

## BASIS FOR FINAL DESIGN

The following Basis for Final Design is a collaborative effort between the Wastewater Management Division and the Facilities Engineering Division to be used by the Engineering Consultants or municipal officials who wish to submit final engineering documents or NPDES permit applications. We strongly encourage the use of this format to assist in our review of the project application and related documents. This is not intended to be a design guideline. The actual design should follow the current reference manuals, including: TR-16, which is the guide for design of wastewater treatment works prepared by the NEIWPC; the Recommended Standards for Wastewater Facilities (called the Ten States Standards); the Design of Municipal Wastewater Treatment Plants by WEF and ASCE; Wastewater Engineering - Treatment, Disposal, and Reuse by Metcalf and Eddy, Inc.; other approved reference/design manuals, and the Environmental Protection Indirect Discharge Rules and Related Statutes for the State of Vermont.

The Basis for Final Design includes the following information:

- (1) "Basis for Final Design Summary": This is a summary of the design criteria, sizes, process narratives, key assumptions, and identification of design standards. It shall follow the format provided below. Although design calculations are not a requirement of the Basis for Final Design, the engineers should be prepared to discuss specific questions about specific design processes and submit additional calculations upon request.

### Hydraulic / Organic Information

I.	Influent Loading	Current	Initial Year	Design Year
	Flow, average			
	Flow, peak daily			
	Flow, peak hourly			
	BOD5, mg/l			
	BOD5, lb/day			
	TSS, mg/l			
	TSS, lb/day			
	Total phosphorus, mg/l			
	Ammonia, summer, mg/l			
	Ammonia, winter, mg/l			
	pH			
	Toxicity			
	Side Stream Impacts (septage, digester supernatant, return from filter backwash and sludge dewatering)			

II.	Effluent Characteristics	Current	Initial Year	Design Year
	BOD5, mg/l			
	BOD5, lb/day			
	TSS, mg/l			
	TSS, lb/day			
	Total phosphorus, mg/l			
	Total phosphorus, lb/day			
	Ammonia, summer, mg/l			
	Ammonia, winter, mg/l			
	UOD, lb/day			
	pH			
	E coli bacteria, #/100 ml			
	Total residual chlorine, mg/l			
	Toxicity			

III. Type of Treatment Process

(Conventional Activated Sludge, Extended Aeration, RBC, SBR, Aerated Lagoon)

IV. Headworks Equipment

- a. Influent Flow Metering (description & range)
- b. Bar Rack/Comminution (description & hydraulic capacity)
- c. Grit Removal/Handling/Disposal
  - Channel Type (description & in-channel velocity)
  - Aerated Grit Chamber (description, detention time, aeration rate)
  - Grit Dewatering & Disposal (description)
- d. Equalization Tank (description, volume, delivery rates, aeration)
- e. Septage Receiving (description, volume, aeration)

V. Primary Clarification

Number of Units/Provisions for Redundancy (recommended min. of 75% of peak hourly design capacity with largest unit out of service)

Description/Volume/Dimensions/Sidewater Depth of Each Surface Overflow Rates (ADF & Peak Hourly) (gpd/sq.ft.)

Anticipated BOD/TSS/TP removal

## VI. Biological Treatment

- a. Aeration Tanks
  - Number of Units/Provision for Redundancy (recommended min. of 75% of average daily design capacity with largest unit out of service)
  - Description/Volume/Dimensions of Each
  - Organic Loading Rate (pounds of BOD/day/1000 cu.ft.)
  - Aeration System/Type/Capability (pounds oxygen/pound BOD (peak hourly))
  - Number of Blowers or Aerators/Provision for Redundancy
- b. Rotating Biological Contactor
  - Number of Units/ Number of Treatment Trains/ Number of Stages/ Provisions for Redundancy (recommended min. of 75% of average daily design capacity with one train out of service)
  - Organic Loading Rate to first stage (pounds of BOD/ 1000 SF/day and pounds of soluble BOD/ 1000 SF/day)
  - Description/ Media Specification
- c. Aerated Lagoons
  - Number of Cells/Dimensions of Each Cell/Detention Time (days) provided
  - Aeration System Capability (pounds oxygen/pound BOD applied)
  - Number of Blowers or Aerators/Provision for Redundancy
- d. Anticipated BOD/TSS/TP removal

