersed villages.”

Leveillee et al. (2006) relate that both sites are large, low-density artifact and feature concentrations that provide evidence of a wide range of activities. Indeed, the apparent low artifact density has been a problem for identifying village sites. Hasenstab (1999) has noted that sampling strategies, especially shovel test pit sampling, contributes to the difficulties of identifying village sites, because subtle features are often not detected, and specific activity concentrations such as those produced by lithic tool rejuvenation may appear as insignificant scatters for want of a context. Realizing this, Leveillee et al. (2006) resorted to machine plow zone stripping followed by systematic study of features at RI 110 and 2280.

One of the theoretical expectations, for a village, is a large number of features exhibiting a wide range of activities. Features should include evidence of habitations, storage pits, and processing facilities, refuse disposal pits or middens, and burials (Leveillee et al. 2006). At both sites, considerable evidence for a wide range of activities was recovered. Waller (2000) notes these data best fit the form of an unplanned village as originally defined by K.C. Chang (1958). It is a community containing households dispersed irregularly about the landscape, often at a relatively considerable distance from planting fields.

Leveillee et al. (2006) believe that the reason we have not been able to identify Late Woodland villages is because many archaeologists expect villages will be densely nucleated and have high artifact densities. They contend that Late Woodland villages were more dispersed, and had five important characteristics:

1. Late Woodland peoples were familiar with the coast as a homeland territory, and an ecological landscape.
2. The social landscape included communities consisting of a series of cooperating households within a dispersed village setting.
3. These villages had domestic dwellings for nuclear and extended families within which various activities necessary to the household could be carried-out.
4. Seasonally, families and households may have nucleated to carry out communal activities such as ceremonies, celebrations, rituals, rites, and funerals.
5. This built-in dualism allowing for family autonomy and, at the same time, larger group unity characterizes present-day Indian peoples of this area.

The Rhode Island data show that the evolution of prehistoric coastal settlement and subsistence patterns is complex, diverse, and on-going since estuarine formation some 2-3,000 years ago. It also demonstrates that adaptation models that expect a single set of patterns, universally applied,

are theoretically naive. The Rhode Island data also calls into question, models that view villages and horticulture as a post-contact phenomenon.

From a methodological standpoint, the Rhode Island data shows that surveys need to sample larger areas, often involving machine stripping, and that artifact and feature density may not be the best means of measuring the archaeological resources of a given landscape. The landscape approach, which examines the relationships between sites and the environmental and physiographic settings of a given area, is an important heuristic device for our understanding of these diverse coastal settlement patterns.

Contact and Historic Period Overview

The first documented visitor to Rhode Island was the navigator Giovanni da Verrazzano who sailed into Narragansett Bay in 1524. The explorer observed and described the local Indians and noted that they were divided into two groups vying over local resources: the Pokanokets or Wampanoags on the eastern side of the bay, and the Narragansetts on the west. The Narragansetts were reputedly the largest tribal presence of the region, with over 5000 members. There were no additional reports from southern New England until 1614, when the Dutch explorer Adriaen Block landed on the large island between New York and Rhode Island that later bore his name.

The first permanent settlement in New England was that of the Plymouth Colony in 1620. The colony of Rhode Island is commonly held to have been founded in 1636 by Roger Williams and others from Massachusetts who sought greater religious freedom than they had been granted under the Boston Puritans. The first European settlement near the project area was the establishment of a trading post known as Cocumscussoc by Roger Williams in 1637 (Woodward 1971)

In the early years of the colony Williams created positive relationships with Rhode Island's Narragansett leaders, Canonicus and Miantonomi, and with Massasoit, the leader of the Wampanoags to the east. It may be that the English settlers were seen as allies against the Pequots and Mohegans, the Narragansett's traditional enemies to the west. Either way, Williams was given permission to settle at the head of Narragansett Bay, where he began trading with the local occupants at the Cocumscussoc trading post he established (James 1975, Williams 1973).

One of the first settlers, Richard Smith, came from Gloucestershire, England. Like most of the early settlers he was a Puritan and originally settled in Taunton, Massachusetts in 1637. It was Richard Smith who eventually purchased Cocumscussoc. This property became the centerpiece of 27 square miles (70 km²) of land he owned in what is now North and South Kingstown. Between the mid 17th and early 18th centuries, Cocumscussoc, now known as Smith's Castle, became a successful plantation that functioned as one of Southern Rhode Island's political hubs. During this period, the property along which Camp Avenue is located would have been part of the Smith's Castle plantation holdings.

Though North Kingstown ("King's Towne") waned as a political power during the early years of the 18th century, its economy flourished. An elite group of land owners, known as the

“Narragansett Planters,” formed a land aristocracy with estates that functioned as plantations, i.e. dependent upon slave labor. By the end of the 18th century the economic viability of the plantation system was challenged by laws which restricted and eventually phased out slavery, as well as the disruption of trade patterns caused by the revolution and formation of the United States. As a result, these large plantations eventually became fragmented into smaller farmsteads.

North Kingstown maintained its status as a largely agrarian and later a textile community throughout the 19th century (Conley 1974). Railroads and improved roadways allowed easier access into the region during the last quarter of the century, allowing textiles to become a second component of the local economy.

During the early 20th century North Kingstown continued to be a rural agricultural area with a declining population (Conley 1980). It was not until the onset of World War II that the area underwent economic revitalization as a result of the government’s purchase of Quonset Point and construction of a naval air base, a base that would become one of the most important military installations in the United States (RIHPHC 1979). When the base was closed in the 1970s North Kingstown suffered as the base had become the most important part of the Town’s economy.

History of Camp Avenue

Camp Avenue likely existed before European contact as an Indian trail leading to Quonset Point (McDonough and Bennet 1989). By 1659 the Camp Avenue area would have been located within the boundaries the Smith’s Castle Plantation, acquired by Richard Smith and his son Richard Smith Jr., as part of the Atherton Purchase. As the plantation system increased in economic importance, a service industry began to spring up in the area. One such service was a Grist Mill constructed by John Tennant, who acquired a farm that encompassed Camp Avenue in 1686 (McDonough and Bennet 1989). This Grist Mill was located on Mill Creek, which is spanned by Camp Avenue within the Project’s APE. It is likely that the mill was located either on or near the present course of Camp Avenue. This is implied by historical accounts that indicate that the mill was associated with a toll bridge (McDonough and Bennet 1989). By 1802 Benjamin Renyolds and Joshua Pearce are noted as the owners abutting the Smith’s Castle property in the vicinity of Camp Avenue on a schematic produced by its owner Jonathan Updike. Camp Avenue was surveyed and accepted as a road by the town of North Kingstown in 1872, and was given its contemporary name circa 1893, when the Rhode Island Militia established a camp at Quonset Point (RIHPHC 1979). Throughout the 20th century Camp Avenue was in constant use by military traffic to access installations on Quonset Point. During the late 20th and early 21st centuries, Camp Avenue transitioned to serve individual residences, apartment buildings, and subdivisions, as well as small businesses near its intersection with Post Road.

PROJECT RESULTS

Results of Literature Review

Rhode Island College (1983-1984)

Dr. E. Pierre Morenon of Rhode Island College was contracted with the Rhode Island Historical Preservation Commission from 1983 - 1984 to study the context of site RI 1000 (the Lischio Site). The 17th century Native American burial site was uncovered during preliminary excavations along the Route 4 Extension Corridor, alongside RI 57; RI 670; RI 669; and RI 667, known together as the Route 4 Extension sites. RI 667 (the Dilon site) was the only site among the group to receive additional attention. It was thought to be a multi-component site dating to the Late Archaic and Late Woodland periods, as well as the 17th century.

RI 1000 is a location surrounded by contemporaneous archaeological resources. Features dating to the mid-1600's indicated that domestic activities, residences and work areas were located within a few hundred meters of this burial ground. As part of the RI 1000 context study, archaeologists completed a sampling study of a 13123 ft (4 km) area centered around RI 1000. Two prehistoric sites were uncovered; RI 1112 and RI 1113, alongside several additional locations that contained historic cultural material.

Rhode Island Department of Transportation (1985)

Michael A. Hebert, archaeologist for the Rhode Island Department of Transportation (RIDOT) completed an Archaeological Assessment and Phase I Historical Survey, Improved Access to Quonset Point/Davisville from Route 4, East Greenwich and North Kingstown, Rhode Island in May 1985. The objective of the study was to identify known or potential archaeological sites and areas of high and low archaeological sensitivity. Identified as having high prehistoric sensitivity are the Hunt's River, Mill Creek, Sandhill Brook, Frenchtown Brook and Fry Brook environs, and glacial till ridges flanking Canonicus Brook. Areas of high historic sensitivity include possible undisturbed terrain adjacent to portions of Davisville, Devil's Foot, Old Baptist, Namcock and Post Roads. Hebert recommended a Phase I archaeological survey, focusing on those areas designated as having a high archaeological sensitivity in order to locate previously unknown sites in the project area, as well as to verify the location of known sites.

Public Archaeology Laboratory, Inc. (1986)

In 1986, the Public Archaeology Laboratory, Inc. (PAL) was hired by Leonard A. Garofalo and Associates, Inc. to conduct Phase I and Phase II archaeological examinations of the Quidnessett Neck prehistoric site, located within the southeastern sections of the Quidnessett Country Club, prior to the construction of condominium housing units adjacent to existing golf course fairways. The archaeological testing was necessary in order to establish site boundaries, determination of

chronological affiliations, an assessment of internal components and an overall consideration of the resource's potential to meet criteria of significance in terms of National Register eligibility.

Results of the testing suggested that Quidnessett Neck is a remnant of a once larger site, now impacted and altered by recent landscape alteration. The low density lithic scatter and isolated artifacts suggest this area contains remnants of a Transitional Archaic to Woodland period lithic workshop. Unfortunately, these results lack the necessary integrity to provide additional insights into the nature of the region's prehistoric land use. Post depositional processes, including plowing, cutting, filling and ongoing golf course-related maintenance and activities "severely impacted and compromised" the site's integrity. No further archaeological investigations were recommended.

Public Archaeology Laboratory, Inc. (1988)

The Public Archaeology Laboratory, Inc. (PAL) was hired by Marshhawk Realty in 1988 to conduct a Phase I intensive archaeological survey of land proposed for the development of seventeen condominium units, thirteen hundred linear feet of roadway, sewer lines and a leach field, in Wickford, Rhode Island. The area was bound on the north by Phillips Street, on the east by Wickford Cove, on the south by the Wickford Branch Railroad and on the west by Tower Hill Road. PAL's objective was to locate and identify prehistoric and historic cultural material remains within the project area.

One prehistoric site (RI 1732/ER Site) and seven "loci" were uncovered during subsurface testing. Cultural material recovered from RI 1732 included incomplete Squibnocket and Levanna projectile points, a variety of nonlocal chipping debris, a high density of local chipping debris and calcined bone. It was determined that this site may represent a large prehistoric workshop with hunting and processing components, possibly occupied during the Late Archaic and/or Late Woodland periods. A Phase II site exam was recommended if the ER site became impacted by any further development. Historic cultural remains included a cemetery along the western boundary of the project area. Avoidance along this boundary was recommended. The highly modified remains of an early nineteenth century residential structure, belonging to a Captain Gardiner, were also revealed, though no further study of his occupation was recommended, as its integrity was severely altered.

New England Archaeological Resources, Inc. (1989)

John E. McDonough and Leslie Bennett of New England Archaeological Resources, Inc., were hired in 1989 by SFM Engineering Associates and Mr. Charles R. Brier to perform a Phase I Archaeological Reconnaissance Survey of a property intended for development on Camp Avenue in North Kingstown. They created four study areas for field investigations. Study Areas 2 and 4 were placed in the vicinity of the house site in the rear of the project area, approximately 500 ft (155 m) south of Camp Avenue. No cultural material was recovered from either area, likely due to the incredibly gravelly and compact consistency of the soil. According to McDonough and Bennett, prehistoric populations would have confronted these same conditions and simply found it easier to avoid them. Study Areas 1 and 3 were placed in the vicinity of the

house site on Camp Avenue. In Area 1, five of the sixteen shovel tests contained prehistoric cultural material, and four of the eight shovel tests in Area 3 contained prehistoric cultural material. No cultural material was recovered from test pits that contained the gravelly soil similar to that in Areas 2 and 4, or in pits adjacent to the wetlands, likely due to poor drainage. The artifact assemblage was "dominated by tertiary and secondary lithic manufacturing debris. The apparent low level of primary reduction materials would indicate that the lithics were brought to this site in a form ready to be finished." Per McDonough and Bennett, the variety of lithic material, its density, and the types represented indicate a long term occupation of the site, though "no statements can be made either way concerning subsistence or resource exploitation." Study Areas 1 and 3 indicate that there is a prehistoric site that extends along Camp Avenue from the road to within a few meters of the wetland. They recommended that this region be avoided if possible.

Office of Public Archaeology (1989)

In 1989, the Office of Public Archaeology (OPA), then located at Boston University, conducted an architectural review and Phase I archaeological survey for the Route 1/Post Road road widening project in North Kingstown (Strauss and Seasholes 1989). The project area extended about 4.02 (km) (2.5 mi) long and 30 m (100 ft) on each side of the center line. Background research for the study indicated that there were no recorded prehistoric or historical sites within the project area, though several historical homes were situated adjacent to the existing roadway. Subsurface testing was completed in seven areas along Post Road that were determined to be tested because they contained a potential for undisturbed prehistoric or historic cultural remains. These areas included Cocumcussoc (55 Richard Smith Drive); Pagoda Inn (7315 Post Road); Laporte property (7535 Post Road); Reynolds property (7447 Post Road); Bergeron and Scott properties (8061 Post Road); Sherman property; and the Markodimitras property. Historical cemetery #56 (Brown and Briggs lot) was also identified, though could not be avoided during the widening of Post Road, and the eastern stone wall was removed.

Because there were no intact archaeological sites or features within the project impact area, archaeologists recommended no further work prior to completion of the Route 1/Post Road road-widening project.

Public Archaeology Laboratory (1990)

The Hoskins Park and South Wind sites (RI 1007 and RI 1006) were uncovered by archaeologists in 1985, during an intensive archaeological survey designed to locate sites prior to a proposed condominium development (Westwick Development) along Mill Creek in North Kingstown, Rhode Island. The goal of the Phase III excavations was to scientifically remove and interpret significant information from the sites prior to their destruction; to study the sites as elements within a larger settlement and subsistence networks; and to suggest that the sites continue to serve as cultural resources. As of 1990, 15% of the site areas were excavated. It was recommended that the remaining 85% be utilized for archaeological field schools and workshops in order to retrieve additional information, as the area will be impacted by natural coastal processes and further development in the future.

Excavations at the sites recovered 2245 pieces of culturally related lithics, including 2155 pieces of debitage and 90 bifacial tool/implement fragments. A total of 38 projectile points were recovered, including Bifurcate, Brewerton side notched, Small Stemmed, Orient Fishtail, Susquehanna Broad, Squibnock Triangle, Jack's Reef, Levanna and Madison varieties. A total of 35 non-projectile point bifaces were recovered, including projectile point blanks or performs, a drill fragment and a cobble netsinker. Overall, the majority of lithic material recovered from both sites (95%) was debitage, including both flakes and shatter. The prehistoric pottery assemblage included 39 fragments from the South Wind site and 88 fragments from the Hoskins Park site. Historic artifacts that were recovered from both sites included 21 sherds of ceramic pottery, kaolin pipe fragments, wrought nails, possible iron kettle fragments, wire cut nails, screws, machine cut nails, bullet shells, and 20th century coins. Glass trade beads were also recovered, and thought to be associated with a Contact Period utilization of Hoskins Park.

It was determined that the Hoskins Park and South Wind sites were initially utilized by native populations between 8500 and 9000 years ago. Late Archaic deposits suggested a small group of people (field camp) occupied the site for a short period. A Middle Woodland occupation of the area also occurred, though it also left a small archaeological deposit, suggesting the area was not in use for an extended amount of time. It was not until the Late Woodland period that an intensive utilization of the area was underway. Diagnostic projectile points, ceramic vessels and six radio-carbon dated features spanning a two generation period indicated either repeated reoccupation or a high population for a short period. Historic activity of the area around Mill Creek was mainly agricultural. In 1942 the Quonset Point Naval Air Station and Davisville base became dominant economic influences in the area. The Hoskins Park site was purchased by the Navy in 1939 and became part of the Quonset Air Station. The construction of multiple housing units for military personnel destroyed the majority of the archaeological deposits around Mill Creek and on Calf Neck. The sampling of historic artifacts recovered from this area attribute to these land uses during the 20th century.

Public Archaeology Laboratory, Inc. (1992)

The Public Archaeology Laboratory, Inc. (PAL) contracted with Picerne Properties and DiPrete Engineering Associates in 1992 to conduct a Phase I intensive archaeological survey of the Shady Lea Subdivision project area, located north and east of Shady Lea Road, east of Route 4 and north of Route 138, encompassing 107 acres (433013.637 m²). Of the 107 acres (433013.637 m²), 77.53 acres (313752.778 m²) were allocated for open space, 4.22 acres (17077.734 m²) would serve as right-of-way, and the remaining 25.4 acres (102790.153 m²) were to be divided among 37 residential house lots.

A low density of chipping debris was recovered from the site, suggesting that it might represent limited occupation by small numbers of prehistoric peoples. Historic resources within the area included short duration trash dumps that appeared to represent secondary trash disposal, characteristic of 19th to early 20th century refuse. Artifacts recovered included panel bottles and fragments, buttons, ceramics and metal buckets. No evidence of a potential historic cemetery, as noted on the North Kingstown tax assessor's map, was found. The location of a possible historic

cemetery is on the southeast bound of the project area, out of the construction zone. The historic and prehistoric resources of the proposed Shady Lea Subdivision were not significant, and no further testing in the area was recommended.

Cultural Resource Specialists of New England (1997)

The Cultural Resource Specialists of New England were hired by Mark Hawkins of Annaquatucket Estates to conduct a Phase II archaeological site examination of the Annaquatucket Site in 1997, prior to construction of the proposed Jenkins Estates Development in North Kingstown. Phase I testing revealed two prehistoric sites in the project area: Loci A and B. The two loci exposed workshops with strikingly different artifactual remains. Loci A revealed a primary reduction activity area with no evidence of habitation, and contained argillite and quartz debitage, as well as broken tools, large quartz cobbles and quartz cores. Loci B revealed a Middle Archaic, high-density lithic workshop, with no evidence of habitation. Attleboro red felsite and black felsite tools were recovered from an unplowed B-Horizon, which is unusual, as the majority of prehistoric sites in New England have been disturbed due to farming practices. The different lithic remains and context within the soil of each loci suggest that they are not related, and two separate prehistoric site forms were filed with the Rhode Island Historical Preservation and Heritage Commission (RIHPHC). No further testing was recommended.

Elizabeth Anderson Comer/Archaeology (2005)

In 2005, Elizabeth Anderson Comer/Archaeology (EAC/A) was hired by LSY Architects and the Department of Health and Human Services, Food and Drug Administration, to assess the archaeological potential within a 1.6 acre parcel comprising the FDA's Allen's Harbor property in Davisville, Washington County, Rhode Island. The study was conducted as part of Federal Real Property Asset Management Assessments being conducted by the Department of Health and Human Services, Federal Food and Drug Administration, and was intended to serve as a planning tool to help guide future facility improvement and maintenance. The study utilized a combination of literature review and inspection and evaluation of current land conditions and past disturbances.

The study deduced that the area was considered to have a high potential effect for archaeological deposits from the Late Archaic and Woodland periods, and from the second half of the 20th century. A Phase I intensive survey was recommended prior to any future development of the parcel.

Public Archaeology Laboratory (2006)

In 2006, Narragansett Electric Company/National Grid US Service Company, located in Providence, Rhode Island, hired the Public Archaeology Laboratory (PAL) to complete a Phase I(c) archaeological survey of the Southern Rhode Island Transmission project, within areas of proposed and potential impacts. The project corridor extended along the existing 25.8 mile (41521.075 m) Southern Rhode Island Transmission Line right-of-way from the Kent County

Substation, located on Cowesett Road in Warwick, to the Wood River Substation, located on Shumankanuc Hill Road in Charlestown. PAL's objective was to determine if Native American and/or post-contact period cultural resources, potentially eligible for listing in the National Register, existed within the areas of proposed impact.

Nine archaeological sites, as well as isolated finds, were uncovered within the project right-of-way. These sites included five pre-contact Native American sites and four post-contact period sites, three of which are remnant farmstead and/or dwelling remains. In Warwick, the Maskerchugg Site (initially identified in 1995 by PAL during a survey along the Kent County 115kV line for Narragansett Electric [Harrison and Leveillee 1995]), was identified as being concentrated on the higher and dryer elevations to the north of the Maskerchugg River. During the 2006 Phase IC survey, the 1995 site identification was reinforced, as testing along the south banks of the river consisted of low-density scatters of debitage, including quartz, Attleboro Red Felsite and quartzite resulting from stone tool manufacture or maintenance. No further investigation of the site was recommended, unless development is planned on the north side of the river.

The Hunt River Site in East Greenwich extended to both the north and south banks. The north bank site begins at telephone pole 56 and moves south to the river; the south bank site extends from the river south to pole 89. The uncovered materials included quartz, quartzite and rhyolite chipping debris that reflect Late Archaic and Woodland period encampments along the river. Further work was recommended, to determine site boundaries and internal characteristics. Isolated finds were also recovered in East Greenwich, including a quartz small stemmed projectile point at pole EG19.

In North Kingstown, the first site uncovered was the Tower Hill Site, located west of Tower Hill Road and north of Girard Lane. A Late Archaic assemblage of materials, including a quartz projectile point, quartz chipping debris, quartzite, Attleboro Red Felsite and argillite were recovered. A shallow pit feature, likely resulting from processing or discard of processed organics during occupation of the site by Native American hunters and collectors was uncovered, as well as a post-contact kaolin pipe fragment and machine-cut nail (from plow zone stratum). The Tower Hill Site was recommended for further study. The second site located in North Kingstown was the Pole 176/177 Site. Lithic debris dating from the Late Woodland Period included six pieces of Braintree slate, two pieces of rhyolite and one piece of quartz, as well as a quartz projectile point. Further study of the area was recommended, to determine spatial limits and determine internal characteristics. Isolated Native American finds along the corridor included an argillite Orient projectile point from the Transitional Archaic Period at pole NK 161. The P. Sweet House, located to the north of Stony Lane, contained a decayed 1 ½-story, gable-roofed, two-bay structure with a center chimney. Shed-roofed additions were attached to the front and back of the building, and no foundation was visible. No further work was recommended. Finally, the Oak Hill Pond Mill Race site, located directly east of Oak Hill Pond and 100 feet south of Oak Hill Road, included two channels from the pond that were mill races used to direct water from Oak Brook to a nearby mill, possibly the "Wollen Mill." A concrete foundation, outside of the projects ROW, was constructed after 1870 (Beers 1870) and was of "uncertain function and association."

In South Kingstown, SK 155 Site, located along the transmission line through the Great Swamp, exposed a variety of Woodland/Middle Woodland Period chipping debris. PAL supposed that occupation of this area focused on the elevated Great Neck section surrounded by the Great Swamp wetlands. Further work was recommended. The Watson Farmstead, located southwest of Wolf Rocks Road, contained remains of a domestic/agrarian complex. A cellar hole, well and two dry-laid fieldstone enclosures were located. Further work was recommended. Finally, the remains of the T.P. Brayman Farmstead Site, located south of Waites Corner Road, revealed the structural remains of a cut-stone foundation. No cellar hole was visible, though the site appears to have been the result of deliberate filling. A sherd of vitrified whiteware was collected from the ground surface, suggesting the structure was destroyed in a fire. Further evaluation of the site was recommended.

