Town of Belchertown

Water Reclamation Facility Plant Tour

New England Water Environment Association - Spring Meeting

June 5, 2001

Existing WWTP Site

Town of Belchertown

WATER RECLAMATION FACILITY UPGRADE AND EXPANSION PROJECT

Acknowledgments

Federal Officials

United States Congress:	Congressman John Olver
Environmental Protection Agency:	Brian Pitt

State Officials

State House of Representatives:	Representative Patrick F. Landers III Representative Thomas Petrolati
State Senate:	Senator Steven Brewer
Department of Environmental Protection:	Stanley Linda Paul Nietupski

Town Officials

Selectmen:	Ronald Aponte Gerald Grasso Steven Rose	Linda Barron Michael Reardon
Former Selectmen:	W. Daniel Fitzpatrick Bernard Kubiak	David Fredenburgh
Town Administrator:	Gary L. Brougham	
DPW Director:	Steven J. Williams	
WWTP Operations Supervisor:	Rollin Dewitt	

Project Consultant

Tighe & Bond, Inc.

53 Southampton Road Westfield, Massachusetts	324 Grove Street Worcester, Massachusetts
25 Village Square Bellows Falls, Vermont	488 Main Avenue Norwalk, Connecticut

Contractor:

R.H. White Construction Company, Inc.
41 Central Street, P. O. Box 404
Auburn, Massachusetts

Town of Belchertown

WATER RECLAMATION FACILITY UPGRADE AND EXPANSION PROJECT

Major Renovations

Lagoon Cleaning and Abandonment

Removal of accumulated sediment is necessary to allow for abandonment of the effluent polishing lagoons and construction of improvements in the area of the lagoons.

Headworks Building

Construction of a new building to enclose a mechanically cleaned fine screen and a by-pass channel. The fine screen is designed to remove larger floating and suspended solids in the influent prior to treatment.

Fine Screen

Pre-Equalization Basins

Retrofit of the existing aeration tanks into equalization basins prior to the Sequencing Batch Reactors (SBR) basins. Equalization provides storage of influent to allow operation of a single SBR either for maintenance purposes or when only one SBR is needed.

SBR Basins

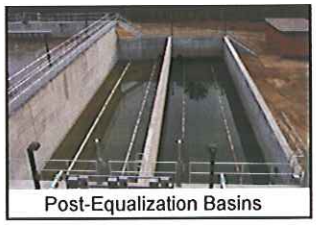
SBR Decanter

Sequencing Batch Reactor Basins

Construction of two new concrete SBR basin structures designed to provide aeration and settling of wastewater. SBRs utilize a variation of the activated sludge process to remove soluble and colloidal pollutants including nutrients.

Post-Equalization Basins

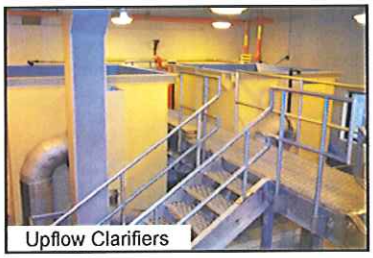
Construction of two new concrete basins designed to accept flow from the SBR basins. Equalization of flow from the SBRs is necessary to minimize the size of the clarifier and filter processes and provide a nearly continuous discharge.



Post-Equalization Basins

Upflow Clarifiers/Disk Filters

Installation of the Upflow Clarifiers and Disk Filters in the Process Building is designed to remove solids generated by the addition of precipitating and coagulating chemicals necessary to remove phosphorus and any small suspended particles that may pass through the SBR process.



Upflow Clarifiers

Disk Filters

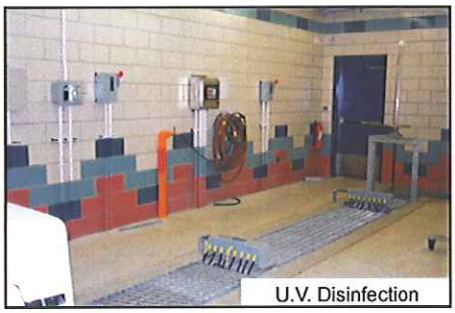

Post-Aeration Basin

Post-Aeration Basin

Construction of one new concrete basin designed to accept effluent from the disk filters. The Post-Aeration Basin serves two purposes within the Water Reclamation Facility (WRF); to increase the dissolved oxygen concentration of the effluent prior to release to Lampson Brook and to serve as a storage reservoir for the plant water system which recycles treated effluent for several process applications within the facility.