## VII. Secondary Clarification

Number of Units/Provision for Redundancy (recommended min. 75% of peak hourly design capacity with largest unit out of service)  
Description/Volume/Dimensions/Sidewater Depth of Each  
Peak Solids Loading Rate (pounds/day/sq.ft.)  
Peak Hourly Surface Overflow Rate (gpd/sq.ft.)  
Peak Hourly Weir Loading Rate (gpd/linear ft.)  
Anticipated BOD/TSS/TP Removal

VIII. Chemical Precipitation

Description/Number of Units/Provision for Redundancy (recommended min. 75% of peak hourly design capacity with largest unit out of service)

Chemical Feed Equipment/Provision for Redundancy

Chemical Type(s)/Chemical Feed Rates/Dosage

Chemical Storage Description/Volume

Anticipated BOD/TSS/TP Removal

IX. RAS/WAS Pumps

Number of Pumps/Provision for Redundancy

Sludge Pumping Capability/Description

X. Filtration

Description/Equipment Type/Media Specification

Number of Units/Provision for Redundancy (recommended min. 100% of peak hourly design capacity with largest unit out of service)

Peak Hourly Filtration Rate (gpm/sq.ft.)

Anticipated BOD/TSS/TP Removal

XI. pH Adjustment

Description/Application Point(s)

Chemical Feed Equipment/Provision for Redundancy

Chemical Type(s)/Feed Rates/Dosage

Chemical Storage Description/Volume

XII. Disinfection

a. Chlorination

- Description/Number of Chlorinators/Provision for Redundancy

- Chemical Feed Rate/Dosage Anticipated

- Chlorine Contact Chamber (description, configuration (dual channels), detention time at peak flow (minimum 30 minutes), length to width ratio, depth to width ratio)

b. Dechlorination

- Description/Number of Sulfonators/Provision for Redundancy

- Chemical Feed Rate/Dosage Anticipated

- Dechlorination Chamber (description, detention time at average daily flow)

- c. Ultraviolet Light Disinfection
  - Description/Number of Banks/Provision for Redundancy
    1. Open Channel Installations
      - Number of lamps/orientation of lamps
      - Minimum Dosage at Peak Flow ( $\mu$ ws/sq.cm.)
      - Aspect ratio/length to width ratio/depth to width ratio
      - Anticipated Disinfection Capability at Maximum Daily TSS Concentration (Colonies E. coli/100ml)
    2. Enclosed Unit Installations
      - Minimum Dosage at Peak Flow ( $\mu$ ws/sq.cm.)
      - Anticipated Disinfection Capability at Max Daily TSS Concentration

XIII. Sludge Thickening/Dewatering

Sludge Generation (volume/dry weight/wet weight)  
 Description/Equipment Type & Size/Number of Units  
 Solids Loading Rate (pounds/hour)  
 Percent Solids In / Out

XIV. Sludge Digestion/Stabilization

Sludge Generation (volume/dry weight/wet weight)  
 Description/Equipment Type & Size/Methodology  
 Number of Units/Provision for Redundancy  
 Percent Solids In / Out  
 Volatile Solids Loading Rates/Detention Times  
 Pathogen and Vector Attraction Reduction Capabilities  
 Air Quality Control (description, equipment types & size, media specification & loading rate, provision for redundancy)

XV. Sludge Storage/Disposal

Description/volume/duration of sludge storage provided  
 Description of sludge disposal methodology

XVI. Effluent Flow Metering (Description & Range)

XVII. Influent/In-plant/Collection System Pump Stations  
 Number of pump units/Provision for Redundancy  
 Description/Type/Capacity of Each Station  
 Provision for Emergency Storage or Back-up Power  
 Description of Pump Control/Alarm System Provided

**XVIII. Standby Power**

**Description/Capacity of Engine Driven Emergency  
Power Generator Provided/Treatment Components Served**

Note: If Ultraviolet Light Disinfection is utilized, the generator must have sufficient capacity to power the entire treatment process so that the TSS concentration of the final effluent is maintained at a level which assures effective disinfection through the UV system, unless sufficient storage volume is provided upstream of the UV system for extended power outages.

- (2) The facility site plan and layout.
- (3) The initial hydraulic profile.