Site File Search

State site files report the presence of 10 prehistoric sites within a 2.4 km (1.5 mi) radius of Camp Avenue (Table 1). The prehistoric sites yield evidence of continuous human habitation in this portion of Narragansett Bay over the past 9000 years. Historic site files were examined for sites lying adjacent to Camp Avenue itself. No sites were returned from this search, though evidence of historic activity along or adjacent to Camp Avenue was discovered through map research (see below). The 4 sites closest to Camp Avenue are considered in more detail below.

The Fuller (RI 142) site was discovered during Phase I survey of a small subdivision (2 lots) that was proposed on land located west and north of Mill Creek and south of Camp Avenue. During this survey 9 of the 24 shovel test pits (STPs) located closest to the road were positive for prehistoric cultural material (McDonough and Bennett 1989). Cultural material was found to be located virtually exclusively on level or gently sloping terrain that displayed a well drained soil profile. The site was recommended for avoidance or Phase II investigation. No further work was conducted, however based on the density and diversity of material recovered was interpreted as evidence that the site was used for long term habitation.

Cederhurst (RI 779 and RI 780) sites each contained low density debitage scatters ($n < 5$) that were located within the footprint of a proposed boat launch and access road along Fishing Cove in Wickford Harbor. No additional information on these sites was available and no records of additional work were found.

RI 1007 (Hoskins Park) is a multi-component site located 549 m (1800 ft) south of the project area. Artifacts recovered from this site include flakes, debitage, points, aboriginal and historic ceramics, glass, beads and faunal remains of both mammals and fish. It was determined that the Hoskins Park site, alongside the South Wind site located 1219 m (4000 ft) south of the project area, were initially utilized by native populations between 8500 and 9000 years ago. Late Archaic deposits suggested a small group of people (field camp) occupied the site for a short period. A Middle Woodland occupation of the area also occurred, though it also left a small archaeological deposit, suggesting the area was not in use for an extended amount of time. It was not until the Late Woodland period that an intensive utilization of the area was underway.

Diagnostic projectile points, ceramic vessels and six radio-carbon dated features spanning a two generation period indicated either repeated reoccupation or a high population for a short period.

TABLE 2. PREVIOUSLY RECORDED ARCHAEOLOGICAL SITES LOCATED WITHIN 2.4 km (1.5 mi) OF THE APE

RIHPHC SITE #	CULTURAL MATERIAL	LOCATION	DISTANCE FROM APE	CHRONOLOGY
RI 142	Fuller/Mill Creek site Quartz and argillite cluster/scatter	315 Camp Avenue	104m (344 ft) south; 78 m (256 ft) east	Prehistoric
RI 694	Devil's Foot site Native burial site with pestles, flakes, wampum and glass vessels	South of Devil's Food Road	524 m (1719 ft) southeast	Contact
RI 780	Cederhurst site Cluster/scatter of quartz flakes	21 Anchor Way	457 m (1500 ft) south	Prehistoric
RI 1007	Hoskins Park site Midden with argillite; felsite; slate; chert; granite; hornfels; quartz; jasper; rhyolite artifact cluster/scatter, aboriginal and historic ceramics, faunal and shell remains, iron and copper	West of Wickford Point Road	549 m (1800 ft) south	Prehistoric; Archaic; Woodland; Middle Woodland; Late Woodland; Contact; Historic
RI 779	Cederhurst site Cluster/scatter of quartz flakes	West of Landing Lane	643 m (2111 ft) south	Prehistoric
RI 1006	South Wind site Midden/habitation site, with argillite; felsite; slate; chert; granite; hornfels; quartz; jasper; rhyolite artifact cluster/scatter, aboriginal and historic ceramics, faunal and shell remains, iron and copper	21, 29, 37, 47, 55, 61 Lands End Drive	1219 m (4000 ft) south	Prehistoric; Paleo; Archaic; Early Archaic; Transitional Archaic Woodland; Historic
RI 294	Cocumscussoc/Smith's Castle Quartzite flakes and cores, rhyolite flakes, debris, quartz squibnocket, grey flint stemless projectile point	41 Richard Smith Drive	1372 m (4500 ft) south	Prehistoric; Contact; Historic
RI 1144	Midden	South of Lands End Drive	1402 m (4600 ft) south	Prehistoric
RI 1145	Artifact cluster/scatter	Cornelius Island	1448 m (4750 ft) south	Prehistoric
RI 1115	Quonset Point Sand Blows site Shale and quartz artifact cluster/scatter	East of Zarbo Avenue	2134 m (7000 ft) east	Prehistoric

The single Contact period site within the vicinity of the project area is Devil's Foot Cemetery (RI 0694). Located just 524 m (1719 ft) southeast of the project area, the site was discovered by Abner A. Hart during sand-pit excavations in 1869. Hart purportedly uncovered "27 copper rings, a large quantity of wampum beads, several two and three gallon dark green wine bottles, some latten spoons and an adult skull" (RIHPC site file RI 0694). Mike Hebert, RIDOT archaeologist and author of the 1984 National Register nomination form for the site (NR #84000562), stated that 6 Jesuit finger rings, several English wine bottles and 5 stone pestles were recovered and on display at the Roger Williams Park Museum (ca. 1983). Two quartz flakes were also recovered from the site, suggesting that it may have been used as an Archaic period campsite, and later as a burial site during the 17th century. According to Hebert, a second burial site was located at the "corner of Post Road and Camp Avenue (and) was excavated in the late nineteenth century" (Hebert 1983). A service station has since been constructed on the site.

Historic Map Research

The earliest known map that portrays settlement in the Camp Avenue area of southern Quidnessett, North Kingstown, is a *Survey of (the) Homestead and Saugo Farms* created by Caleb Harris in 1802 (Figure 3) for Lodowick Updike, nephew of Richard Smith, Jr. and proprietor of his estate in Wickford following Smith's death in 1692 (Cole 1889). Post Road is clearly depicted as the "Road from Providence" and is lined with trees. Camp Avenue appears to be the southern property boundary for land owned by Benjamin Reynolds. The eastern boundary that separates the Reynold's land from that owned by Joshua Pearce is the Mill Creek, identified as Sawmill Cove. Pearce's Mill and Mill Pond are identified at the northern end of the creek. South of Pearce's land, along the eastern banks of the cove is a "Horse Pound" and "Grove of Wood". Calf Pasture Neck ejects into what is known today as Wickford Harbor.

Additional cartographic evidence is portrayed on Henry Francis Walling's 1855 *Map of the State of Rhode Island* (Figure 4). This map depicts historic Post Road, referred to in early land deeds as 'the Pequot Path,' 'the Road to Pequot,' 'the Country Road,' etc (Bicknell 1920), traversing north to south, flanked by the Stonington Railroad to the west and Narragansett Bay to the east. Camp Avenue branches off from Post Road, proceeding southeast across Mill Creek. Development in the Quidnessett area ca. 1855 is relatively sparse – only four landowners are depicted on today's Camp Avenue. A grist mill is identified closest to Post Road, between Camp Avenue and the creek (Plate 1).

The mill was erected in the late 18th century by the Tennent family. It was purchased by the Tourgee family at the start of the 19th century and used by local farmers to make flour. George Washington Tanager (Tourgee) is noted just south of the mill. He was the last miller and the first to utilize the water power from Mill Creek to operate a small sawmill and woodworking shop adjacent to the grist mill. J. Spink and J. H. Spink were located at the southeast end of the roadway on the north and south sides, respectively (Walling 1855).

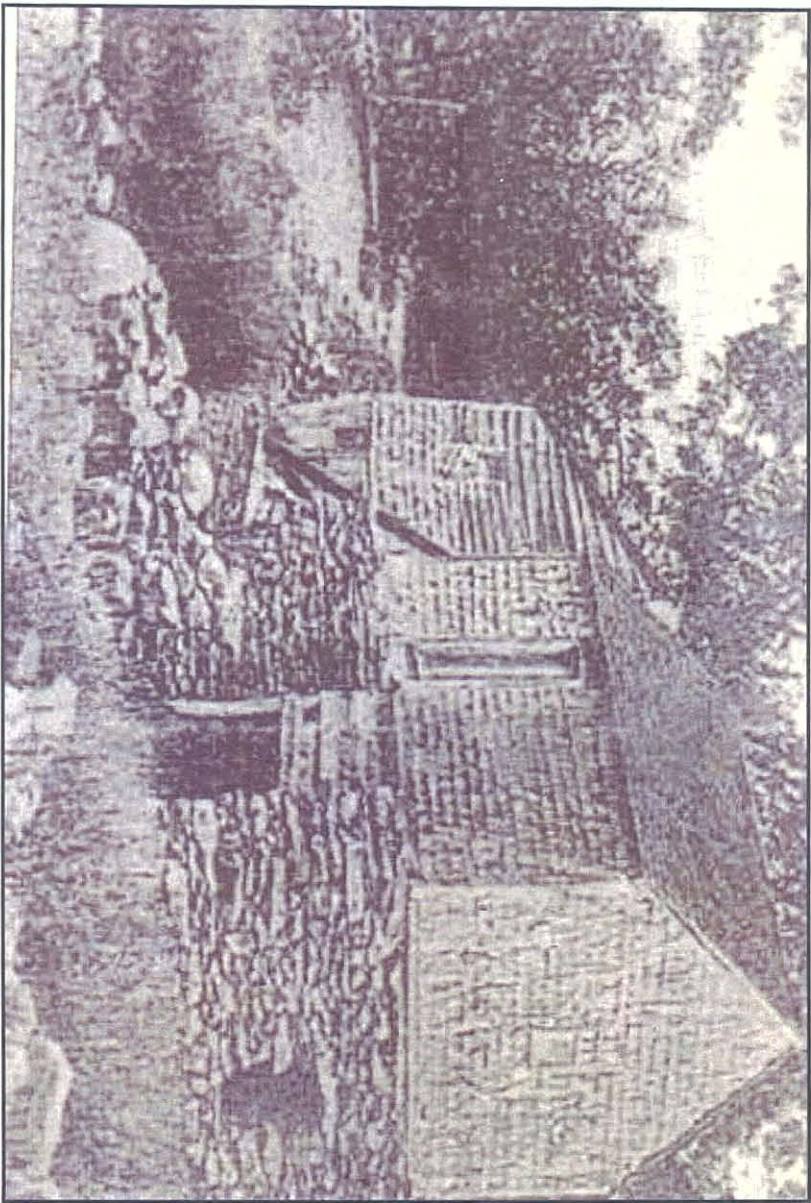
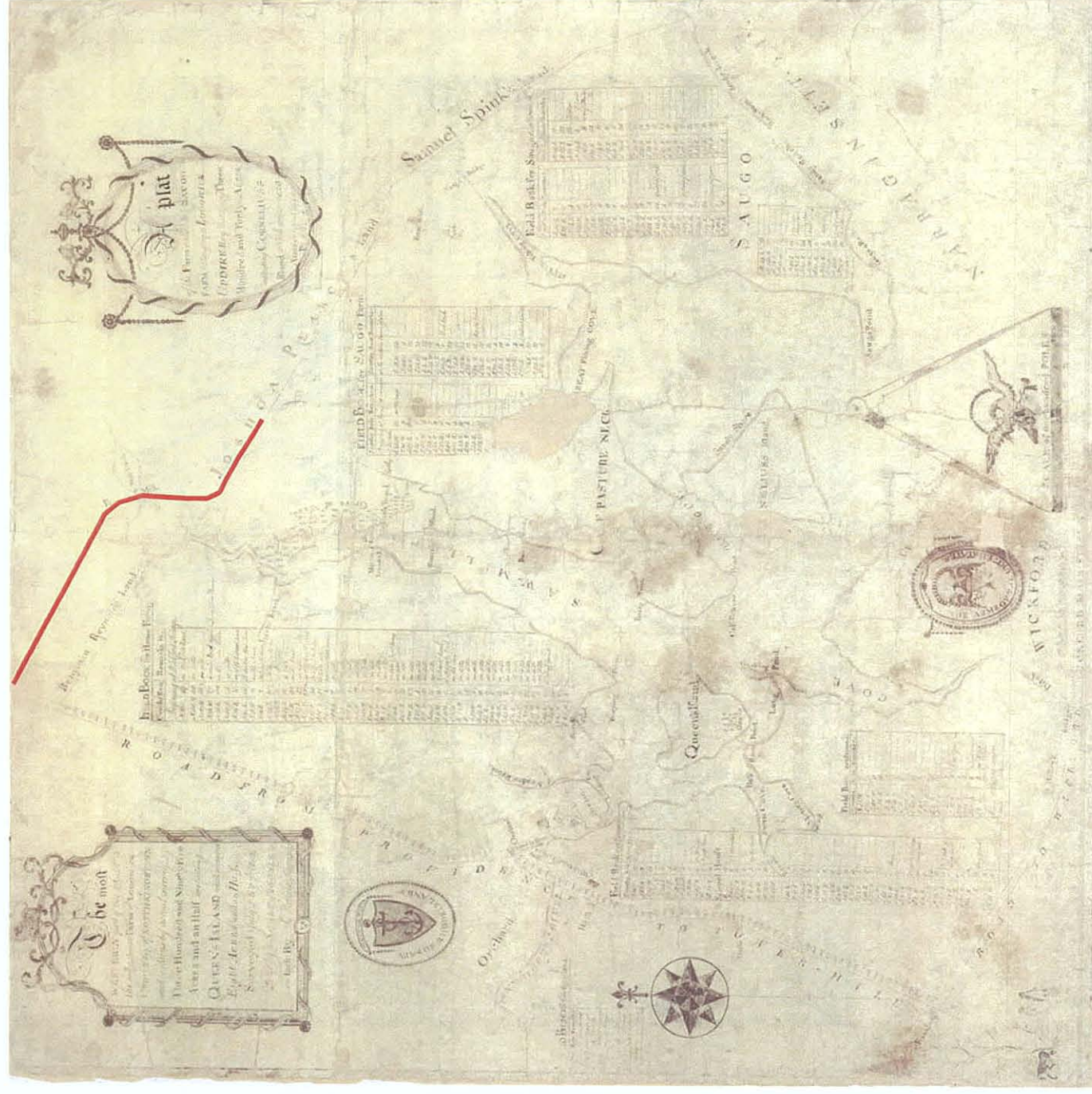


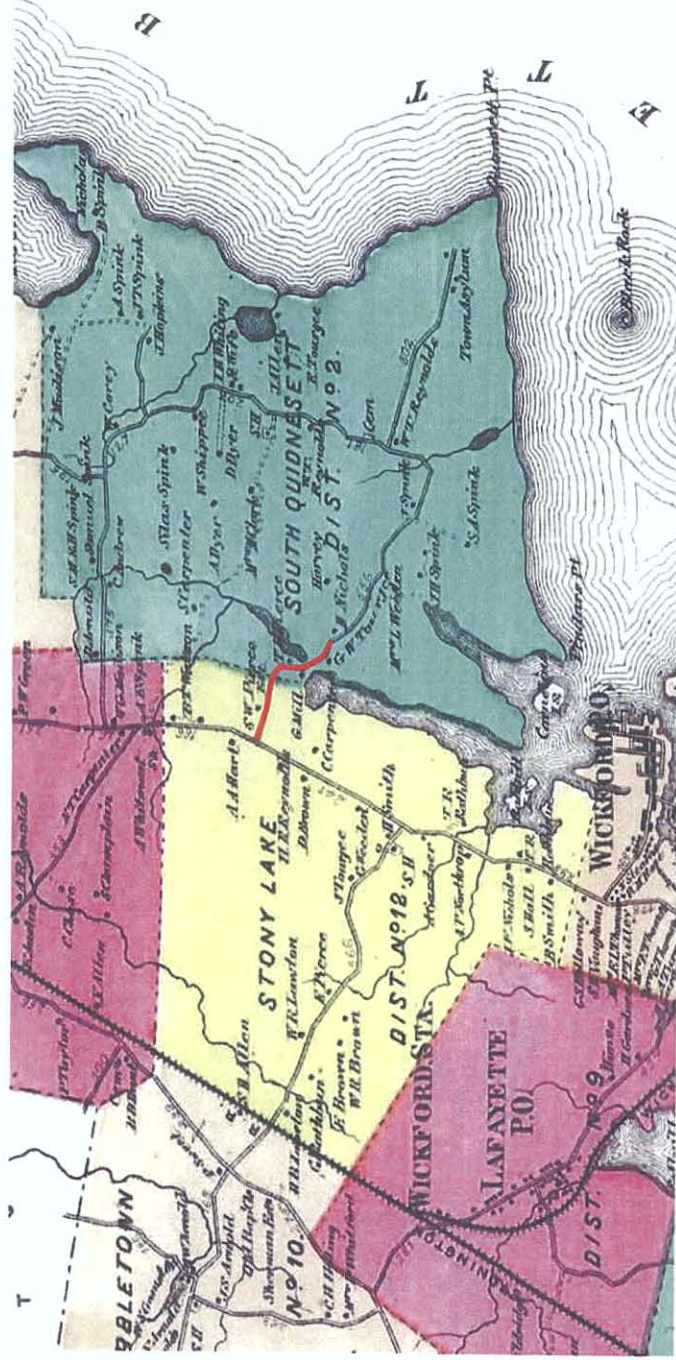
Plate 1. Tourgee Grist Mill in the early 1900s



Survey of Homestead and Saugo Farms (Harris 1802)
with Generalized Project Area



Detail of the Map of the State of Rhode Island (Walling 1855)
with Generalized Project Area



Detail of D.G. Beer's Atlas (1870)
with Generalized Project Area

D.G. Beer's 1870 Atlas reveals concentrated development around the village of Wickford, as well as further north into Davisville, with dispersed estates and farms scattered between the two (Figure 5). The S. W. Pierce estate is located within close proximity to Post Road on the north side of Camp Avenue, followed by the T. H. Pierce residence, immediately adjacent to Mill Creek. The grist mill continues its operation at the head of Mill Creek, and C. Carpenter is identified southwest of the mill, between Post Road and the creek. As the road winds southeast, the property of George Washington Tourjee abuts the southeast edge of the creek. H. Nichols is located across the Avenue from Tourjee. Further south, Mrs. L. Weeden and J. H. Spink continue to reside on the south side of the roadway. The property of Sam A. Spink is marked between J. H. and the Bay. J. Spink is located in the same vicinity, on the north side of Camp Avenue (Beers 1870).

Two and a half decades later, the mapmakers Everts & Richards (1895) depicted the increased development of Post Road (Figure 6). At the southeast corner of Post Road and Camp Avenue, A. A. Hart owns a dwelling and rear barn; just south is the store of D. Arnold, and the residence of W. A. Carpenter. The grist mill is continues to be in use. Driveways mark the entry to homes on the east side of the creek, including J. E. Smith, M. W. Hart and M. W. Harris on the south of Camp Avenue, and J. W. Harvey on the north (Everts & Richards 1895).

Results of Phase I Archaeological Reconnaissance Survey

Field Reconnaissance was conducted on June 3, 2011 by Jacob Freedman. The project area along Camp Avenue was observed to be lined by both mixed commercial and residential properties. Commercial enterprises are located at the west end of the avenue, at its intersection with Post Road with single family homes, subdivisions, and apartment complexes located to the east. This area contains existing subsurface utility infrastructure, the location of which will be integrated into a Phase IB archaeological testing program to avoid their disturbance.

The landform along Camp Avenue is composed of an elevated plateau near Post Road that meets a series of stream terraces to the east. These terraces run generally north south and are related to the Late Pleistocene and early Holocene down cutting of Mill Creek. From its intersection with Post Road Camp Avenue runs along the elevated plateau for 300 m (984 ft) to Station 5 (Plate 2). The landform then slopes down moderately at 10-15 degrees for 60 m (197 ft) between stations 5 and 9 before running along a level terrace for 185 m (607 ft) between stations 9 and 15 near Robin Drive (Plate 3). Near Station 15 Camp Avenue curves southward along level terrain for 250 m (820 ft) until the roadway crosses Mill Creek near Station 23 (Plate 4). The roadway then runs along a level landform to its intersection with Asqah Drive, where the project terminates.

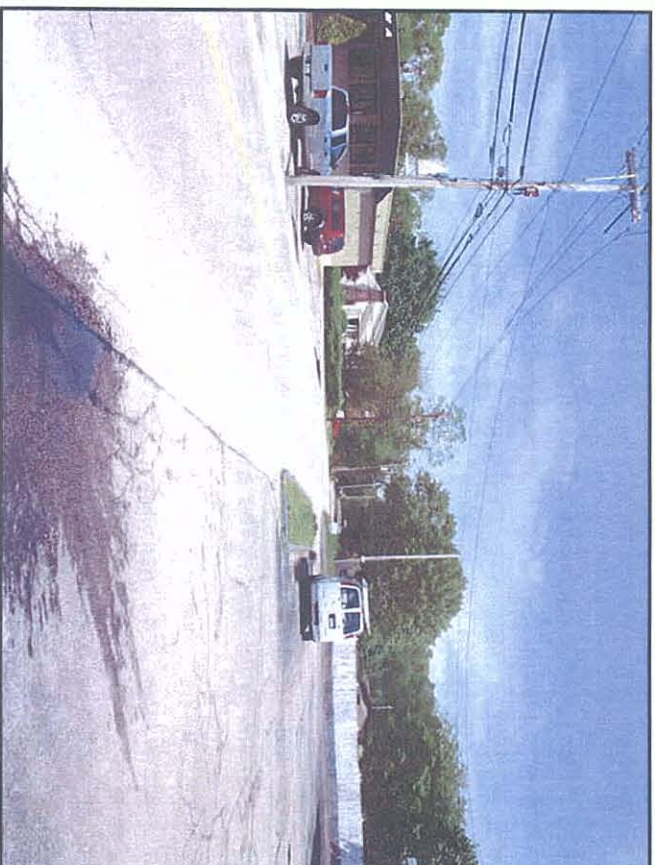


Plate 2. View looking east from Post Road along Camp Avenue



Plate 3. View looking east along Camp Avenue near Robin Drive

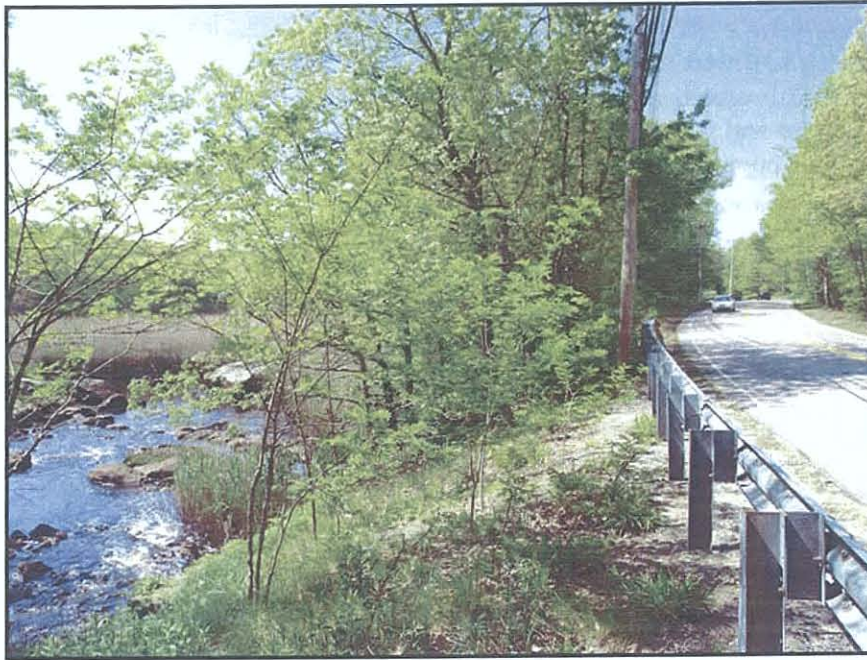


Plate 4. View looking northwest near Mill Creek

CONCLUSIONS

Prehistoric Sensitivity

The Bay Area Coastal Context (see above; RIHPHC 1986) is analogous to the Salt Pond Region, where salt ponds are replaced by small bays and estuaries (McDonough and Bennet 1989). These locations provide access to both fresh water and the rich and varied food sources associated with the coastal zone, i.e. anadromous fish runs, shell fish, and mammals accessing wetland areas, and are typically associated with a diverse range of prehistoric activities. In addition, portions of this area also display the micro-environmental setting (level, elevated landforms with well drained soils and access to a diverse resource base) that is typically associated with prehistoric habitation.

