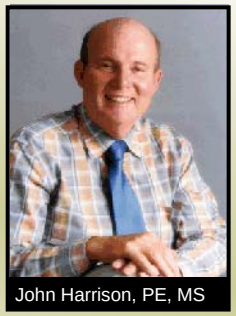

John Harrison, PE, MS

Wastewater Treatment Mentoring Series FREE Training

FREE Zoom Virtual Training

This is to offer a free series of 60 minute training sessions on the following 10 wastewater related subjects. Continuing education or professional development units will be rewarded upon successful completion of each session. Complementary post-course mentoring is offered those who wish to further their knowledge base.

For more information contact: wwixjohn@gmail.com
Questions?.... phone/text: 971-563-7471

1. Wastewater Treatment Basics: Wed 10 Feb 2021

Introduce the fundamentals of wastewater collection and treatment.

Includes: Flow schematics, descriptions of equipment and steps used to accomplish wastewater collection & treatment.

2. Introduction to Biological Treatment: Wed 24 Feb 2021

Describes the biology and equipment associated with treatment using lagoons, activated sludge & trickling filter related processes.

Includes: Needs and effects of oxygen, temperature, solids and nutrients on treatment performance.

3. Operation of Activated Sludge (AS) Processes: Wed 10 Mar 2021

Provides the range of loading and conditions for AS operation. Troubleshooting AS problems and case histories given.

Includes: Control parameters, equations and operational tools for assessing and changing plant operation.

4. Operation Trickling Filter (TF) and Related Processes Wed 24 Mar 2021

Presents process variations for TFs, TF Solids Contact and related processes. Operational tools and recommended loading given.

Includes: Operational control methods and load equations. Discusses media types, distribution methods and hydraulic flushing.

5. Biological Nutrient Removal (BNR): Wed 7 Apr 2021

Describes efforts to control nutrients and the biological processes for removing both nitrogen (N) and phosphorus (P).

Includes: Process modifications and control schemes for removing nutrients. Case histories for BNR presented.

6. Natural Treatment Systems: Wed 21 Apr 2021

Explains the components and performance of ponds, lagoons and various types of land application systems.

Includes: Presents the advantageous and disadvantages of operating natural versus mechanical treatment systems.

7. New and Emerging Wastewater Technology: Wed 5 May 2021

Illustrates how to upgrade existing reactors with biological selectors. Emerging technology such as membrane biological reactors (MBRs) and moving bed bioreactors (MBBR) are explained. Experiences with aerobic granular sludge (AGS) are given.

8. Aeration and Power Consumption: Wed 19 May 2021

Describes aeration equipment & explains oxygen transfer. Compares & discusses power consumption by treatment process.

Includes: Introduction to various aeration diffusers and air blowers. Covers standard versus field transfer including calculations for O2 transfer.

9. Foam and Bulking Sludge Control: Wed 2 Jun 2021

Introduction to indicator organisms and causes of excessive foam, filaments and bulking sludge.

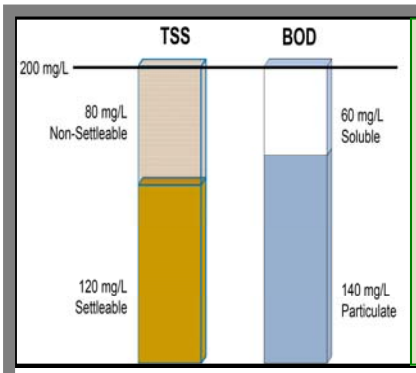
Includes: Problem identification followed by operator or engineering solutions to foam/filament problems.

10. Operator Certification and Engineering Review: Wed 16 & 30 Jun plus 14 Jul 2021

Prepares operators to take entry and initial level state certification exams for wastewater treatment. Good for non-operators also.

Includes: Help for students to find and understand correct answers using questions from past certification exams.

View More & Register: https://www.consultjrh.com/learning-center



Wastewater Treatment Basics

FREE Zoom—Mentoring Session

Objective: Introduce the fundamentals of wastewater collection and treatment.

