
Chapter 4 Figures

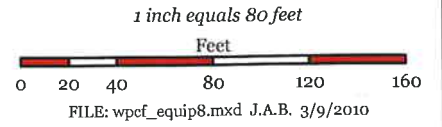


TOWN OF BARNSTABLE MASSACHUSETTS

Comprehensive Wastewater and Nutrient Management Plan

Hyannis WPCF Site Plan

Figure 4-1



TOWN OF BARNSTABLE GEOGRAPHIC INFORMATION SYSTEMS UNIT

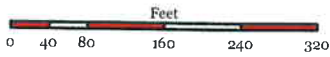
FIGURE PREPARED FOR STEARNS & WHEELER GHD

Note 1. Aerial photo taken on July 10, 2009.

TOWN OF BARNSTABLE MASSACHUSETTS

Comprehensive Wastewater and Nutrient Management Plan

Marstons Mills WWTF Site Figure 4-2









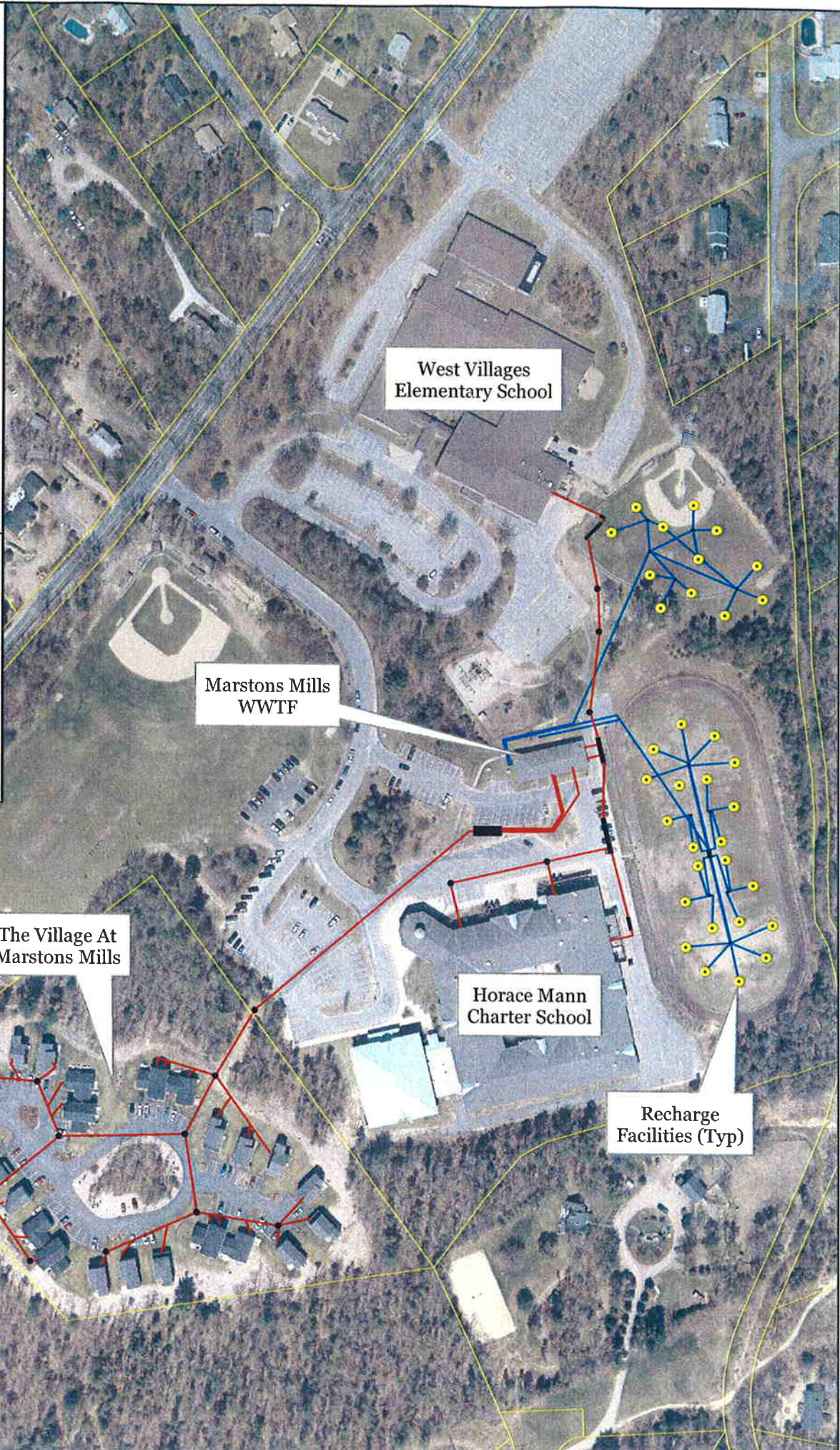
CWNMP_MM/WWTF_8x11_Fig4-2.mxd J.A.B. 5/13/2010

TOWN OF BARNSTABLE GEOGRAPHIC INFORMATION SYSTEMS UNIT

FIGURE PREPARED FOR STEARNS & WHEELER GHD

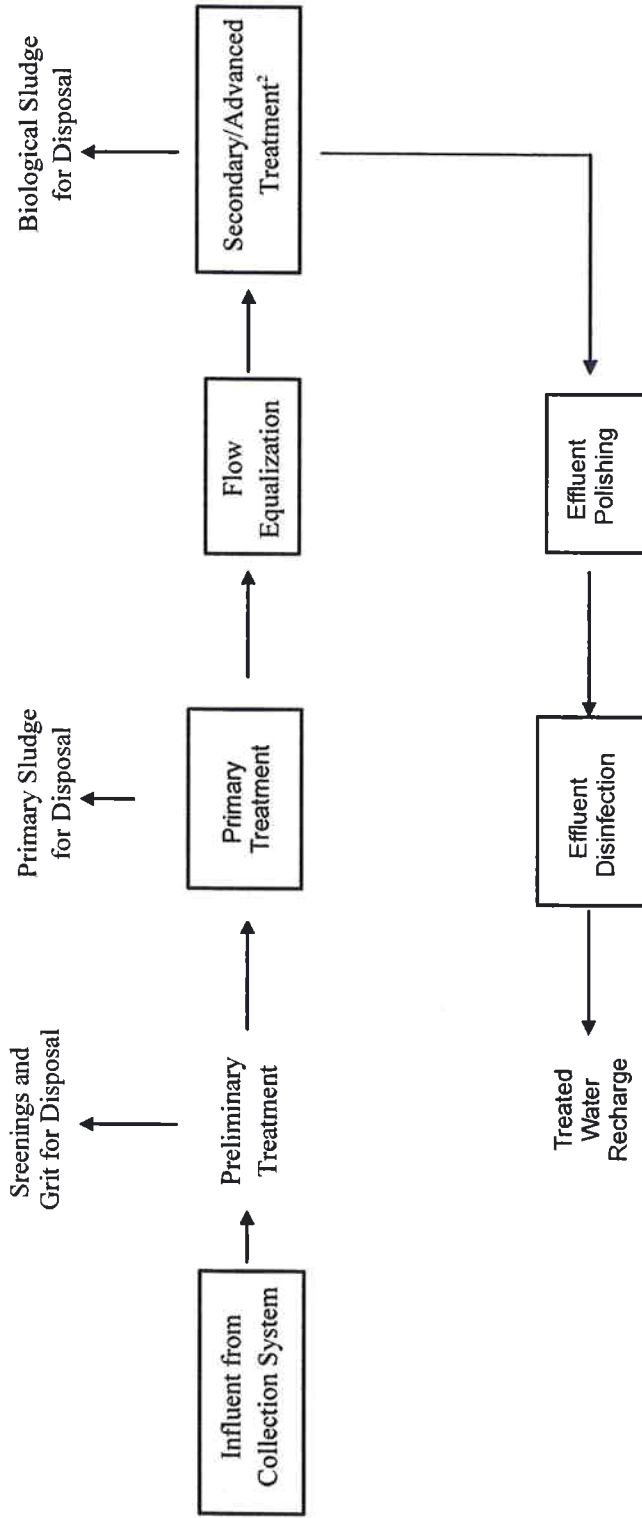
Aerial Photo Taken April 19, 2008

-  Sewer Lines
-  Treated Water Lines
-  Leaching Facility
-  Sewer Manholes
-  Distribution Box
-  Parcels



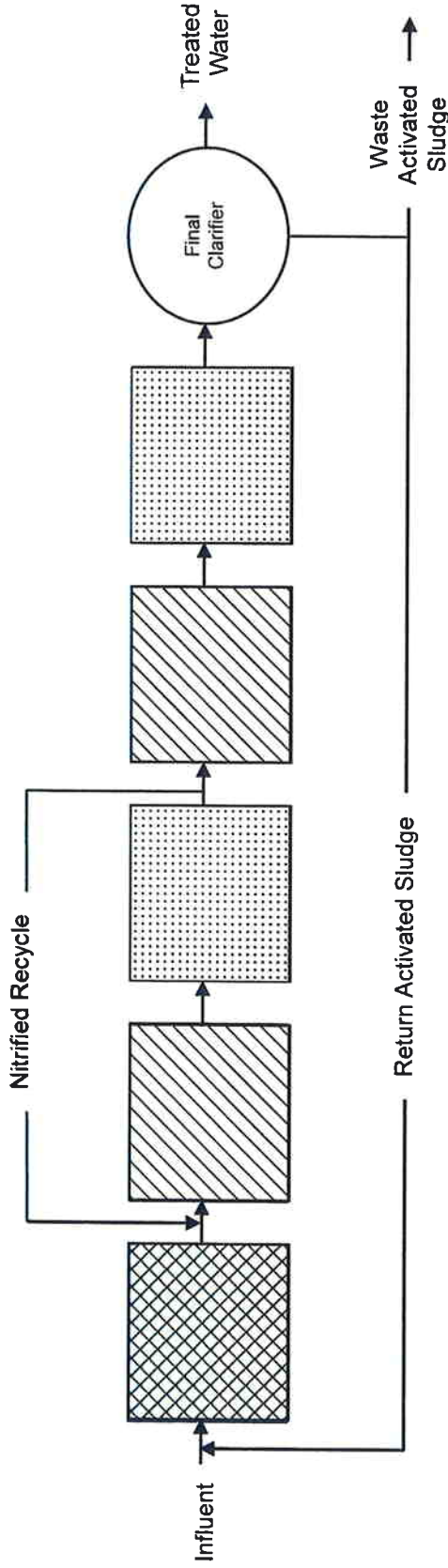
Parcel lines on this map are only graphic representations of Assessor's tax parcels. They are not true property boundaries and do not represent accurate relationships to physical objects on the map such as building locations.

This map is for planning purposes only. It is not adequate for legal boundary determination or regulatory interpretation. This map does not represent an on-the-ground survey.






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Note: The process shown is the 5-stage Bardenpho process. Other examples of multiple-stage processes include the 4-stage Bardenpho, the Modified Ludzack-Ettinger (MLE) Process, UCT, VIP, and A²O Processes, which have variations of the number of compartments and the number and size of recycle. The MLE Process is the most widely used (and is used at the Hyannis WPCF) but others can be used to meet specific requirements.