Not only does the environmental setting along Camp Avenue fulfill the criteria of both the large and small scale models of prehistoric land use, but it is also a setting where numerous prehistoric sites have been previously discovered. Most significant in its proximity to the Project is the Fuller Site (RI 142), which was discovered adjacent to Camp Avenue just west of its crossing of Mill Creek. Although only studied at the Phase I level, RI 142 was interpreted as the site of either long term or repeated short term occupation. It should also be noted that a burial site was reportedly excavated near the intersection of Post Road and Camp Avenue in the late 19th century (Hebert 1983). These sites may fit within a larger network including large habitation sites in the area such as Cocumscussoc/Smith's Castle (RI 294) and South Wind (RI 1006).

Based on this evidence, the level and elevated portions of Camp Avenue within 150 m (492 ft) of Mill Creek, its associated estuary, or brackish wetlands, are considered highly sensitive for prehistoric archaeological resources except where urban activity has disturbed the natural stratigraphy. In addition, the area within 100 m (328 ft.) of the intersection of Post Road and Camp Avenue is considered moderately sensitive for prehistoric remains based on the presence of burials nearby. This area is not considered highly sensitive, because it is reported to have been previously excavated and was likely subsequently disturbed by the 20th century construction of a service station. The remainder of Camp Avenue within the project area is considered to have low sensitivity for prehistoric archaeological resources, based on prehistoric land use patterns (see above), a lack of reported sites, or contemporary disturbance.

Historic Sensitivity

The area of Camp Avenue was first deeded to Europeans in 1659 as part of the Atherton Purchase. The Smith's Castle Plantation retained ownership of the property until the late 17th century, when maps show Camp Avenue as the border between the Smith's Castle Plantation and the farms of Benjamin Reynolds and Joshua Pearce. The Camp Avenue area appears to have undergone little development through the 19th century, remaining a locale of dispersed estates and few recorded structures. Both residences and commercial activity appear to have been concentrated near the intersection of Camp Avenue and Post Road. This intersection continues to be the center of commercial activity today, and as such, has likely undergone extensive modern disturbance. The exception to this pattern is a grist mill erected by John Tenant in the late 18th century.

This mill remained in operation through the 19th century and was expanded by George Tourgee, one of its later owners. In addition, the mill is reported to be collocated with a private toll bridge in operation during the 18th century (Simister 1974). The mill fell into a state of disrepair in the 20th century and was destroyed by a hurricane in 1938.

Based on this evidence, the area of Camp Avenue within 100 m (328.083 ft) of Post Road is considered to be moderately sensitive for archaeological resources. In addition, the location where Camp Avenue crosses Mill Creek is considered to be highly sensitive for archaeological resources related to the historic grist and saw mills that may have been present at this location. While these resources were reportedly destroyed in the hurricane of 1938, portions of the extensive stone foundations and water control features associated with the mill may remain extent below the surface. The remainder of Camp Avenue within the project area is considered to have low sensitivity for historic archaeological resources, based on the lack of historic evidence for structures in the area. Because of the agricultural nature of this land, the possibility remains that unmapped farm outbuildings may have been present in the area.

Recommendations

Because portions of the project area along Camp Avenue are considered to have high or moderate sensitivity for both prehistoric and historic archaeological resources a Phase IB survey including controlled subsurface testing is recommended. Subsurface testing is recommended below the road deck along the proposed route of the sewer main at 15 m (49 ft.) intervals in areas of moderate sensitivity and at 10 m (33 ft.) in areas of high sensitivity. Given this sensitivity, it is recommended that fieldwork be completed as soon as possible in order to ensure that the discovery of significant resources will not impact the proposed construction schedule. To this end, Gray & Pape is prepared to submit a permit application and conduct fieldwork during the fall of 2011.

Because the coastal zone in this area was intensively utilized prehistorically, i.e. burials and large habitation, and many types of historic structures, i.e. farm outbuildings and paupers graves, are not recorded on historic maps it is recommended that an archaeological monitor with stop work authority be present during construction activities along Camp Avenue.

These recommendations are offered in compliance with Section 106 of the National Historic Preservation Act of 1966 (as amended).

Yours Sincerely,

A handwritten signature in dark ink, appearing to read "Jacob Freedman", with a stylized, flowing script.

Jacob Freedman, M.A., R.P.A.

REFERENCES CITED

- Anderson, David G.
2001 Climate and Culture Change in Prehistoric and Early Historic Eastern North America. *Archaeology of Eastern North America* 29:143-186.
- Arnold, James N. and J. Fones
1894 *The Records of the Proprietors of the Narragansett: Otherwise Called the Fones Record*. Rhode Island Colonial Gleanings. Vol. 1, (1990) Narragansett Historical Publishing Co., Providence, Rhode Island.
- Baker, David Sherman
1876 *An Historical Sketch of North Kingstown*. Book & Job Printers, Providence, Rhode Island.
- Beers, D.G.
1870 Map of North Kingstown. *Atlas of the State of Rhode Island and Providence Plantations*. Compiled and Published by D.G. Beers & Co., Philadelphia.
- Bendremer, Jeffrey C. M., Elizabeth Kellogg and Tonya Baroody Largy
1991 A Grass-Lined Maize Storage Pit and Early Maize Horticulture in Central Connecticut. *North American Archaeologist* 12 (4): 25-349.
- Bendremer, Jeffrey C. M. and Robert A. Dewer
1993 The Advent of Maize Horticulture in New England. *Corn and Culture in the Prehistoric New World*. Westview Press, Boulder, Colorado.
- Bernstein, David J.
1993 *Prehistoric Subsistence on the Southern New England Coast*. Academic Press.
- Bicknell, Thomas Williams
1920 *The History of the State of Rhode Island and Providence Plantations, Volume 2*. American Historical Society.
- Bourque, Bruce
1992 *Prehistory of the Central Maine Coast*. Rutledge, New York, New York.
- Bradley, James W.
2007 PaleoIndian Sites and Finds in the Lower Merrimac River Drainages. *Bulletin of the Massachusetts Archaeological Society*, 68 (1): 12-20.
- Bunker, Victoria
2002 New Hampshire's Prehistoric Settlement and Chronology. *The Indian Heritage of New Hampshire and Northern New England*. McFarland & Company, Inc., Jefferson, New Hampshire.

Carroll, Charles

- 1932 *Rhode Island: Three Centuries of Democracy, Volume 1*. Lewis Historical Publishing Company, Inc.

Ceci, Lynn

- 1990 Radiocarbon Dating Village Sites in Coastal New York: Settlement Pattern Change in the Middle to Late Woodland. *Man in the Northeast* 39-1-28.

Chang, K. C.

- 1958 Study of Neolithic Social Groupings: Examples from the New World. *American Anthropologist* 60:298-334.

Clauson, J. Earl

- 1975 Cocumcussoc. In *Facts and Fancies Concerning North Kingstown, Rhode Island*. Daughters of the American Revolution, Pettasquamscutt Chapter. Globe Printing Company, East Providence, Rhode Island.

Clements, Joyce and Richard Petyk

- 2008 *Phase I/II Archaeological Investigations in Support of a Geophysical Survey at Smith's Castle, North Kingstown (Wickford), Washington County, Rhode Island*. Gray & Pape, Inc. Report on file at the Rhode Island Historical Preservation and Heritage Commission.

Cole, J. R.

- 1889 *History of Washington and Kent Counties, Rhode Island, including their early settlement and progress to the present time; a description of their historic and interesting localities; sketches of their towns and villages; portraits of some of their prominent men, and biographies of many of their representative citizens*. W. W. Preston & Co., New York.

Conley, Patrick T.

- 1980 *North Kingstown: An Historical Sketch*. Cogens, Inc. Providence, Rhode Island.

Dincauze, Dena F.

- 1968 Cremation Cemeteries in Eastern Massachusetts. *Papers of the Peabody Museum of Archaeology and Ethnology, Harvard University*, Vol. 59 (1). Peabody Museum, Cambridge, Massachusetts.
- 1971 An Archaic Sequence for Southern New England. *American Antiquity* 36, 2:194-198.
- 1974 An Introduction to Archaeology in the Greater Boston Area. *Archaeology of Eastern North America* 2: 39-66.
- 1976 The Neville Site: 8,000 Years at Amoskeag, Manchester, New Hampshire. *Peabody Museum Monographs* 4.

- 1991 An Appreciation of Lynn Ceci's Contributions to Northeast Native American Studies. *Bulletin of the Massachusetts Archaeological Society* 52:68-71.
- Dincauze, Dena F. and Mitchell Mulholland
1977 Early and Middle Archaic Site Distributions of Habitats in Southern New England. *Annals of the New York Academy of Sciences* 288: 439-456.
- Doucette, D. L.
2005 Reflections of the Middle Archaic: A View from Annasnappet Pond. *Bulletin of the Massachusetts Archaeological Society* 66: (1): 22-33.
- Doyle, Richard A., Nathan D. Hamilton, James B. Peterson and David Sanger
1985 Late Paleo-Indian Remains from Maine and Their Correlations in Northeastern Prehistory. *Archaeology of Eastern North America*, 13: 1-34.
- Dunford
1992 Conditional Sedentism: The Logistical Flexibility of Estuarine Settlements in Circumscribed Environments. Paper Presented at the Fifty-seventh Annual Meeting of the Society for American Archaeology, Pittsburg.
- Everts & Richards
1895 *New Topographical Atlas of Southern Rhode Island*. Everts & Richards, Philadelphia.
- Fowler, William
1966 Ceremonial and Domestic Products of Aboriginal New England. *Bulletin of the Massachusetts Archaeological Society* 27 (3 & 4): 51-59.
- Funk, Robert E.
1978 Post-Pleistocene Adaptations. *Handbook of North American Indians*, Vol. 15, Northeast, Smithsonian Institute, Washington D.C.
- Geremia, James J. & Associates, Inc.
2008 *Town of North Kingstown Comprehensive Wastewater Facilities Plan for the Post Road Corridor*. Providence, Rhode Island.
- Gramley, R. Michael
1982 The Vail Site. *Bulletin of the Buffalo Museum of Sciences*, 30. Buffalo, New York.

1990 What is Known and Not Known About Human Occupation of the Northeastern United States Until 10,000 B.P. *Archaeology of Eastern North America* 18: 5-31.

- Harris, Caleb
 1802 *Survey of Homestead and Saugo Farms (Map for Lodowick Updike, Esq.)*. Copy available at the Cocumscussoc Association Archives, Smith's Castle, North Kingstown (Wickford), Rhode Island.
- Harris, Ted, and Elizabeth A. Comer
 2005 *FDA Facility Utilization Assessment: Allen's Harbor Facility, Davisville, Washington County, Rhode Island*. Elizabeth Anderson Comer/ Archaeology, Baltimore, Maryland. Report on file at the Rhode Island Historical Preservation and Heritage Commission.
- Harrison, Burr, Paul Russo and Alan Leveillee
 1992 *Phase I Intensive Archaeological Investigations: Shady Lea Subdivision*. The Public Archaeology Laboratory, Inc. Report on file at the Rhode Island Historical Preservation and Heritage Commission.
- Harrison, Burr, and Alan Leveillee
 1995 *Kent County 115 kV Electric Transmission Line Project, Phase II Archaeological Site Examination of the Maskerchugg Site, Warwick, Rhode Island*. The Public Archaeology Laboratory, Inc. Report on file at the Rhode Island Historical Preservation and Heritage Commission.
- Hebert, Michael A.
 1985 *Archaeological Assessment and Phase I Historical Survey, Improved Access to Quonset Point/Davisville From Route 4, East Greenwich and North Kingstown, Rhode Island*. Rhode Island Department of Transportation. Report on file at the Rhode Island Historical Preservation and Heritage Commission.
- Hasenstab, Robert J.
 1999 Fishing, Farming and Finding the Village Sites: Centering Late Woodland New England Algonquians. In *The Archaeological Northeast*. M. A. Levine, K. E. Sassaman, and M. Nassaney, editors. Pp.139-153. Bergin and Garvey, Westport, CT.
- Hoffman, Curtiss
 2005 *South Brook Archaeological Survey, Final Report*. On file at the Massachusetts Historical Commission, Boston, Massachusetts.
- Huling, Mary Kenyon
 1941 The Tourgee Tide Mill. In *Facts and Fancies Concerning North Kingstown, Rhode Island*. Daughters of the American Revolution, Pettaquamscutt Chapter. Globe Printing Company, East Providence, Rhode Island.
- James, Sidney
 1975 *Colonial Rhode Island: A History*. Scribner, New York, New York.

- James, Sydney V., Sheila L. Skemp and Bruce Colin Daniels
 2000 *The Colonial Metamorphoses in Rhode Island: a study of institutions in change.* University Press of New England, Hanover, New Hampshire.
- Jones, Brian D.
 1999 The Middle Archaic Period in Connecticut: The View. *Mashantucket Bulletin of the Archaeological Society of Connecticut* 62: 101-123.
- Kerber, Jordan E.
 1984 Prehistoric Human Ecology and Environments of Potowomut Neck, Warwick, Rhode Island: An Interdisciplinary Approach. Ph.D. dissertation, Department of Anthropology, Brown University, Providence, RI.
 2006 *Cross-Cultural Collaboration: Native peoples and archaeology in the northeastern United States.* University of Nebraska.
- Largy, Tonya and Pierre Morenon
 2008 Maize Agriculture in Coastal Rhode Island: Imaginative, Illusive, or Intensive? *Current Northeast Paleoethnobotany II.* New York State Museum Bulletin 512. University of the State of New York, Albany, New York.
- Leveillee, Alan
 1979 *A Reconnaissance Archaeological Survey Along the Route 4 Extension Project Corridor, East Greenwich – North Kingstown, Rhode Island.* Public Archaeology Laboratory, Inc. Report on file at the Rhode Island Historical Preservation and Heritage Commission.
- Leveillee, Alan, and Burr Harrison
 1996 An Archaeological Landscape in Narragansett, Rhode Island: Point Judith Upper Pond. *Bulletin of the Massachusetts Archaeological Society* 58-63.
- Leveillee, Alan and Joseph N. Waller
 1999 *Phase I(c) Archaeological Survey Confreda Fields Soccer Complex, Warwick, Rhode Island.* PAL. Report on file at the Rhode Island Historical Preservation and Heritage Commission.
- Leveillee, Alan and Louis Sardelli
 1988 *A Phase II Archaeological Site Examination of the Quidnessett Neck Prehistoric Site, North Kingstown, Rhode Island.* The Public Archaeology Laboratory, Inc. Report on file at the Rhode Island Historical Preservation and Heritage Commission.
- Leveillee, Alan, and Peter F. Thorbahn
 1984 *An Archaeological Assessment of the Sakonnet River.* Report 46-1. Public Archaeology Laboratory, Pawtucket, RI.

Leveillee, Alan and Renee Van Coughyen

- 1990 *The Hoskins Park and South Wind Sites: A Program of Archaeological Data Recovery in Rhode Island's Coastal Zone*. The Public Archaeology Laboratory, Inc., Pawtucket, Rhode Island. Report on file at the Rhode Island Historical Preservation and Heritage Commission.

Leveillee, Alan, Ron Dalton, and Craig Chartier

- 1993 *Results of the Phase I Archaeological Survey, Highland II Urban Collector and Phase II Site Examination of the Highlander Site (RI-1688), Cumberland and Woonsocket, Rhode Island*. Report on file at the Rhode Island Historical Preservation and Heritage Commission.

Leveillee, Alan, Donna Ingham and Mark Lance

- 2006 *Intensive Archaeological Survey of the Southern Rhode Island Transmission Project: Warwick to Charlestown, Rhode Island*. PAL. Report on file at the Rhode Island Historical Preservation and Heritage Commission.

Luedtke, Barbara

- 1987 *The Pennsylvania Connection: Jasper in Massachusetts Archaeological Sites*. *Bulletin of the Massachusetts Archaeological Society* 48 (1).

Massachusetts Historical Commission

- 1984 *Guide to Prehistoric Site Files and Artifact Classification System*. Massachusetts Historical Commission, Boston, Massachusetts.

McBride, Kevin A.

- 1991 *Phase II Archaeological Investigation of the Briggs/Brown Cemetery for the Reconstruction of Post Road Project in North Kingstown, Rhode Island*. Public Archaeology Survey Team, Inc. Report on file at the Rhode Island Historical Preservation and Heritage Commission.

McBride, Kevin A. and Robert E. Dewar

- 1987 *Agriculture and Cultural Evolution: Causes and Effects in the Lower Connecticut River Valley*. *Emergent Horticultural Economies of the Eastern Woodlands*.

McDonough, John E. and Leslie Bennett

- 1989 *A Phase I Archaeological Reconnaissance Survey of Land Belonging to Nathan & Joyce Fuller, Camp Avenue, North Kingstown, Rhode Island*. New England Archaeological Resources, Inc. Report on file at the Rhode Island Historical Preservation and Heritage Commission.

McMaster, Robert L.

- 1960 *Sediments of Narragansett Bay System and Rhode Island Sound, Rhode Island*. *Journal of Sedimentary Petrology* 30:249-274.
- 1983 *A 9,000 Year View of Narragansett Bay*. *Maritimes* 27: 7-10.

- 1984 Holocene Stratigraphy and Depositional History of the Narragansett Bay System, Rhode Island, U.S.A. *Sedimentology* 31:777-792.
- McWeeney, Lucinda
 1999 A Review of Late Pleistocene and Holocene Climate Changes in Southern New England. *Bulletin of the Archaeological Society of Connecticut* 62:3-18.
- McWeeney, Lucinda and Douglas C. Kellogg
 2001 Early and Middle Holocene Climate Changes and Settlement Patterns Along the Eastern Coast of North America. *Archaeology of Eastern North America* 29: 187-213.
- Morenon, E. Pierre
 1984 Establishing the Context of RI 1000: A Narragansett Indian Burial Ground in North Kingstown, Rhode Island. *Occasional Papers in Archaeology, No. 21*. Rhode Island College. Report on file at the Rhode Island Historical Preservation and Heritage Commission.
- Olsen, Stephen, Donald D. Robadue, Jr. and Virginia Lee
 1980 An Interpretive Atlas of Narragansett Bay. *Marine Bulletin 40*. Coastal Resources Center, University of Rhode Island, Kingston, RI.
- Peck, J.A., and R.L. McMaster
 1991 Stratigraphy and Geologic History of Quaternary Sediments in the Lower West Passage, Narragansett Bay, Rhode Island. *Journal of Coast Research* 11:25-37.
- Pfeiffer, John
 1990 Late and Terminal Archaic Periods of Connecticut Prehistory: A Model of Continuity. *Experiments and Observations on the Terminal Archaic of the Middle Atlantic Region*. Archaeological Services, Bethlehem, Pennsylvania.
- Rhode Island Historical Preservation and Heritage Commission
 1979 *North Kingstown, Rhode Island*. Statewide Historical Preservation Report, W-NK-1. Rhode Island Historical Preservation and Heritage Commission, Providence, Rhode Island.
- 1985 *RI 1006 (South Wind Site)*. Rhode Island Historical Preservation and Heritage Commission Site Inventory Files. Accessed 1 August 2011.
- 2002 *Native American Archaeology in Rhode Island*. Rhode Island Historical Preservation and Heritage Commission, Providence, Rhode Island.
- 2007 *Performance Standards and Guidelines for Archaeological Surveys*. Rhode Island Historical Preservation and Heritage Commission, Providence, Rhode Island.

2008 *Town of North Kingstown Comprehensive Plan 2008 Update.*

Rhode Island Historical Society

- 1835 *Collections of the Rhode Island Historical Society, Volume III.* Marshall, Brown, and Company, Providence, Rhode Island.

Rector, Dean D.

- 1981 *Soil Survey of Rhode Island.* United States Department of Agriculture, Soil Conservation Service, in cooperation with the Rhode Island Agricultural Experiment Station. Washington, D.C.

Ritchie, William

- 1969 *The Archaeology of Martha's Vineyard.* Natural History Press, Garden City, New York.
- 1971 The Archaic in New York. *New York State Archaeological Association Bulletin* 52: 2-12.

Robinson, Brian

- 1992 Early and Middle Archaic Period Occupation in the Gulf of Maine Region: Mortuary and Technological Patterning. *Early Holocene Occupation in Northern New England.* Occasional Publications in Main Archaeology No. 9. Augusta, Maine.

Sanderson, Edward F.

- 2008 Letter to James J. Geremia, Geremia & Associates, Inc., from Edward F. Sanderson, Executive Director and State Historic Preservation Officer, Rhode Island Historical Preservation and Heritage Commission, Old State House, 150 Benefit Street, Providence, Rhode Island 02903-1209. 18 December 2009.

Schafer, J. P.

- 1961 "Surficial geology of the Wickford Quadrangle, Rhode Island." *U. S. G. S. Map* #136.

Snow, Dean

- 1980 *The Archaeology of New England.* Academic Press, New York, New York.

Strauss, Alan E., and Nancy S. Seasholes

- 1989 *Architectural Review and Phase I Archaeological Survey of the Reconstruction of Post Road in North Kingstown, Rhode Island.* Office of Public Archaeology. Report on file at the Rhode Island Historical Preservation and Heritage Commission.

Strauss, Alan E., Louis Sardelli and Gerald Macomber

- 1996 *Phase I Archaeological Survey of the Proposed Jenkins Estates Development in North Kingstown, Rhode Island*. Cultural Resource Specialists of New England, Providence, Rhode Island. Report on file at the Rhode Island Historical Preservation and Heritage Commission.

Strauss, Alan E., Louis Sardelli and Gerald Macomber

- 1997 *Phase II Archaeological Site Examinations at the Annaquatucket Site Loci A and B in North Kingstown, Rhode Island*. Cultural Resource Specialists of New England, Providence, Rhode Island. Report on file at the Rhode Island Historical Preservation and Heritage Commission.

USDA Natural Resources Conservation Services (NRCS)

- 2011 *Custom Soil Resource Report for Camp Avenue*. Soil Survey Geographic database for Washington County, Rhode Island. <http://websoilsurvey.nrcs.usda.gov> accessed August 26, 2011.

Van Couyghen, Renee and Alan Leveille

- 1988 *A Phase I Intensive Archaeological Survey of the Wickford Condominium Project Area, North Kingstown, Rhode Island*. The Public Archaeology Laboratory, Inc. Report on file at the Rhode Island Historical Preservation and Heritage Commission.

Waller, Joseph N., Jr.

2000. Late Woodland Settlement and Subsistence in Southern New England Revisited: The Evidence from Coastal Rhode Island. *North American Archaeologist* 21:139 – 53.

Walling, Henry Francis

- 1855 *Map of the State of Rhode Island*. Map on file at the Rhode Island Historical Preservation and Heritage Commission.

Wilbur Smith and Associates

- 1985 *Phase I/II Cultural Resource Survey, Jamestown Drainage Alternative/I-895 FEIS*. Report Prepared for the Rhode Island Department of Transportation.

Williams, Roger

- 1973 *A Key Into the Language of America*, Edited by John J. Teunissen and Evelyn J. Hinz, Wayne State University Press, Detroit, Michigan.

