

TOWN OF ORLEANS COMPREHENSIVE WASTEWATER MANAGEMENT PLAN

TABLE OF CONTENTS

SECTION	DESCRIPTION	PAGE
ES	Executive Summary	ES-1
1	INTRODUCTION	1-1
2	EXISTING CONDITIONS	2-1
	2.1 Land Use and Demographics	2-1
	2.2 Environmentally Sensitive Areas	2-5
	2.2.1 Watersheds	2-6
	2.2.2 Freshwater Ponds	2-6
	2.2.3 Coastal Embayments	2-10
	2.2.4 Protected Areas	2-11
	2.3 Soils	2-15
	2.4 Groundwater	2-17
	2.5 Water Use and Wastewater Flows	2-19
3	WASTEWATER MANAGEMENT NEEDS	3-1
	3.1 Approach	3-1
	3.2 Sanitary Needs	3-2
	3.2.1 Title 5 Variances	3-2
	3.2.2 Intensive Water Use	3-8
	3.2.3 Receiving Water Impacts	3-10
	3.2.4 Combined Indicators of Sanitary Needs	3-12
	3.3 Water Supply Protection	3-14
	3.3.1 Private Wells	3-14
	3.3.2 Public Wells	3-14
	3.3.3 Overview of Water Supply Protection Needs	3-18
	3.4 Surface Water Protection	3-18
	3.4.1 Freshwater Ponds	3-18
	3.4.2 Estuaries	3-21
	3.5 Convenience and Aesthetics	3-28
	3.6 Economic Growth	3-32
	3.7 Summary of Current Needs	3-33
4	FUTURE CONDITIONS	4-1
	4.1 Future Wastewater Quantities	4-1
	4.1.1 Definition of Terms	4-1
	4.1.2 Theoretical Build-Out	4-2
	4.1.3 Practical Build-Out	4-3

TABLE OF CONTENTS (Cont.)

SECTION	DESCRIPTION	PAGE
	4.1.4 Planning Horizon	4-4
4.2	Population Projections	4-7
4.3	Future Wastewater Needs	4-9
4.4	"No Action" Alternative	4-9
5	IDENTIFICATION AND EVALUATION OF WASTEWATER PLAN COMPONENTS	5-1
5.1	Wastewater Flows and Loads	5-1
	5.1.1 Summary of Wastewater Management Needs	5-1
	5.1.2 Strategies for Reductions of Flows and Loads.....	5-3
5.2	Wastewater Collection.....	5-6
	5.2.1 Collection System Options.....	5-6
	5.2.2 Criteria for Identifying Properties to be Served	5-7
5.3	Wastewater Treatment	5-8
	5.3.1 Effluent Limitations and Expected Performance	5-9
	5.3.2 Management of Residuals	5-17
5.4	Wastewater Reuse and Disposal	5-19
	5.4.1 Wastewater Disposal Technology	5-19
	5.4.2 Wastewater Reuse Opportunities.....	5-20
5.5	Siting of Wastewater Treatment and Disposal Facilities	5-22
	5.5.1 Initial Site Identification and First-Level Screening	5-22
	5.5.2 Target Effluent Disposal Capacity.....	5-22
	5.5.3 Second-Level Site Screening.....	5-23
	5.5.4 Site-Specific Exploration Needs.....	5-27
	5.5.5 Next Steps	5-28
5.6	Non-Traditional Nitrogen Control Measures.....	5-28
6	FORMULATION OF COMPOSITE WASTEWATER PLANS	6-1
6.1	Initial Plan Formulation.....	6-1
6.2	Evaluative Criteria.....	6-2
6.3	Overview of Wastewater Plans Recommended for Detailed Evaluation.....	6-5
6.4	Plan Descriptions	6-8
6.5	No Action Plan	6-10
6.6	Importance of Nitrogen Balance	6-10
6.7	Extent of Sewer System.....	6-11
7	EVALUATION OF ALTERNATIVE PLANS	7-1
7.1	Introduction	7-1
7.2	Transfer of Water Among Watersheds.....	7-2
7.3	Transfer of Nitrogen Among Watersheds	7-7

TABLE OF CONTENTS (Cont.)