-  Anaerobic Zone
-  Anoxic Zone
-  Aerobic Zone


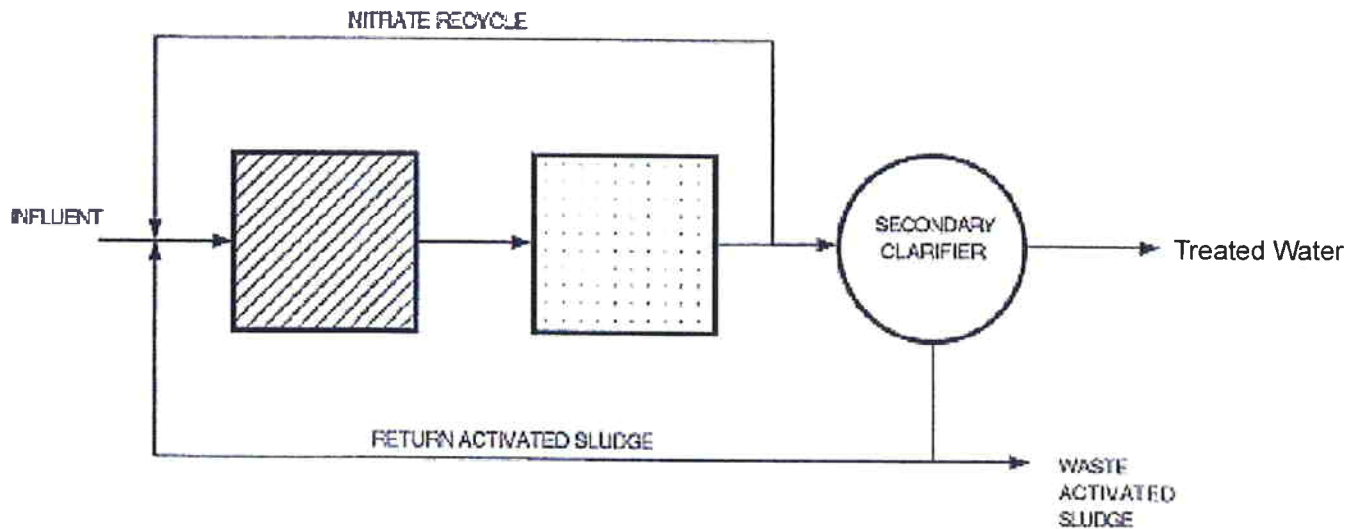
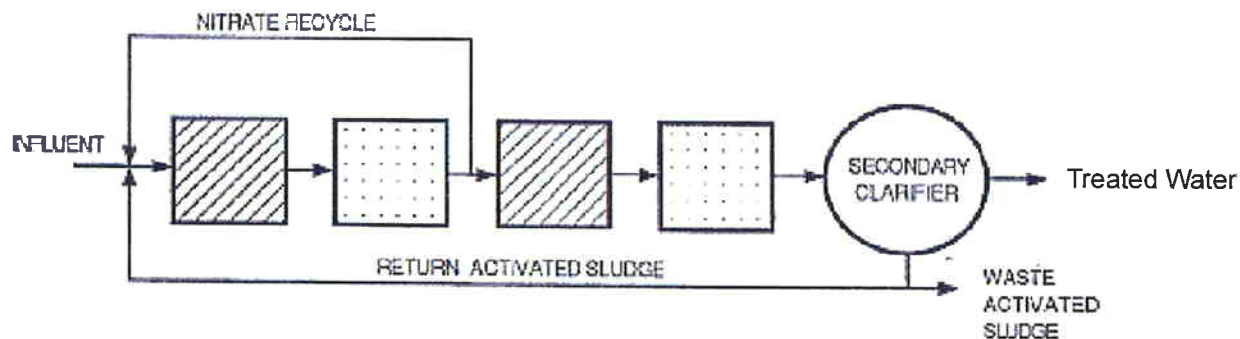
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	Comprehensive Wastewater and Nutrient Management Plan
	Multiple-Stage Process Schematic
Job No.: 861247400	Date: 05/11/2010

FIGURE 4-4

MODIFIED LUDZACK-ETTINGER PROCESS.



4-STAGE BARDENPHO PROCESS



- ANOXIC ZONE
- AEROBIC ZONE



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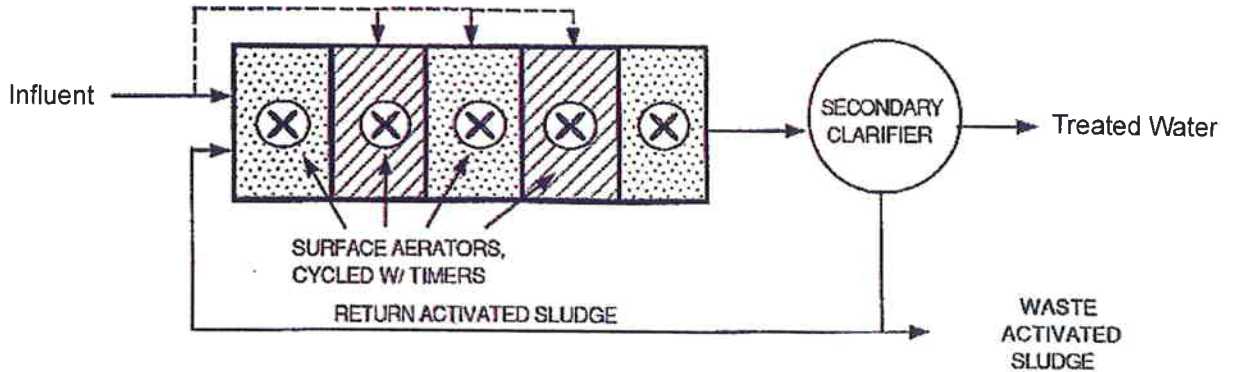
Town of Barnstable, Massachusetts

**Comprehensive Wastewater and
Nutrient Management Plan**

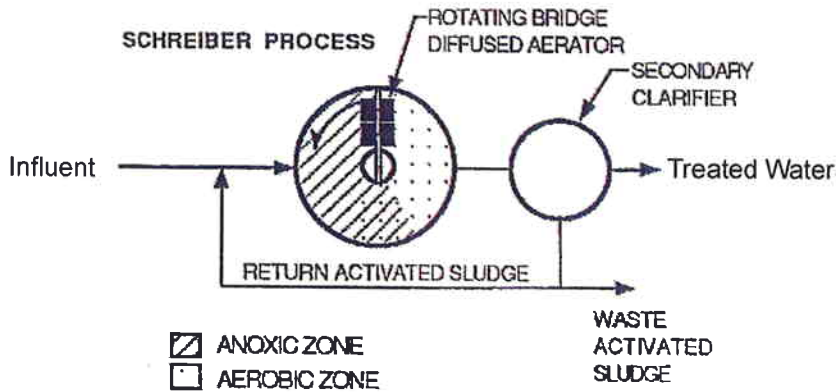
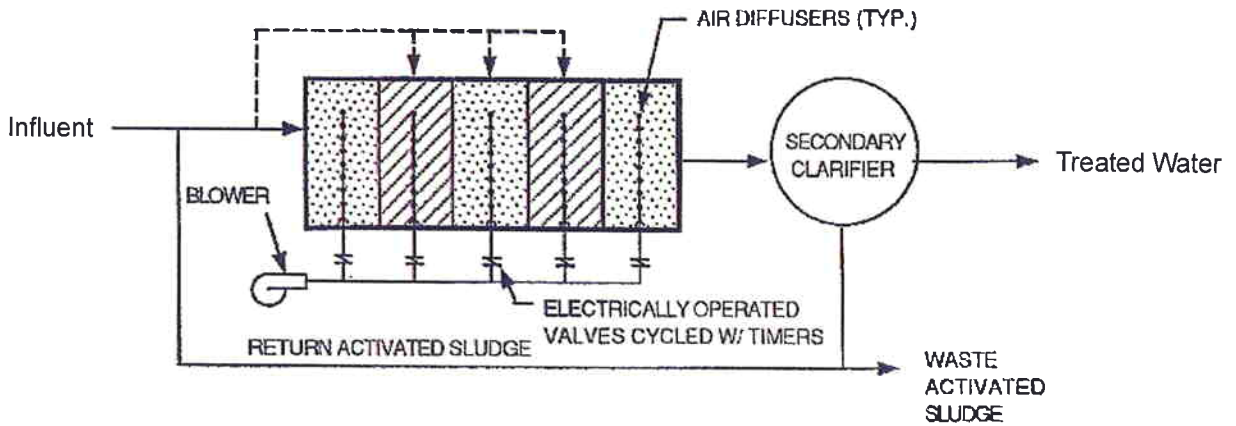
**Multiple-Stage Processes For
Nitrogen Removal**

FIGURE 4-5

CYCLICAL AERATION PROCESS WITH SURFACE AERATION



CYCLICAL AERATION PROCESS WITH DIFFUSED AERATION



HYANNIS, MASSACHUSETTS

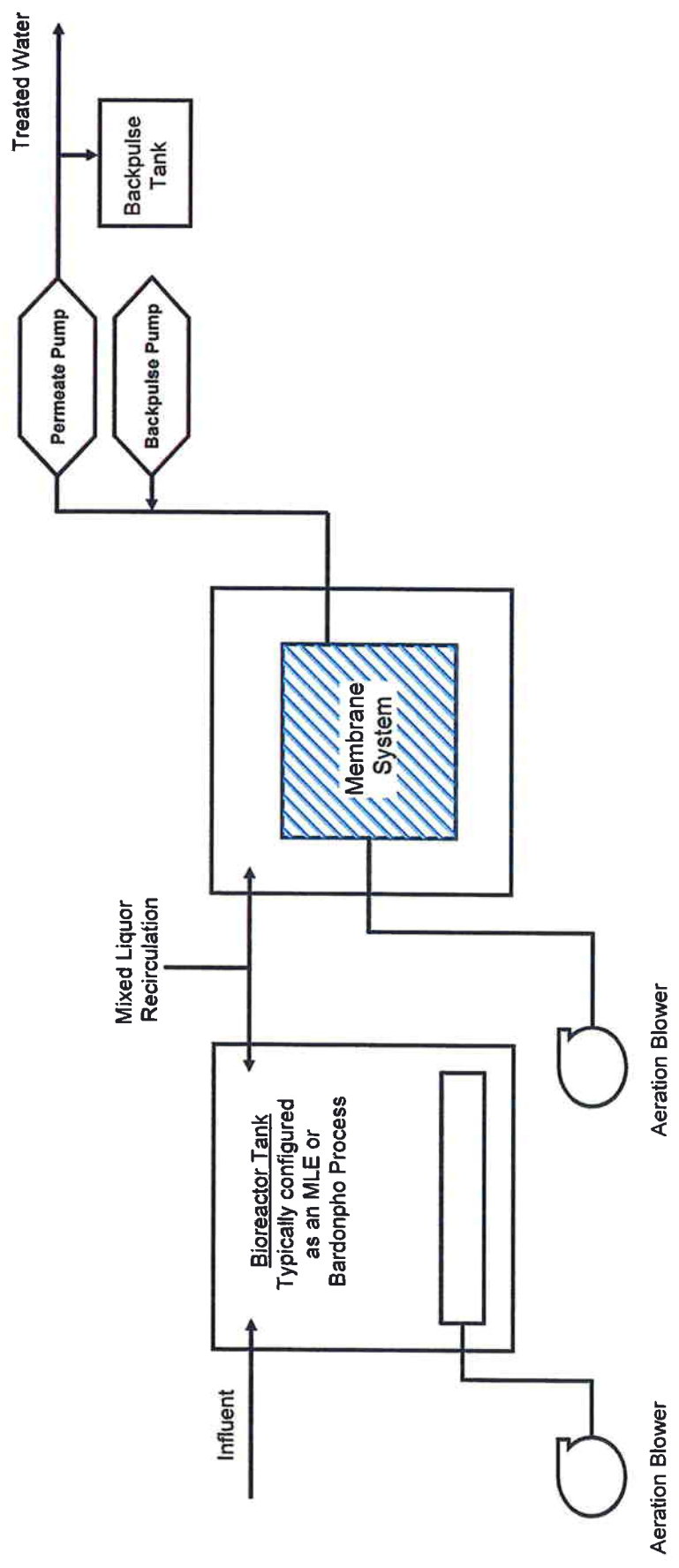
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Town of Barnstable, Massachusetts
**Comprehensive Wastewater and
 Nutrient Management Plan**
Multiple-Stage Cyclical Aeration