Woodward, Carl R.

- 1971 *Plantation in Yankeeland: The Story of Cocumscussoc, Mirror of Colonial Rhode Island*. Pequot Press, University of Wisconsin.

APPENDIX C

NORTH KINGSTOWN/QUONSET DEVELOPMENT CORPORATION AGREEMENT

**INTERGOVERNMENTAL AGREEMENT FOR
WASTEWATER SERVICES
BETWEEN
THE QUONSET DEVELOPMENT CORPORATION
AND
THE TOWN OF NORTH KINGSTOWN, RHODE ISLAND**

THIS AGREEMENT made this 6th day of July, 2010 by and between the Rhode Island Economic Development Corporation, acting by and through its agent and attorney-in-fact the Quonset Development Corporation, a governmental agency of the State of Rhode Island, by and through its Managing Director, hereinafter collectively referred to as "QDC", and the Town of North Kingstown, a municipal corporation of the State of Rhode Island, by and through its Town Council, hereinafter referred to as "TOWN".

WITNESSETH:

WHEREAS, QDC is operating a Wastewater Treatment Facility and other appurtenant facilities located in the Quonset Business Park (Park), to collect, treat and dispose of the Wastewater for the occupants of the Park and certain neighboring properties; and

WHEREAS, the QDC Wastewater Treatment Facility is operated in accordance with the Rhode Island Pollutant Discharge Elimination System Permit No. RI0100404; and

WHEREAS, it is in the Town's best financial interest to enter into an agreement with the QDC for wastewater service to the Town in lieu of the Town constructing new facilities, and incurring construction, operation and maintenance costs for such new facilities; and

WHEREAS, certain properties within the Town are currently connected into the QDC Wastewater Treatment Facility (the parcels identified in Exhibit 1 shall be identified as existing TOWN users of the QDC Wastewater Treatment Facility); and

WHEREAS, certain modifications and/or additions must be made to the QDC Wastewater Treatment Facility in order to collect and treat Wastewater from the TOWN; and

WHEREAS, additional modifications are required to be made to the Town's System in order to convey Wastewater from the TOWN to the QDC Wastewater Treatment Facility; and

WHEREAS, subject to bond financing therefor, the TOWN is prepared to purchase and reserve capacity in the QDC Wastewater Treatment Facility not to exceed an average daily flow of 0.2 million gallons per day "MGD"; and

WHEREAS, QDC and the TOWN are authorized by law to enter into contracts with each other for the purpose of aiding in the prevention or abatement of water pollution and/or to make mutually suitable arrangements for the disposal of Wastewater.

NOW, THEREFORE, in consideration of the mutual undertaking of the parties hereto, the parties agree as follows:

1. DEFINITIONS

1.1 For all purposes of this AGREEMENT and amendments thereto, the following listed terms shall have the meanings set forth below:

- A. "Biochemical Oxygen Demand" (BOD) means the quantity of oxygen utilized in the biochemical oxidation of organic matter under the standard laboratory procedure of five (5) days, at 20 degrees Celsius expressed in terms of weight and concentration (milligrams per liter).
- B. "Capacity Purchase Price" means the price determined as follows: (i) the parties have agreed that the base purchase price for the .2MGD to be reserved for use by the Town is \$2,460,000 (the "Base Price") as of the date of this Agreement; and (ii) the Capacity Purchase Price will be the Base Price multiplied by the increase in the McGraw Hill Construction Index published by Engineering News Record ("Construction Cost Index"). The Base Price will be multiplied by a fraction the denominator of which is Construction Cost Index published for the date closest to the date hereof and numerator is the Construction Cost Index for the date closest to the date the QDC gives notice to the Town that it will expand the treatment capacity of the QDC Wastewater Treatment Facility in accordance with Section 2.3 hereof. The product will be the Capacity Purchase Price.
- C. "Domestic Wastewater" means liquid wastes:
 - (i) From the noncommercial preparation, cooking, and handling of food; or
 - (ii) Containing human excrement and similar matter from the sanitary conveniences of dwellings, commercial buildings, industrial facilities, institutions and other structures and facilities. It shall not contain groundwater, storm water, surface water, or cooling water or Industrial Wastewater.
- D. "Industrial Wastewater" means the liquid wastes resulting from the processes employed in industrial, manufacturing, trade, or business establishments, as distinct from Domestic Wastewater.
- E. "Infiltration" shall mean the water entering a Wastewater Treatment System from the ground through such means as defective pipe, pipe joints, connections or manhole walls. Infiltration does not include and is distinguished from Inflow.
- F. "Inflow" shall mean the water discharged to a Wastewater Treatment System (including service connections) from such sources as roof leaders, cellar, yard, and area drains; foundation drains; cooling water discharges; drains from springs and swampy areas; manhole covers; cross-connection from sewers; catch basins; Stormwater runoff; street

wash waters; and drainage in general. Infiltration/Inflow is the total quantity of water entering a Wastewater Treatment System from both Infiltration and Inflow.

- G. "Measured Wastewater Flow" means the total unadjusted flow volume recorded at flow metering devices, referred to in Article 4 hereof.
- H. "TOWN Flow" or "Flow from Town" means the amount of Wastewater flowing from the TOWN into QDC's system as determined by Article 4 hereof.
- I. "TOWN's Future Wastewater Flow" means the .2MGD of capacity being purchased by the Town in accordance with the terms of this Agreement.
- J. "TOWN's System" means the Sanitary Sewer interceptor lines, lateral sewer lines, Wastewater collection system, and other appurtenances located, or to be located in the TOWN which are intended to convey Wastewater from sources in the TOWN to QDC's System.
- K. "Park" shall mean the Quonset Business Park, as further described on Exhibit A attached hereto.
- L. "Pretreatment" shall mean the reduction of the amount of pollutants, the elimination of pollutants, or the alteration of the nature of pollutant properties in Wastewater to an acceptable state, as determined appropriate by QDC, prior to or in lieu of discharging or otherwise introducing such pollutants into a Wastewater Treatment Facility. The reduction or alteration can be obtained by physical, chemical, or biological processes, except as prohibited by Title 40, Code of Federal Regulations, Section 403.6(d).
- M. "Pretreatment Standards" means all applicable Federal rules and regulations implementing section 403 of Title 33 U.S.C. §1251 et. seq. of the Clean Water Act, as well as any non-conflicting State or local standards, and QDC's Sewer Treatment System User Regulations. In cases of conflicting standards or regulations, the more stringent thereof shall be applied.
- N. "Quonset Development Corporation System" or "QDC System" or "QDC Wastewater Treatment System" or "QDC Wastewater Treatment Facility" means QDC's existing Wastewater collection and treatment system within the boundaries of the Park.
- O. "Rhode Island Department of Environmental Management" shall mean the State agency which administers and regulates Wastewater discharges.
- P. "Rhode Island Pollutant Discharge Elimination System" means the Rhode Island system for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing discharge permits and imposing and enforcing Pretreatment requirements pursuant to Title 46, Chapter 12 of the General Laws of Rhode Island and the Clean Water Act.

- Q. "QDC's Sewer Treatment System User Regulations" shall refer to Section 7 of the QDC Development Regulations, as amended from time to time, a copy of which is attached as Exhibit B.
- R. "Sanitary Sewer" shall mean a sewer which carries Sewage and to which storm, surface, and groundwater are not intentionally admitted.
- S. "Sewage" shall mean a combination of the water-carried wastes from residences, business buildings, institutions and industrial establishments.
- T. "Shall" is mandatory; "May" is permissive.
- U. "Significant Industrial User" means any industrial user of QDC's Wastewater Treatment System:
 - (i) Whose Wastewater flow exceeds an average of 25,000 gallons per day of Wastewater to the Wastewater Treatment System (excluding sanitary, non-contact cooling or boiler blowdown wastewater); or
 - (ii) Whose Wastewater flow exceeds Five (5) percent or more of the average dry weather hydraulic or organic capacity of the Wastewater Treatment System; or
 - (iii) Whose Wastewater concentration of BOD and Total Suspended Solids exceeds 250 [mg/l]; or
 - (iv) Who is a federal EPA categorical industry; or
 - (v) Who is an industry with sanitary or non-toxic discharges using solvents, toxic chemicals and/or hazardous chemicals that could potentially be discharged into a Wastewater Treatment System.
- V. Intentionally Omitted.
- W. "Stormwater" means any flow occurring during or immediately following any form of natural precipitation and resulting therefrom.
- X. "Total Suspended Solids" means the total suspended matter that floats on the surface of, or is suspended in, Wastewater, or other liquids, and which is removable by laboratory filtering.
- Y. "Wastewater" means Sewage and the liquid and water-carried Industrial Wastewater, and Domestic Wastewater from dwellings, commercial buildings, industrial facilities, institutions and other structures and facilities, together with any groundwater, surface water, and storm water that may be present (including Infiltration/Inflow), whether treated or untreated, which is discharged into or permitted to enter a Wastewater Treatment System.

- Z. "Wastewater Treatment System or Wastewater Treatment Facility" or "System" means any devices, facilities, structures, equipment or works owned or used by the TOWN and/or QDC for the purpose of the transmission, storage, and treatment of Sewage, Domestic Wastewater and/or Industrial Wastewater, including intercepting sewer, outfall sewers, Sewage and/or Wastewater collection systems, pumping, power, and other equipment and their appurtenances, extensions, improvements, remodeling, additions, and alterations thereof; elements essential to provide standby treatment units and clear well facilities; and any work, including site acquisition of the land that will be an integral part of the treatment process or is used for ultimate disposal of residues from such treatment.

2. GENERAL AGREEMENT

- 2.1 Notwithstanding any other provision of this Agreement, the obligations of the Town hereunder are subject to applicable provisions of its Charter and Rhode Island law and to the appropriation of funds in each fiscal year to permit the Town to perform such obligations or to bond financing therefor, as applicable.
- 2.2 Notwithstanding any other provision of this Agreement, the obligations of QDC hereunder are subject to its Enabling Act (42-64.10-1 et seq.) and Rhode Island law and the performance by the Town of all of its obligations hereunder in accordance with the terms of this Agreement.
- 2.3 The Town agrees to purchase the Town's Future Wastewater Flow for the Capacity Purchase Price. The Capacity Purchase Price will be paid by the Town to QDC one hundred eighty (180) days following written notice from QDC to the Town that QDC has determined, in its sole judgment, ← 80% that it will expand the treatment capacity of the QDC Wastewater Treatment Facility.
- 2.4 The QDC Wastewater Treatment Facility will be under the sole control and supervision of the QDC, including without limitation, obtaining all permits, approvals, consents and related items required for any upgrade of the QDC Wastewater Treatment Facility.
- 2.5 There are certain Wastewater sources located in the TOWN which are presently connected to the QDC System. Such sources may continue to discharge Wastewater to the QDC System at the current levels as set forth on Exhibit 2 attached hereto (the "Existing Flow"). These sources shall not be considered part of the TOWN's Future Wastewater Flow (0.2 MGD of future capacity): provided, however, that any increase in the Existing Flow resulting from a change of use, expansion of existing facilities or otherwise shall be included in the 0.2 MGD allocated to the Town. In addition, upon execution of this Agreement, QDC will charge the TOWN based upon Measured Wastewater Flow for the Existing Flow, as measured at the designated metering locations, and other applicable service charges. QDC will read the meters monthly and invoice the TOWN quarterly and the TOWN will make quarterly payments to QDC for these charges. The Town shall assume responsibility for billing the users of the Existing Connectors (defined below) before QDC shall have any obligation to accept the Town's Future Wastewater Flow.

- 2.6 The TOWN agrees to construct and maintain, at its own cost the sewer collection system, including collector and interceptor sewers, pumping facilities and sewer force mains, within the TOWN required to convey Wastewater to the QDC Wastewater Treatment Facility in accordance with this Agreement. Plans and specifications for the work to be performed by the Town are subject to the prior written approval of QDC.
- 2.7 Upon the execution of this Agreement, the TOWN will commence and diligently pursue to completion the following:
- (i) The Town shall install metering devices for the Wastewater flow to the QDC Wastewater Treatment Facility of such quality, number, and in such locations as deemed necessary by QDC to record Wastewater flow from the TOWN entering the QDC System, including without limitation, at QDC's Manhole 57b, Manhole 25-P-4, Manhole 25-011, and to include locations referenced in iii below and in accordance with a time schedule approved by QDC;
 - (ii) The Town shall design, permit and fund modifications to the DS-55 Pump Station, such design is subject to prior QDC approval. QDC will procure and construct the improvements to DS-55 upon receipt of funds from the Town to cover all costs and expenses of construction; and
 - (iii) The TOWN shall assume responsibility for and accept ownership of the portion of the QDC Wastewater Treatment Facility located outside of the Park ("Existing Connectors") and responsibility for billing the users of the Existing Connectors.

Once the Town has completed the undertakings listed in (i) through (iii) above, to QDC's reasonable satisfaction, QDC will accept (and the Town will be responsible for connecting, at its cost, subject to QDC's prior approval of plans and specifications for such connections) the Town's Future Wastewater Flow up to 200,000 gallons per day ("gpd"). Once the Town's Future Wastewater Flow reaches 200,000 gpd, the Town will suspend all future connections and additional Wastewater flow to the QDC Wastewater Treatment Facility.

- 2.8 The TOWN's System shall connect and meter all existing and future Wastewater flow into the QDC System at, but not limited to, the following locations:
- i. Post Road South at QDC's Manhole 57b
 - ii. QDC's Manholes 25-P-4 and Manhole 25-011
 - iii. Mark Drive Area and Quidnesset School
 - iv. At other points mutually agreed to by the Town and QDC.
- 2.9 The TOWN has established that the Town's Future Wastewater Flow will include the Post Road Phase 1 South project area, as presented in the approved Post Road Corridor Wastewater Facilities Plan a copy of which plan is attached hereto as Exhibit 3, provided such future Wastewater does not exceed 0.2 MGD.
- 2.10 The QDC will be responsible for the maintenance and operation of all of the flow meters described in Sections 2.7 and 2.8 above. QDC will invoice the TOWN for the operational costs as defined in

Article 4 based on the actual meter reading. The TOWN will be responsible to invoice the individual users of the QDC System located outside Quonset Business Park, including the users of the Existing Connectors.

- 2.11 The TOWN shall adopt, within thirty (30) days of the date hereof, the existing or as amended QDC's Sewer Treatment System User Regulations and Industrial Pretreatment Standards, as amended from time to time, in order to maintain the integrity of the treatment process. The Town and the Town's users shall be subject to said QDC Sewer Treatment System User Regulations and industrial Pretreatment Standards, as amended.
- 2.12 Prior to the TOWN taking ownership of the Existing Connectors, QDC shall clean and inspect the Existing Connectors. A written and video inspection report shall be submitted to the TOWN for review. Any Infiltration deficiencies found in the Existing Connectors shall be corrected at QDC's expense before the TOWN takes ownership of and responsibility for the Existing Connectors.
- 2.13 Once the deficiencies have been reasonably addressed, QDC shall transfer title to the Existing Connectors to the TOWN at no cost. The TOWN shall become responsible for all future (capital and operational) costs relating to the Existing Connectors. Anything herein to the contrary notwithstanding, until such time as the Town has accepted ownership and responsibility for the Existing Connectors, including billing the users of the Existing Connectors directly, QDC will not accept the Town's Future Wastewater Flow

3. PROJECT COSTS AND PAYMENTS

In addition to the costs that the Town is otherwise responsible for under this Agreement, the Town shall be responsible for one hundred percent (100%) of the cost of:

- (i) The Rhode Island Department of Environmental Management approval of the Town's Wastewater Facilities Plan for the Post Road_Phase 1 South, Corridor;
- (ii) The upgrade of the Davisville Pump Station (DS-55);
- (iii) the installation of all metering devices required pursuant to this Agreement.

4. OPERATION AND MAINTENANCE

- 4.1 QDC shall continue to accept the Existing Flow. QDC shall accept the Town's Future Wastewater Flow upon (i) completion of the upgrade of Davisville Pump Station (DS-55), (ii) installation of all metering devices, (iii) the Town's acceptance of responsibility for and ownership of all of the Existing Connectors (including billing the users of the Existing Connectors directly), and (iv) evidence, satisfactory to QDC, of the Town's financial ability to pay the Capacity Purchase Price in accordance with the terms of this Agreement.
- 4.2 QDC agrees to provide adequate and qualified operating personnel for the QDC System.

- 4.3 QDC shall charge the TOWN based upon Measured Wastewater Flow for the Town Flow as measured at the designated metering locations and other applicable service charges in accordance with Section 42-64-7.8(b) GLRI. QDC will read the meters monthly and invoice the TOWN quarterly and the TOWN will make quarterly payments to QDC for these charges. All parcels located in the TOWN which are connected to the QDC System, including the users of the Existing Connectors, shall be assessed a sewer assessment by the Town. In the event the Town does not make payment within thirty (30) days of the invoice, QDC may set off such amount against any Pilot or other payments due from QDC to the Town.

5. ASSESSMENTS

- 5.1 Any Significant Industrial User located in the TOWN shall be assessed directly by QDC in accordance with the QDC's Ordinance and Pretreatment Program for annual permit fees and excess concentrations of BOD and Total Suspended Solids.

6. REGULATIONS OF OPERATION

- 6.1 The TOWN shall comply with the Sewer Treatment System User Regulations. The TOWN shall delegate to QDC, through adoption of an Industrial Wastewater Pretreatment ordinance, the enforcement of Industrial Pretreatment of wastes to insure Wastewater is acceptable to meet local, State and Federal standards. The Wastewater Treatment Facility shall be operated in such a manner that the effluent discharge complies with applicable State and Federal standards.
- 6.2 In exercising the rights of QDC with respect to the TOWN, QDC agrees that it will not treat the TOWN on a different basis than is applicable to QDC users except as is provided herein.
- 6.3 QDC and the TOWN agree to maintain complete and accurate books and records concerning all matters relative to this Agreement and the performance thereof, to retain the same for a period of at least seven (7) years following the fiscal year to which such books and records relate, and to permit the agents, accountants and other duly authorized representatives of the other party to have access to all such books and records during reasonable business hours for the purpose of examining any of the same and making extracts or copies thereof. QDC and the TOWN agree to make available to the representatives and agents of the other party, all facilities and equipment related to the wastewater system of each, especially all meters, metering devices and records.

7. MISCELLANEOUS CLAUSES

- 7.1 No failure or delay in performance of this AGREEMENT by either party shall be deemed to be a breach thereof when such failure or delay is occasioned by or due to any act of God, strikes, lockouts, wars, riots, epidemics, explosions, sabotage, breakage or accident to machinery or lines of pipe, the binding order of a Court or governmental authority, or any other cause, whether of the kind herein enumerated or otherwise, not within the control of the party involved. Failure to make any payment when due under the terms of this Agreement shall not be subject to this Section 7.1.
- 7.2 If any section, subsection, sentence, clause, phrase or portion of this AGREEMENT is for any reason held invalid or unconstitutional by any court of competent jurisdiction, such portion shall be

deemed a separate, distinct and independent provision, and such holding shall not affect the validity of the remaining portions hereof.

7.3 All connections to the QDC System in the TOWN shall be inspected by an independent engineering firm approved by QDC at the time of construction to assure compliance with QDC's Sewer Treatment System User Regulations or the TOWN's Sewer Ordinances, whichever is more stringent. Copies of the inspection reports shall be provided to QDC.

7.4 Time is of the essence of this Agreement.

8. EFFECTIVE DATE OF CONTRACT

8.1 This AGREEMENT shall become effective upon approval by the Town Council of North Kingstown and QDC's Board and upon execution by the respective duly authorized representatives.

8.2 This agreement shall remain in full force and effect for a period of ten (10) years unless and until it is amended by the mutual consent of all parties.

9. ASSIGNMENT/SALE

9.1 QDC may assign or sell any or all of its interests in the QDC System to a third party or enter into a management or operating agreement with a third party to manage or operate the QDC System or any part thereof on such terms and conditions as QDC deems appropriate.

10. DEFAULT

10.1 In the event of a dispute or default under the terms of this Agreement; and if, the parties are unable to resolve the issue by informal negotiations, the parties may agree to mediation, otherwise either party shall be entitled to pursue any and all remedies available under law, in equity or otherwise and to recover damages, including without limitation, reasonable attorney's fees.

IN WITNESS WHEREOF the parties have caused this AGREEMENT to be executed by their respective fully authorized officers and their corporate seals affixed hereto the day and year first above written.