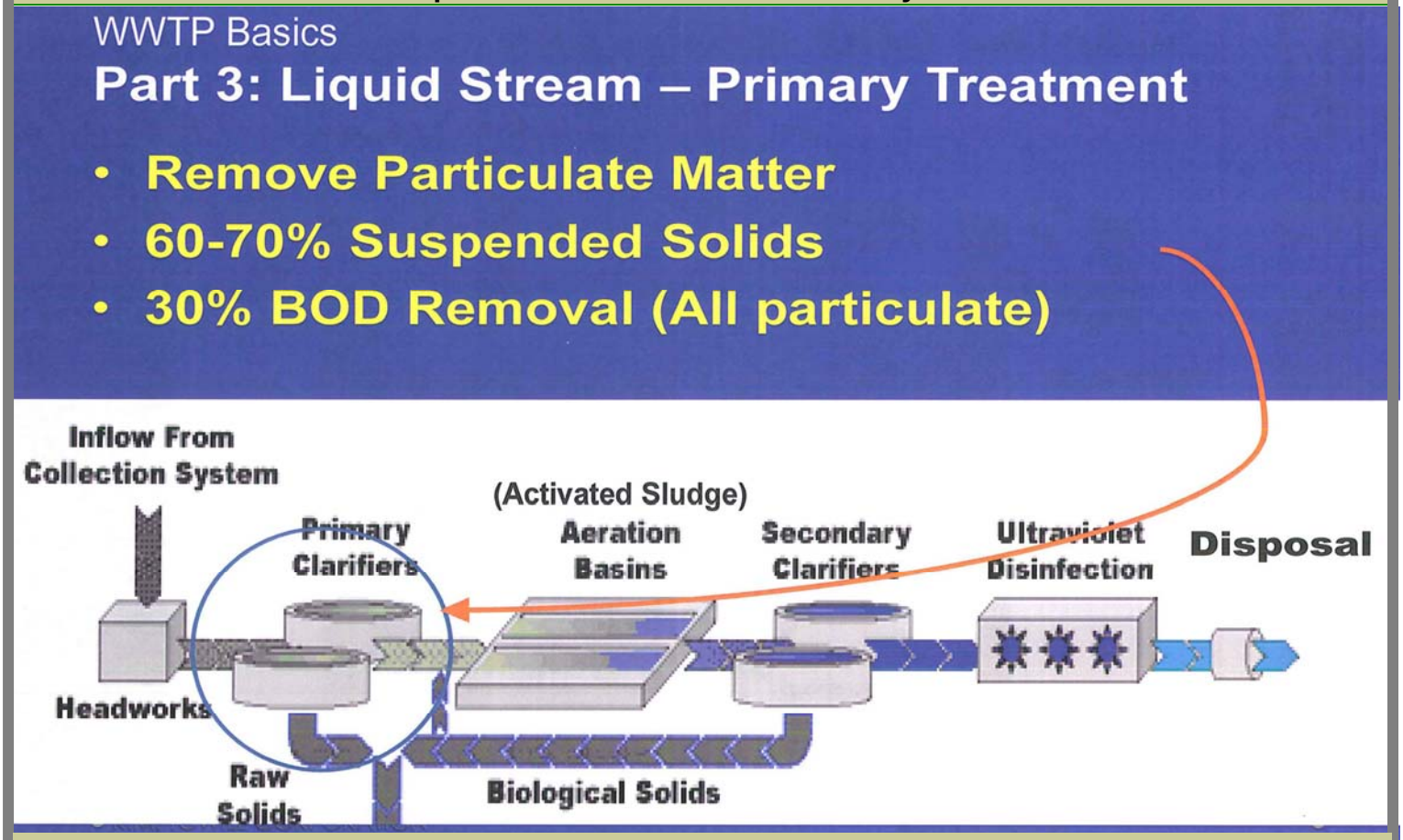
Includes: Flow schematics, descriptions of equipment and steps used to accomplish wastewater collection & treatment.

Introduces participants to the broad picture of wastewater treatment starting with wastewater sources and characteristics. Clearly describes the function of each step in wastewater treatment and gives pictures or examples of equipment often used in both liquid and solids treatment. Presents basic information on percent removal and treatment performance.

Answer these Example Questions:

1. What are BOD and TSS and what are typical domestic wastewater strengths (mg/L)?
2. A lagoon system obtains oxygen from what source?
3. T/F: Pathogens are usually removed in the aeration basin.
4. T/F: A City does not require an Industrial Pretreatment Program for controlling a metal plating operation since these are classified as categorical industries and regulated by EPA.
5. What can result from failure to constantly maintaining at least 1.0 to 2.0 mg/L of oxygen in the aeration basin?

Example Slide: The Function of Primary Clarifiers



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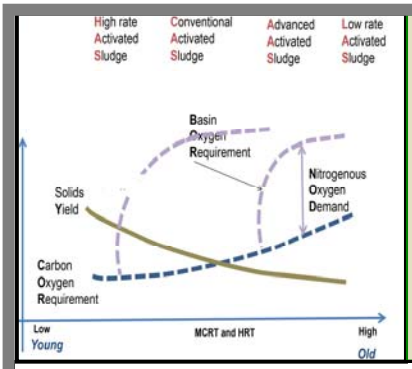


Introduction to Biological Treatment

FREE Zoom—Mentoring Session

Describes the biology and equipment associated with treatment using lagoons, activated sludge & trickling filter related processes.

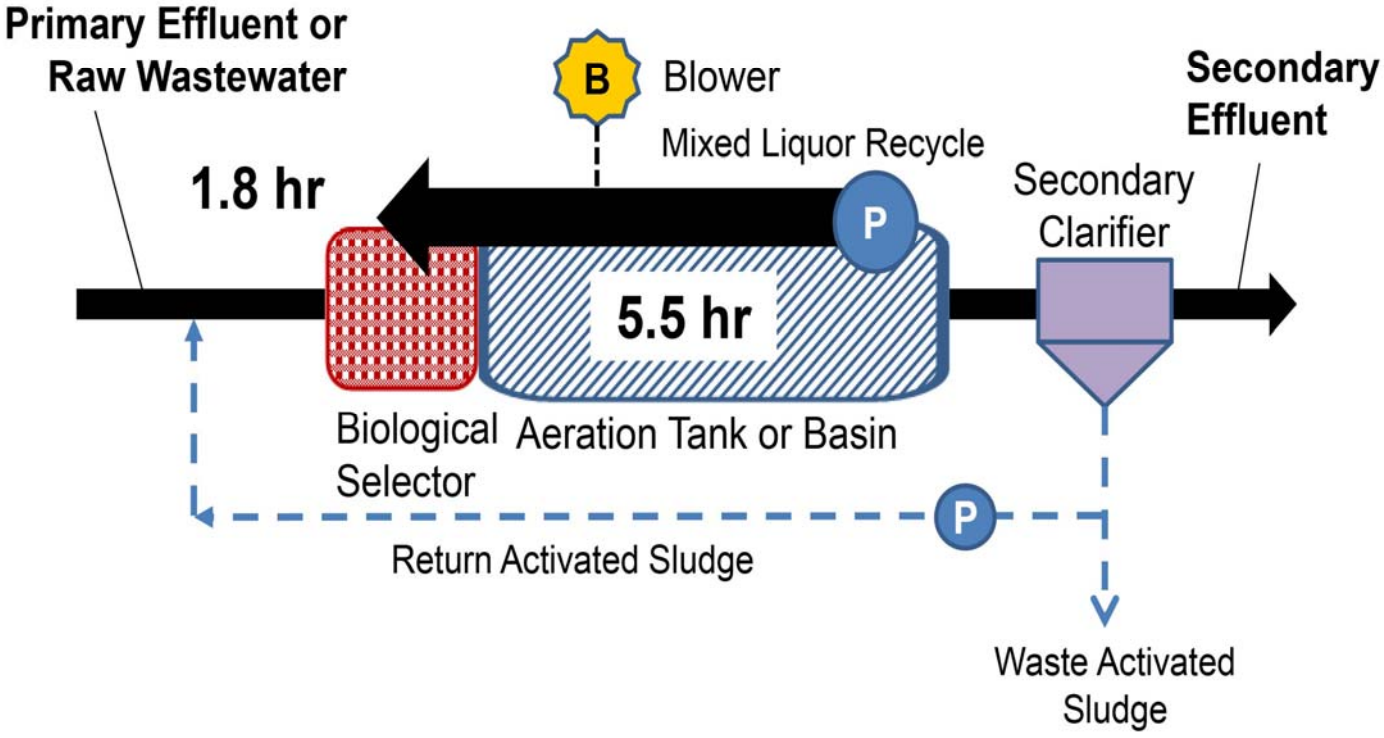
Includes: Needs and effects of oxygen, temperature, solids and nutrients on treatment performance.