SECTION	DESCRIPTION	PAGE
7.4	Extent of Sewer System.....	7-8
7.5	Need for Land Purchases and Easements.....	7-9
7.6	Capital Costs	7-9
7.7	Operation and Maintenance Costs	7-13
7.8	Net Present Worth Costs.....	7-14
7.9	Impacts of User Charges and Tax Rate.....	7-15
7.10	Environmental Impacts.....	7-15
7.11	Energy Consumption.....	7-15
7.12	Suitability of Treatment Facility Sites.....	7-18
7.13	Truck Traffic at Tri-Town Site	7-20
7.14	Expandability	7-21
7.15	Flexibility for Phasing	7-22
7.16	Potential for Water Reuse.....	7-24
7.17	Regulatory Acceptability.....	7-25
7.18	Ease in Implementation	7-26
7.19	Potential for Impacting Town Growth Rate	7-27
7.20	Potential for Siting a Public Works Facility at the Tri-Town State.....	7-28
7.21	Overall Public Acceptability.....	7-30
7.22	Summary of Evaluation.....	7-30
8	EVALUATION OF ENVIRONMENTAL IMPACTS.....	8-1
8.1	Introduction	8-1
8.2	Project Description.....	8-1
8.3	Alternatives to the Project	8-1
8.4	Existing Environment.....	8-2
8.5	Assessment of Impacts	8-2
8.5.1	Surface Water Quality.....	8-2
8.5.2	Groundwater Quality	8-3
8.5.3	Wetlands.....	8-4
8.5.4	Floodplains.....	8-4
8.5.5	Coastal Resources.....	8-5
8.5.6	Open Space And Recreation	8-5
8.5.7	Rare and Endangered Species	8-6
8.5.8	Archaeological and Historic Resources.....	8-7
8.5.9	Traffic	8-7
8.5.10	Air Quality.....	8-8
8.5.11	Noise	8-8
8.5.12	Energy	8-9
8.5.13	Generation of Solid Waste	8-9
8.5.14	Public Health.....	8-9
8.5.15	Community Growth and Land Use.....	8-9

TABLE OF CONTENTS (Cont.)

SECTION	DESCRIPTION	PAGE
	8.6 Regulatory Standards and Requirements.....	8-10
	8.7 Mitigation Measures.....	8-11
	8.8 The "No Action" Alternative.....	8-12
9	POTENTIAL FOR REGIONALIZATION.....	9-1
	9.1 Introduction.....	9-1
	9.2 Regionalization Options.....	9-1
	9.3 Evaluation of Options.....	9-3
10	POTENTIAL FOR WATER REUSE.....	10-1
	10.1 Introduction.....	10-1
	10.2 Reuse Options.....	10-1
	10.3 Level of Treatment.....	10-5
	10.4 Cost Estimates.....	10-6
	10.5 Regulatory Issues.....	10-6
	10.6 Other Non-Cost Factors.....	10-7
11	RECOMMENDED PLAN.....	11-1
	11.1 Introduction.....	11-1
	11.2 Development of Recommended Plan.....	11-1
	11.2.1 Activities of the WMSC.....	11-1
	11.2.2 Public Consultation Process.....	11-2
	11.2.3 Plan Selection.....	11-3
	11.3 Overview of Recommended Plan.....	11-4
	11.4 Structural Elements of Recommended Plan.....	11-5
	11.4.1 Wastewater Collection System.....	11-5
	11.4.2 Wastewater Treatment System.....	11-6
	11.4.3 System for Effluent Disposal and Reuse.....	11-8
	11.4.4 Facilities for Septage Handling.....	11-11
	11.4.5 Facilities of Sludge Handling.....	11-11
	11.4.6 Local Wastewater Management Systems.....	11-12
	11.4.7 Alternate Layouts for Tri-Town Site.....	11-13
	11.5 Non-Structural Elements of Recommended Plan.....	11-13
	11.5.1 Fertilizer Control Program.....	11-15
	11.5.2 Stormwater Management.....	11-16
	11.5.3 Water Conservation Program.....	11-16
	11.5.4 Flow and Load Reduction Initiative.....	11-16
	11.5.5 Enhancement of Embayment Flushing Rates.....	11-17
	11.5.6 Land Use Controls.....	11-18
	11.6 TMDL Compliance Plan.....	11-19
	11.7 Phasing of Facilities Construction.....	11-22
	11.8 Regionalization.....	11-28
	11.9 Soil and Groundwater Studies at Tri-Town Site.....	11-29

TABLE OF CONTENTS (Cont.)