FIGURE 4-6




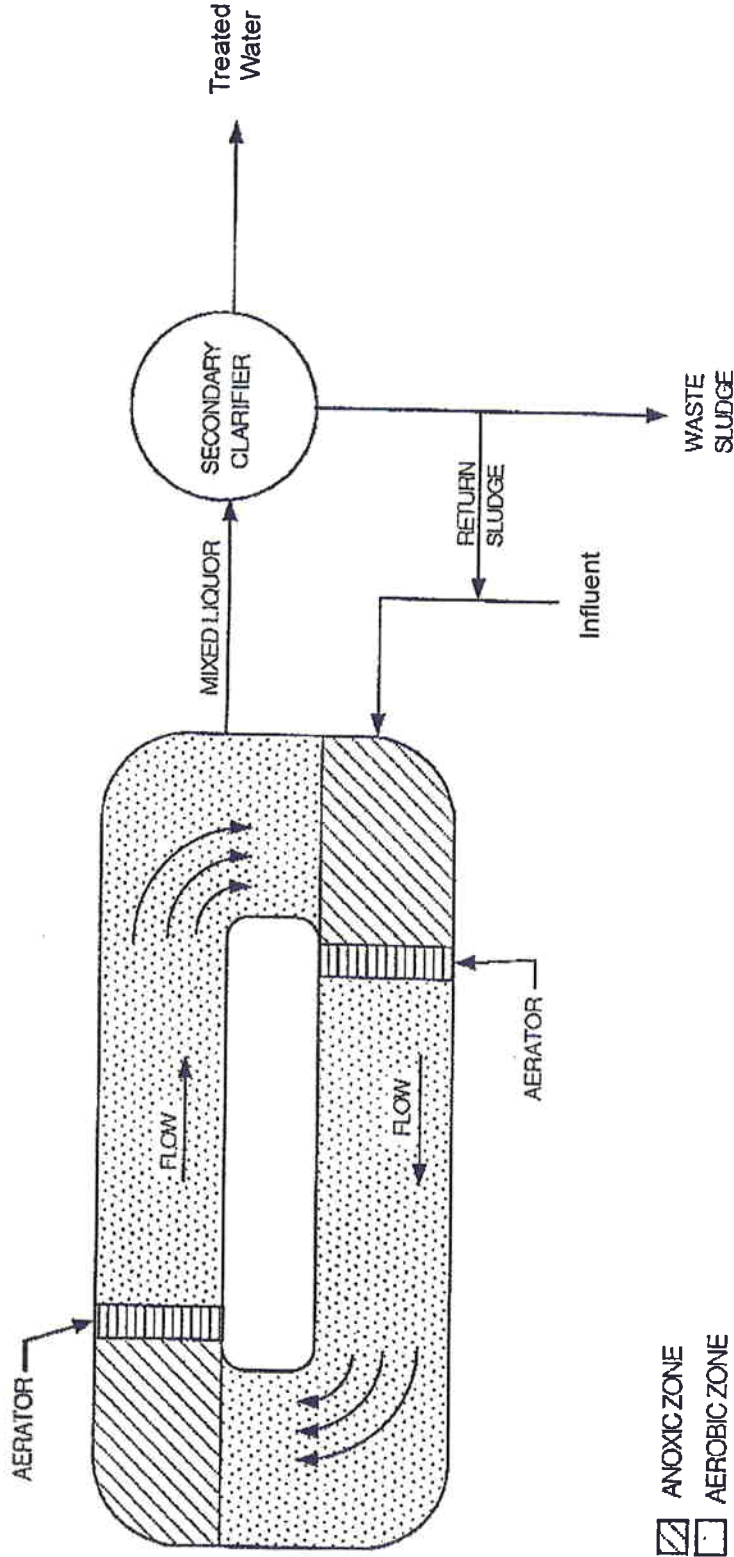
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	Comprehensive Wastewater and Nutrient Management Plan
	Membrane Bioreactor System
Job No.: 861247400	Date: 05/11/2010

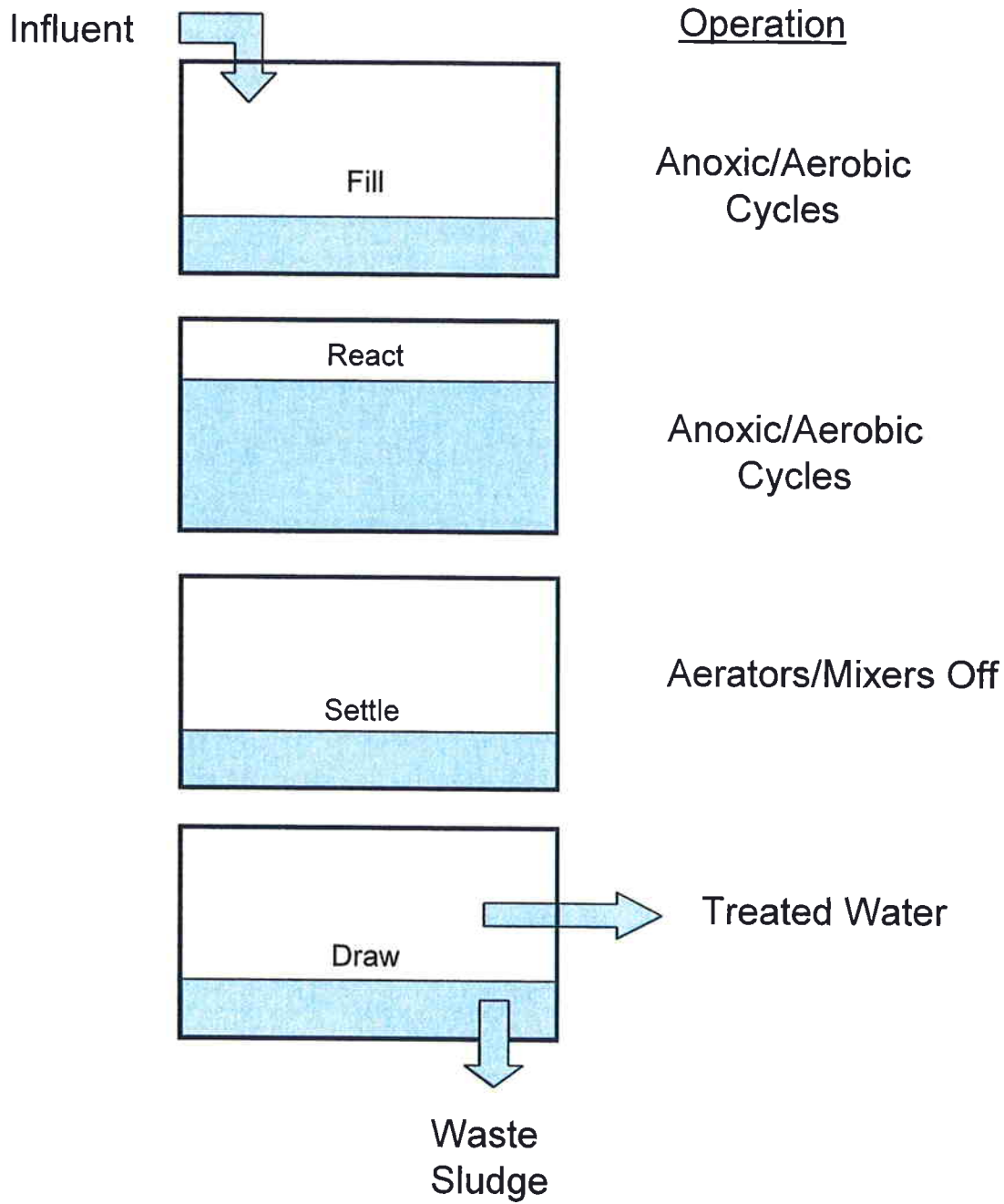
FIGURE 4-7




Town of Barnstable, Massachusetts
 Comprehensive Wastewater and
 Nutrient Management Plan
 Oxidation Ditch
FIGURE 4-8

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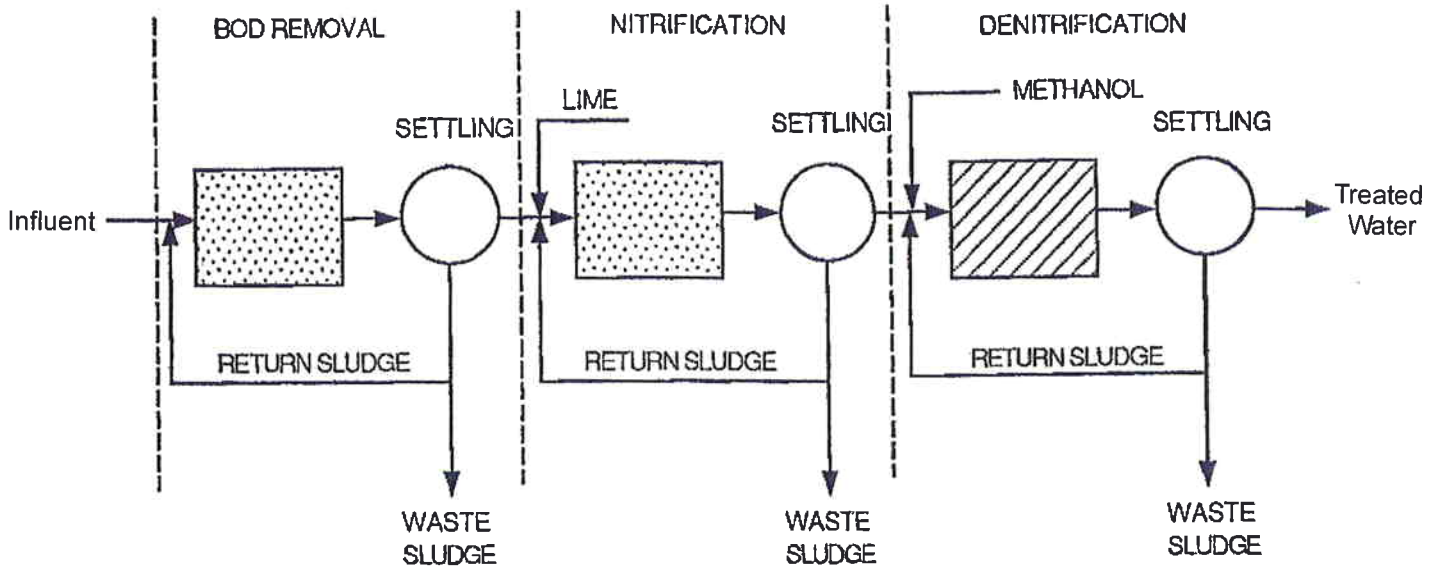
Town of Barnstable, Massachusetts

Comprehensive Wastewater and Nutrient Management Plan

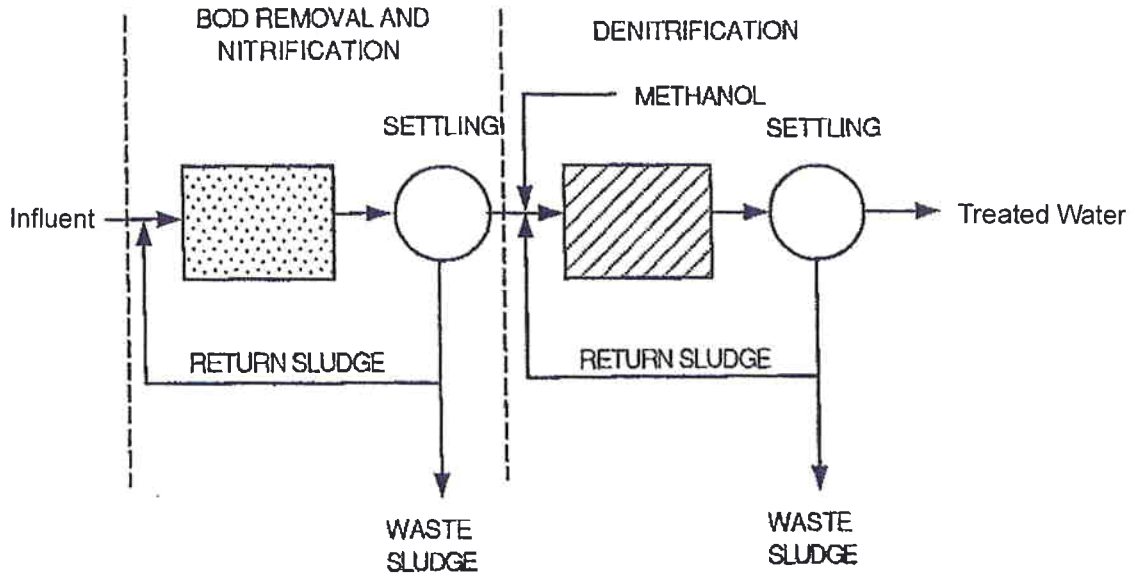
Sequencing Batch Reactor



FIGURE 4-9


THREE - SLUDGE NITRIFICATION/DENITRIFICATION



TWO - SLUDGE NITRIFICATION/DENITRIFICATION



 ANOXIC ZONE
 AEROBIC ZONE

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	Comprehensive Wastewater and Nutrient Management Plan
	Multiple Sludge Processes
	FIGURE 4-10
Job No.: 861247400 Date: 05/11/2010	