Disinfection Building

Construction of a new building to enclose the ultraviolet light disinfection system and a by-pass channel. The disinfection system is designed to inactivate pathogens in the effluent prior to discharge to Lampson Brook.


U.V. Disinfection

Process Building

Construction of a new building to house treatment components and administrative space.

Dewatering Building

Rehabilitation of the existing Dewatering Building to accommodate changes to the dewatering/thickening processes and construction of a new laboratory.

Site Work/ Yard Piping

Installation of new piping, construction of access drives and site grading for new structures.

Total Bid Price $8,294,000

Town of Belchertown

WATER RECLAMATION FACILITY UPGRADE AND EXPANSION PROJECT

Background

The Belchertown Wastewater Treatment Plant (WWTP) was originally constructed by the Commonwealth of Massachusetts in the 1920's to treat domestic sewage from the former Belchertown State School (BSS). The sewage collection system was subsequently extended to provide service to a small portion of the Town. The WWTP was upgraded to activated sludge secondary treatment (extended aeration) in the late 1960's and improvements in the mid-1980's improvements were made to the residuals handling systems. Further sewer extensions to other Town residents have also taken place over the years.

In September of 1991, renewal of the facility's National Pollution Discharge Elimination System (NPDES) discharge permit imposed more stringent discharge limits for Biochemical Oxygen Demand, Total Suspended Solids, Ammonia and Phosphorus, particularly during the summer months. The WWTP has been unable to consistently achieve compliance with these limits. The BSS closed in September 1992 and on September 30, 1994, ownership of a portion of the BSS property including the WWTP was transferred from the Commonwealth to the Town of Belchertown. The Town, recognizing their current and future sewer service needs, accepted responsibility to upgrade the facility to achieve NPDES permit compliance. The Town also recognized the substantial burden that the revisions to Title V (septic system regulations) impose on many homeowners within Belchertown and have planned for additional sewer service to areas of need.

Process Narrative

As shown on the attached proposed process schematic, influent wastewater enters the Water Reclamation Facility (WRF) at the new Headworks Building which contains both manually-cleaned coarse (2" spacing) bar rack and automatically-cleaned fine screening (1/4" spacing). The manually cleaned screen is intended to protect the fine screen from large items such as bricks or boards that may damage it. Screenings generated by the fine-screen are washed and dewatered prior to discharge into a hopper. A second channel is included in the Headworks Building to serve as a by-pass, an overflow in the event of a failure or for future use. The second channel is equipped with a coarse bar rack. Following screening, wastewater enters the existing grit chamber where the heavy, denser particles such as sand, small stones and eggshells are removed. Consistent with current practice, grit will be removed via a "vactor" truck.

Following screening and grit removal, wastewater can flow either directly to secondary treatment or to any combination of three Pre-Equalization Basins. The Pre-Equalization Basins are the existing aeration basins converted with piping modifications and new aeration and mixing equipment. The Pre-Equalization Basins provide influent storage to allow use of a single Sequencing Batch Reactor (SBR) Basin or can be used with two SBR Basins to "slug-feed" the system for more efficient performance. Each Pre-Equalization Basin will be outfitted with coarse-bubble diffused aeration and submersible mixers. Normal operation of the Pre-Equalization Basins requires that one or two of the Pre-Equalization pumps transfer stored wastewater to the SBRs. However, if the pumps fail due to mechanical problems or loss of power, the Pre-Equalization Basins will automatically fill to an overflow structure level and the sewage flow will be conveyed via a gravity flow pipe connection to the SBRs.