Discusses the evolution of biological wastewater treatment from lagoons to membrane biological reactors (MBRs). Covers fixed film reactors (trickling filters-TF's) and related processes. Simplified flow schematics and photographs of primary equipment are provided. Attendees will understand acceptable loading rates and limitations of commonly used biological treatment processes.

Answer these Example Questions:

1. What are the unique features of the activated sludge process that make it appealing?
2. Which types of filter media are used in trickling filters and what is best for use in a roughing filter?
3. What are common process modes for activated sludge?
4. What are acceptable loading rates for trickling filters?
5. How are lagoons classified and what equipment is commonly used?
6. What is the impact of not having primary clarification before the aeration basin?

Example Slide: Parts of Modern Activated Sludge Plant



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Operation of Activated Sludge

FREE Zoom—Mentoring Session

Provides the range of loading and conditions for AS operation. Troubleshooting AS problems and case histories given.

Includes: Control parameters, equations and operational tools for assessing and changing plant operation.

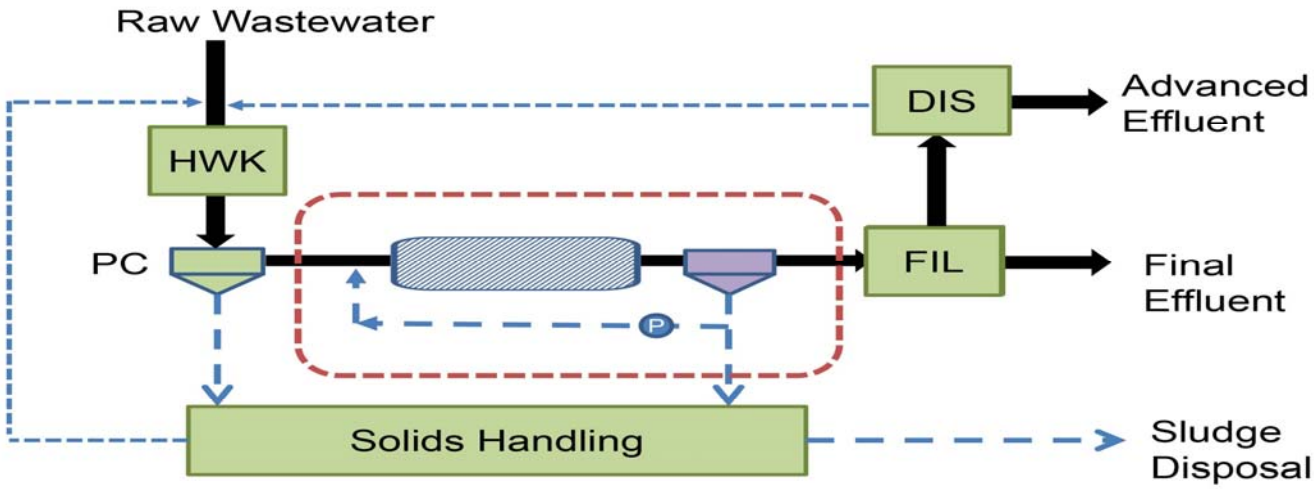
Conveyed will be a clear understanding of the activated sludge process, process control, monitoring equipment, and troubleshooting including determining the effects of changing WAS and RAS rates. Participants will become familiar with treatment units and components of activated sludge. They should be able to grasp the acceptable range and use of parameters such as: food-to-microorganism (F/M) ratio, respiration rate, and the mean cell retention time (MCRT).

Answer these Example Questions:

1. Draw a schematic for conventual activated sludge system and for step feed activated sludge?
2. Given a primary effluent BOD of 150 mg/L and 2.0 mgd flow; what is the BOD load to the aeration basin?
3. How do F/M and MCRT affect plant performance, oxygen demand and solids yield?
4. Calculate F/M, MCRT and respiration rates.
5. What are biological selectors and how are they constructed and sized?
6. What are possible solutions to common operating problems with activated sludge?

Example Slides: Range of Solids Yield & Oxygen Requirements

	MCRT	Solids Yield		Oxygen Rqt		Process Rating
	Days	w Pri	wo Pri	COR	BOR	
Young	3	0.8	0.9	0.8	0.8	High rate AS
	7	0.7	0.8	1.0	1.4	Conventional AS
Old	15	0.6	0.7	1.2	1.7	Adv AS or Low AS



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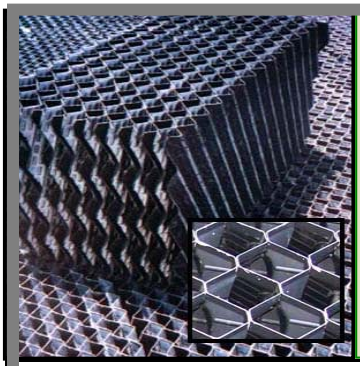


Operation of Trickling Filters & Related Processes

FREE Zoom—Mentoring Session

Presents process variations for TFs, TF Solids Contact and related processes. Operational tools and recommended loading given.