**RHODE ISLAND ECONOMIC DEVELOPMENT
CORPORATION ACTING BY AND THROUGH ITS
AGENT AND ATTORNEY-IN-FACT
QUONSET DEVELOPMENT CORPORATION**

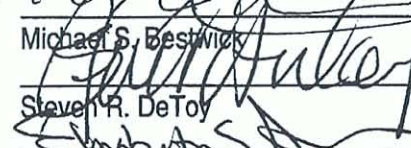
By: _____


MANAGING DIRECTOR

TOWN OF NORTH KINGSTOWN

Town Council


Michael S. Bestwick


Steven R. DeToy


Elizabeth S. Dolan


Carol H. Houston


Charles H. Stamm

BK2489PG090

THIS PAGE LEFT BLANK INTENTIONALLY

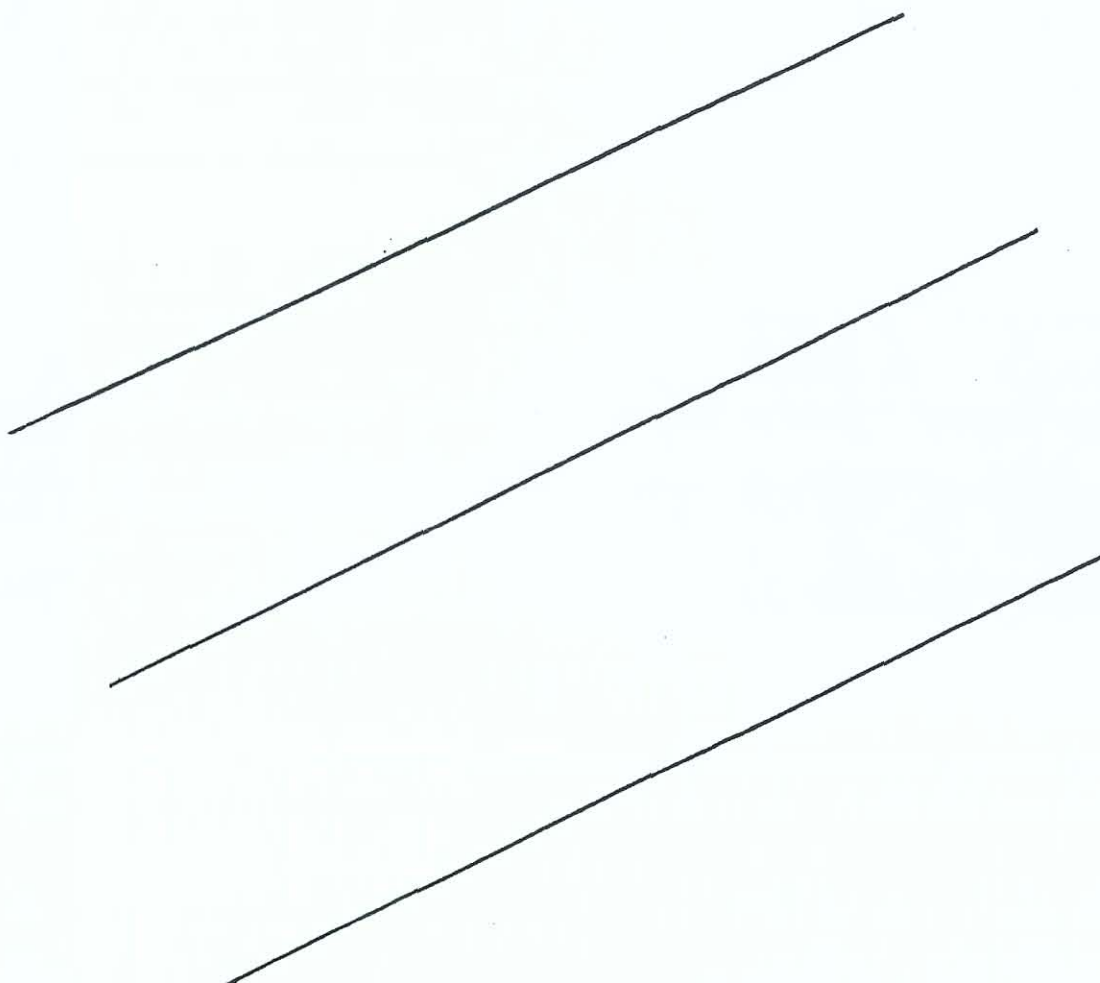


Exhibit 1

Existing NK Parcels with Sewer Service

6/23/2010

District	PLAT_LOT
ASQAH	
ASQAH	178-001
ASQAH	
Essex Village	
Essex Village	146-054
Essex Village	146-055
Essex Village	146-202
Essex Village	
Fishing Cove School	
Fishing Cove School	140-003
Fishing Cove School	
G. Grossmans	
G. Grossmans	178-002
G. Grossmans	178-003
G. Grossmans	
Kings Grant	
Kings Grant	146-053
Kings Grant	
Kingtown Heights	
Kingtown Heights	143-109
Kingtown Heights	143-110
Kingtown Heights	143-111
Kingtown Heights	
Lischio	
Lischio	147-034
Lischio	147-037
Lischio	147-042
Lischio	147-073
Lischio	147-078
Lischio	
Lischio/Moran	
Lischio/Moran	147-017
Lischio/Moran	147-080
Lischio/Moran	147-089
Lischio/Moran	
MHRH	
MHRH	181-017
MHRH	181-019
MHRH	

Existing NK Parcels with Sewer Service

6/23/2010

District	PLAT_LOT
Phoenix Properties	
Phoenix Properties	147-045
Phoenix Properties	147-058
Phoenix Properties	
Quidnessett School	
Quidnessett School	143-108
Quidnessett School	
Quonset School	
Quonset School	179-003
Quonset School	
Travelers Aid	
Travelers Aid	181-005
Travelers Aid	
Wickford Point	
Wickford Point	107-007
Wickford Point	107-008
Wickford Point	107-009
Wickford Point	107-010
Wickford Point	107-011
Wickford Point	107-012
Wickford Point	107-013
Wickford Point	107-014
Wickford Point	107-015
Wickford Point	107-016
Wickford Point	107-017
Wickford Point	107-018
Wickford Point	107-019
Wickford Point	107-020
Wickford Point	107-021
Wickford Point	107-022
Wickford Point	107-023
Wickford Point	107-024
Wickford Point	107-025
Wickford Point	107-026
Wickford Point	107-027
Wickford Point	107-028
Wickford Point	107-029
Wickford Point	107-030
Wickford Point	140-004
Wickford Point	140-005
Wickford Point	140-006
Wickford Point	140-007
Wickford Point	140-008
Wickford Point	140-009
Wickford Point	140-010
Wickford Point	140-011
Wickford Point	140-012
Wickford Point	140-013
Wickford Point	140-014
Wickford Point	140-015

Existing NK Parcels with Sewer Service

6/23/2010

District	PLAT_LOT
Wickford Point	140-016
Wickford Point	140-017
Wickford Point	140-018
Wickford Point	140-019
Wickford Point	140-020
Wickford Point	140-021
Wickford Point	140-022
Wickford Point	140-023
Wickford Point	140-024
Wickford Point	140-025
Wickford Point	140-026
Wickford Point	140-027
Wickford Point	140-028
Wickford Point	140-029
Wickford Point	140-030
Wickford Point	140-031
Wickford Point	140-032
Wickford Point	140-033
Wickford Point	140-034
Wickford Point	140-035
Wickford Point	140-036
Wickford Point	140-037
Wickford Point	140-038
Wickford Point	140-040
Wickford Point	140-043
Wickford Point	140-044
Wickford Point	140-045
Wickford Point	140-046
Wickford Point	140-048
Wickford Point	140-049
Wickford Point	140-050
Wickford Point	140-051
Wickford Point	140-052
Wickford Point	140-053
Wickford Point	140-054
Wickford Point	140-055
Wickford Point	140-056
Wickford Point	140-057
Wickford Point	140-058
Wickford Point	140-059
Wickford Point	140-060
Wickford Point	140-061
Wickford Point	140-062
Wickford Point	140-063
Wickford Point	140-064
Wickford Point	140-065
Wickford Point	140-066
Wickford Point	140-067
Wickford Point	140-068
Wickford Point	140-069
Wickford Point	140-070
Wickford Point	140-071
Wickford Point	140-072
Wickford Point	140-073
Wickford Point	140-074
Wickford Point	140-075
Wickford Point	140-076
Wickford Point	140-077
Wickford Point	140-078
Wickford Point	140-079

BK 2489 PG 094

Existing NK Parcels with Sewer Service

6/23/2010

District	PLAT_LOT
Wickford Point	140-080
Wickford Point	140-081
Wickford Point	140-082
Wickford Point	140-089
Wickford Point	

EXHIBIT 2

EXISTING FLOW

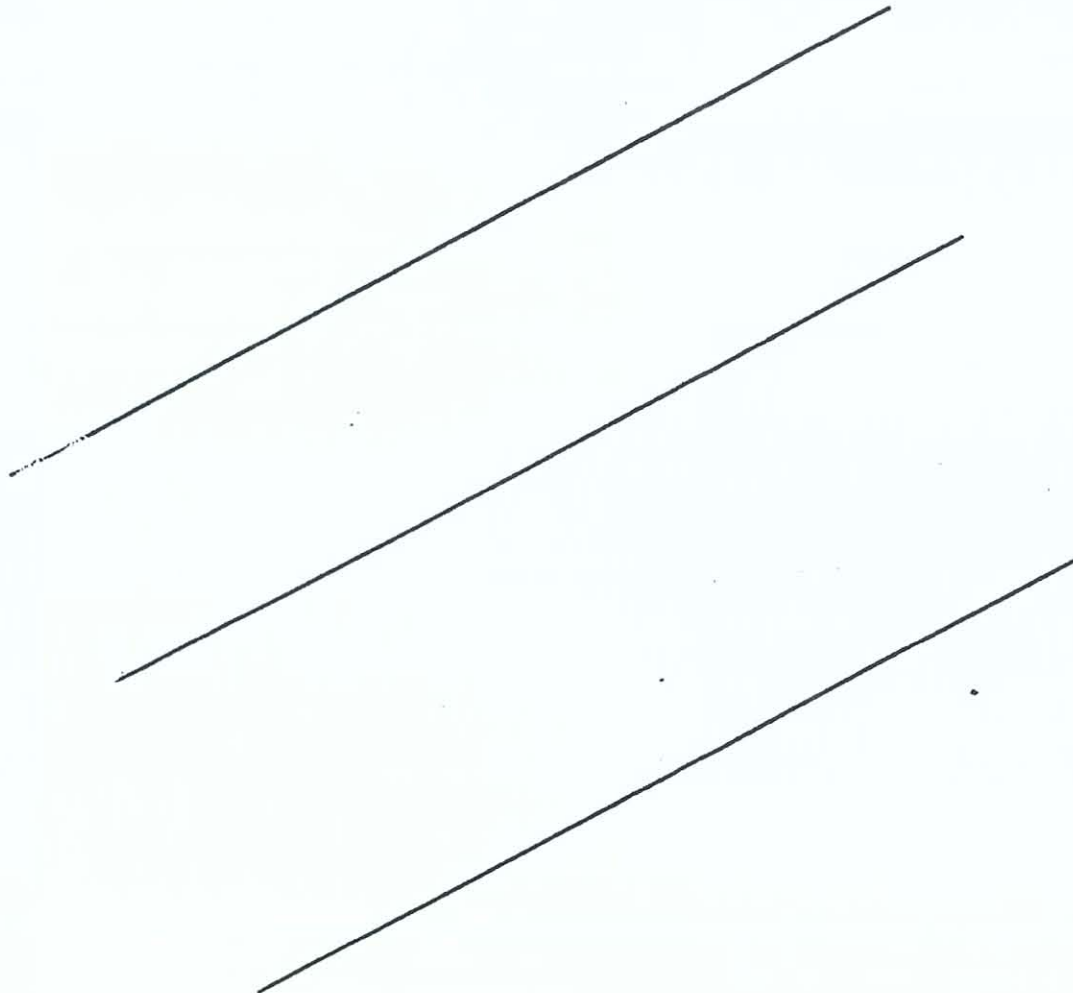
<u>Location</u>	<u>Annual Flow (MG/Yr)</u>	<u>Daily Avg. Flow (MGD)</u>
ASQAH	5.4	0.014
Essex Village	5.5	0.015
G. Grossmans	5.6	0.015
Kings Grant	5.5	0.015
MHRH	0.4	0.001
Kingstown Heights	0.2	<0.001
Fishing Cove School	0.4	0.001
Quonset School	<0.2	<0.001
Quidnesset School	<0.2	<0.001
Phoenix Properties	3.2	0.009
Lischio	4.3	0.012
Lishio/ Moran - under Construction	26.3	0.072
Travelers Aid	4.5	0.012
Wickford Point	4.8	0.013

Total -----66.5 MG/Yr -----<0.183 MGD

BK 2489PG096

EXHIBIT 3

POST ROAD, PHASE 1 SOUTH, CORRIDOR WASTEWATER FACILITIES PLAN



BK 2489PG 097

EXHIBIT A
QUONSET BUSINESS PARK

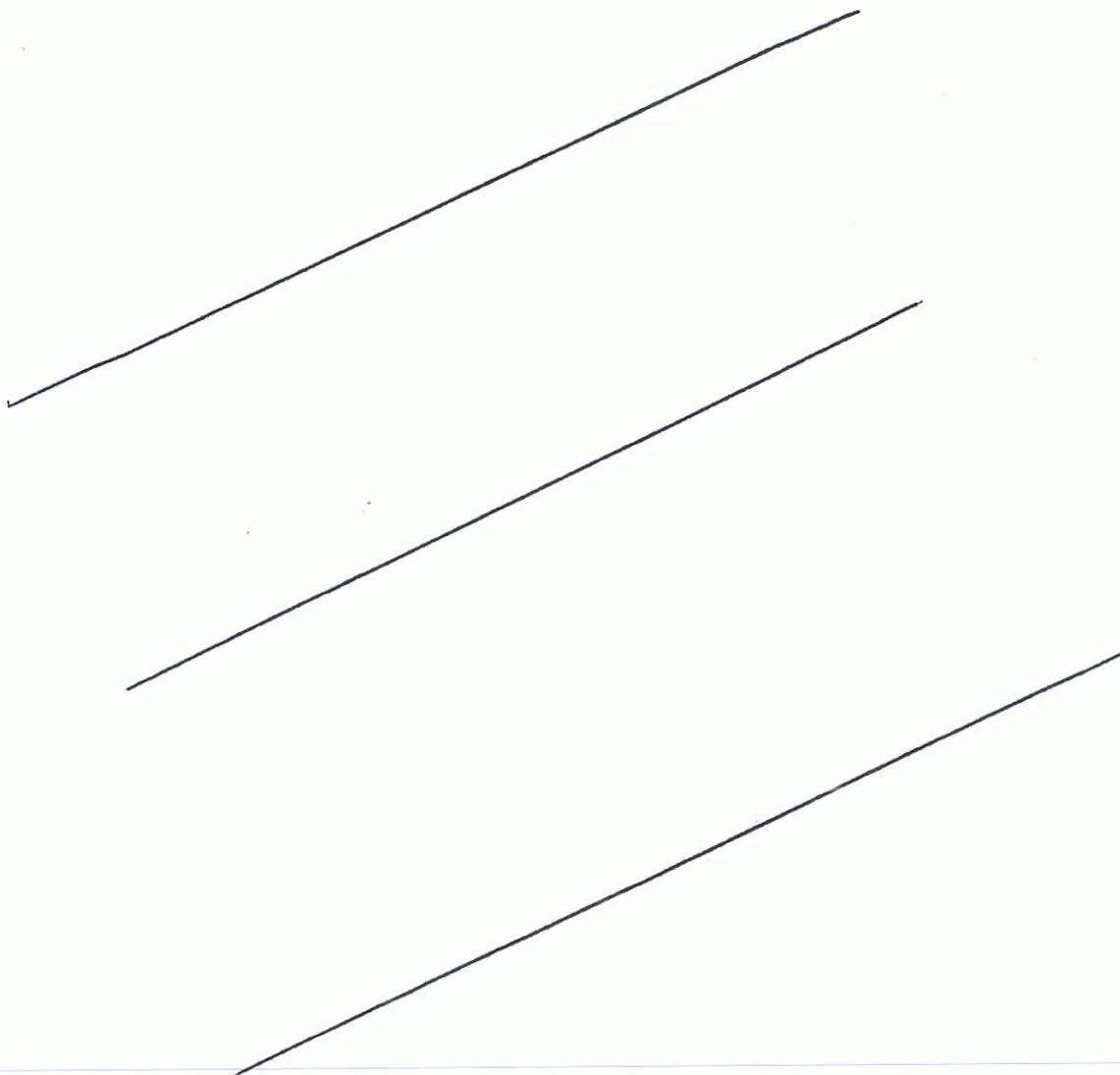
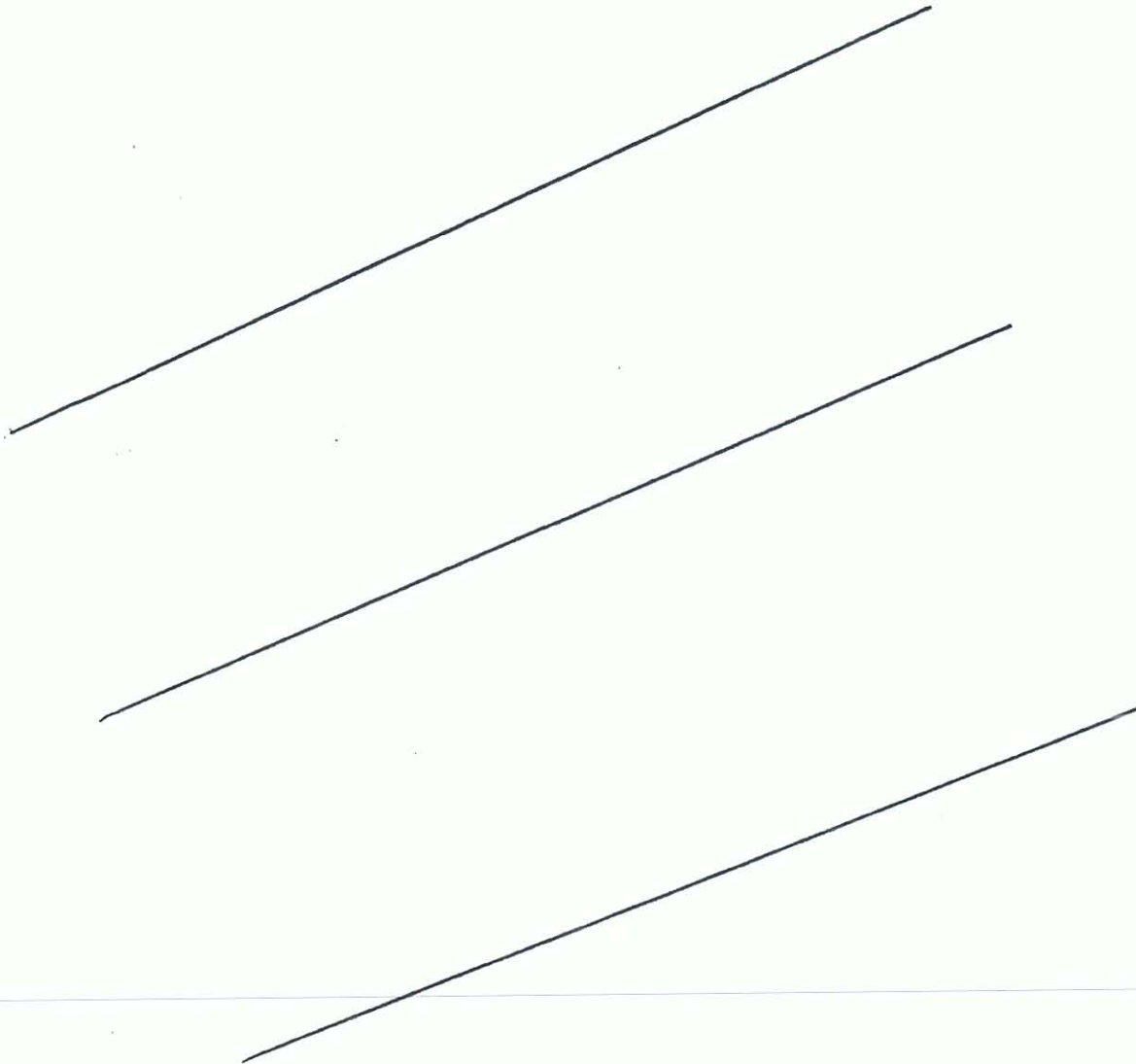


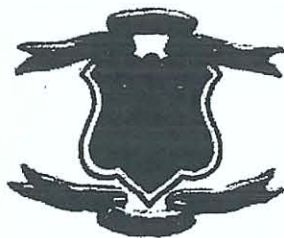
EXHIBIT B

QDC'S SEWER TREATMENT SYSTEM USER REGULATIONS



BK 2489PG100

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
RHODE ISLAND ECONOMIC DEVELOPMENT CORPORATION



QUONSET DAVISVILLE PORT AND COMMERCE PARK
SEWER TREATMENT SYSTEM USER REGULATIONS

Date of Public Notice: April 22, 2002

Date of Public Hearing: May 22, 2002

Effective Date: July 1, 2002

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

RHODE ISLAND ECONOMIC DEVELOPMENT CORPORATION

SEWER TREATMENT SYSTEM USER REGULATIONS

Section 1.00. Purpose.

The purpose of these regulations is to set forth the rules governing the use of the Rhode Island Economic Development Corporation's sewers and drains, the installation and connection of building sewers, the discharge of waters and wastes into the sewers, and the penalties for violations.

Section 2.00. Legal Authority.

These rules and regulations are promulgated pursuant to the requirements and provisions of R.I.G.L. §42-64-7(16) and the Administrative Procedures Act, R.I.G.L. § 42-35-1 et seq., and particularly § 42-35-3.

Section 3.00. Definitions.

Unless the context specifically indicates otherwise, the meaning of terms used in these regulations shall be as follows:

3.01. "Biochemical Oxygen Demand" (BOD) shall mean the quantity of oxygen utilized in the biochemical oxidation of organic matter under standard laboratory procedure in five (5) days at 20°C, expressed in milligrams per liter.

3.02. "Building Drain" shall mean that part of the lowest piping of a drainage which receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the building sewer, beginning five (5) feet (1.5 meters) outside the inner face of the building wall and terminating at the building sewer or, if no building sewer is required, at the point of connection to the Rhode Island Economic Development Corporation (RIEDC) sewer or other place of disposal.

3.03. "Building Sewer" shall mean the extension from the building drain to the point of connection to the RIEDC sewer or other place of disposal.

3.04. "Chemical Oxygen Demand" (COD) shall mean the quantity of oxygen utilized in the chemical oxidation of wastewater under standard laboratory procedures.

3.05. "Director" shall mean the General Manager of the Quonset Davisville Port and Commerce Park, or an authorized deputy, agent or representative.

3.06. "Floatable Oil" is oil, fat or grease in a physical state such that it will separate by gravity from wastewater by treatment in an approved pretreatment facility. A wastewater shall be considered free of floatable oil if it is properly pretreated and does not interfere with the collection system.

3.07. "Garbage" shall mean solid wastes from the domestic and commercial preparation, cooking, and dispensing of food, and from the handling, storage, and sale of produce.

3.08. "Industrial Cooling Water" shall mean water used to reduce temperature in an industrial process.

3.09. "Industrial User" shall mean a user who discharges or has the capacity to discharge industrial wastewater or industrial sewage directly or indirectly into the sewer.

3.10. "Industrial Wastes" shall mean the liquid wastes resulting from industrial manufacturing, trade, or business processes and shall be distinct from sanitary sewage.

3.11. "Interference" shall mean a Discharge which, alone or in conjunction with a discharge or discharges from other sources, both:

- (a) Inhibits or disrupts the Wastewater Treatment Facility (WWTF), its treatment processes or operations, or its sludge processes, use or disposal; and
- (b) Causes a violation of any requirement of the WWTF's and Rhode Island Pollutant Discharge Elimination System (RIPDES) permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent

State or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including Title II, more commonly referred to as the Resource Conservation and Recovery Act [RCRA], and including State regulations contained in any State Sludge management plan prepared pursuant to subtitle D of the SWDA), the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection Research and Sanctuaries Act.

3.12. "Natural Outlet" shall mean any outlet into a natural watercourse, pond, ditch, lake or other body of surface or groundwater.

3.13. "New Source" shall mean:

- (a) Any building, structure, facility or installation from which there is or may be a discharge of pollutants, the construction of which commenced after the publication of proposed Pretreatment Standards under section 307(c) of the Federal Water Pollution Control Act (WPCA) which will be applicable to such source if such Standards are thereafter promulgated in accordance with that section, *provided that*:
 - (1) The building, structure, facility or installation is constructed at a site at which no other source is located; or
 - (2) The building, structure, facility or installation totally replaces the process or production equipment that causes the discharge of pollutants at an existing source; or
 - (3) The production or wastewater generating processes of the building structure, facility or installation are substantially independent of an existing source at the same site.
- (b) Construction on a site at which an existing source is located results in a modification rather than a new source if the construction does not create a new building, structure, facility or installation meeting the criteria of subparagraphs (a)(2) or (a)(3) of this section but otherwise alters, replaces, or adds to existing process or production equipment.
- (c) Construction of a new source as defined under this paragraph has commenced if the owner or operator has:

(1) Begun or caused to begin as part of a continuous onsite construction program:

A. Any placement, assembly, or installation of facilities or equipment; or

B. Significant site preparation work including clearing, excavation, or removal of existing buildings, structures, or facilities which is necessary for the placement, assembly, or installation of new source facilities or equipment; or

(2) Entered into a binding contractual obligation for the purchase of facilities or equipment, which are intended to be used in its operation within a reasonable time. Options to purchase or contracts which can be terminated or modified without substantial loss, and contracts for feasibility, engineering, and design studies do not constitute a contractual obligation under this paragraph.

3.14. "Pass Through" shall mean a Discharge which exits the WWTF into waters of the United States in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, are a cause of a violation of any requirement of the WWTF's RIPDES permit, including an increase in the magnitude or duration of a violation.

3.15. "Permit" shall mean an authorization, license or equivalent control document issued by the RIEDC, unless otherwise identified.

3.16. "Person" shall mean any individual, partnership, firm, association, joint venture, public or private corporation, trust, estate, commission, board, public or private institution, utility, cooperative, municipality, any other political subdivision of this state, any department or agency of the federal government, or any other legal entity.

3.17. "pH" shall mean the logarithm of the reciprocal of the weight of hydrogen ions in grams per liter of solution.

3.18. "Properly Shredded Garbage" shall mean the wastes from the preparation, cooking and dispensing of food that have been shredded to such a degree that all particles will be carried freely under the flow conditions normally

prevailing in public sewers, with no particle greater than one-half (1/2) inch (1.27 centimeters) in any dimension.