Sequencing Batch Reactors are, as the name implies, a batch process rather than the more commonly seen continuous flow-through processes such as currently used at the former Belchertown wastewater treatment plant. The SBR process consists of a series of batch operations that are accomplished within one basin. The process includes the following series of unit operations that comprise a complete cycle:

- Filling of the Basin with wastewater
- Aeration and/or mixing of the wastewater/sludge mixture (mixed liquor)
- Settling of the mixed liquor
- Decanting of clarified supernatant
- Removal (wasting) of settled sludge

Each operation of the SBR process can be separately controlled and manipulated to respond to a wide range of influent wastewater characteristics and effluent treatment requirements. Each SBR basin will be outfitted with fine-bubble diffused aeration, effluent decant mechanisms, submersible mixers and waste sludge pumps.

Effluent from the SBR process flows to the Post-Equalization Basins each of which will be equipped with coarse-bubble diffused aeration. Equalization of SBR effluent is necessary to minimize the size of the clarifier and filter processes that follow the SBRs and to provide a nearly continuous discharge from the WRF. Normal operation of the Post-Equalization Basins requires that one or two of the Post-Equalization Basin's three pumps transfer stored SBR effluent to the Upflow Clarifiers. However, if the pumps fail due to mechanical problems or loss of power, the Post-Equalization Basins will automatically fill to an overflow structure level and the flow will be conveyed via a gravity flow pipe connection to just upstream of the parshall flume.

The two Upflow Clarifiers and two Disk Filters are designed to work together in series flow for the precipitation, flocculation and removal of suspended solids and dissolved nutrients. A small portion of these solids will be in the SBR effluent, however a majority will be formed as part of the chemical removal of phosphorus from the SBR effluent. Aluminum sulfate, polymer and sodium hydroxide are added near the pumps in the Post-Equalization Basin to provide mixing. The Upflow Clarifiers act as an upflow roughing filter and provide an environment for precipitation and flocculation of solids and for the removal of a large percentage of the solids that are formed. The Disk Filters remove the remainder of the solids that pass-through the clarifiers. Either the clarifiers or the filter can work independently, however normal operation will utilize one Upflow Clarifier and one Disk Filter. Backwash from both processes is returned to the Pre-Equalization Basin and can be stored there independent of other sludge materials or mixed with the incoming wastewater.

The Post-Aeration Basin receives flow from the Disk Filters and is equipped with a fine-bubble diffused aeration system. The Post-Aeration Basin serves two purposes in the overall scheme of WRF operation. It provides additional aeration to "polish" the effluent, ensuring that the required dissolved oxygen concentration is always achieved. Secondly, the Post-Aeration Basin serves as a storage reservoir for the plant water and Disk Filter spray wash systems. Following the Post-Aeration Basin, effluent flows through a parshall flume to continuously monitor and record the treated sewage flow discharge from the facility.

The final treatment process within the WRF is the disinfection of the effluent prior to disposal. Flow enters the Disinfection Building which contains two channels. One channel is outfitted with an ultraviolet light disinfection system designed to inactivate pathogens. A second channel is provided as a by-pass or for future use.