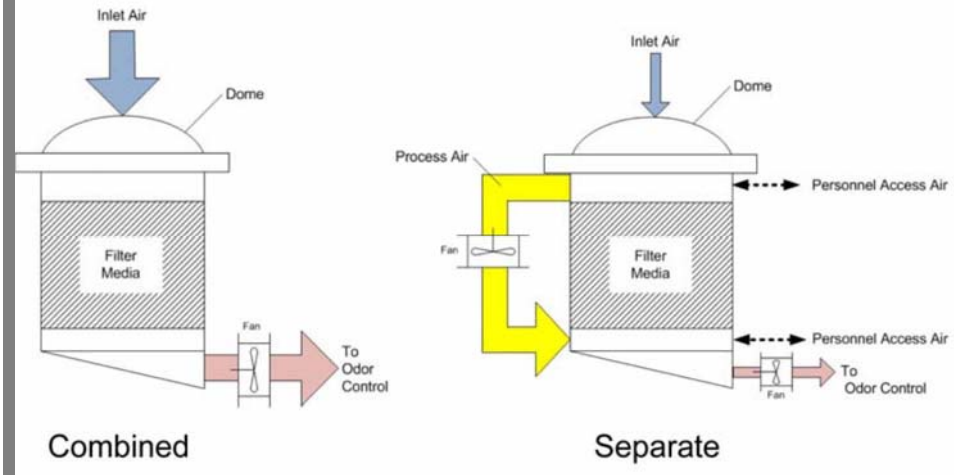
Includes: Operational control methods and load equations. Discusses media types, distribution methods and hydraulic flushing.

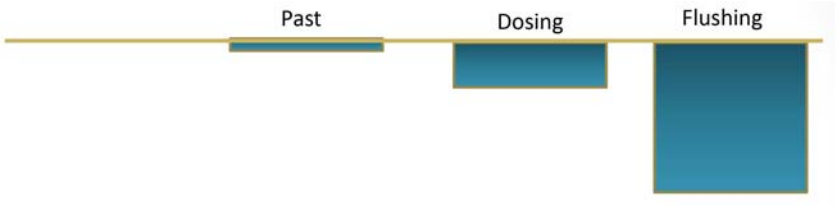
The effects of media choice on TF performance will be discussed. Recent advances in flushing techniques using hydraulic and mechanical drives are presented. Methods for calculating dosing/flushing rates are given. Case histories of plants successfully dealing with nuisance organisms and odor control are discussed. Operators of combined plants such as TF solids contact or TF activated sludge will learn the strength of each portion of their plant.

Answer these Example Questions:

1. What are the differences between roughing, biofilters and trickling filters?
2. What are loading rates for various types or TF's and related processes?
3. How can sloughing of biofilters be controlled?
4. Describe how some facilities have coped with snails and redworms?
5. How can operations be sure that the hydraulic flushing of a filter is complete?
6. How much air circulation is necessary to assure aerobic conditions in a biotower?

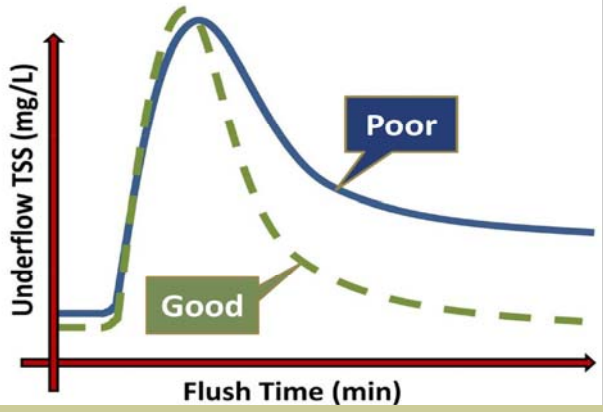
Example Slides: Air Ventilation and TF Flushing





Item	Past	Dosing	Flushing
IHL (in / pass)	1/8 to 1.2	1.6 to 4.0	8 to 24
RPM	3 – 0.3	0.25 – 0.10	0.05 – 0.016
MPR	0.3 - 3	4 - 10	8 - 24

Note: for THL = 1.0 gpm / sf



More information Contact: wwixjohn@gmail.com Questions: Phone/Text 971-562-7471

Biological Nutrient Removal

FREE Zoom—Mentoring Session

Describes efforts to control nutrients and the biological processes for removing both nitrogen (N) and phosphorus (P).

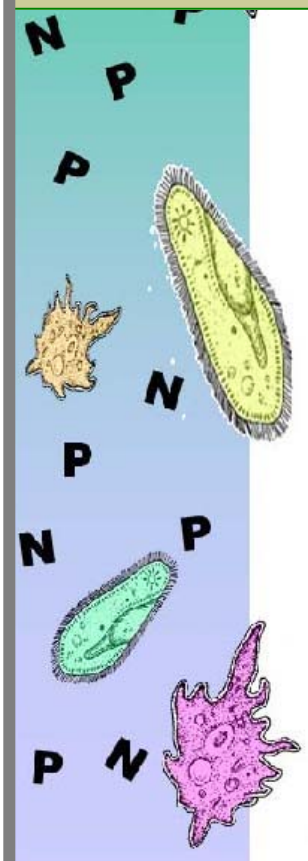
Includes: Process modifications and control schemes for removing nutrients. Case histories for BNR presented.