3.19. "Pollutant" shall mean dredged spoil, solid waste, incinerator residue, sewage, garbage, sludge, munitions, chemical wastes, biological materials, heat, wrecked or discarded equipment, rock, sand and cellar dirt and industrial, municipal, agricultural or other pollution-causing agents.

3.20. "Pollution" shall mean the man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water.

3.21. "RIEDC" shall mean Rhode Island Economic Development Corporation.

3.22. "RIEDC Sewers" shall mean a sewer regulated, operated and maintained by the RIEDC for the purpose of affording sewage collection service to its users.

3.23. "Sanitary Sewer" shall mean a sewer that carries sewage and to which storm, surface and ground waters are not intentionally admitted.

3.24. "Sewage" shall mean a combination of the water-carried wastes from residents, business buildings, institutions, and industrial establishments, together with such ground, surface, and storm waters as may be present.

3.25. "Sewage Treatment Plant" shall mean any arrangement of devices and structures used for treating sewage.

3.26. "Sewage Works" shall mean all facilities for collecting, pumping, treating and disposing of sewage.

3.27. "Sewer" shall mean a pipe or conduit for carrying sewage.

3.28. "Shall" is mandatory; "may" is permissive.

3.29. "Significant Industrial User" shall mean:

(a) all industrial users subject to Categorical Pretreatment Standards; and

(b) any other industrial user that:

(1) discharges an average of 25,000 gallons per day or more of process wastewater to the WWTF; or

(2) contributes a process waste stream which makes up 5 percent or more of the average dry weather hydraulic or organic capacity of the WWTF; or

(3) is designated as such by the RIEDC the basis that the industrial user has a reasonable potential for adversely affecting the WWTF's operation or for violating any pretreatment standard or requirement.

3.30. "Slug" shall mean any discharge of water, sewage or industrial waste that in concentration of any given constituent or in quantity of flow exceeds a user's average discharge and adversely affects the sewer and/or the performance of the sewage treatment plant.

3.31. "Storm Drain" (sometimes termed "Storm Sewer") shall mean a sewer that carries storm and surface waters and drainage, but excludes sewage and industrial wastes, other than unpolluted cooling water.

3.32. "Suspended Solids" shall mean solids that either float on the surface of, or are in suspension in, water, sewage, or other liquids, and which are removable by laboratory filtering.

3.33. "Toxic" shall mean any substance listed as toxic under section 307(a)(1) of the Clean Water Act, as amended, 33 U.S.C. §§ 1251 et seq., or listed under the Hazardous Substances Right-to-Know Act, R.I.G.L. §§ 28-21-1 et seq., or as may otherwise be designated by the Director from time to time.

3.34. "User" shall mean the owner of any residential, commercial, or industrial property or any publicly owned building or non-profit institution with a direct or indirect connection to the sewer.

3.35. "Watercourse" shall mean a channel in which a flow of water occurs either continuously or intermittently.

Section 4.0. Building Sewers and Connections.

4.01. No person shall uncover, make any connections with or opening into, use, alter, or disturb any RIEDC sewer or appurtenance thereof without first obtaining a written permit from the Director. All such connections shall be subject to such terms and conditions as the Director shall prescribe.

4.02. There shall be two classes of building sewer permits, one class for residential and commercial service, and one class for service to establishments producing industrial wastes. For either class, the user shall make application on a special form furnished by the RIEDC. The permit application shall be supplemented by any plans, specifications, or other information considered pertinent in the judgment of the Director. A permit and inspection fee of not less than twenty-five dollars for an industrial building sewer permit shall be paid to the RIEDC at the time the permit is issued or renewed.

4.03. All costs and expenses incidental to the installation and connection of the building sewer shall be borne by the user who shall indemnify the RIEDC from any loss or damage that may directly or indirectly be occasioned by the installation of the building sewer.

4.04. A separate and independent building sewer shall be provided for every building that is not already connected to the RIEDC's sewer system on the date this regulation is put into effect. Where one building stands at the rear of another on an interior lot, the building sewer from the front building may be extended to the rear building and the whole considered as one building sewer; however, the RIEDC does not and will not assume any obligation or responsibility for damage caused by or resulting from any such single connection.

4.05. Old building sewers may be used in connection with new buildings only when they are found, on examination and testing by the Director, to meet all requirements of this regulation.

4.06. The size, slope, alignment, materials of construction of a building sewer, and the methods to be used in excavating, placing of the pipe, jointing, testing, and backfilling the trench, shall all conform to the requirements of the building and plumbing code of the State of Rhode Island and to other applicable rules of the RIEDC. In the absence of Code provisions or in amplification thereof, the materials and procedures set forth in appropriate specifications of the American Society of

Testing and Materials ("ASTM") and the Water Pollution Control Federation ("WPCF") Manual of Practice No. 9 shall apply.

4.07. Whenever possible, the building sewer shall be brought to the building at an elevation below the basement floor. In all buildings in which any building drain is too low to permit gravity flow to the public sewer, sanitary sewage carried by such building drain shall be lifted by an approved means and discharged to the building sewer.

4.08. No person shall make connection of roof downspouts, exterior foundation drains, areaway drains, or other sources of surface runoff or ground water to a building sewer or building drain that in turn is connected directly or indirectly to an RIEDC sanitary sewer.

4.09. The connections of the building sewer into the RIEDC sewer shall conform to the requirements of the building and plumbing code or other applicable rules of the RIEDC, or the procedures set forth in appropriate specifications of the ASTM and WPCF Manual of Practice No. 9. All such connections shall be made gastight and watertight. Any deviation from the prescribed procedures and materials must be approved by the Director before installation.

4.10. The applicant for the building sewer permit shall notify the Director when the building sewer is ready for inspection and connection to the RIEDC sewer. The connection shall be made under the supervision of the Director or his representative.

4.11. All excavations for building sewer installation shall be adequately guarded with barricades and lights so as to protect the public from hazard. Streets, sidewalks, pavements, and other RIEDC property disturbed in the course of the work shall be restored in a manner satisfactory to the RIEDC.

Section 5.0. Discharge Requirements, Limitations, And Prohibitions.

5.01. The RIEDC may limit, reject or prohibit any direct or indirect discharge of pollutants or combination of pollutants (as defined by applicable federal or state law or as described below) into the RIEDC Sewers.

5.02. Specifically prohibited substances, waters or wastewaters are:

(a) Groundwater, stormwater, and surface waters, roof runoff, tidewater, subsurface drainage, cooling water, and uncontaminated industrial process waters.

(b) Gasoline, benzene, naphtha, fuel oil, or other flammable or explosive liquids, solids or gases.

(c) Any trucked or hauled pollutants, except at discharge points designated by the RIEDC and in accordance with Section 13.0.

(d) Slugs.

(e) Sludges or deposited solids resulting from an industrial or pretreatment process. Storm water and all other unpolluted drainage shall be discharged to such sewers as are specifically designated as storm sewers, or to a natural outlet approved by the Director and other regulatory agencies. Industrial cooling water or unpolluted process waters may be discharged, on approval of the Director and other regulatory agencies, to a storm sewer or natural outlet.

5.03. In addition to those limitations in Section 5.02 and 5.04, no person shall discharge or cause or allow to be discharged directly or indirectly into the RIEDC Sewers, any other substances, water or wastewater that either singly or by interaction with other substances will or is likely to:

(a) interfere with the operation of the RIEDC Sewers by:

(1) harming either the sewerage system or wastewater treatment process;

(2) being otherwise incompatible with the treatment process; or

(3) contaminating the sludge or contributing to sludge disposal problems.

(b) violate applicable federal and state law and the terms of the RIEDC Sewers' federal and state permits, including but not limited to RIPDES and National Pollutant Discharge Elimination System (NPDES) permits.

(c) endanger the environment by adversely affecting receiving waters or otherwise.

(d) endanger the health or welfare of persons.

5.04. No person shall discharge or cause or allow to be discharged either directly or indirectly into the RIEDC Sewers, any substance, water or wastewater that has:

(a) a temperature higher than 104 degrees Fahrenheit (40 degrees Celsius).

(b) any toxic or non-toxic gases in sufficient quantity, either singly or by interaction with other wastes, to injure or interfere with any waste treatment process, constitute a hazard to humans or animals, create a public nuisance, create a toxic effect in the receiving waters of the RIEDC Sewers or exceed the limiting standards issued from time to time under Section 307 (a) of the WPCA, 33 U.S.C. Section 1317 (a), as amended to date or hereafter.

(c) any water or waste which by itself or by interaction with other materials, emits chemical contaminants into the atmosphere of any confined area of the sewer system at levels in excess of short term exposure limit Threshold Limit Value established for air-borne contaminants by the American Conference of Governmental Industrial Hygienists or the National Institute for Occupational Safety and Health.

(d) any liquids, solids or gases which by reason of their nature or quantity are, or may be sufficient, either alone or be interaction with other substances, to cause fire or explosion or be injurious in any other way to the RIEDC Sewers. At no time shall two successive readings on any explosion hazard meter at the point of discharge into the RIEDC Sewers (or at any point in the RIEDC Sewers) be more than five (5%) percent nor any single reading be over ten (10%) percent of the Lower Explosive Limit of the meter.

(e) pollutants that will cause corrosive structural damage to the WWTF, but in no case discharges with pH lower than 5.0, unless the works is specifically designed to accommodate such discharges.

(f) petroleum oil, non-biodegradable cutting oils, or products of mineral oil in amounts that will cause interference or pass through.

(g) fats, wax, grease or oils of vegetable or animal origin as measured by freon extraction in excess of one hundred (100) mg/l or containing other substances which may solidify or become viscous at temperatures between thirty-two (32) degrees F or zero (0) degrees C, and one hundred four (104) degrees F or forty (40) degrees C. Waters or wastes containing such substances, excluding normal household waste, shall exclude all visible floating oils, fats and greases. The use of chemical or physical means (such as temperature variation, emulsifying agents, mechanical mixers) to bypass or release fats, oils, and greases into the RIEDC Sewers is prohibited.

(h) any garbage that has not been properly shredded. Garbage grinders may be connected to the RIEDC Sewers from homes, hotels, institutions, restaurants, hospitals, catering establishments, or similar places where garbage originates from the preparation of food in kitchens for the purpose of consumption on the premises or when served by caterers. The installation and operation of any garbage grinder equipped with a motor of three-fourths (3/4) horsepower (0.76 hp metric) or greater shall be subject to the review and approval of the Director.

(i) solid or viscous pollutants in amounts which will cause obstruction to the flow in the WWTF resulting in interference;

(j) unusual concentrations of dissolved solids such as, but not limited to, sodium chloride and sodium sulfate, and waste waters having excessive suspended solids concentrations.

(k) color or turbidity in such an amount that it will prevent the RIEDC from discharging a treated effluent in compliance with any state or federal rules, regulations or permit requirements.

(l) BOD or COD concentrations in such quantities as to constitute a significant load on the RIEDC Sewers or to cause the effluent from the RIEDC Sewers to violate any state or federal rules, regulations or permit requirements, including but not limited to NPDES and RIPDES permits.

(m) any radioactive wastes or isotopes of such half-life or concentration as may exceed limits established by state or federal laws or regulations.

(n) any process wastewater, as defined by the Director, containing concentrations of the substances listed below in excess of the assigned discharge limits:

~~_____~~
~~_____~~
~~_____~~

	Milligrams per Liter
Cadmium (Total)	0.26
Chromium (Total)	1.71
Copper (Total)	2.07
Cyanide (Total)	0.20
Lead (Total)	0.27
Mercury (Total)	0.003
Nickel (Total)	2.38
Silver (Total)	0.24
Zinc (Total)	0.76
TTO*	1.50

?? The term "TTO" shall mean total toxic organics, which is the summation of all quantifiable values greater than 0.01 milligrams per liter of the toxic organics listed at 40 C.F.R. § 433.11.

(o) concentrations of substances in excess of Federal Categorical Pretreatment standards, where applicable.

(p) pollutants which may create a fire or explosion hazard including, but not limited to, waste streams with a closed cup flashpoint of less than one-hundred forty (140) degrees F or sixty (60) degrees C using the test methods specified in 40 C.F.R. § 261.21.

(q) pollutants that result in the presence of toxic gases, vapors, or fumes in a quantity that may cause acute worker health and safety problems.

5.05. No user shall, by increasing the use of process water or in any other way, attempt to dilute a discharge as a partial or complete substitute for adequate treatment to achieve compliance with the limitations contained in the Federal Categorical Pretreatment Standards, 40 C.F.R., or in any other pollutant specific limitation developed by the RIEDC. The RIEDC shall, in its sole discretion, use EPA formulas or any other reasonable method for determining discharge levels where dilution is reasonably suspected.

5.06. If any wastewater is discharged or is proposed to be discharged to the RIEDC Sewers in violation of the prohibitions described in this section, the Director may in his sole discretion:

- (a) reject the wastes;
- (b) require a discharger to demonstrate and implement those in-plant modifications that will reduce or eliminate the discharge of such substances to conform to these Rules;
- (c) require pretreatment, including storage facilities or flow equalization necessary to reduce or eliminate the objectionable characteristics or substances, so that the discharge will not violate these Rules;
- (d) require controls to be installed that will regulate the quantities and rates of discharge;
- (e) require payment to the RIEDC to cover its added cost of handling, monitoring, and treating the wastes;
- (f) revoke a discharger's permit; and
- (g) take any other administrative sanctions, enforcement actions, and remedial actions as may be desirable, necessary, or permitted to achieve the purpose of these Rules.

When considering the above alternatives, the Director shall give consideration to the economic impact of each alternative on the discharger. If the Director permits the pretreatment or equalization of waste flows, the design and installation of the plants and equipment shall be subject to the review and approval of the Director, and shall be subject to the requirements of all applicable codes, ordinances, and laws.

5.07. Grease, oil, and sand interceptors shall be provided by the person generating such wastes when, in the opinion of the Director, they are necessary for the proper handling of liquid wastes containing grease in excessive amounts, or any flammable wastes, sand, or other harmful ingredients; except that such interceptors shall not be required for private living quarters or dwelling units. All interceptors shall be of a type and capacity approved by the Director and shall be located as to be readily and easily accessible for cleaning and inspection. In the maintaining of these

interceptors, the person generating the wastes shall be responsible for the proper removal and disposal by appropriate means of the captured material and shall maintain records of the dates and means of disposal that are subject to review by the Director. Any removal and hauling of the collected materials not performed by generator's personnel must be performed by currently licensed waste disposal firms.

5.08. Where pretreatment or flow-equalizing facilities are provided for any waters or wastes, they shall be maintained continuously in satisfactory and effective operation by the provider at his expense.

5.09. When required by the Director, the licensee or other permitted user of any property serviced by a building sewer carrying industrial wastes shall install a suitable control manhole together with such necessary meters and other appurtenances in the building sewer to facilitate observation, sampling and measurement of the wastes. Such manhole, when required, shall be accessible and safely located, and shall be constructed in accordance with plans approved by the Director. The manhole shall be installed by the licensee or other permitted user, at his expense, and shall be maintained by him so as to be safe and accessible at all times.

5.10. Whenever required by the Director by regulation, order, or permit, any industry discharging into the sanitary sewer shall monitor its discharge, perform analysis, keep records and report to the Director information needed to determine compliance with this regulation. This information may include:

- (a) wastewater discharge rate (both peak and average);
- (b) chemical analysis of wastewaters;
- (c) information on raw materials, processes, and products affecting wastewater volume and quality;
- (d) quantity and disposition of specific liquid, sludge, oil, solvent, or other materials important to sewer use control;
- (e) a plot plan of the property served showing sewer and pretreatment facility location;
- (f) details of wastewater pretreatment facilities;

(g) details of systems to prevent and control losses of materials through spills to the RIEDC sewer.

5.11. All measurements, tests and analyses of the characteristics of waters and wastes to which reference is made in this regulation shall be determined in accordance with the most recent U.S. Environmental Protection Agency-approved methods and procedures (40 C.F.R. Part 403 and 40 C.F.R. Part 136), and shall be determined at the control manhole provided, or at any other suitable sampling site. Sampling shall be carried out by accepted methods to reflect the effect of constituents upon the sewage works and to determine the existence of hazards to life, limb, and property. The particular analyses involved will determine the duration and type of sampling which shall be conducted.

5.12. The Director shall be given forty-five (45) days' prior notification of:

- (a) any proposed substantial change in volume or character of pollutants over that being discharged into the sanitary sewers at the time of this regulation's adoption; and
- (b) any proposed new discharge into the sanitary sewers from any source which would be a new source as defined by Section 306 of Public Law 92-500, or a proposed new discharge into the sanitary sewers from any source which would be subject to Section 301 of Public Law 92-500 if it were *discharging* such pollutants.

5.13. No statement contained in this Section shall be construed as preventing any special agreement or arrangement between the RIEDC and any industrial user whereby an industrial waste of unusual strength or character may be accepted by the RIEDC for treatment, subject to payment therefore by the industrial concern, provided that such agreements do not contravene federal and state pretreatment standards, Sections 5.03 and 5.04.

Section 6.00. Protection from Damage

No unauthorized person shall maliciously, willfully, or negligently break, damage, destroy, uncover, deface, or tamper with any structure, appurtenance, or equipment that is a part of the sewage works. Any person violating this provision shall be subject to *immediate arrest* by regular law enforcement agencies under charge of disorderly conduct.

Section 7.00. Powers and Authority of Inspectors

7.01. The Director and other duly authorized employees of the RIEDC bearing proper credentials and identification shall be permitted:

- (a) to enter without delay all properties for the purposes of inspection, observation, measurement, sampling, and testing in accordance with the provisions of this regulation;
- (b) during regular working hours and at other reasonable times, and within reasonable limits and in a reasonable manner, to have access to and to copy any records, inspect any monitoring equipment and sample any effluents which the owner or operator of such discharge source is required to sample under these rules or state or federal law;
- (c) to set up on the user's property such devices as are necessary to conduct sampling inspection, compliance monitoring and/or metering operations. The owner or his representatives shall have no authority to inquire into any processes including metallurgical, chemical, oil, refining, ceramic, paper, or other industries beyond that point having a direct bearing on the kind and source of discharge to the sewers or waterways or facilities for waste treatment.

7.02. The Director and other duly authorized employees of the RIEDC bearing proper credentials and identification shall be permitted to enter all properties served by the sewage system for the purpose of, but not limited to, inspection, observation, measurement, sampling, repair, and maintenance of any portion of the sewerage works lying within said property.

Section 8.00. General Sewer Use Charges

8.01. In general, sewer use charges shall reflect the average cost of treating all sanitary wastes. This shall be done by apportioning the total of all normal sewer works costs among the various categories of users in accordance with flows generated or capacity demanded. For users generating industrial wastes with characteristics that vary significantly from the composition of all other wastes introduced into the sewage works, the Director may require that the basic apportionment be supplemented to reflect the additional expense imposed on the RIEDC by such abnormalities.

8.02. Each user of the RIEDC's sewer works shall be charged monthly a fee determined by multiplying the flow contributed or capacity demanded by flow rates (dollars per 1000 gallons) determined by the Director. The flow rate will be established annually and will be the same for all categories of users.

8.03. In addition, users generating industrial wastes having abnormal treatment requirements may be charged additional amounts at rates established by the Director.

Section 9.00. Industrial Discharge Permit System

9.01. All industrial users connected to or discharging to the RIEDC Sewers must obtain a wastewater discharge permit. All industrial users proposing to connect to or discharge into the RIEDC Sewers must obtain a wastewater discharge permit before connecting to or discharging to the RIEDC Sewers.

9.02. Industrial users seeking a wastewater discharge permit must have completed and filed with the RIEDC in application on the prescribed form, together with any applicable fee, by the date specified by the Director. In support of this application, the user shall submit the following information:

- (a) name, business address, location of the facility (if different from business address), and Standard Industrial Classification (SIC) number of the applicant;
- (b) total water consumption from all sources and supporting documentation when appropriate;
- (c) type, frequency, and volume of discharges;
- (d) average and peak wastewater flow rates, including daily, monthly, and seasonal variations, if any;
- (e) site plans, floor plans, mechanical and plumbing plans, pretreatment plans and details to show all building connections and appurtenances by size, location and elevation;

(f) description of activities, pretreatment facilities and plant processes on the premises, including all materials and types of material that are or could be discharged;

(g) type of product produced;

(h) number of employees, number of shifts, and hours of work;

(i) the name and concentration of any pollutants in the discharge, for a minimum of four consecutive operating days, which are regulated by the RIEDC, the state or the federal government, and a written statement as to whether or not applicable pretreatment standards are being met, and if not, whether additional in-plant modification and additional pretreatment is required for the user to meet such applicable pretreatment standards;

(j) if additional pretreatment or in-plant modification will be required to meet the pretreatment standards, the user must provide a schedule by which to achieve the standards in the shortest possible time;

(1) This schedule shall be reported as the Pretreatment Compliance Schedule. The following conditions shall apply to this schedule.

(2) The schedule shall contain increments of progress in the form of dates for the commencement and completion of major events leading to the construction and operation of additional pretreatment required for the user to meet the applicable pretreatment standards (e.g., hiring an engineer, completing preliminary plans, executing contracts for major components, commencing construction, completing construction).

(3) Not later than fourteen (14) days following each completion date in the schedule, the user shall submit a progress report to the RIEDC including, at a minimum, whether or not he complied with the increments of progress. If such increment of progress was not completed on time, the user shall also report the date on which he expects to complete the increment of progress, the reason for the delay, and the steps being taken by the user to return to the schedule established. In no event shall completion dates for increments of progress be more than nine (9) months apart

(k) Any other pertinent information as may be needed to evaluate the permit application.

The Director shall evaluate the data furnished by the industrial user and may require additional information. Based on the application, the Director may issue a wastewater discharge permit subject to the terms and conditions enumerated in the permit.

The Director may deny a request for a permit when the information supplied indicates the industrial user will be unable to reasonably meet RIEDC standards. Any person denied a permit may request a hearing in accordance with the provisions of Section 11.00.

9.03. Wastewater discharge permits shall be expressly subject to specific permit provisions contained therein as well as to provisions of these rules and all other regulations, user charges and fees established by the RIEDC. Permit conditions may include, but are not limited to, the following:

- (a) the average and maximum wastewater constituents and characteristics permitted in the process water discharges;
- (b) limits on rate and time of discharge or requirements for flow regulation and equalization;
- (c) requirements for installation of inspection and sampling facilities and specifications for self-monitoring;
- (d) requirements for the submission of periodic self-monitoring compliance reports, including all notices and self-monitoring reports required by EPA, which shall include, but not be limited to, volume or rates of flow, concentrations of controlled pollutants or other information which relates to the generation of waste;
- (e) requirements for maintaining and submitting technical reports and plant records relating to wastewater discharges;

(f) daily average and daily maximum discharge rates, or other appropriate conditions when pollutants subject to limitations and prohibitions are proposed or present in the user's wastewater discharge;

(g) compliance schedules;

(h) requirements for installation of pretreatment systems and spill prevention control plans;

(i) provisions for authorized RIEDC employees and agents to enter and inspect the premises, including provisions for copying records, inspecting monitoring equipment and sampling effluent;

(j) compliance with federal, state and other governmental laws, rules;

(k) fees and costs including supplemental fees assessed because of the special nature of the user's effluent in accordance with the provisions of Section 8.03, and additional costs and fees including reasonable attorneys' fees based on the costs of enforcing these regulations or the permit.