Aerobic RBC for BOD Removal and Nitrification

Methanol or Organic Carbon Feed

Anoxic RBC for Nitrogen Removal

Primary Effluent

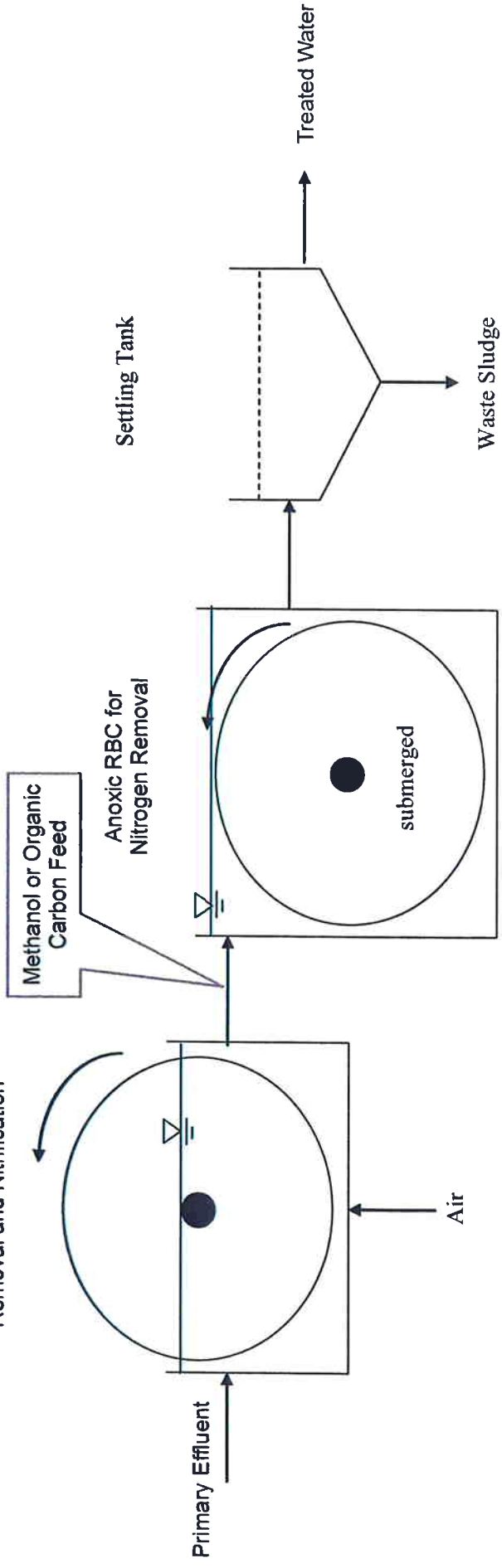
Air

submerged

Settling Tank

Treated Water

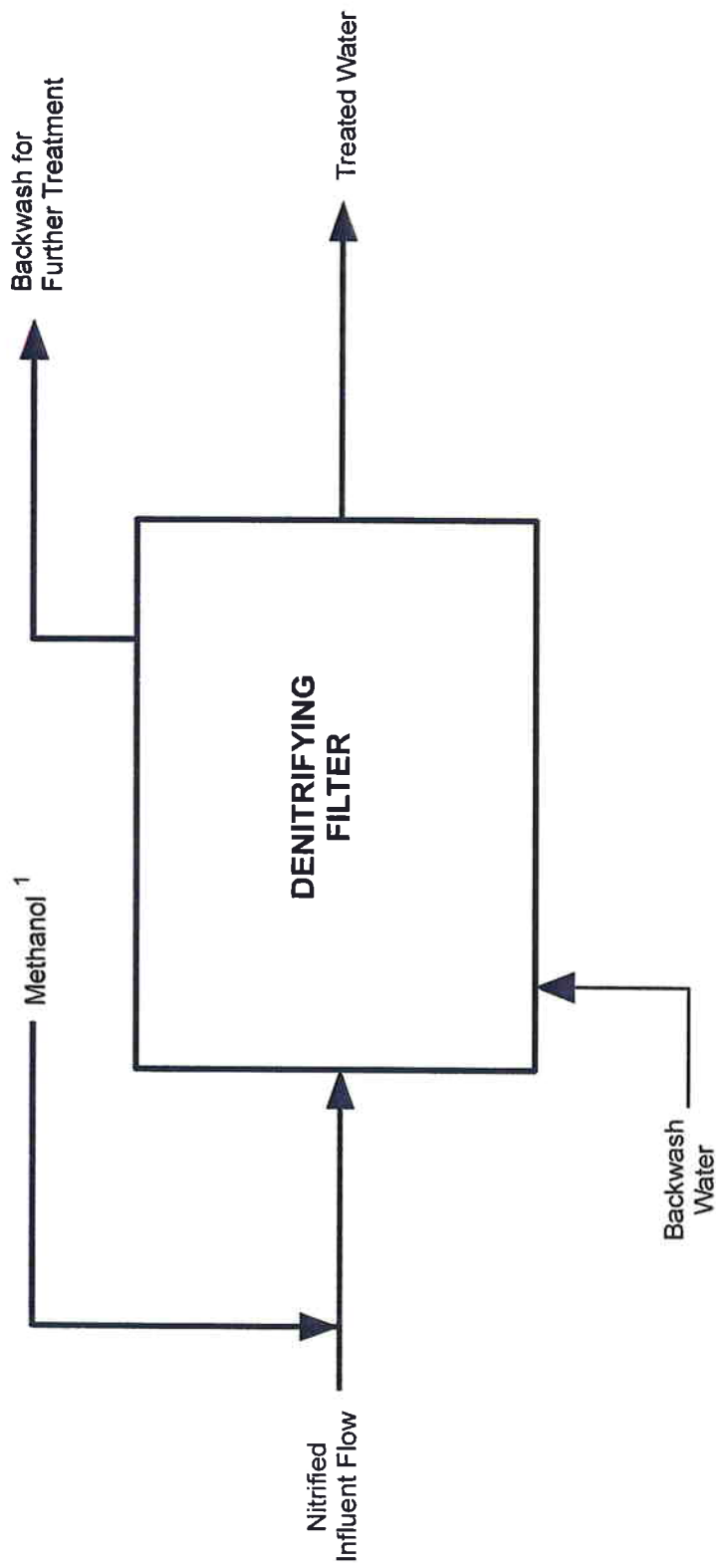
Waste Sludge




Town of Barnstable, Massachusetts
Comprehensive Wastewater and
Nutrient Management Plan
Rotating Biological Contactor
FIGURE 4-11

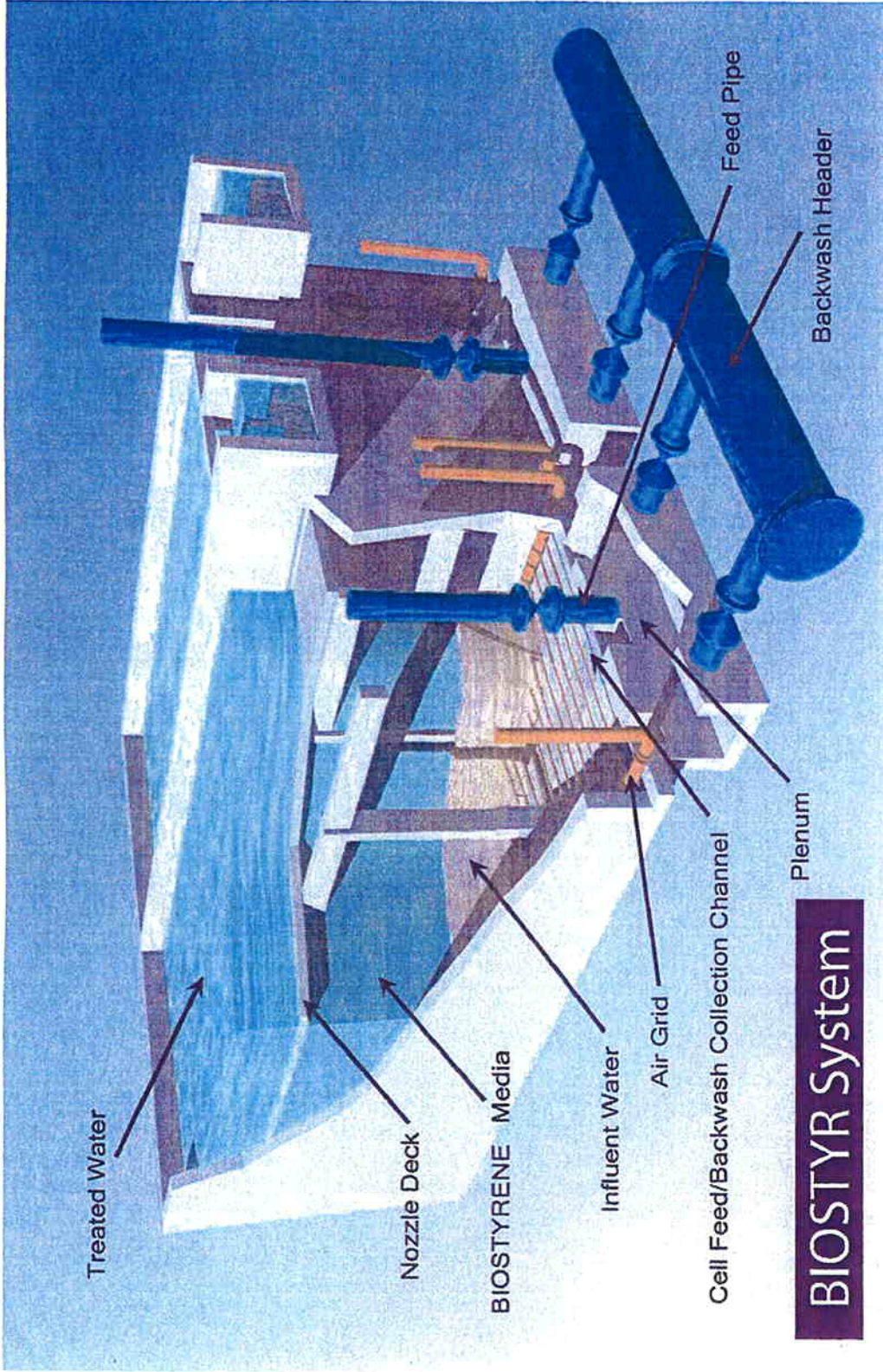
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¹ Methanol addition is not needed for wood chip bed filters

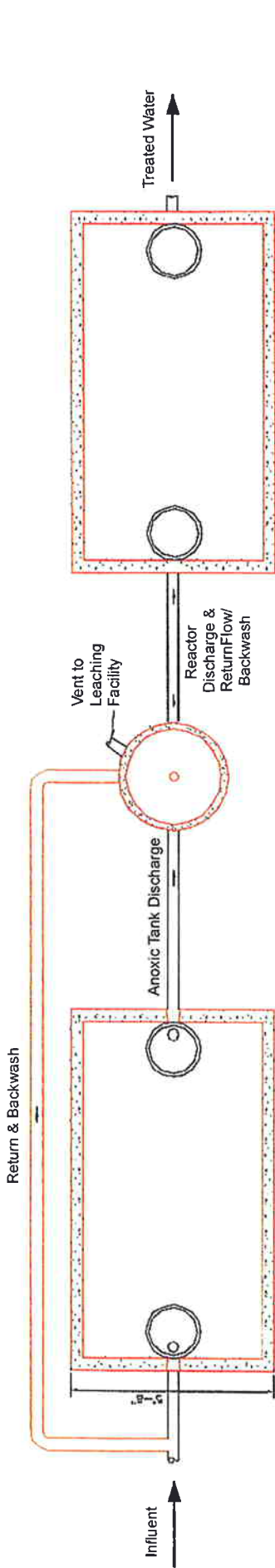
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	Comprehensive Wastewater and Nutrient Management Plan
Denitrifying Filter	
FIGURE 4-12	
Job No.: 861247400	Date: 05/11/2010



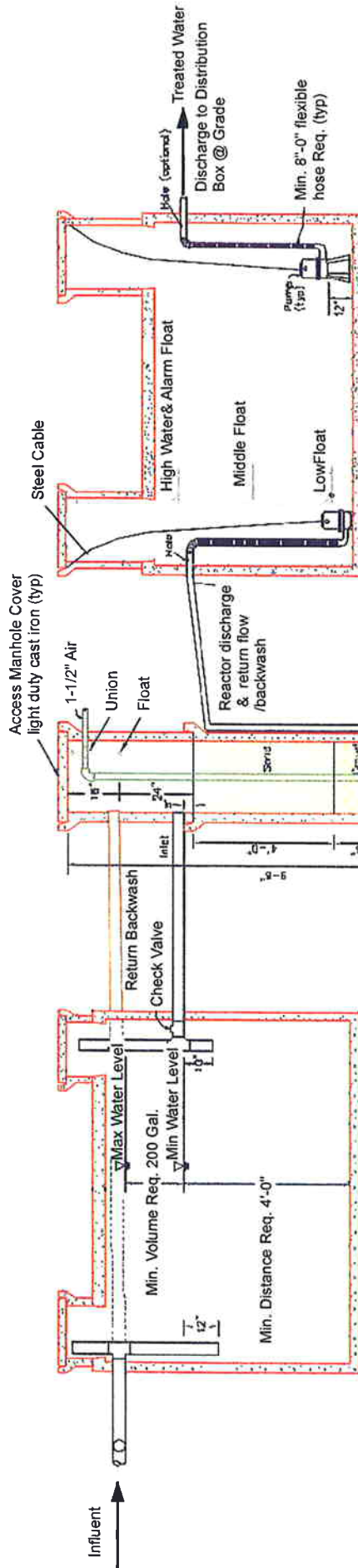
BIOSTYR System

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Job No.: 861247400 Date: 05/11/2010	