SECTION	DESCRIPTION	PAGE
	11.9.1 Studies Conducted to Date	11-29
	11.9.2 Future Testing Program	11-30
	11.9.3 Long-Term Monitoring Plan	11-31
11.10	Implementation Steps	11-31
	11.10.1 Establishment of a Managing Entity.....	11-31
	11.10.2 Land Acquisition	11-32
	11.10.3 Regulations, Bylaws and Policies.....	11-32
	11.10.4 Permitting.....	11-34
	11.10.5 Coordination with OBEGWPD on Septage Management and Land Requirements	11-35
	11.10.6 Coordination with Brewster and Eastham on Wastewater Regionalization	11-37
	11.10.7 Pond and Estuary Monitoring.....	11-37
	11.10.8 Energy Conservation/Generation and Green Design...	11-38
	11.10.9 Water Service to Properties Near Wastewater Disposal Locations	11-38
	11.10.10 Independent Review of MEP Studies	11-39
	11.10.11 Implementation Schedule.....	11-39
11.11	Financial Plan	11-41
	11.11.1 Current Estimates of Cost	11-41
	11.11.2 Capital Costs.....	11-41
	11.11.3 Operation and Maintenance Costs.....	11-42
	11.11.4 Application for SRF Loans	11-43
	11.11.5 Potential for Grants.....	11-44
	11.11.6 Financing Policy with Respect to Betterments and Taxes	11-45
	11.11.7 Costs to Typical Users and Non-Users	11-45
11.12	Environmental Mitigations	11-47

TABLE OF CONTENTS (Cont.)**LIST OF TABLES**

TABLE	DESCRIPTION	PAGE
1-1	LIST OF COMMONLY USED ACRONYMS AND ABBREVIATIONS	1-4
2-1	SUMMARY OF LAND USE AND DEMOGRAPHIC DATA	2-2
2-2	CURRENT WASTEWATER FLOWS PER LOT	2-22
2-3	ANNUAL AVERAGE WASTEWATER QUANTITIES BY WATERSHED CURRENT CONDITIONS.....	2-25
3-1	ENVIRONMENTAL SIGNIFICANCE RATING SYSTEM FOR TITLE 5 VARIANCES.....	3-3
3-2	SUMMARY OF TITLE 5 VARIANCE ANALYSIS	3-6
3-3	SUMMARY OF SANITARY NEEDS.....	3-12
3-4	POND TROPHIC STATUS, IMPAIRED USES AND WASTEWATER MANAGEMENT PRIORITIES	3-20
3-5	WASTEWATER FLOWS UPGRADIENT OF EVALUATED PONDS.....	3-23
3-6	REQUIRED NITROGEN LOAD REDUCTIONS BY SUB-EMBAYMENTS OF PLEASANT BAY	3-26
3-7	SUMMARY OF NEEDS ASSOCIATED WITH CONVENIENCE AND AESTHETIC FACTORS	3-30
3-8	SUMMARY OF CURRENT NEEDS IN ALL CATEGORIES	3-34
4-1	SUMMARY OF ASSUMPTIONS USED IN BUILD-OUT ANALYSIS	4-5
4-2	SUMMARY OF FUTURE NEEDS IN ALL CATEGORIES	4-10
4-3	ANNUAL AVERAGE WASTEWATER QUANTITIES BY WATERSHED AT PLANNING HORIZON.....	4-11
5-1	SUMMARY OF ALTERNATIVES FOR WASTEWATER MANAGEMENT COMPONENTS.....	5-5
5-2	EXPECTED EFFLUENT LIMITATIONS.....	5-10
5-3	EXPECTED EFFLUENT QUALITY	5-12
5-4	GENERAL CATEGORIES OF WASTEWATER SYSTEMS.....	5-14
5-5	INITIAL CAPACITY ESTIMATES FOR IDENTIFIED DISPOSAL SITES.....	5-25
6-1	INITIAL PLAN IDENTIFICATION.....	6-3
6-2	EVALUATIVE CRITERIA USED IN RATING WASTEWATER PLANS	6-4
6-3	SUMMARY OF WASTEWATER PLAN #1	6-13
6-4	SUMMARY OF WASTEWATER PLAN #2	6-16
6-5	SUMMARY OF WASTEWATER PLAN #3	6-19
6-6	COMPARISON OF WASTEWATER PLANS	6-22

TABLE OF CONTENTS (Cont.)**LIST OF TABLES (CONT.)**

TABLE	DESCRIPTION	PAGE
7-1	DISPOSITION OF EFFLUENT.....	7-4
7-2	DISPOSITION OF WASTEWATER NITROGEN.....	7-8
7-3	SUMMARY OF CAPITAL COST ESTIMATES.....	7-11
7-4	EVALUATION OF ENERGY USAGE.....	7-16
7-5	COMPARISON OF WASTEWATER TREATMENT SITES.....	7-19
7-6	SUMMARY OF EVALUATIVE CRITERIA.....	7-31
11-1	WASTEWATER SYSTEM DESIGN DATA FOR CORE PROGRAM.....	11-10
11-2	PRELIMINARY PHASING PLAN FOR CORE PROGRAM.....	11-24
11-3	NUTRIENT LOAD REDUCTION BY PHASE.....	11-27
11-4	SCHEDULE FOR IMPLEMENTATION TASKS.....	11-40
11-5	PRELIMINARY ESTIMATE OF CAPITAL COSTS FOR CORE PROGRAM.....	11-42
11-6	PRELIMINARY ESTIMATE OF OPERATION AND MAINTENANCE COSTS FOR CORE PROGRAM.....	11-43
11-7	EQUIVALENT ANNUAL COSTS FOR TYPICAL RESIDENTS.....	11-46