9.04. Users shall provide treatment of wastewater as required to comply with this section, and shall achieve compliance with all federal, state, and RIEDC pretreatment standards within the time limitations specified by the federal, state, and RIEDC pretreatment regulations. Any equipment required to pretreat wastewater to a level acceptable to the RIEDC shall be provided, operated and maintained at the user's expense. Detailed plans showing the pretreatment equipment and operating procedures shall be submitted to the RIEDC for review and shall be acceptable to the RIEDC before construction of the facilities. Any review and inspection conducted by the RIEDC is for the sole purpose of determining compliance with the technical provisions of these rules. The RIEDC does not assume responsibility for means, methods or techniques used, or for the safety of construction works, the site, or for compliance by users with applicable laws and regulations other than this section. Review of the RIEDC does not constitute any form of guarantee or insurance with respect to the performance of the equipment and processes. The review of such plans and operating procedures will in no way relieve the user from the responsibility of modifying the equipment as necessary to produce an effluent acceptable to the RIEDC under the provisions of this section. Any subsequent significant changes in the pretreatment equipment or method of operation shall be reported to and be acceptable to the RIEDC prior to the user's initiation of the changes.

9.05. Each user shall provide protection from accidental discharge of prohibited materials or other substances regulated by these rules. Equipment to prevent accidental discharge or prohibited materials into the facilities shall be provided and maintained at the owner's or user's own cost and expense. Detailed plans showing equipment and operating procedures to provide this protection shall be submitted to the RIEDC for review, and shall be approved by the RIEDC before construction. It is understood that any review and inspection conducted by the RIEDC is for the sole purpose of determining compliance with the technical provisions of these rules. The RIEDC does not assume responsibility for means, methods or techniques used, or for the safety of construction works, the site, or for compliance by users with applicable laws and regulations other than this section. Review by the RIEDC does not constitute any form of guarantee or insurance with respect to the performance of the equipment and processes. All existing users shall also complete such a plan as required by a compliance schedule or permit. No new user proposing to discharge into the RIEDC Sewers shall be permitted to introduce pollutants into the RIEDC Sewers until accidental discharge procedures have been approved by the RIEDC. Review and approval of such plans and operating procedures shall not relieve the industrial user from the responsibility of modifying the user's equipment as necessary to meet the requirements of these rules. In the case of an accidental discharge, it is the responsibility of the user to notify the RIEDC of the incident as soon as possible. The notification shall include location of discharge, type of waste, concentration and volume, and corrective actions.

9.06. Within five (5) days following an accidental discharge into the facilities, the user shall submit a detailed written report describing the nature and cause of the discharge and the measures to be taken by the user to prevent similar future occurrences. Such notification shall not relieve the user of any expense, loss, damage or other liability that may be incurred by the RIEDC as a result of damage to the wastewater facilities, nor shall notification relieve the user of liability for any other damage to persons or property arising out of such accidental discharge. Notification will not exempt the user from any fines, civil or criminal penalties or any other liability that may be imposed by these rules or other applicable law.

9.07. No permit holder shall discharge industrial wastewater in excess of the quantity, rate of discharge, concentrations or any other limits specified in the permit. Any person desiring to modify a discharge in a manner that would violate conditions of the existing permit must first apply for an amended permit.

9.08. Permits shall be issued for a specified time period, generally for one (1) year but not to exceed five (5) years. A permit may be issued for a period of less than one (1) year, or may be stated to expire on a specific date. If the user is not notified by the RIEDC thirty (30) days prior to the expiration of the permit, the permit shall automatically be extended for one three (3) month period.

9.09. An industrial user may apply for modification of a discharge permit by filing a new application form showing substantial, significant and material changes that have been proposed since filing the original application. No application for modification will be considered unless it demonstrates such changes.

Within nine (9) months of the promulgation of a national categorical pretreatment standard, the wastewater discharge permit of users subject to such standards shall be revised to require compliance with such standard within the time frame prescribed by such standard. Where a user subject to a national categorical pretreatment standard has not previously submitted a wastewater discharge permit application, the user shall apply for a wastewater discharge permit within one hundred eighty (180) days after the promulgation of the applicable national categorical pretreatment standard. In addition, a user with an existing wastewater discharge permit shall submit to the Director within one hundred eighty (180) days after the promulgation of an applicable federal Categorical Pretreatment Standard the information required by Section 9.02(i) and (j).

After review of the application and inspection of the facility, the Director may in his sole discretion modify the original permit. If such application is rejected, the existing permit shall remain in full force and effect.

The terms and conditions of the permit may be subject to modification and changed by the Director during the life of the permit. The Director may in his sole discretion place further restrictions, limitations and conditions in a permit. The user shall be informed of any proposed changes in the permit at least thirty (30) days prior to the effective date of change. Any changes or new conditions in the permit shall include a reasonable time schedule for compliance. A user may request a hearing on modifications to his or her permit in accordance with the provisions of Section 11.00.

9.10. Wastewater discharge permits are issued to a specific user for a specific operation. No wastewater discharge permit may be reassigned, transferred or sold to a new owner, new user, different premises, or a new or changed operation.

9.11. Any industrial user who violates the conditions of a permit, these rules, or applicable state and federal regulations is subject to having the permit revoked. Violations subjecting an industrial user to revocation of a permit include, but are not limited to, the following:

- (a) failure of an industrial user to accurately report the wastewater constituents and characteristics of his or her discharge;
- (b) failure of an industrial user to report significant changes in operations, or wastewater constituents;
- (c) refusing the RIEDC statutorily authorized access to the industrial user's premises for the purposes of inspection or monitoring; or
- (d) violation of conditions of the permit.

Revocation of an industrial user's discharge permit shall be in accordance with the notice and hearing provisions of Section 11.00. However, notwithstanding any other provisions of this section, the Director may in his sole discretion immediately revoke any discharge permit where the discharge reasonably appears to present an imminent endangerment to the health or welfare of persons.

9.12. Before any further discharge of industrial wastewater may be made by a user whose permit has been revoked, the user must apply for, and be granted, a reinstatement of the terminated permit or a new permit, as the Director may require, as well as paying costs occasioned by the violation. Any such fines, fees, charges and costs shall be paid for by the user before any new permit will be issued. When all costs cannot be readily determined, the RIEDC may require and accept a bond or irrevocable letter of credit which it considers sufficient and which will be subject to appropriate adjustment after all costs have been determined. Costs shall include, but not be limited to:

- (a) inspection, monitoring, sampling and related expenses;
- (b) restitution to other affected parties;
- (c) reasonable attorneys' fees incurred by the RIEDC in enforcing the permit;
- (d) disconnecting and reconnecting the user to the facility; and

- (e) other actual damages incurred due to the violation.

Section 10.00. Validity

The invalidity of any section, clause, sentence, or provision of these rules shall not affect the validity of the remainder that can be given effect without such invalid part or parts.

Section 11.00. Enforcement and Penalties

11.01. Any person violating these rules may be sent a "Notice of Deficiency" by the Director. The Notice shall list the violations noted, the rules violated, and shall require that the violations be corrected within a reasonable time. Failure to correct such violations within the time allowed will result in the issuance of a "Notice of Violation" by the Director.

11.02. Any person violating the provisions of these rules may be served by the Director with a written "Notice of Violation" stating the nature of such violation. The violator shall immediately and permanently cease all violations. Nothing herein shall require issuance of a Notice of Deficiency prior to issuance of a Notice of Violation. No prior notices shall be required for the Director to initiate civil proceedings in Superior Court.

11.03. Notwithstanding any provisions for notice or hearing, liability for violations of these rules shall be deemed to commence as the date such violation was discovered by the RIEDC or may otherwise be proven.

11.04. The Notice of Violation issued by the Director pursuant to Section 11.02 shall require the violator to show cause at a hearing why he or she should not be found in violation of these rules and why enforcement action should not be taken. The Notice of Violation shall state the time and place of the hearing, the legal authority and jurisdiction under which the hearing is to be held, a reference to the rules involved and a short and plain statement of the matters of fact and law asserted. The Notice of Violation shall be served personally or by registered or certified mail (return, receipt requested) allowing at least twenty (20) working days before the hearing. Service may be upon any agent or officer of a corporation.

- (a) Answer. Within fifteen (15) working days of service of the Notice of Violation, the violator shall file an Answer to it. For each claim set forth in the

Notice of Violation, the Answer shall contain full, direct and specific answers, admitting, denying or explaining material facts. If there is insufficient knowledge to answer with specificity it shall be so stated, and this shall be treated as a general denial. The Answer shall contain all affirmative defenses that are relied upon and may cite the statutes and regulations that form the basis of each defense. All allegations contained in the Notice of Violation that are not specifically admitted in the Answer shall be deemed denied. The Hearing Officer upon his or her own initiative or upon the request of the RIEDC or the violator may permit the violator to amend an Answer or to postpone the hearing for good cause.

If the violator fails to appear for the scheduled hearing, he or she may be found in default. Default constitutes, for purposes of this action and any subsequent action in Superior Court, an admission of all facts alleged in the Notice of Violation and a waiver of the violator's right to a hearing on the factual allegations in the Notice of Violation.

(b) Hearing Officer. The Board of Directors of the RIEDC shall designate certain persons to act as hearing officers in cases arising under these rules.

With the adoption of these rules, the Director is empowered to appoint persons who are duly designated by the Board of Directors of the RIEDC and who are not involved in the enforcement action to act as hearing officer. A person designated as a hearing officer shall be a person who meets specific qualifications adopted by the Board of Directors of the RIEDC. The hearing officer shall:

- (1) have the right to issue subpoenas in the name of the RIEDC to compel the appearance of witnesses and the production of any books, records or other documents;
- (2) take evidence;
- (3) transmit in a timely manner a report of the evidence and hearing, including transcripts and other evidence, together with findings of fact and conclusions of law, and recommendations of action to the Director. The Hearing Officer may also issue findings as to the number of days during which the violation occurred and appropriate penalties.

(c) Other Hearings. All other provisions for public hearings not specifically described herein shall be in accordance with R.I.G.L. § 42-35-9.

(d) Orders by the Director. After the Director has reviewed the evidence, he may issue an order to the violator to cease and desist committing such violations, to remedy such violations, to revoke the violator's discharge permit, assess fines, and condition future permits upon payment of the costs of implementing and enforcing the terms of such permit, including attorneys' fees and administrative costs. The decision may include a finding as to the number of days during which the violation occurred and appropriate penalties. Every day in which a violation occurred shall be deemed a separate offense. The Superior Court shall have jurisdiction to enforce such order and the Director may institute civil or criminal proceedings in the name of the RIEDC.

11.05. Civil/Criminal Penalties

(a) Any person who shall violate the provisions of any permit, rule, regulation or order of the RIEDC shall be subject to a civil penalty of not more than twenty-five thousand dollars (\$25,000) for each day during which such violation occurs.

(b) Any person who shall be found guilty of violating willfully or with criminal negligence, any provisions of any permit, rule or regulation, or an order of the RIEDC shall be punished by a fine of not more than twenty-five thousand dollars (\$25,000) or by imprisonment for not more than 30 days, or by both fine and imprisonment

11.06. Notwithstanding any other provision herein, the Director may, after informal notice to the discharger as described below, immediately and effectively halt or prevent any discharge of pollutants into the RIEDC Sewers which reasonably appears to present an imminent endangerment to the health or welfare of persons.

Upon determination by the Director that a discharge reasonably appears to present an imminent endangerment to the health or welfare of persons, he may issue an immediate compliance order. Informal notice shall consist of a telephone call to the discharging facility's owner or any agent or officer of a corporation. Such compliance order shall become effective notwithstanding inability to contact the foregoing persons. A registered letter, return receipt requested, which states the

existence of the violation and the action deemed necessary will be sent as soon as practicable. No request for a hearing prior to issuance of the compliance order may be made.

Any such immediate compliance order issued under this section without notice and prior hearing shall be effective for no longer than forty-five (45) days, provided, however, that for good cause shown such order may be extended one additional period not exceeding forty-five (45) days.

11.07. Notwithstanding any other provisions herein, the Director may, in accordance with the notice and procedures described below, halt or prevent any discharge into the RIEDC Sewers which presents or may present endangerment to the environment or which threatens to interfere with the operation of the facilities.

Such Notice shall provide for a time within which said alleged violation shall be remedied, and shall inform the person to whom it is directed that a written request for a hearing on said alleged violation may be filed with the Director within ten (10) days after service of the notice. Notice will be deemed properly served upon a person if a copy thereof is served upon him or her personally sent by registered mail, return receipt requested, or such person is served with notice by any other method of service now or hereafter authorized in a civil action under the laws of this state. If a person upon whom a notice of violation has been served under the provisions of this section or if a person aggrieved by any such notice of violation requests a hearing before the Director within ten (10) days of the service of notice of violation, the Director shall set a time and place for said hearing, and shall give the person requesting such a hearing at least five (5) days written notice thereof. After such hearing, the Director may make findings of fact and law and shall sustain, modify or withdraw the notice of violation. If the Director sustains or modifies the notice, such decision shall be deemed a compliance order and shall be served upon the person responsible in any manner provided for the service of the notice of this section.

Such compliance order shall state a time within which said violation shall be remedied. Nothing herein shall prohibit the Director from requiring immediate compliance.

Whenever a compliance order has become effective, whether automatically or not, where no hearing has been requested, or where an immediate compliance order has been issued, or upon decision following hearing, the Director may institute injunctive proceedings in the Superior Court for enforcement of such compliance

order and for appropriate temporary relief. In such proceedings the correctness of a compliance order shall be presumed and the person attacking such order shall bear the burden of proving error in such compliance order; except that the Director shall bear the burden of proving in such proceedings the correctness of an immediate compliance order. The remedy provided for in this section shall be in addition to other remedies provided by law. Any party aggrieved by a final judgment of the Superior Court may, within thirty (30) days from the date of entry of such judgment, petition the Supreme Court for a writ of certiorari to review any questions of law.

11.08. Notwithstanding the provisions of Sections 11.02 and 11.03, if the RIEDC or its duly authorized employees and agents, upon presenting identification and appropriate credentials, are denied access to carry out inspection, surveillance, and monitoring procedures, the Director may immediately institute civil proceedings, including proceedings for necessary injunctive relief.

11.09. If any person shall construct, install, alter or repair any sewer or connect to any sewer in violation of the requirements of these rules, the RIEDC may, in its discretion, order or direct such person to uncover and fully expose any or all portions of such sewer or connection and afford the RIEDC and its representatives adequate opportunity for examination and inspection of the work. If the connection and appurtenances thereto shall be found not to be in full accord with the requirements of these rules and standards, the RIEDC may serve the offender with a written notice as provided in Section 11.02.

11.10. Affirmative Defenses to Discharge Violations.

(a) Upset Provisions

(1) For the purposes of this section, "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with pretreatment standards because of factors beyond the reasonable control of the user. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

(2) An upset shall constitute an affirmative defense to an action brought for noncompliance with pretreatment standards if the requirements of Section 11.10(a)(3) are met.

(3) A user who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

A. An upset occurred and the user can identify the cause(s) of the upset;

B. The facility was at the time being operated in a prudent and workman-like manner and in compliance with applicable operation and maintenance procedures;

C. The user submitted the following information to the RIEDC within twenty-four (24) hours of becoming aware of the upset [if this information is provided orally, a written submission must be provided within five (5) days];

(i) a description of the discharge and cause of noncompliance;

(ii) the period of noncompliance, including exact dates and times or, if not corrected, the anticipated time the noncompliance is expected to continue;

(iii) steps being taken and/or planned to reduce, eliminate and prevent recurrence of the noncompliance.

(4) In any enforcement proceeding, the user seeking to establish the occurrence of an upset shall have the burden of proof.

(5) The user shall control production of all discharges to the extent necessary to maintain compliance with Pretreatment Standards upon reduction, loss or failure of its treatment facility until the facility is restored or an alternative method of treatment is provided. This requirement applies in the situation where, among other things, the primary source of power of the treatment facility is reduced, lost or fails.

(b) Bypass.

?

(1) "Bypass" means the intentional diversion of waste streams from any portion of the user's treatment facility.

- (2) "Severe property damage" means substantial physical damage to property, damage to the treatment facilities that causes them to become inoperable, or substantial and permanent loss of natural resources that can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.
- (3) A user may allow bypass to occur where it does not violate pretreatment standards or requirements, and only if it is necessary to assure efficient maintenance and/or operation. These bypasses are not subject to the provisions (4), (5), and (6) below.
- (4) If a user knows in advance of the need for a bypass, the RIEDC shall be given notice, if possible at least ten (10) days before the date of the bypass.
- (5) A user shall orally notify the RIEDC of an unanticipated bypass that exceeds applicable pretreatment standards or requirements within twenty-four (24) hours of becoming aware of the bypass. A written submission shall also be provided within five (5) days of becoming aware of the bypass, including exact times and dates, and if the bypass has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the bypass.
- (6) Bypass is prohibited and the RIEDC may take enforcement action against an individual user for a bypass, unless:
- A. bypass was unavoidable to prevent loss of life, personal injury or severe property damage;
 - B. there are no feasible alternatives to bypass, such as use of auxiliary treatment facilities, retention of wastes, or maintenance during normal periods of downtime. This condition is not satisfied if adequate backup equipment should have been installed to prevent bypass which occurred during normal periods of equipment downtime or preventative maintenance; and
 - C. the user submitted notices as required by Section 11.10(b)(4).

The Director may approve an anticipated bypass, after considering its adverse effects, if the RIEDC determines that the bypass will meet the three conditions listed in this section.

Section 12.00. Confidential Information

Information and data on a user obtained from reports, questionnaires, permit applications, permits and monitoring programs and from inspections shall be available to the public or other governmental agencies without restriction unless the user specifically requests and is able to demonstrate to the satisfaction of the RIEDC that the release of such information would divulge information, processes or methods of production entitled to protection as trade secrets of the user.

When requested by the person furnishing a report, the portions of a report which might disclose trade secrets or secret processes shall not be made available for inspection by the public but shall be made available upon written request to governmental agencies for uses related to these regulations, any NPDES permit, any RIPDES Permit, and/or any pretreatment program; provided, however, that such portions of a report shall be available for use by the State or any state agency in judicial review or enforcement proceedings involving the person furnishing the report. Wastewater constituents and characteristics will not be recognized as confidential information.

Information accepted by the RIEDC as confidential, shall not be transmitted to any governmental agency or to the general public by the RIEDC until and unless a ten (10) day notification is given to the user.

Section 13.00. Septage Hauler Discharge Permits

13.01. No septage hauler shall discharge to the RIEDC WWTF without first obtaining a permit from the RIEDC. No septage hauler will be allowed a permit unless the hauler has a valid license issued by the Rhode Island Department of Environmental Management to haul septage waste.

13.02. Septage Hauler Discharge Permit applications shall be completed on a form provided by RIEDC. All information requested in the permit application must be provided, including any additional information determined to be necessary by the Director

- (a) The completed application and any supporting documentation must be submitted to the RIEDC at least sixty (60) days prior to the issuance of a

permit. Applications for permit renewal must be submitted at least sixty (60) days prior to the expiration of any existing permit.

(b) Incomplete permit applications will not be considered. At the discretion of the Director, an incomplete permit application may be returned to the applicant for additional information, or the incomplete permit application may be denied.

(c) After receipt of a completed permit application, the Director may request additional information to supplement the submission. If supplemental information is not supplied within thirty (30) days of the request of the Director, the permit application is deemed denied. Applicants denied a permit due to failure to provide supplemental information in a timely manner may re-submit the entire permit application with all requested supplemental information as an application for a new permit.

13.03. Limitations and Prohibitions

(a) Only domestic septage originating from sources within the geographic boundaries of the State of Rhode Island may be discharged by a permitted septage hauler into the RIEDC WWTF.

(b) No commercial, institutional, or other non-residential septage that is not domestic in character shall be discharged into the RIEDC WWTF.

(c) Discharge of septage shall be limited to the times and locations selected by the Director. No septage shall be discharged into any user's connection, catch basin, storm drain, drainage system or manhole.

(d) In the discretion of the Director, septage hauler permit holders may be limited in the frequency of use or volume of discharge into the RIEDC WWTF. Limitations may be included in the terms and conditions of a septage hauler's permit, or may be established at any time by the Director.

(e) No septage hauler shall carry or discharge any material considered a hazardous waste under federal or state law, nor shall any hauler mix any amount of hazardous material with domestic septage for the purpose of dilution or for any other reason.

(f) Prohibited substances, as identified in Section 5.00 of these rules, shall apply to septage.

(g) The Director has the right to refuse the discharge of any load of septage into the RIEDC WWTF.

13.04. Fees

(a) Each septage hauler permit application must be accompanied by a permit application fee. The permit application fee amount shall be set by the Director.

(b) Permit holders shall be assessed a per-load charge, established by the Director.

(c) All applications for modifications or renewal of an existing permit shall be accompanied by the appropriate fee. The fee amount shall be established by the Director.

(d) The Director may revise fee amounts at any time. Any changes in permit application, modification, or renewal fees and changes in the per-load charge shall be incorporated by reference. Notice to all septage permit holders shall be sent to the address provided on the permit application at least twenty (20) days prior to the changes taking effect.

13.05. No less than sixty (60) days prior to the expiration of a permit, or to a change in operation of a permit holder requiring modification of an existing permit, the applicant shall submit an application for renewal or modification.

13.06. Each septage permit issued herein shall be valid for the period of time specified in the permit. No permit shall be issued or renewed for a time period to exceed three (3) years. A permit for the discharge of septage may be revoked at the discretion of the Director for violation of any of the provisions of these rules.

13.07. Septage haulers are subject to enforcement under the provisions of Section 11.00 for violation of any section of these rules.

13.08. Sampling and Testing

- (a) The Director may require all permitted septage haulers to provide a representative sample of each load of septage prior to discharge into the RIEDC WWTF.
- (b) Specific sampling methods, testing requirements, and other restrictions shall be included in the terms and conditions of the permit.
- (c) The Director reserves the rights to have RIEDC personnel obtain samples of the septage prior to or during discharge.
- (d) The Director may require the septage hauler to suspend the discharging of septage until the analysis of the sample is complete.

13.09 Discharge of Septage.

- (a) Discharge of septage shall occur only at the locations designated by the Director. Discharge at any other location in the RIEDC system is absolutely prohibited.
- (b) The hours of permitted discharge shall be established by the Director. Discharge shall be limited to the hours and days established by the Director.
- (c) Discharge of septage must be performed under the supervision of designated RIEDC personnel. Discharge without RIEDC supervision is absolutely prohibited.

13.10. Record Keeping Requirements

- (a) The permittee must provide a completed RIEDC septage hauler manifest form. The form shall contain information regarding the septage from each septage generator. The permittee shall also sign the form, indicating that no wastes other than those listed have been accepted. The manifest must be reviewed by an RIEDC representative prior to discharge. Failure to accurately record every load, falsification of data, or failure to transmit the form to the plant operator prior to discharge may result in revocation of this permit and/or a fine of up to \$25,000 per day as allowed by these rules.
- (b) The permittee shall retain all records which substantiate any information supplied in permit applications, monitoring information, septage manifest

BK 2489PG 136

forms, records of data pertaining to hauled loads, and any other information requirements of these rules for a period of three (3) years. Records that are retained by the permittee must be made available for inspection by authorized representatives of the RIEDC

(c) In the event that a dispute or litigation involving the subject of any records that have been retained is pending, the records are to be kept by the permittee for a period of three (3) years following the resolution of such litigation or dispute.

The foregoing rules and regulations, after due notice and an opportunity for hearing, are hereby adopted and filed with the Secretary of State this ____ day of June, 2002, to become effective thirty (30) days after filing, in accordance with the provisions of R.I.G.L. § 42-35-2(a)(2), § 42-35-3, and § 42-117-8.