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Plan View



2000 Gallon Anoxic Tank

1000 Gallon Clear Well Tank

Amphidrome Reactor

Profile View

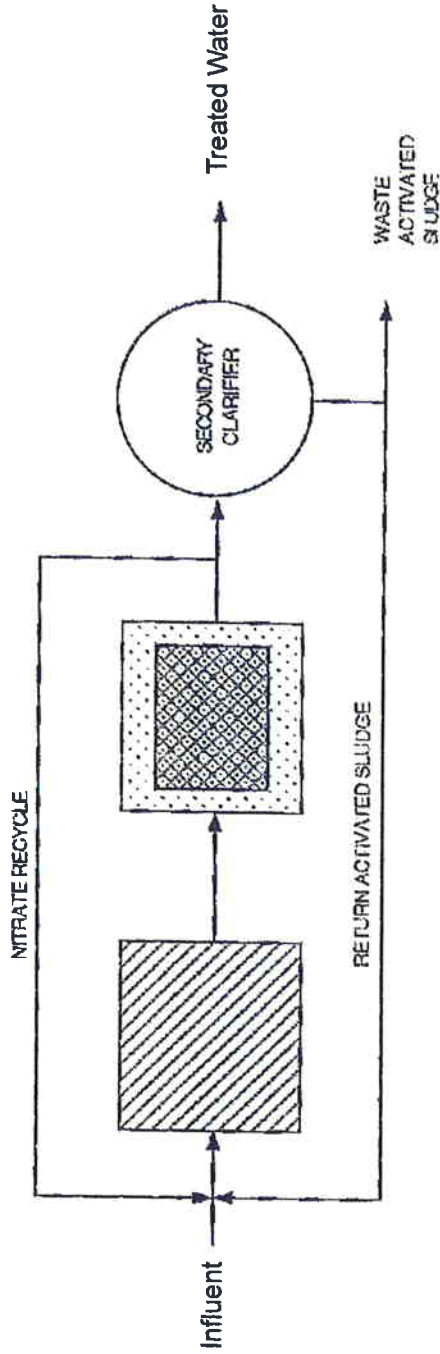
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Town of Barnstable, Massachusetts
 Comprehensive Wastewater and
 Nutrient Management Plan

Amphidrome System

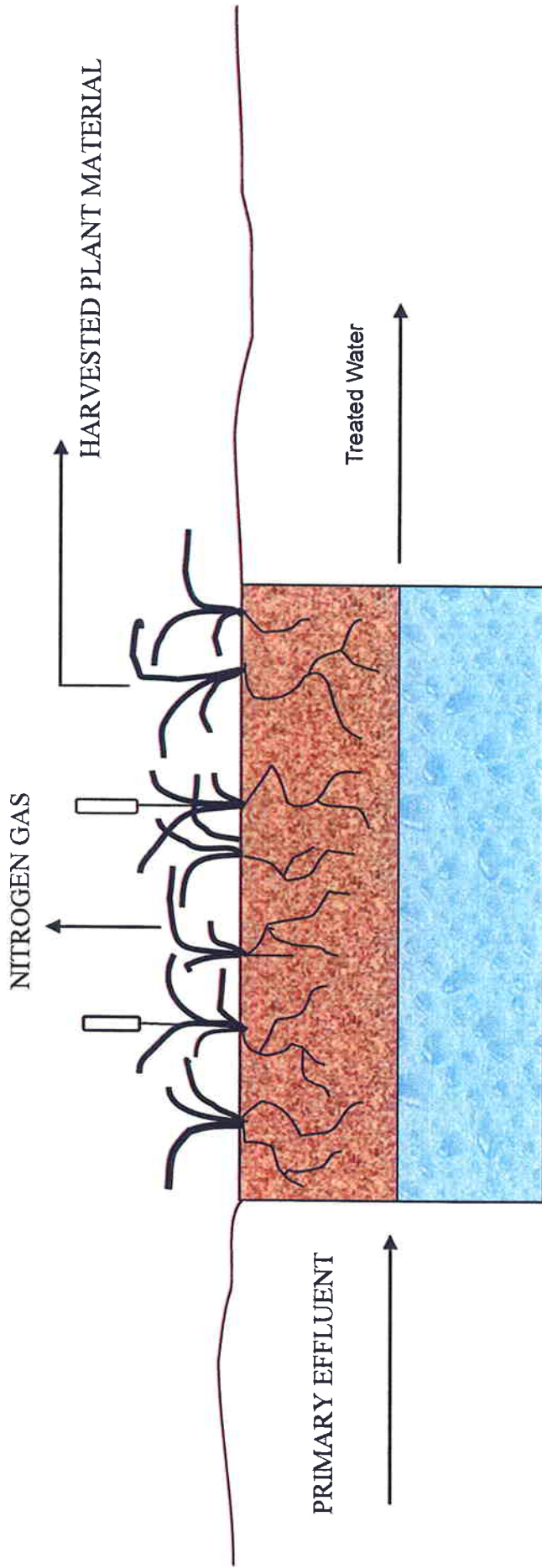
FIGURE 4-14



NOTE: THE PROCESS SHOWN IS THE MODIFIED LUDZACK ETTINGER (MLE) PROCESS CONTAINING FIXED FILM MEDIA IMMERSSED IN THE AEROBIC ZONE TO ENHANCE NITRIFICATION. THE FIXED FILM MEDIA COULD ALSO BE IMMERSSED IN THE AEROBIC ZONE(S) OF MULTIPLE SLUDGE PROCESS.

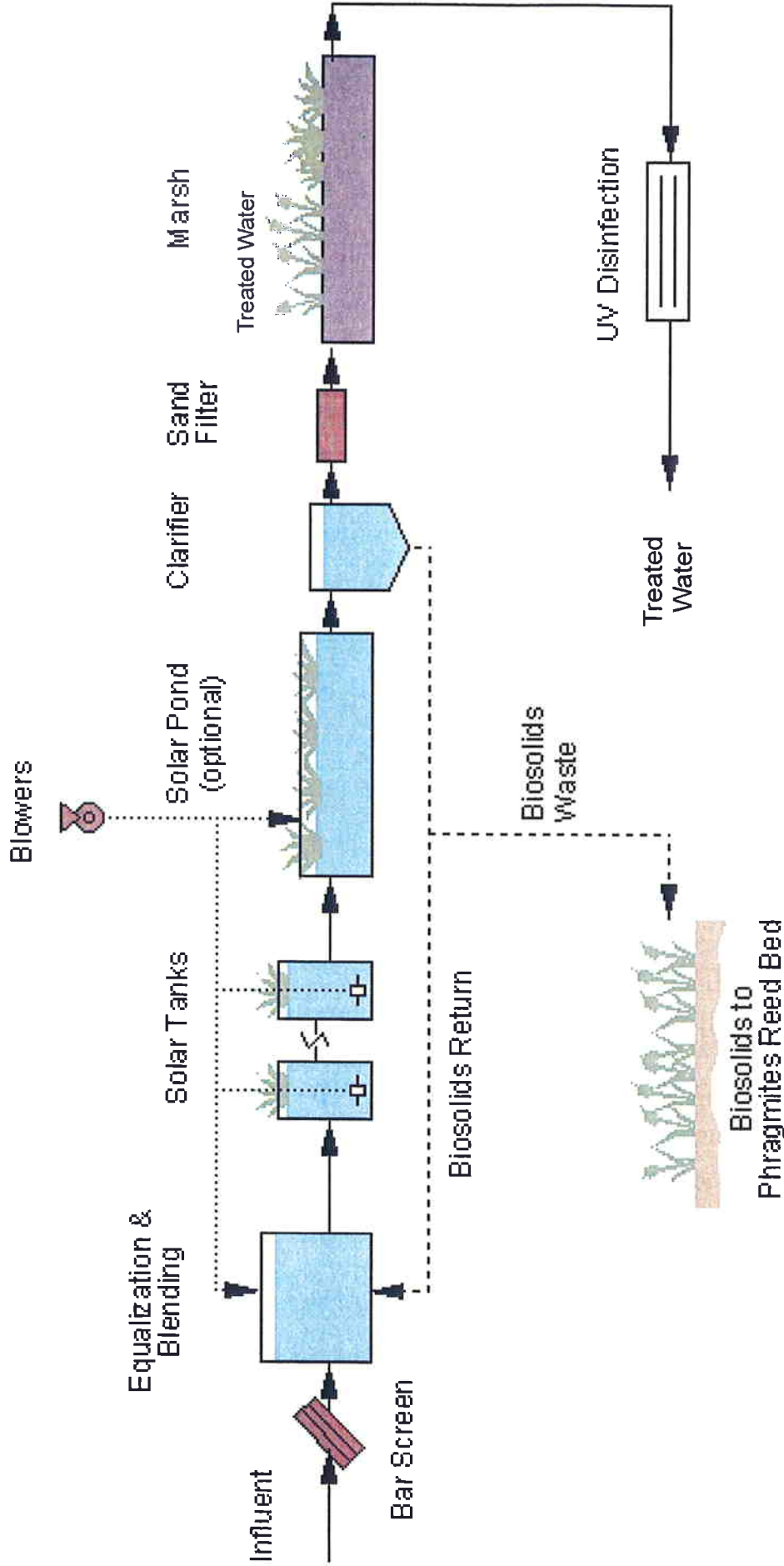
-  ANOXIC ZONE
-  AEROBIC ZONE
-  FIXED FILM MEDIA

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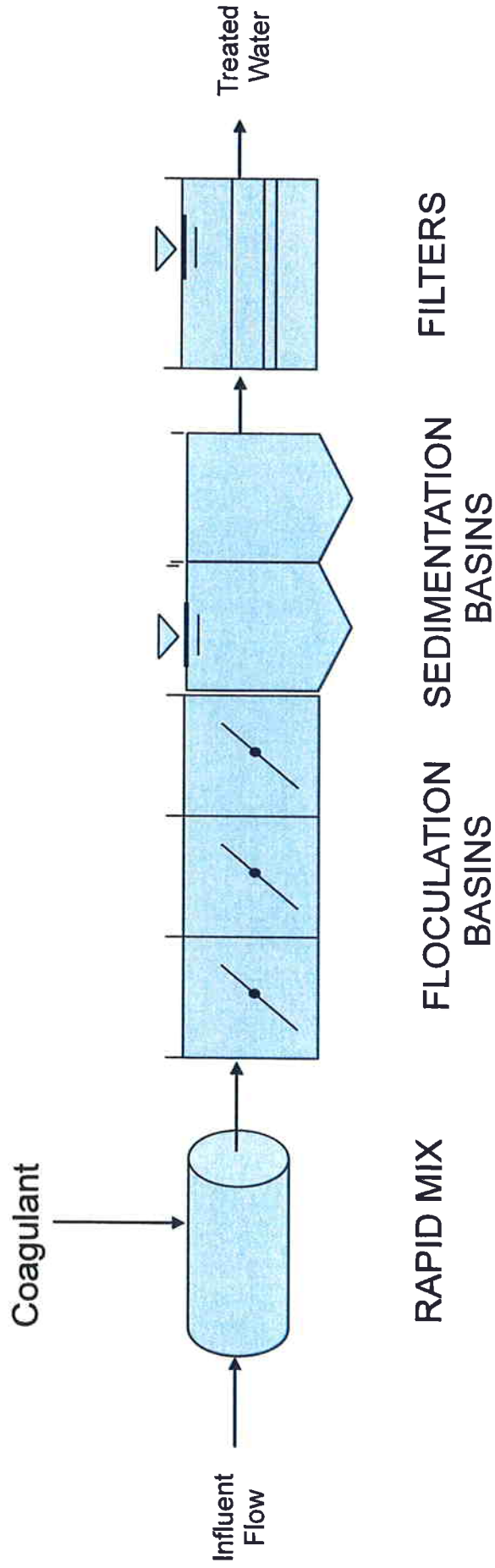
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Town of Barnstable, Massachusetts
 Comprehensive Wastewater And
 Nutrient Management Plan
 Solar Aquatics System
FIGURE 4-17

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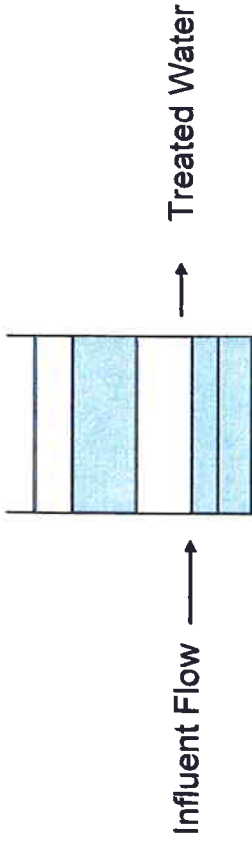
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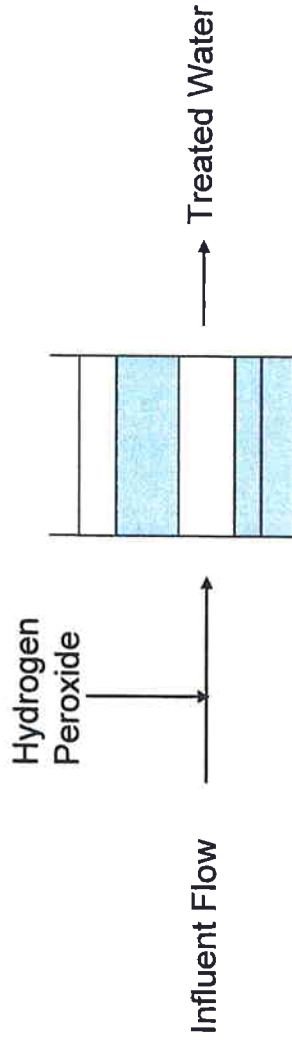
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Granular Activated Carbon (GAC)