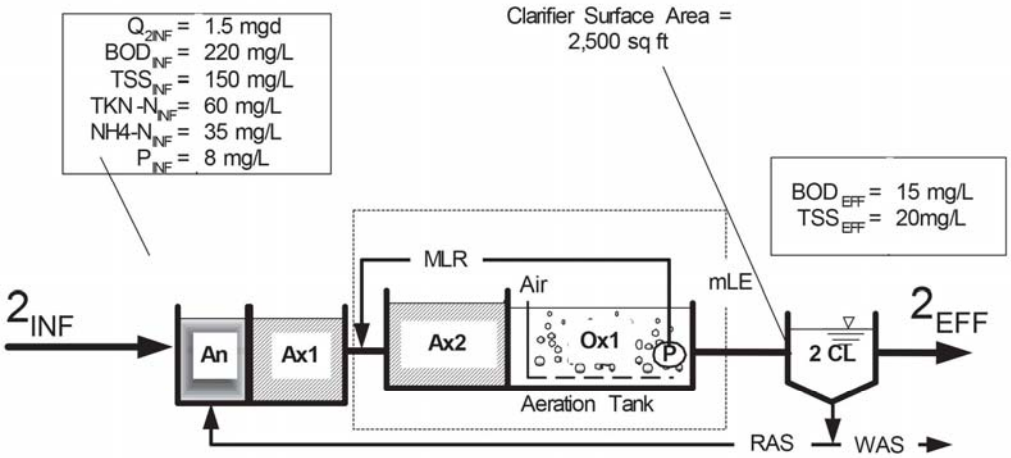
Attendees will learn the impact of nutrients (nitrogen-N and phosphorus-P) on the environment and on human health. Common biological processes for removing nitrogen and phosphorus with be described. Factors that affect the ability to accomplish nutrient removal will be covered such as water temperature, alkalinity and wastewater characteristics. Case histories of successful nutrient removal will be presented. Methods of coping with floating solids and foam that often occur with nutrient removal will be discussed.

Answer these Example Questions:

1. What are the environmental and health concerns associated with nutrients?
2. How can existing systems be modified to remove N and P?
3. What are the effects of nutrient removal on oxygen demand, pH and solids characteristics?
4. What affects the ability to nitrify, denifrify and remove P biochemically?
5. Calculate critical loading for nutrient removal based on temperature and discharge limits in your area.

Example Slide: Compartmentalized Aeration Basin for BioP Removal





Reactor Volume	Gallons
V_{An} =	35,000
V_{An1} =	35,000
V_{An2} =	55,000
V_{Ox1} =	375,000
V_{Total} =	500,000

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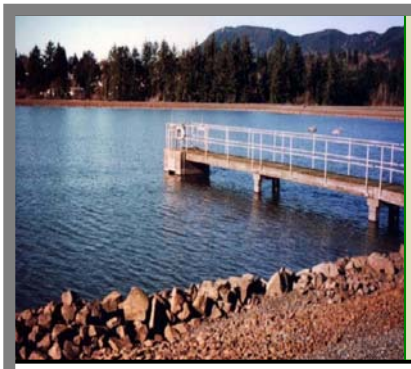


Natural Treatment Systems

FREE Zoom—Mentoring Session

Explains the components and performance of ponds, lagoons and various types of land application systems.

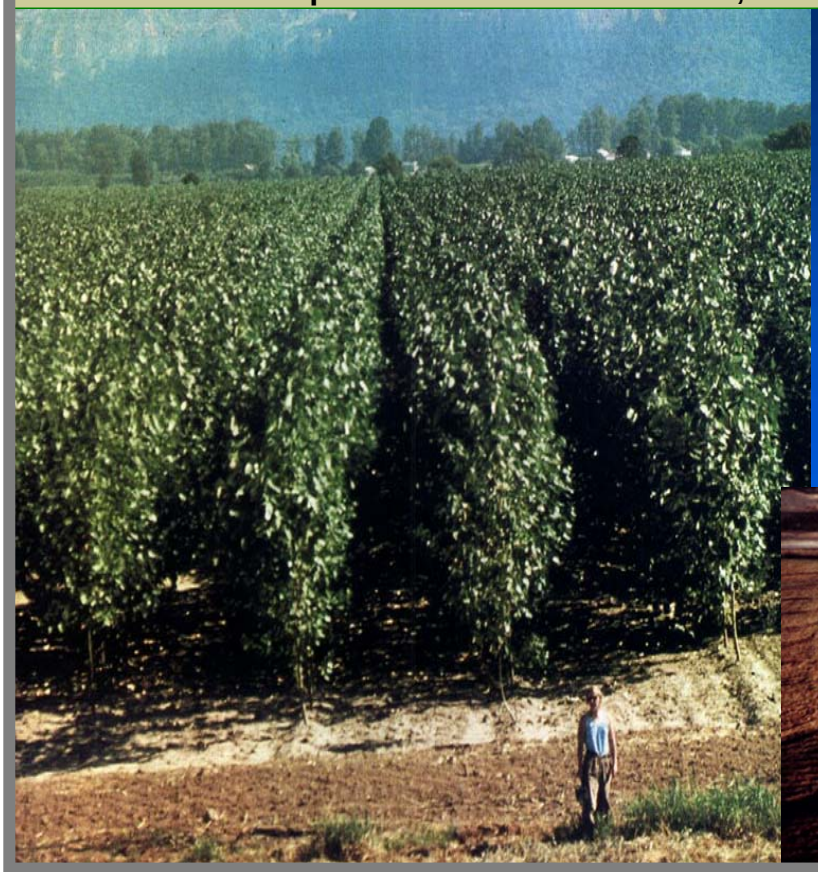
Includes: Presents the advantageous and disadvantages of operating natural versus mechanical treatment systems.

Learn how to incorporate "Natural" systems as an integral part of a wastewater treatment and reuse strategy. This session is especially suited for small to moderate sized facilities where land may be available. Natural systems include alternatives which depend primarily on natural biological reactions for treatment rather than relying on the use of mechanical equipment or the addition of chemicals. Presented are the basics of natural systems. Learn what can be expected from natural systems and where the limitations are. Presented are case history information on natural systems.

Answer these Example Questions:

1. What are the advantages and disadvantages of using stabilization ponds?
2. How can algae and duckweed be controlled in natural systems?
3. Are wetlands or aquatic plants affective in producing high quality effluent?
4. What are acceptable application rates for rapid infiltration ponds, tree plantation and irrigation systems?
5. Where are exemplary case histories using natural treatment systems and how are they performing?