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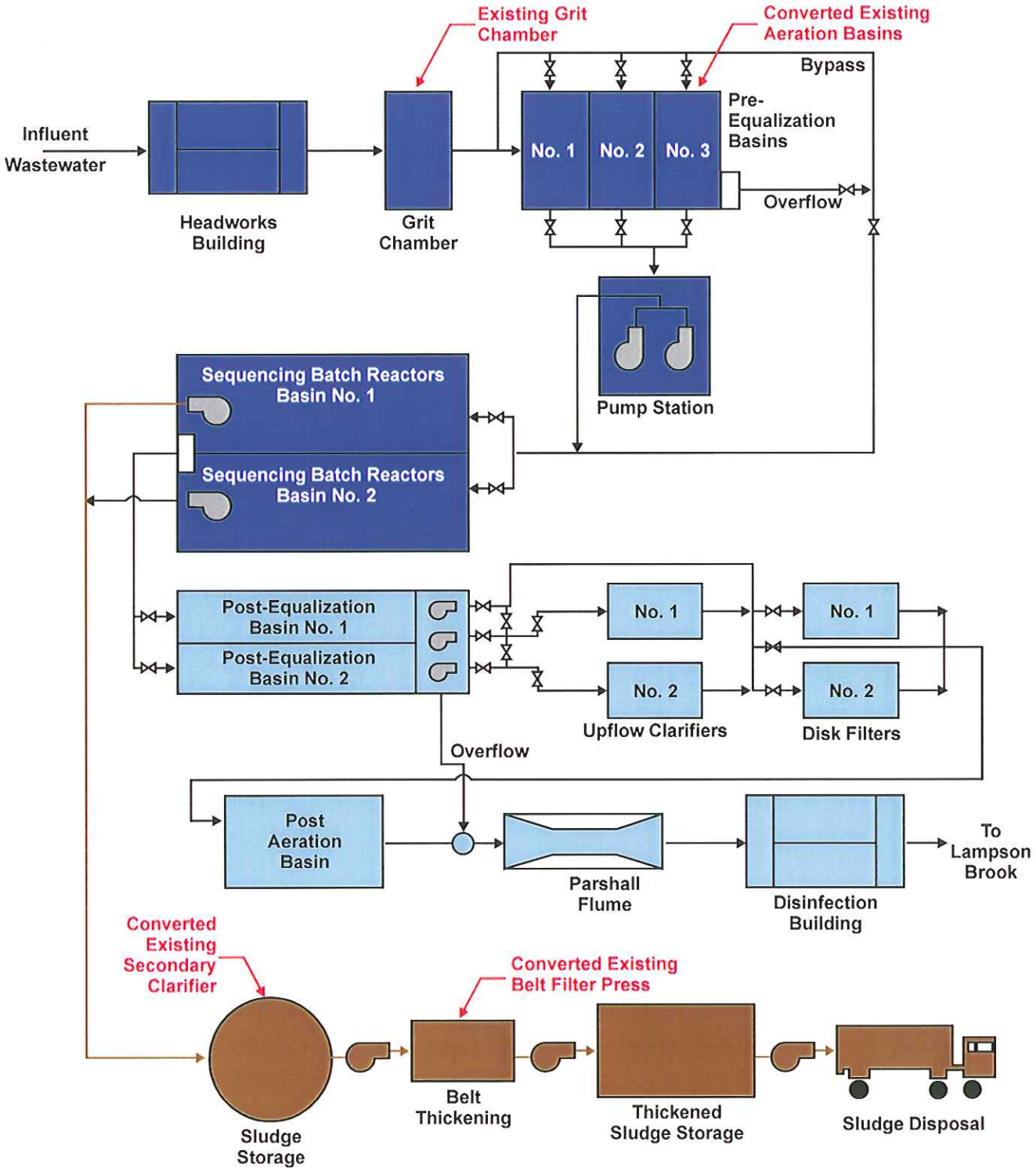
Process Schematic



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WATER RECLAMATION FACILITY UPGRADE AND EXPANSION PROJECT

Current NPDES Permit Limits

Winter Period (October 16th - April 30th)					
			Average Monthly	Average Weekly	Maximum Daily
Flow	(mgd)		1.00	-	-
BOD_5	(mg/L)		30	30	45
TSS	(mg/L)		30	30	45
NH_3-N	(mg/L)		10	10	15
Phosphorus	(mg/L)		0.25	-	-
Spring Period (May 1st - May 31st)					
			Average Monthly	Average Weekly	Maximum Daily
Flow	(mgd)		1.00	-	-
BOD_5	(mg/L)		15	15	20
TSS	(mg/L)		20	20	30
NH_3-N	(mg/L)		7	7	15
Phosphorus	(mg/L)		0.25	-	-
Fecal Coliform	(#/100 ml)		200	400	400
Summer Period (June 1st - October 15th)					
			Average Monthly	Average Weekly	Maximum Daily
Flow	(mgd)		1.00	-	-
BOD_5	(mg/L)		5	5	7.5
TSS	(mg/L)		15	15	20
NH_3-N	(mg/L)		1	1	1.5
Phosphorus	(mg/L)		0.25	-	-
Fecal Coliform	(#/100 ml)		200	400	400