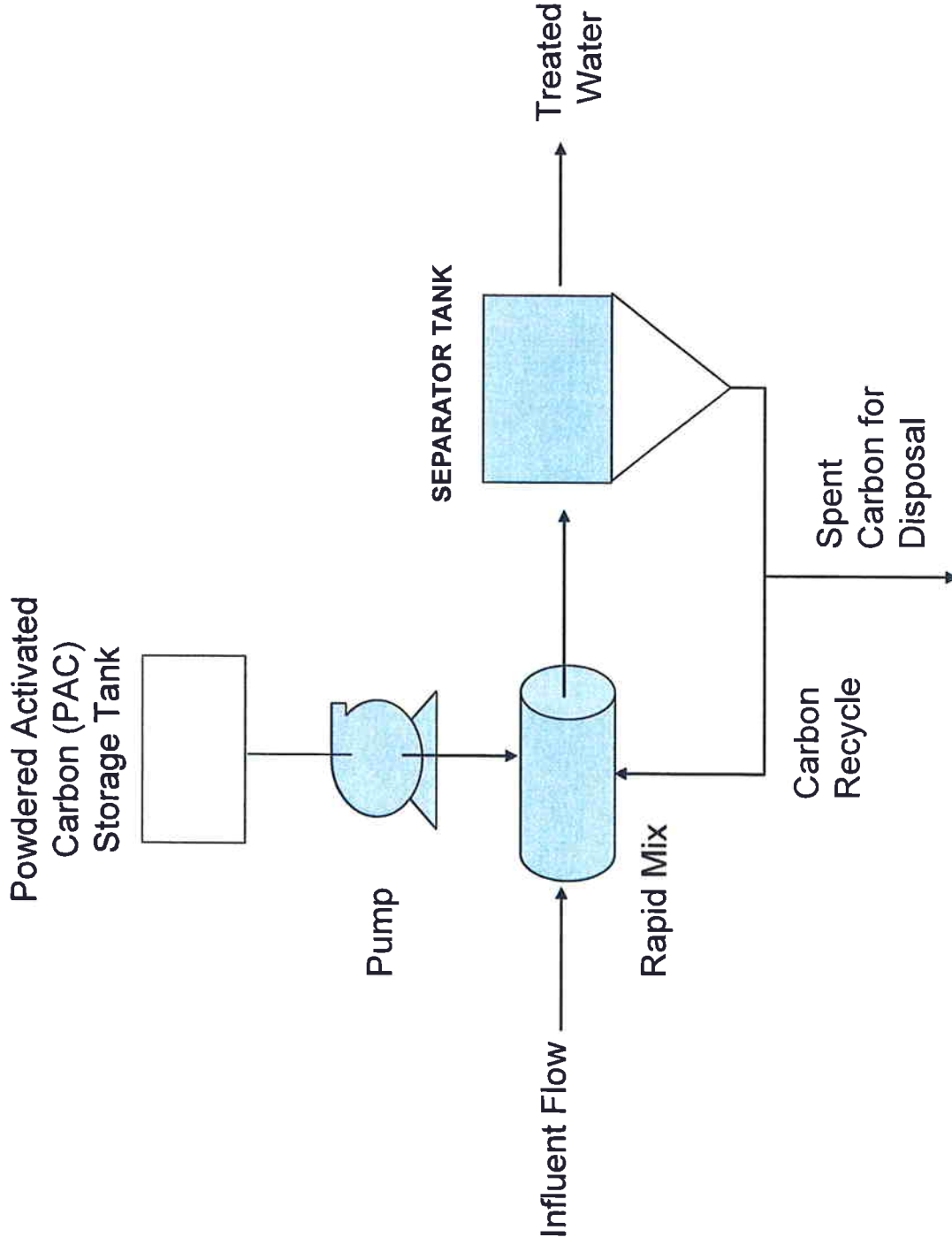


Biological Activated Carbon (BAC)



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Town of Barnstable, Massachusetts
Comprehensive Wastewater and
Nutrient Management Plan
Activated Carbon Contactors
FIGURE 4-19



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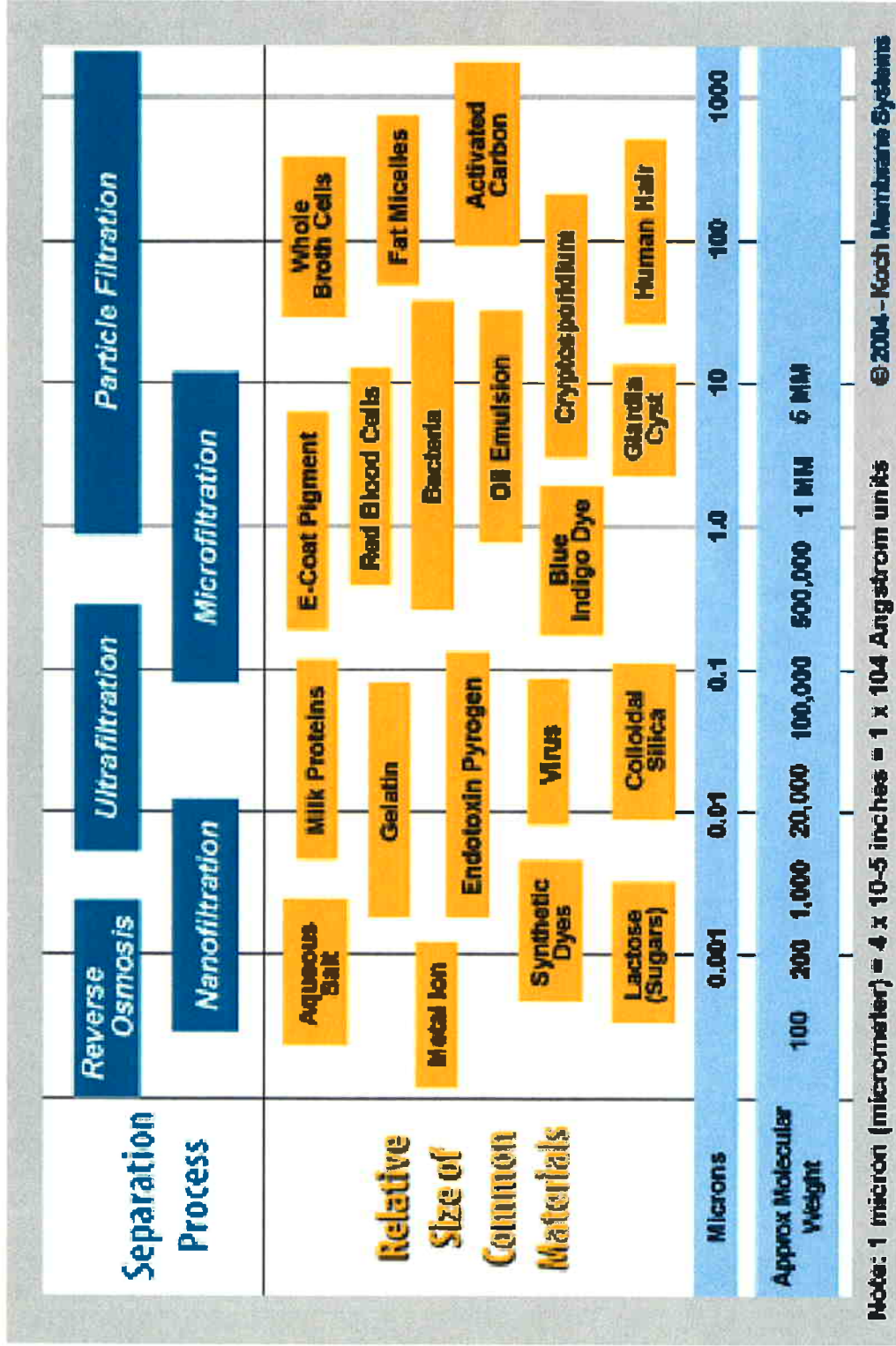


Image Source: Koch Membrane Systems
<http://www.kochmembrane.com>

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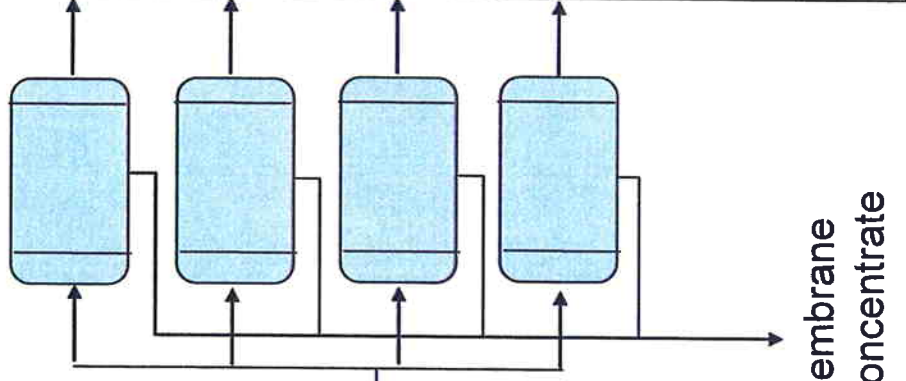
166 Plymouth Road
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Town of Barnstable, Massachusetts
 Comprehensive Wastewater and
 Nutrient Management Plan
 Relative Pore Size of the
 Membrane Filtration Processes

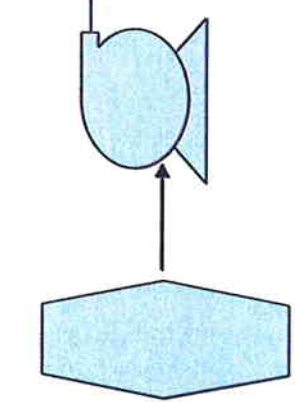
FIGURE 4-21

**MEMBRANE
MODULES**



Pretreatment
Chemicals

Treated
Wastewater
Effluent



**FILTERS
(5-10 um)**

PUMP

**Membrane
Concentrate**

Treated Water

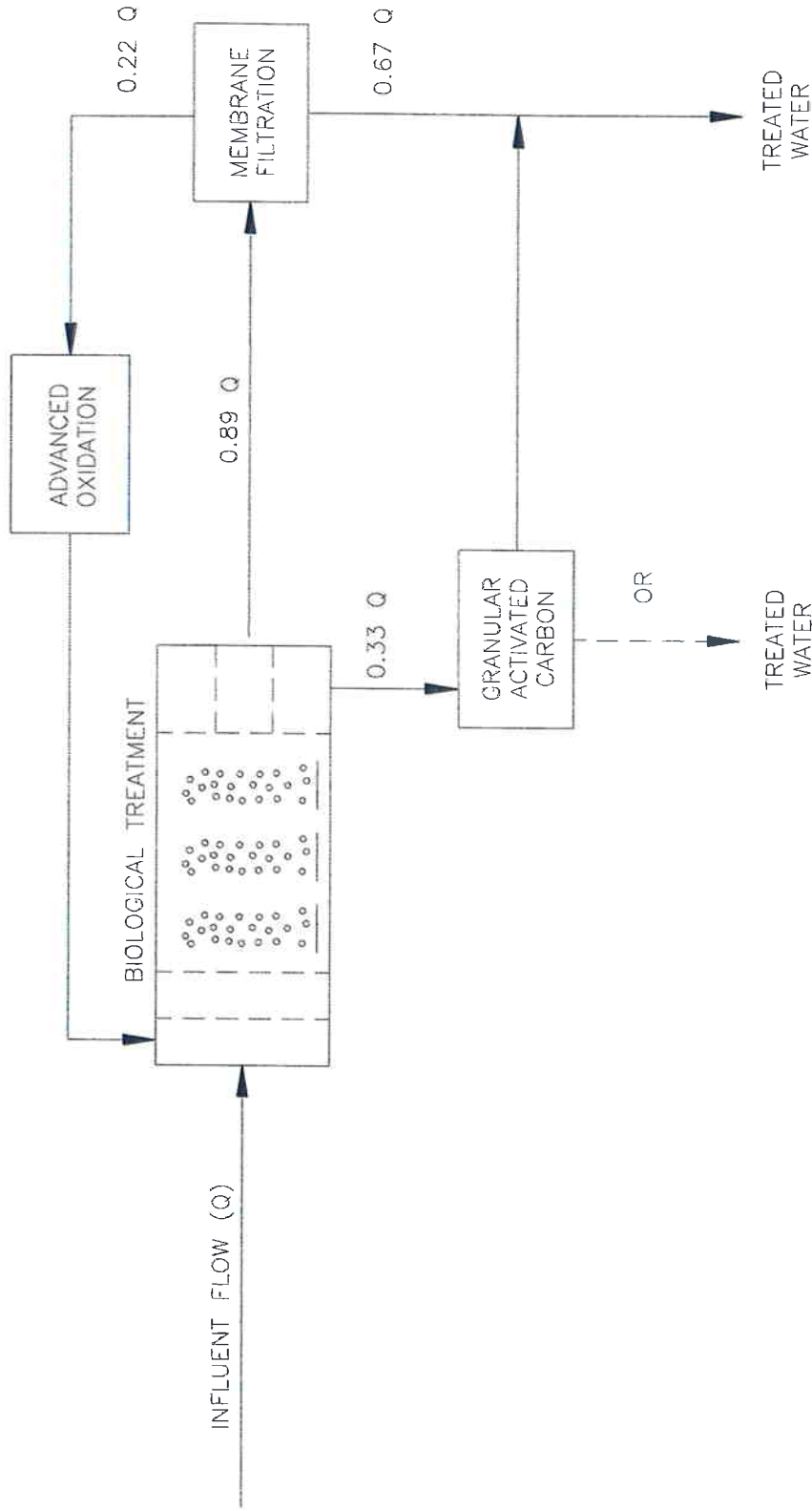
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**Comprehensive Wastewater and
Nutrient Management Plan**
Membrane Filtration