Example Slides: Tree Plantations, Overland Flow Irrigation and Ponds



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New & Emerging Wastewater Technology

FREE Zoom—Mentoring Session

Illustrates how to upgrade existing reactors with biological selectors and the use of emerging technology to reduce power & save space.

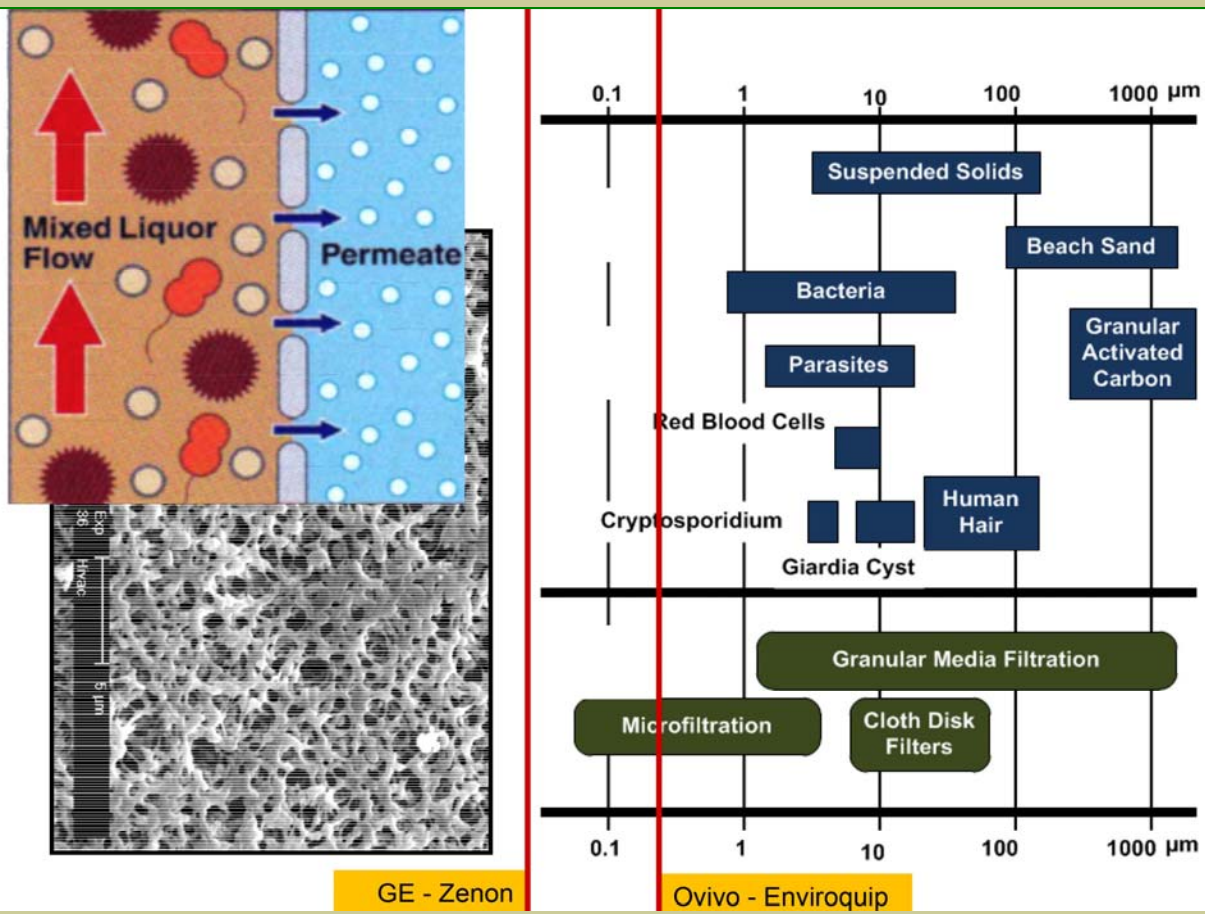
Includes: Membrane biological reactors (MBRs) and moving bed bioreactors (MBBRs) are explained. Experiences with aerobic granular sludge (AGS) are given.

Many plants need to modernize or upgrade because of capacity issues or the need to meet new treatment standards. New technologies are finding accepted use in order to upgrade/modernize and save space or energy. Participants in this session will learn about membrane bioreactors (MBRs) that produce high-quality effluent without the use of clarifiers. Given will be descriptions, design criteria and performance when converting activated sludge to moving bed bioreactors (MBBR) or integrated fixed film activated sludge (IFAS). Experiences from case histories will allow participants to judge the advantages and disadvantages of the emerging technologies.

Answer these Example Questions:

1. Describe membranes types and application using membrane bioreactors (MBRs).
2. How can moving bed bioreactors (MBBRs) be used to upgrade an existing activated sludge basin and what are the pros/cons?
3. What are the space-saving and energy aspects of new and innovative processes?
4. Are there added risks and a steep learning curve with innovative technologies?

Example Slide: MBR Pore Size Comparison



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Aeration & Power Consumption

FREE Zoom—Mentoring Session

Describes aeration equipment & explains oxygen transfer. Compares power consumption by treatment process.

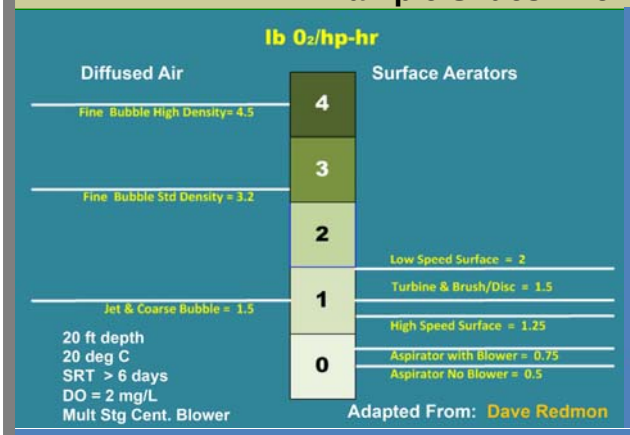
Includes: Introduction to various aeration diffusers and air blowers. Covers standard versus field transfer including calculations for O2 transfer.