LIST OF FIGURES

FIGURE	DESCRIPTION	PAGE
1-1	MAJOR WATERSHEDS.....	1-3
2-1	ZONING DISTRICTS.....	2-3
2-2	LAND USE.....	2-4
2-3	MONTHLY VARIATION IN RESIDENT POPULATION.....	2-5
2-4	MAJOR GROUNDWATER BASINS.....	2-7
2-5	FRESHWATER PONDS.....	2-8
2-6	ACEC'S WETLANDS, AND OPEN SPACES.....	2-12
2-7	OUTSTANDING RESOURCE WATERS AND SHELLFISH GROWING AREAS.....	2-13
2-8	FLOOD PLAINS.....	2-16
2-9	SOIL CONDITIONS.....	2-18
2-10	PERCHED WATER TABLE.....	2-20

TABLE OF CONTENTS (Cont.)**LIST OF FIGURES (CONT.)**

FIGURE	DESCRIPTION	PAGE
2-11	CURRENT WASTEWATER FLOW PER LOT	2-23
2-12	CURRENT WASTEWATER FLOWS BY MAJOR WATERSHED	2-24
2-13	SEASONAL VARIABILITY IN WATER USE AND WASTEWATER FLOW	2-27
3-1	TITLE 5 VARIANCES 1995-2005	3-7
3-2	WATER USE INTENSITY	3-9
3-3	RECEIVING WATER QUALITY	3-11
3-4	LOTS WITH SANITARY NEEDS	3-13
3-5	EXTENT OF PUBLIC WATER SUPPLY LINES	3-15
3-6	DEVELOPED LOTS IN PUBLIC WATER SUPPLY ZONE IIS...	3-16
3-7	POND PROTECTION NEEDS.....	3-22
3-8	CONVENIENCE AND AESTHETIC FACTORS.....	3-31
3-9	AGGREGATED NEEDS.....	3-35
4-1	WASTEWATER FLOW PROJECTIONS AT BUILD-OUT	4-6
4-2	DETERMINATION OF WASTEWATER FLOW AT END OF PLANNING HORIZON.....	4-8
5-1	GENERIC WASTEWATER MANAGEMENT SYSTEM.....	5-2
5-2	TRI-TOWN SEPTAGE TREATMENT FACILITY	5-18
6-1	WASTEWATER PLAN LEGEND	6-6
6-2	WASTEWATER PLAN #1	6-14
6-3	WASTEWATER PLAN #1	6-15
6-4	WASTEWATER PLAN #2.....	6-17
6-5	WASTEWATER PLAN #2.....	6-18
6-6	WASTEWATER PLAN #3.....	6-20
6-7	WASTEWATER PLAN #3.....	6-21
7-1	SCHEMATIC REPRESENTATION OF WASTEWATER MANAGEMENT PLANS.....	7-3
10-1	POSSIBLE RECLAIMED WATER PIPELINE.....	10-4
11-1	LOCATION OF COLLECTION SYSTEM INFRASTRUCTURE AND TREATMENT FACILITY.....	11-7
11-2	LAYOUT OF PROPOSED WASTEWATER TREATMENT AND DISPOSAL FACILITIES AT TRI-TOWN SITE	11-9
11-3	PROPOSED WASTEWATER TREATMENT AND DISPOSAL FACILITIES ALTERNATE LAYOUTS.....	11-14
11-4	POSSIBLE SEWER PHASING PLAN	11-26

TABLE OF CONTENTS (Cont.)**LIST OF APPENDICES**

(Included in Separate Volume)

APPENDIX	DESCRIPTION
A	Evaluation of Freshwater Ponds - Bakers Pond, Boland Pond, Cedar Pond, Crystal Lake, Ice House Pond, Pilgrim Lake, Sarah's Pond, and Shoal Pond
B	Information on Wastewater Management Components
C	Public Consultation
D	Preliminary Sizing Data for Wastewater Treatment and Disposal Elements of Recommended Plan
E	Hydrogeologic Investigations at Site 241
F	Hydrogeologic Modeling at Site 241
G	Executive Summaries of Relevant Technical Reports by the Massachusetts Estuaries Project
H	Habitat Assessment Letter Report LEC Environmental Consultants, Inc.
I	Cluster Systems (<i>not included in April 2009 Draft CWMP</i>)