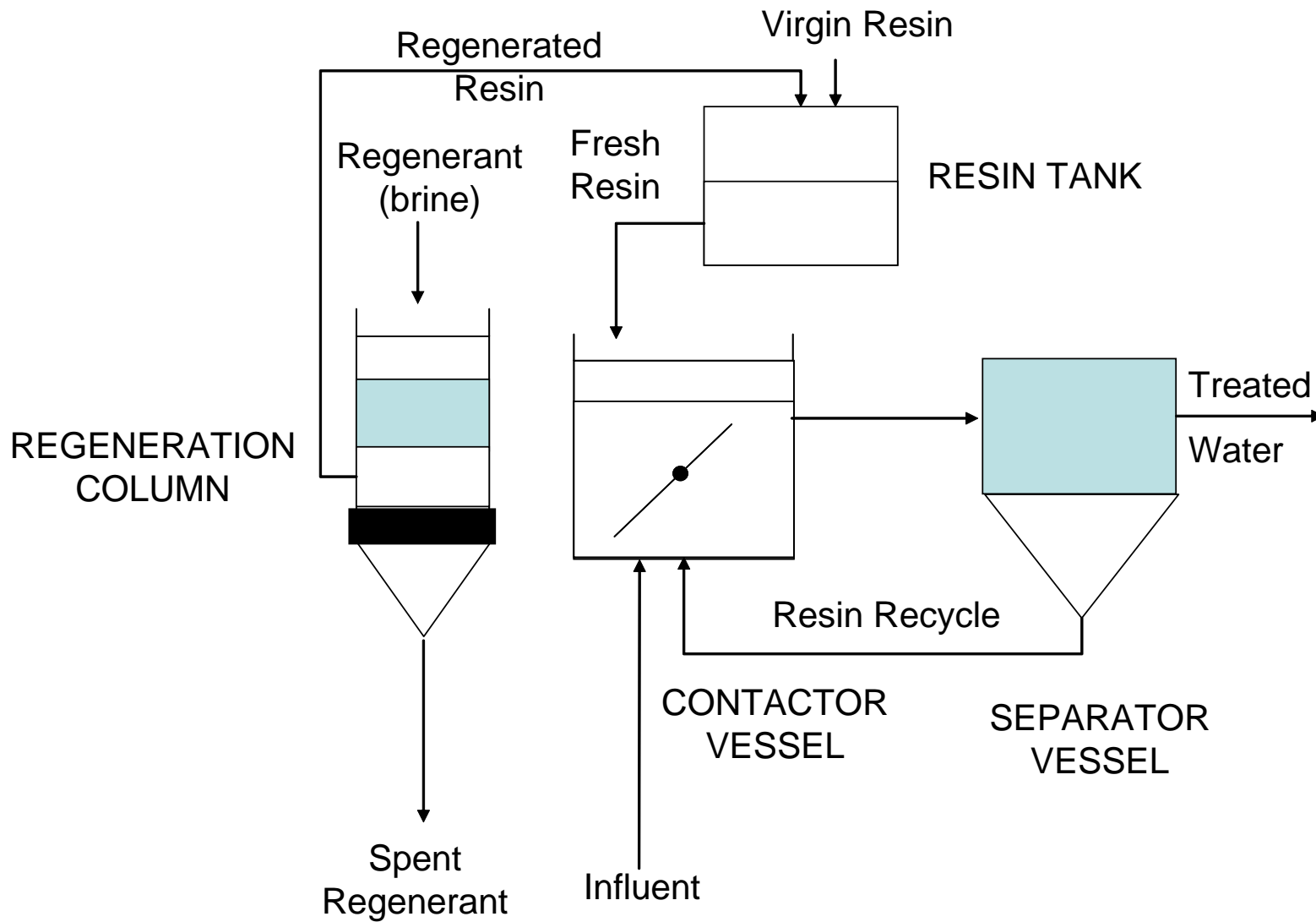
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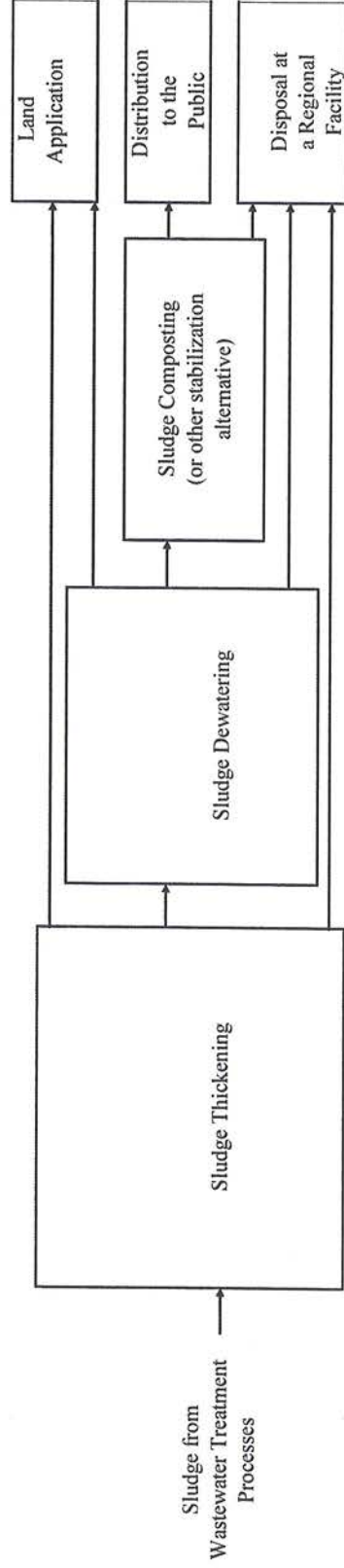
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FIGURE 4-22

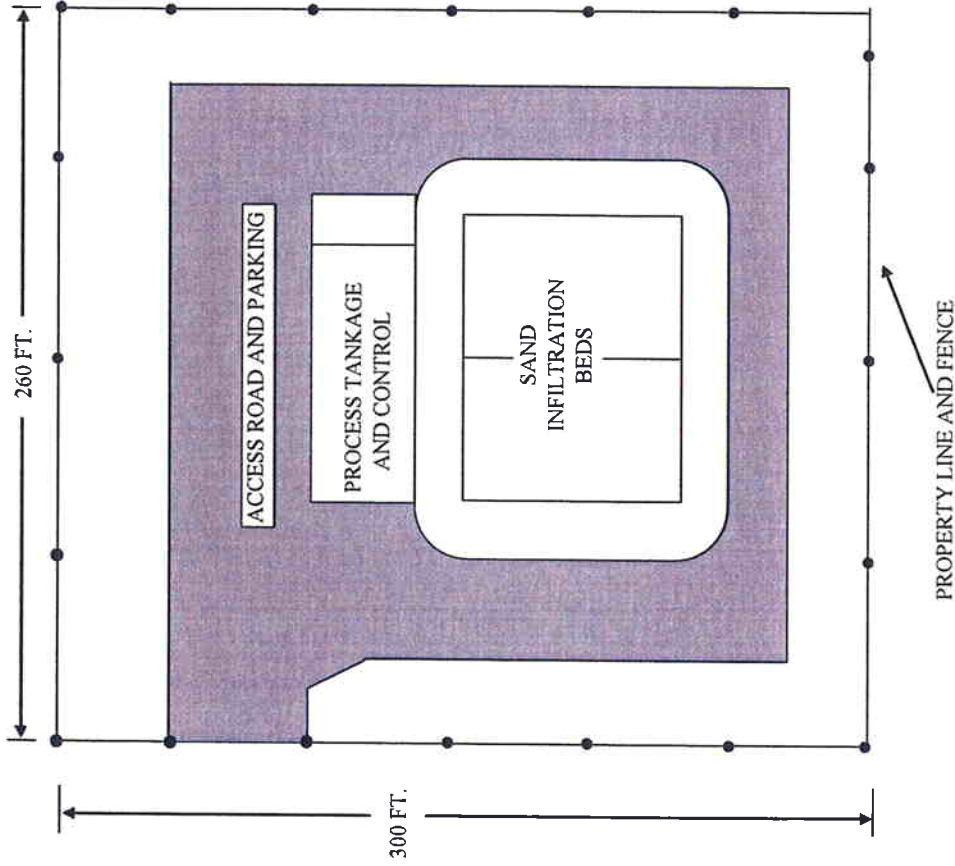


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	Comprehensive Wastewater and Nutrient Management Plan
	Sludge Processing and Disposal Alternatives
Job No.: 861247400 Date: 05/11/2010	FIGURE 4-25

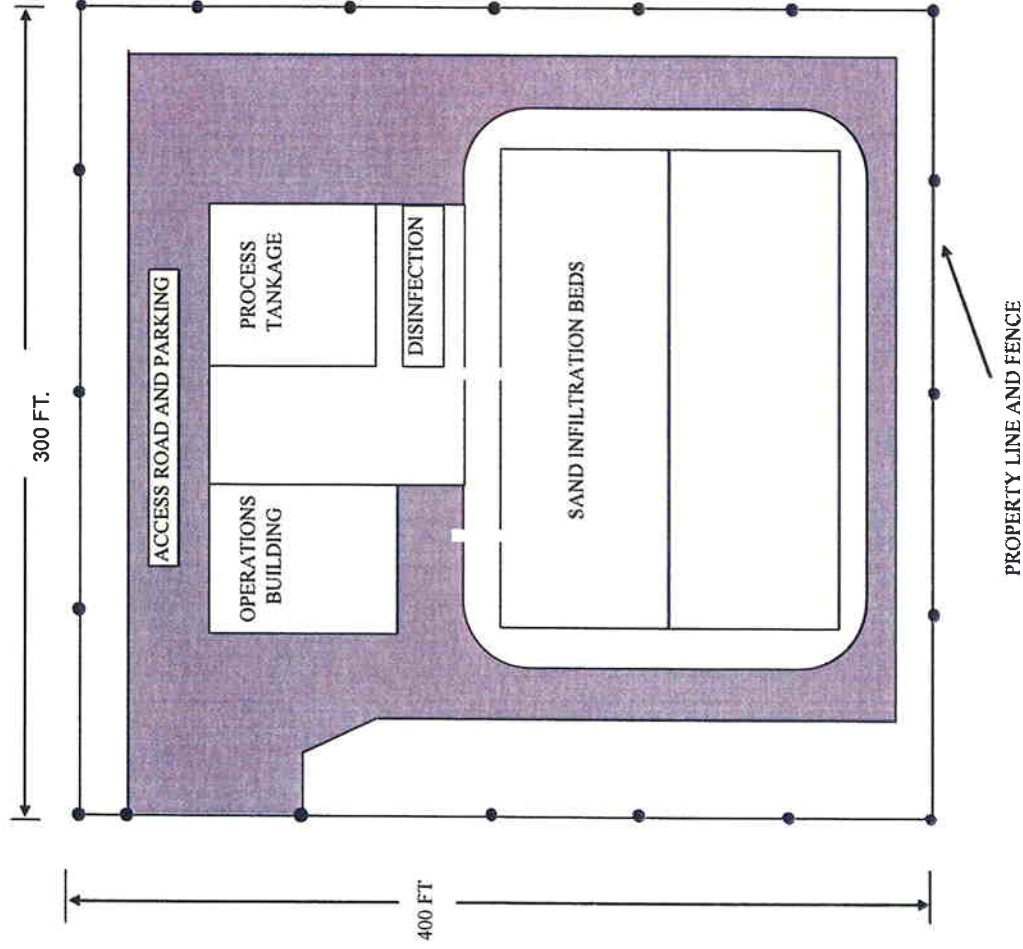


Note:

1. Total area is approximately 78,000 sq. ft. or 1.8 acres.

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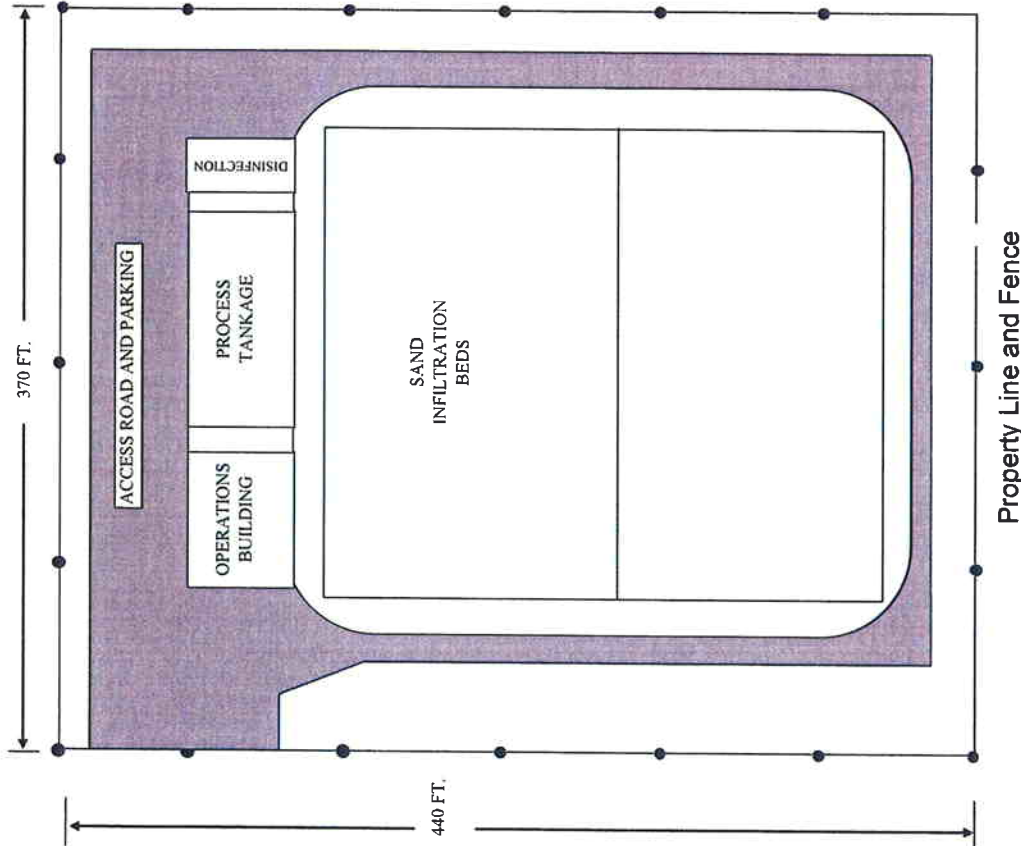
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Note:
Total area is approximately 120,000 sq.ft. or 2.8 acres

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Town of Barnstable, Massachusetts
Nutrient Management Plan
Example Layout for 35,000 GPD Small Sewage Treatment Facility
FIGURE 4-27



Note:
Total area is approximately 163,000 sq.ft. or 3.7 acres

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	Job No.: 861247400 Date: 05/11/2010	Example Layout for 110,000 GPD Small Sewage Treatment Facility

New Silver Beach WWTF
North Falmouth, MA



Soccer Field with
Subsurface Leaching Beds



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Date: 5/2010 Project No. 8612474

TOWN OF BARNSTABLE

**Comprehensive Wastewater and
Nutrient Management Plan**

**Satellite WWTF at New Silver Beach
North Falmouth, MA**

FIGURE 4-29

Private WWTF at Cotuit Landing



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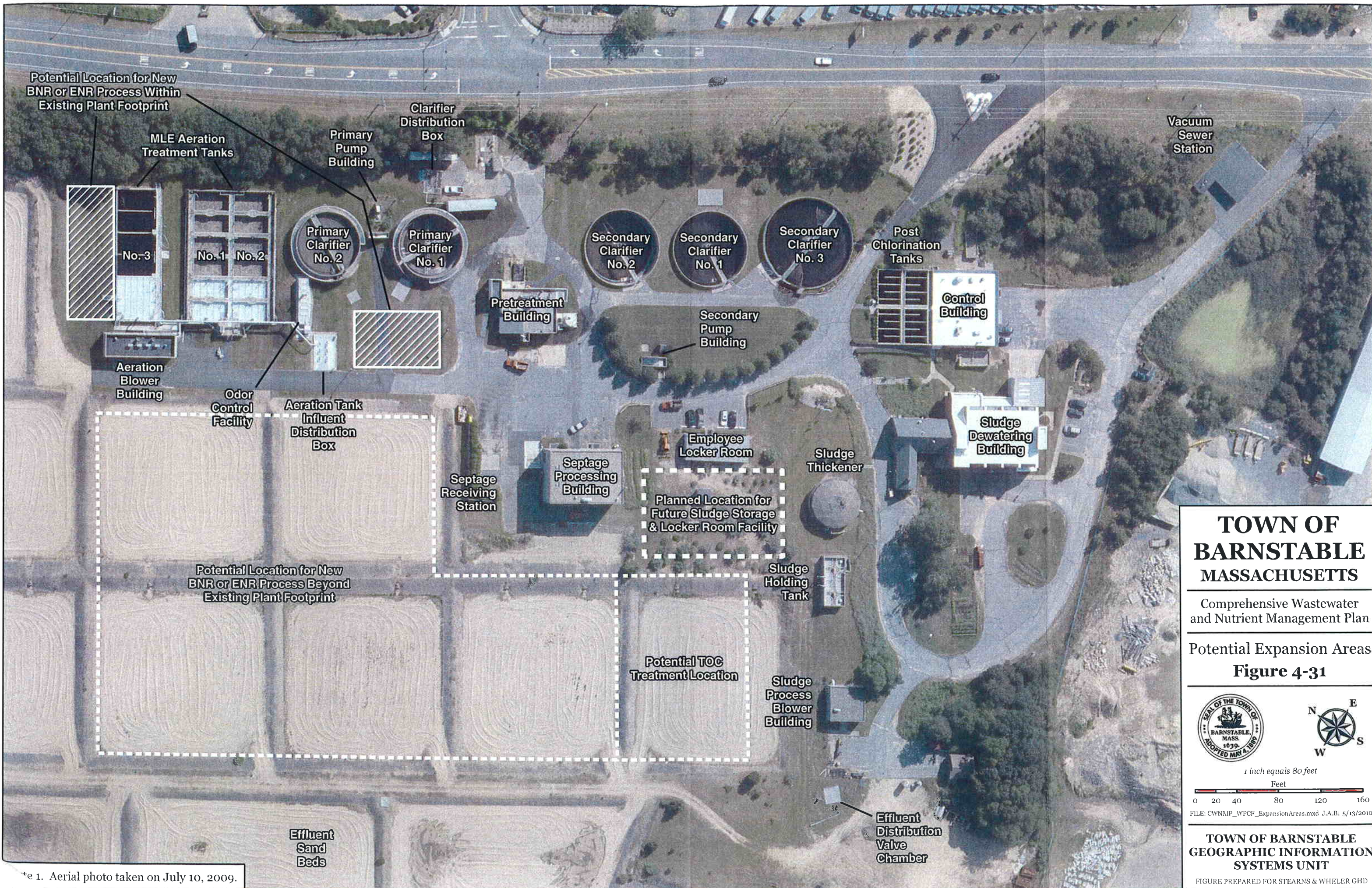
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TOWN OF BARNSTABLE
Comprehensive Wastewater and
Nutrient Management Plan

Private WWTF at Cotuit
Landing Stop & Shop

FIGURE 4-30



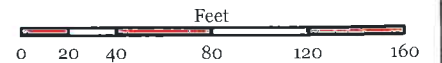
TOWN OF BARNSTABLE MASSACHUSETTS

Comprehensive Wastewater and Nutrient Management Plan

Potential Expansion Areas
Figure 4-31



1 inch equals 80 feet

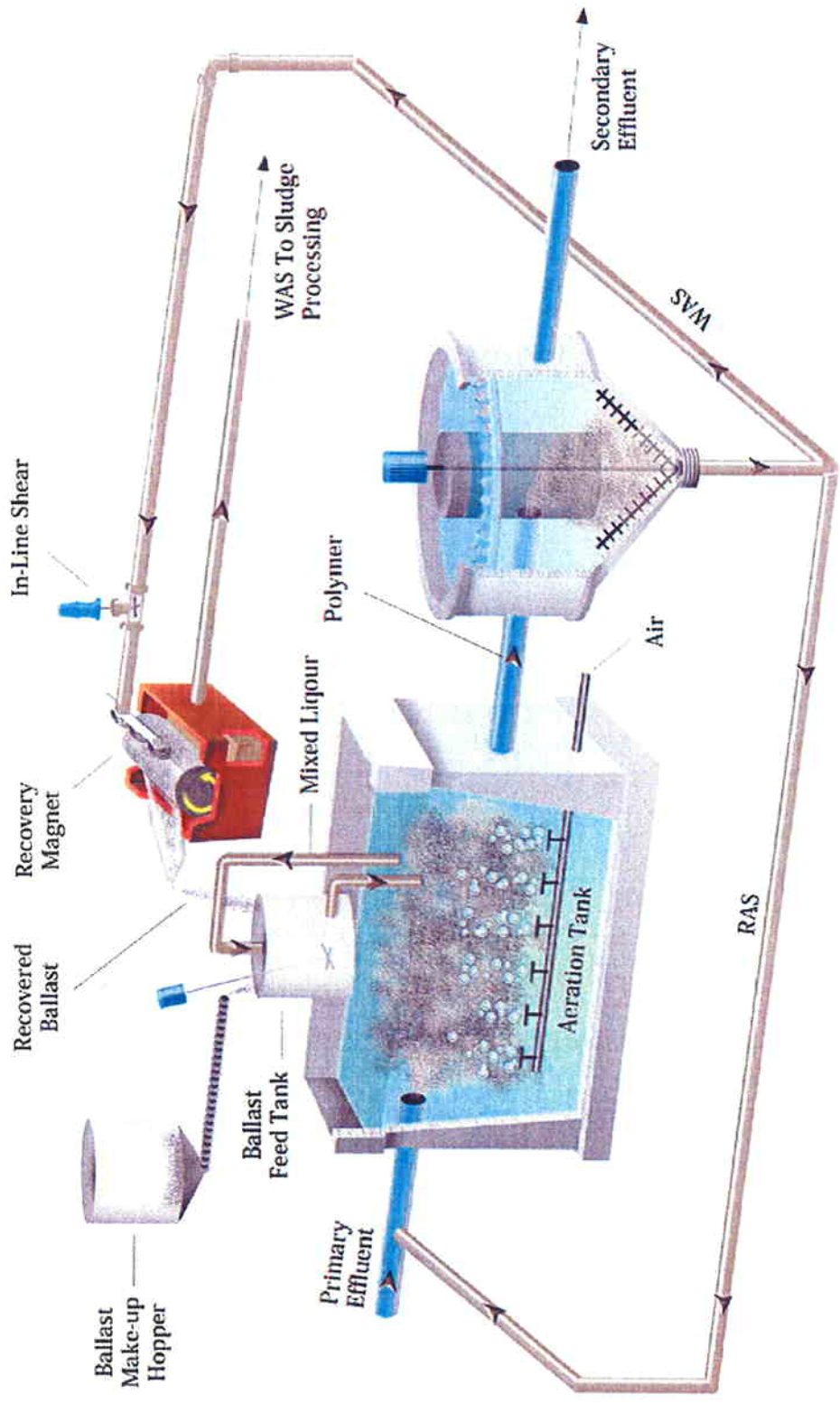


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FIGURE PREPARED FOR STEARNS & WHEELER GHD

*e 1. Aerial photo taken on July 10, 2009.



Location: F:\Jobs\80000861247400 Barnstable
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	Biomag Process FIGURE 4-32
Job No.: 861247400 Date: 05/11/2010	