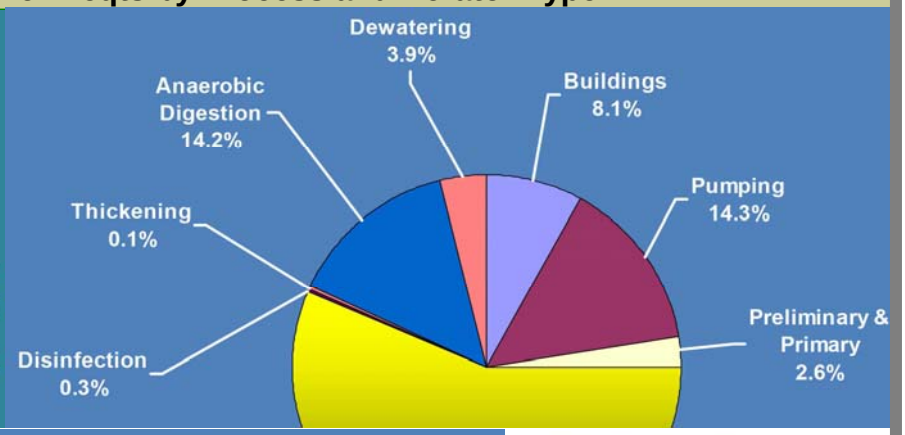
Next to effluent quality, energy conservation and wise selection of aeration equipment are often of major concern at the wastewater treatment plant. Participants will learn in what parts of the plant energy use is the highest and where the greatest gains can be made to reduce power cost. You will be able to calculate energy requirements based on BOD and nutrient loads. Attendees will learn how to estimate air and power requirements for various types of aeration equipment. The differences between field and standard oxygen demand will be explained. Participants will be better prepared to purchase aeration equipment.

Answer these Example Questions:

1. What is the difference between coarse bubble and fine bubble aeration?
2. For a 1.5 mgd flow with BOD of 150 mg/L and ammonia N of 30 mg/L ; what is the oxygen demand and associated air requirements for a fine bubble aeration system with water depth of 15 feet?
3. For high-speed surface aerators what is the efficiency and how much hp would be required to satisfy the oxygen demand in Q 2 above?
4. What are the essential equations for calculating power consumption?
5. How do treatment processes compare in energy consumption and what can be done to reduce power?

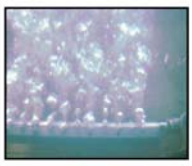
Example Slides: Power Reqts by Process and Aerator Type



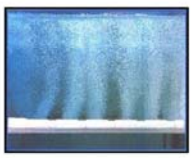


High Speed Turbo Blower

hp = (0.005) (psig) (scfm)



Coarse



Fine

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Foam & Bulking Sludge Control

FREE Zoom—Mentoring Session

Introduction to indicator organisms and causes of excessive foam, filaments and bulking sludge.

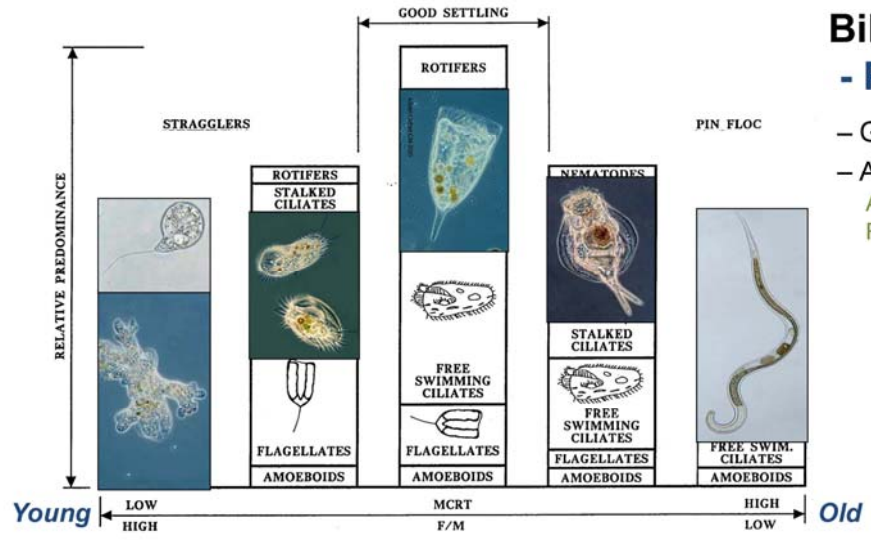
Includes: Problem identification followed by operator or engineering solutions to foam/filament problems.

Much information can be gained by observing the secondary clarifier as to what type of solids are floating on the water surface. Participants will see examples of various types of visible solids near or at the surface of the secondary clarifier. Microscopic examination of indicator organisms will also be discussed. Examples of modification to reactors that minimize foaming and bulking sludge will be presented.

Answer these Example Questions:

1. What are the indicator organisms often present with foam and bulking sludge problems?
2. How do ashing, clumping or billowing solids appear different in the secondary clarifier & what does that tell us?
3. Can operational or engineering modifications be used to control foam and filaments?
4. Which chemicals are effective in controlling bulking sludge and how should they be applied?

Example Slides: Indicator Organisims and Foam Observations



Billowy, White Foam

- Plant Startup – Low MCRT

– Generally indicates young, slow settling sludge

– Also Found

After hydraulic washout
Result of over wasting

- Indicates old, rapid settling sludge
- Settling may be slow
  - – Hindered settling
- Often filamentous
  - – Nocardia
  - – M. parvicella

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Operator Certification & Engineering Review

FREE Zoom—Mentoring Session

Prepares operators to take state certification exams for wastewater treatment. Good for non-operators such as managers or engineers.

Includes: Help for students to find and understand correct answers using questions from past certification exams .