Date

Tom Schumpert, Executive Director

Revision of 4/11/02

TOWN OF NORTH BRIGHTON
JAMES D. MARQUESS TOWN CLERK
2010 JUL -6 AM 10:47

FIRST AMENDMENT AND SUPPLEMENTAL AGREEMENT

This First Amendment and Supplemental Agreement to the Intergovernmental Agreement for Wastewater Services dated July 6, 2010 and recorded in the Town of North Kingstown Records of Land Evidence on July 6, 2010 (the "Wastewater Services Agreement"), is entered into by and between the Rhode Island Economic Development Corporation, acting by and through its agent and attorney in fact, the Quonset Development Corporation (hereinafter collectively referred to as "QDC") and the Town of North Kingstown (hereinafter referred to as the "Town").

RECITALS

WHEREAS, the QDC and the Town wish to amend and supplement the terms and provisions of the Wastewater Services Agreement to address the Town's desire to discharge additional wastewater flow to the QDC Wastewater Treatment Facility as reflected in the Wastewater Facility Plan for the Town of North Kingstown Executive Summary prepared by James J. Geremia & Associates, Inc. dated October, 2011; and

WHEREAS, QDC acknowledges that the long term wastewater flows from the Town's service area will require an additional 628,000 gpd; and

WHEREAS, QDC is prepared to accommodate and accept the Town's additional wastewater flow provided the Town provides satisfactory evidence of its ability to pay for the upgrades to the QDC Wastewater Treatment Facility.

WHEREAS, QDC acknowledges, that the Town's initial request of 200,000 gpd can be accommodated by the QDC Wastewater Treatment Facility under its current permitting.

AGREEMENTS

NOW, THEREFORE, for good and valuable consideration, receipt of which is hereby acknowledged, the parties hereto mutually agree as follows:

1. Amend Article 1. Definition of the Wastewater Services Agreement by adding to Section 1.1 the following:

"A.A. "Town's Additional Wastewater Flow" means .628 MGD of capacity being purchased by the Town in accordance with the terms of this Agreement."

2. Amend the Wastewater Services Agreement by deleting Section 2.3 in its entirety and substituting therefor the following:

"2.3 The Town will pay the Capacity Purchase Price (\$2,460,000.00) by delivering to QDC a promissory note in the form attached hereto as Exhibit A payable over a term of twenty years with interest at the rate of 2.75% per annum

payable in equal annual installments of \$161,552.46 each commencing January 2, 2013 and on the 2nd day of January of each year thereafter with a final payment of all outstanding principal and interest due on January 2, 2033.”

3. Amend the Wastewater Services Agreement by deleting Section 2.7 in its entirety and substituting therefor the following:

“2.7 Upon execution of this Agreement, the Town will be responsible for the following:

(i) The Town agrees to begin consolidating its connection point to the QDC Wastewater Treatment Facility and over a five (5) year period from the installation of the ASQAH meter and in accordance with a schedule satisfactory to QDC, the Town will install metering devices for the Town Flow into the QDC system, including without limitation, at QDC’s Manhole 57b, Manhole 25-P-4, Manhole 25-011, and such other points as QDC reasonably determines to be necessary to adequately measure the Town Flow.

(ii) As part of Post Road South Phase I, the Town will install a flow metering station at the ASQAH connection point. The design plans and specifications for such flow metering station shall be subject to QDC’s prior approval. Such flow metering station must be operational and approved by QDC prior to QDC accepting any portion of the Town’s Additional Wastewater Flow.

(iii) The Town shall assume responsibility for and accept ownership of the portion of the QDC Wastewater Treatment Facility located outside of the Park (Existing Connectors”) and responsibility for the users of the Existing Connectors.

(iv) Once the operating condition of the DS-SS Pump Station reaches an operating pump run of 12 hours over 24 hour period, then Town shall promptly design, permit and finish modifications to the DS-55 Pump Station, in accordance with plans and specifications approved by QDC. QDC will procure and construct the improvements to DS-55 Pump Station upon receipt of funds from the Town to cover all costs and expenses of construction. QDC will provide the Town with a written notice when the operating condition reaches 12 hours over a 24 hour period. The QDC will not accept any portion of the Town’s Additional Wastewater Flow prior to the completion of the modifications to the DS-55 Pump Station.

(v) Once the Town’s Future Wastewater Flow reaches 200,000 gpd, the Town will suspend all future connections and additional wastewater flow to the QDC Wastewater Treatment Facility”.

4. Amend the Wastewater Services Agreement by deleting Section 4.1 in its entirety and substituting therefor the following:

“4.1 QDC shall continue to accept the Existing Flow. QDC shall accept the Town’s Future Wastewater Flow upon (i) completion of the upgrade of Davisville Pump Station (DS-55) as provided in Section 2.7(iv) above, (ii) installation of all metering devices as provided in Section 2.7(i) above, (iii) the Town’s acceptance of responsibility for and ownership of all of the Existing Connectors (including billing the users of the Existing Connectors directly), and (iv) evidence, satisfactory to QDC, of the Town’s financial ability to pay the Capacity Purchase Price in accordance with the terms of this Agreement.”

5. Amend Article 5 of the Wastewater Services Agreement by adding Section 5.2 as follows:

“5.2 If the QDC Wastewater Treatment Facility is required to reduce its effluent loadings from its current treatment levels (for example, BOD, nutrient removal, etc.) as a result of the Rhode Island Department of Environmental Management’s (RIDEM) discharge permit modifications or otherwise, the Town will pay its share of such increases through the rate schedule in effect, from time to time, for users of the Wastewater Treatment Facility.”

6. Amend the Wastewater Services Agreement by adding a new Article 11 as follows:

”11. Town’s Additional Wastewater Flow

11.1 Once the Town’s obligations set forth in Article 2 and Article 3 of this Agreement have been addressed to the satisfaction of QDC, and the Town has met all of its other obligations under this Agreement, the Town may request, in writing, that QDC upgrade the QDC Wastewater Treatment Facility to accommodate the Town’s Additional Wastewater Flow (.628MGD). Upon receipt of such request, QDC will conduct an analysis of necessary upgrades and costs to accommodate the Town’s Additional Wastewater Flow. Based on the current design of the QDC Wastewater Treatment Facility, it is anticipated that in order to accommodate the Town’s Additional Wastewater Flow, it will be necessary to upgrade the QDC Wastewater Treatment Facility from 1.78 MGD to approximately 2.6 MGD. QDC will prepare and submit a permit application to RIDEM with respect to the necessary permit modifications to allow the upgrade of the QDC Wastewater Treatment Facility. QDC will also complete the facilities planning, engineering and design necessary to support an Order of Approval application for future upgrades to the QDC Wastewater Treatment Facility.”

11.2 Within one hundred eighty days (180) following receipt of the Town’s request, QDC will provide the Town with an estimate of the “Total Costs” to upgrade the Wastewater Treatment Facility and the projected schedule for the permitting and construction of the upgrades. The “Total Cost” to update the Wastewater Treatment Facility will include all costs to upgrade and increase the capacity of the Wastewater Treatment Facility (currently anticipated that the

upgrade will be to 2.6 MGD) including, without limitation, all costs and expenses related to planning, design, engineering, permitting, equipment, construction and commencement of operations.

11.3 The Town will pay to QDC 100% of the Total Costs. Such payment will be paid by the Town to QDC upon such terms and conditions as shall be mutually agreed to by the Town and QDC as evidenced by a written agreement between the Town and QDC (the "Payment Agreement"). QDC will not commence the work associated with the upgrade of the QDC Wastewater Treatment Facility prior to the parties entering into the Payment Agreement."

7. Except as set forth in this Amendment, all the provisions of the Wastewater Services Agreement shall remain unchanged and in full force and effect.

IN WITNESS WHEREOF, the parties have caused this Amendment to be executed by their respective fully authorized officers this ____ day of _____, 2011.

RHODE ISLAND ECONOMIC DEVELOPMENT
CORPORATION ACTING BY AND THROUGH
ITS AGENT AND ATTORNEY-IN-FACT
QUONSET DEVELOPMENT CORPORATION

TOWN OF NORTH KINGSTOWN

By:_____

Town Council

EXHIBIT A

BUYER'S PROMISSORY NOTE

\$2,460,000.00

_____, 2011

FOR VALUE RECEIVED, the Town of North Kingstown ("Maker") promises to pay to Rhode Island Economic Development Corporation, acting by and through its agent and attorney in fact, Quonset Development Corporation ("Holder") at 95 Cripe Street, North Kingstown, Rhode Island 02852 the principal sum of Two Million Four Hundred Sixty Thousand Dollars (\$2,460,000.00) on or before January 2, 2033 (the "Maturity Date"), together with interest, in arrears, from the date hereof on the unpaid principal balance from time to time, outstanding and on all unpaid installment of interest, whether before or after the maturity of or default under this Note, at the annual rate of 2.75%. Interest at such rate shall be paid in arrears, commencing January 2, 2033 and continuing on the second day of January of each year thereafter (a "Payment Date").

Unless sooner paid, the principal and interest shall be paid in equal consecutive annual installments, on each Payment Date, and a final payment of all unpaid principal and accrued interest on the Maturity Date in accordance with Exhibit A attached hereto.

This Note may be prepaid at any time, in whole or in part, without penalty.

Whenever any of the days on which payments of interest or principal required to be made hereunder falls on a Sunday or a public holiday, such payment shall be due on the next following normal business day.

The sums due and payable under this Note are payable in the legal tender of the United States of America at the office of Holder set forth above or at such other place as Holder, his heirs or assigns, may designate to Maker in writing from time to time.

All sums paid under this Note shall be applied first to any interest, fees, expenses and other charges then due and unpaid, in such order as Holder shall determine, with the remaining balance, if any, to be applied to unpaid principal.

The occurrence of any of the following events shall constitute an Event of Default under this Note:

(a) Failure of Maker to pay any installment of principal or interest or other amount when due under this Note, and the continuance of such failure for more than five (5) business days after written notice by Holder to Maker;

(b) The insolvency or inability of Maker to pay its debts as they mature, or the appointment of a receiver, trustee, custodian or other fiduciary for, or for any of the property of, or an assignment for the benefit of creditors by Maker;

(c) The filing of a petition, complaint, motion or other pleading seeking relief under any receivership, insolvency or debtor relief law, or the seeking of any readjustment of indebtedness, reorganization, composition, extension of any similar type of relief, or the filing of a petition, complaint or motion under any chapter of the Federal Bankruptcy Code, as the same now exists or may hereafter be amended (the "Code"), by or against Maker (a "Bankruptcy Proceeding"); or

(d) The dissolution, liquidation of Maker or sale of substantially all of the assets of Maker.

Upon the occurrence of any Event of Default, subject to the terms of this Note, this Note, at the option of Holder, shall become immediately due and payable without presentment, demand, protest or notice of any kind, all of which are hereby expressly waived by Maker. Holder's failure to exercise such right shall not constitute a waiver of the right to exercise the same at any other time.

No renewal or extension granted, or any indulgence shown to, or any release of, or any dealings between Holder and any other person, corporation or entity now or hereafter interested herein or in the property securing this Note, shall discharge, extend or in any way affect the obligations of Maker hereunder.

Maker shall remain primarily liable on this Note until full payment, unaffected by any agreement or transaction between Holder and any other party as to payment of principal, interest or other monies, by any forbearance or extension of time, guaranty or assumption by others, or by any other matter, as to all of which notice is hereby waived by Maker.

Maker will pay the reasonable legal and other fees and expenses of Holder reasonably incurred in connection with or incidental to the enforcement of any of the obligations of Maker or rights of Holder under this Note.

This Note shall be construed in accordance with the laws of the State of Rhode Island.

This Note may not be modified or terminated orally.

IN WITNESS WHEREOF, this Note has been executed, under seal, as of _____, 2011.

WITNESS:

Town of North Kingstown

By: _____

Name:

Title:

APPENDIX D

POWERPOINT SLIDES – PUBLIC MEETING NO. 1

Town of North Kingstown Comprehensive Wastewater Management Facilities Plan



JAMES J. GEREMIA & ASSOCIATES, INC.
CONSULTING ENVIRONMENTAL ENGINEERS & SCIENTISTS



What is a Wastewater Management Facilities Plan? & Why is it necessary?

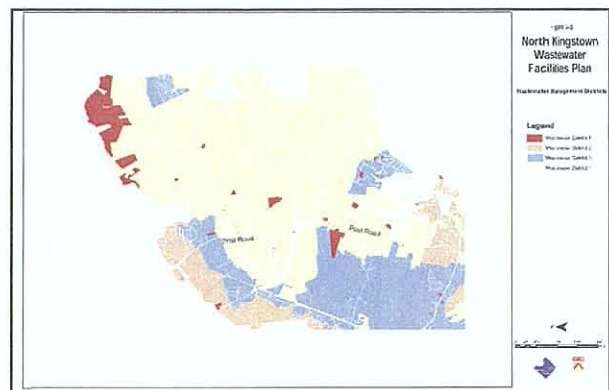
What is a Wastewater Facilities Plan?

- It is a planning tool which complements the Town's Comprehensive Plan.
- It will identify whether OWTS Systems or Sewers are appropriate for the Town.
- It will examine the environmental conditions surrounding the coastal, wetlands and groundwater recharge areas.

Why is it needed?

- Outlines the necessary procedures the Town needs to implement.
- It will outline the cost to the community, both capital and operational.
- Provide the Town the opportunity to obtain low interest loans through the State SRF Program.

EXISTING CONDITIONS



Existing Conditions

- 96% of the Town is on OWTS Systems
- 4% of the Town is on Sewers, connected to QDC's System
 - Two Pump Stations Mark Drive & Wickford Point
 - 5,000 linear feet of force main
 - 8,300 linear feet of gravity sewer

Facilities Connected to QDC

- ASQAH
- Essex Village
- Kings Grant
- MHRH
- Kingstown Heights
- Fishing Cove School
- Quidnessett School
- Phoenix Properties
- Travelers Aid
- G. Grossmans
- Wickford Point
- Lischio
- Lischio/ Moran

Why consider Sewers for the Town?

- Address environmental concerns in the area.
- Address the future planning needs of this area.

How are potential Sewered Areas selected?

- Examine the Comprehensive Plan for Proposed or Existing High Density Development.
- Examine Areas of Chronic On site Failure or Repairs
- Examine the Effect on the Groundwater Recharge Areas
- Close Proximity to QDC System

Proposed Project Areas

- Post Road Corridor
- Wickford Village / Poplar Point
- Shore Acres

Status of On-Site Systems

- The Post Road Project Area consists of 1,509 on-site systems, 217 needed repair or corrective action.
- The Wickford/Poplar Point Project Area consists of 550 on-site systems, 135 needed repair or corrective action.
- The Shore Acres Project Area consists of 213 on-site systems, 34 needed repair or corrective action.

Why do Systems Fail?

- Population density
 - High concentration of residences over a small land area, causing oversaturation
- Leaching system does not operate correctly
 - Water cannot pass through
 - System drains freely

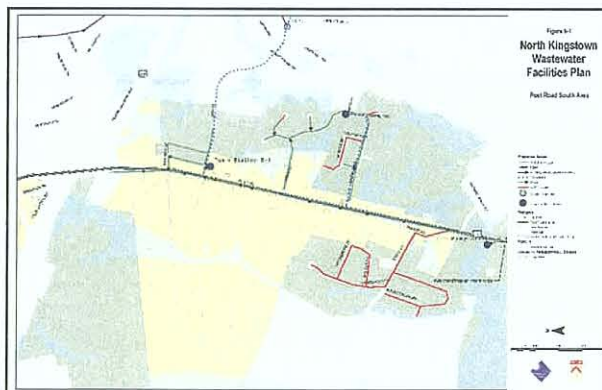
Future Conditions

Future Project Areas

- Post Road Corridor
- Wickford Village / Poplar Point
- Shore Acres

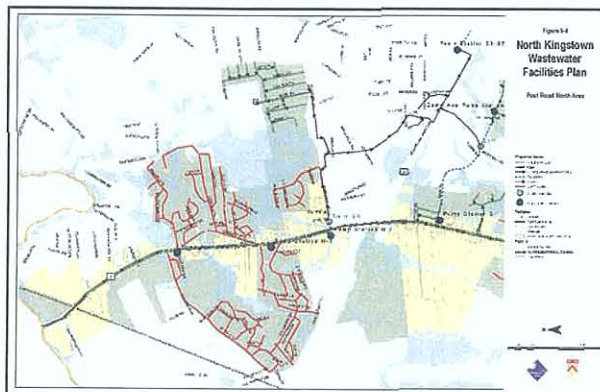
Post Road Corridor South

- Commercial Land 285 Acres
- Residential Neighborhoods 179 Homes
 - Dana Drive / Oakdale Road
 - Stony Lane and Sedgefield Road



Post Road Corridor North

- Commercial Land 240 Acres
- Residential Neighborhoods 1152 Homes
 - Pine River Road
 - Mark Drive
 - Chadsey Road, Heritage Road, Brookhaven Road
 - School Street, Brookside Drive, Ranger Road

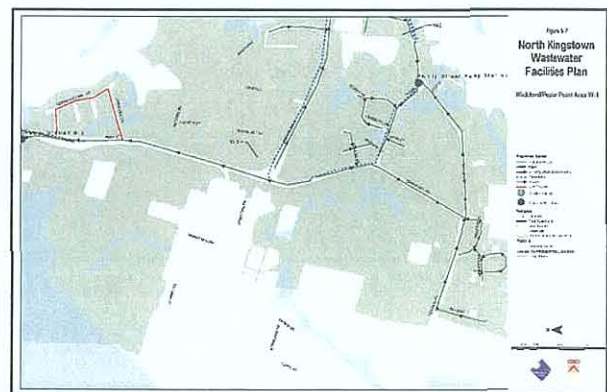


Wickford Village / Poplar Point

- Wickford Village Subarea W1
 - Philips Street Pump Station
- Wickford Village Subarea W2
 - Beach Street Pump Station
- Wickford Village Subarea W3
 - Main Street Pump Station

Wickford Village Subarea W1

- 338 Residential Properties
- 7 Commercial Properties
- Municipal Facilities
 - Library
 - Middle School
 - Former Wickford Elementary School



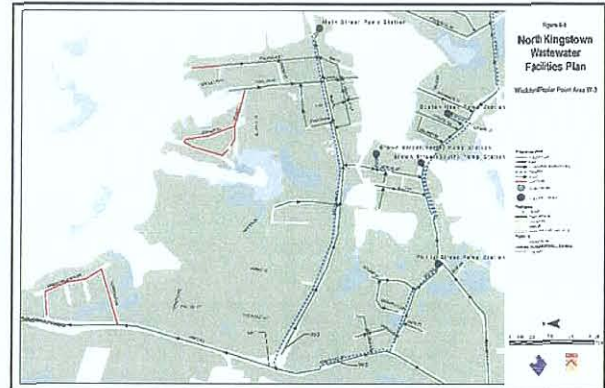
Wickford Village Subarea W2

- 216 Residential Properties
- 38 Commercial Properties
- Marina 319 Boat Slips
- Municipal Facilities
 - Town Hall
 - Senior Center



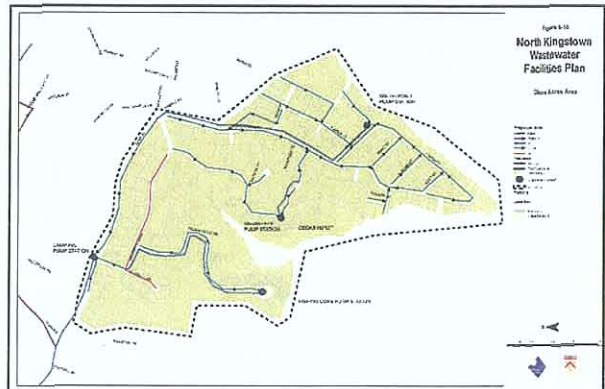
Wickford Village Subarea W3

- 166 Residential Properties
- 20 Commercial Properties
- Marina 130 Boat Slips



Shore Acres

- Sauga Point
- Cedar Hurst
- Fishing Cove



PROJECTED AVERAGE DAILY FLOW FROM PROPOSED SEWERED AREAS - DESIGN YEAR 2030

Area Name	Number Residential Units	Number Commercial Acres	Est. Length of Sewer (mi.)	Residential Flow (GPD)	Commercial Flow (GPD)	Inflow/Infiltration (MGD)	Total Flow (GPD)
PostRoad N	1,152	204	13	208,397	158,100	3,900	370,397
PostRoad S	179	242	4	32,381	187,550	3,000	222,931
Wickford/Poplar	720	40 units	7	130,248	30,300	8,000	168,548
Shore Acres	344		4	62,230	0	4,000	66,230
TOTALS	2,395	486	28	433,256	375,950	18,900	828,106

QDC

Overview of QDC's System

- Wastewater Treatment
 - Current flows are 0.488 MGD
 - Plant is designed for organic loading for 1.78 MGD
 - Plant is designed for hydraulic loading for 2.6 MGD
- Collection System
 - 20 miles of sewers ranging from 4" to 24"
 - 100% of the flow generated from the Town enters DS-55

Status QDC

- July 2010 QDC agreed to accept the Town's initial wastewater flow of 200,000GPD
- QDC and the Town established the mechanism to permit the balance of the Town's wastewater flow of 828,000 GPD
- QDC and the Town will modify the agreement to address DEM comments

Project Cost

Project Cost

- Capital Cost
 - Betterment Assessment
 - Payment Period 20 Years
- Operating Cost
 - User Fee
 - Paid Annually based upon usage

Capital Cost

SUMMARY OF CAPITAL COST

	Commercial Cost	Residential Cost	Commercial Acreage	Residential L.F.	Commercial Cost/Acre	Residential Cost/L.F.
Post Road South	\$9,026,200	\$ 4,830,606	285	39,200	\$31,670	\$123.23
Post Road North	\$10,389,300	\$19,250,500	240	119,600	\$43,288	\$160.96
Pine River		\$ 1,330,800		10,200		\$130.47
Mark Drive		\$ 3,534,000		28,400		\$124.45
W1 Wickford Village / Poplar Pl.		\$15,354,600	*			
W2 Wickford Village / Poplar Pl.		\$11,872,600	*			
W3 Wickford Village / Poplar Pl.		\$ 6,865,500	*	97,200		\$350.85
Shore Acres (gravity)		\$13,207,800		42,800		\$308.60
Shore Acres (low pressure)		\$ 6,034,800		42,800		\$141.00

SUMMARY OF ANTICIPATED ANNUALIZED COST		
	Total Cost Per Unit	20-Year Bond @ 3% Interest
<u>Post Road South</u>		
Commercial	\$ 9,026,200	\$12,014,181
Residential	\$ 4,830,606	\$ 6,429,701
<u>Post Road North</u>		
Commercial	\$10,389,800	\$13,829,179
Residential	\$19,250,500	\$25,623,074
Pine River (Residential)	\$ 1,330,800	\$ 1,771,340
Mark Drive (Residential)	\$ 3,534,000	\$ 4,703,874
Wickford Village/Poplar Pt. (Residential)	\$34,102,600	\$45,391,727
Shore Acres (Residential) – gravity	\$13,207,800	\$17,580,033
Shore Acres (Residential) – LP	\$ 6,034,800	\$ 8,032,525

SUMMARY OF COST TO IMPROVE QDC'S INFRASTRUCTURE		
Projects		Total Cost
Diversion Structure and Gravity Line	\$	1,284,000
Upgrade to WWTF (2.6 MGD)		4,965,000
ASQAH Dr. Interceptor		567,900
Newcomb Rd. Interceptor		608,800
TOTAL	\$	7,422,700

Annual Cost

COLLECTION SYSTEM PROBABLE MAINTENANCE COSTS	
Expenditure Category	Annual Cost
Salaries	130,000
Insurance	15,000
Legal Engineering	5,000
Insurance	19,000
Supplies	2,000
Utilities	24,000
Pump Station Supplies	2,000
Repair/Maintenance	10,000
Renewal/Replacement Equipment	5,000
TOTAL	\$212,000

Questions ?