Designed to help operators and engineers reach their goals for professional certification. Targets the needs for Grade 1 and 2 Operator Certification. The review has also benefitted non-operators , plant managers and engineers . The approach to learning is to use past actual exam questions to bring participants up-to-speed as quickly as possible. Background presentations are kept short and inter-active Q/A is used as the main approach for knowledge transfer.

Answer these Example Questions:

1. The main function of a primary clarifier is to remove: nitrogen, suspended solids or BOD?
2. Typical hydraulic detention time in an aeration basin is: 2 hrs, 6 hrs or 16 hrs?
3. Y/N: Does ultraviolet radiation leave a chemical residue?

Review Session Descriptions—Presented as Interactive Q/A—by raising of virtual hands

Training whether it be to engineers/managers (photo—top page) or to operational staff (above) is best done in person. When that is not possible the 3 Review Sessions Described to the right can provide a virtual alternative.

1. Operation Entry and Mid Level: Training involves illustrations to get the bigger picture of wastewater treatment. Principles and objectives of wastewater treatment are presented. Commonly used water and wastewater related terms are explained. Topics include collections, wastewater sources, preliminary and primary treatment. Essential information on key biological processes is provided.

2. Operation Mid and Senior Level: Focuses on materials associated with process loading and performance. Along with some entry level material Q's include those requiring mid-level math such as process loading (F/M, MCRT, and hydraulic/organic loading). Illustrations are provided regarding proper action when facing changes in conditions or upset. Added topics are disinfection, solids handling and advanced treatment.

3. Operational Management and Engineering: Involves reasoning and explaining operational conditions and plant management. Participants should have available the use of a hand calculator. Added topics are health and safety plus life-cycle analysis.

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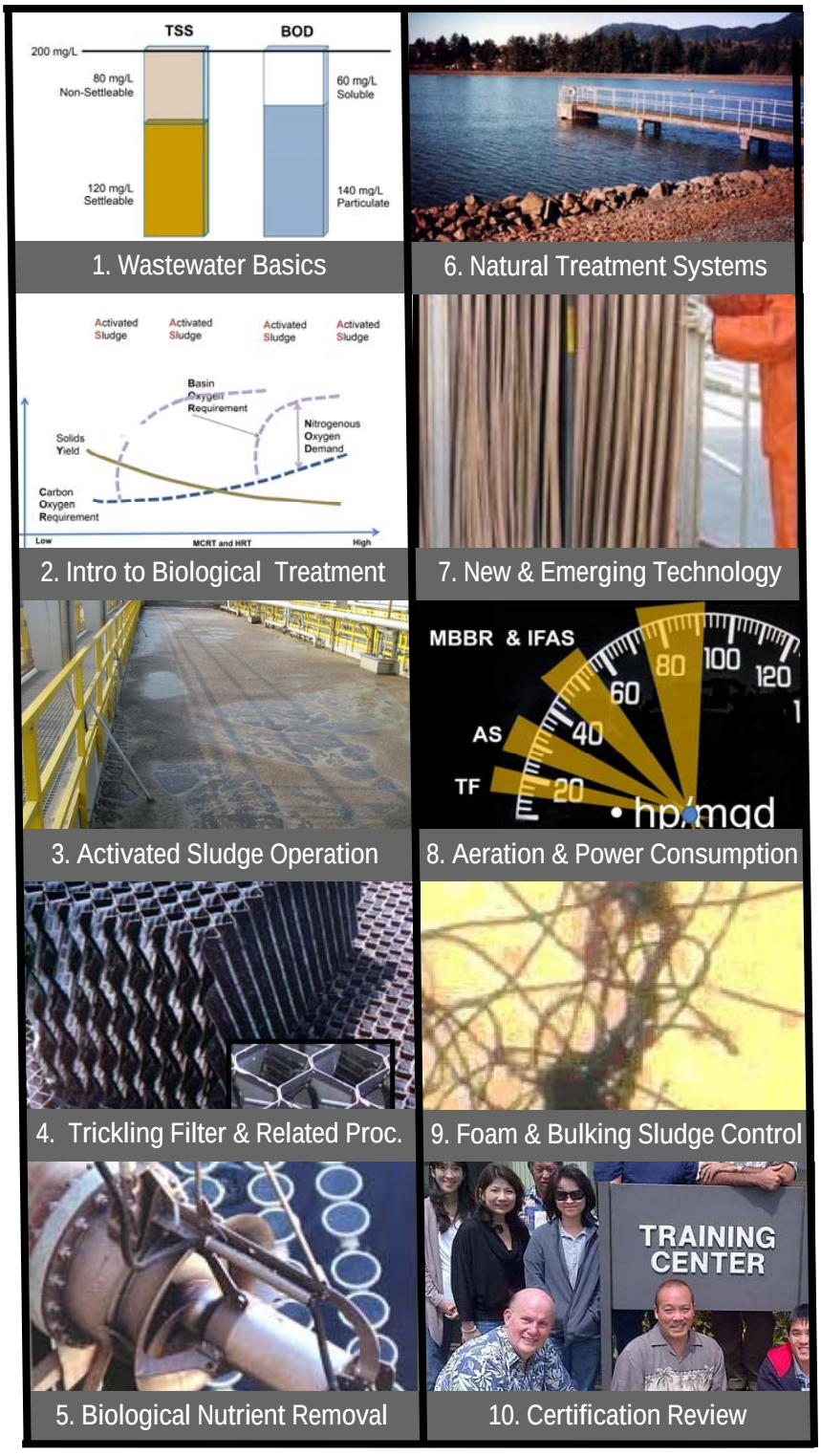
TSS
BOD
200 mg/L
80 mg/L
Non-Settleable
120 mg/L
Settleable
60 mg/L
Soluble
140 mg/L
Particulate
1. Wastewater Basics
6. Natural Treatment Systems
Activated Sludge
Activated Sludge
Activated Sludge
Activated Sludge
Basin Oxygen Requirement
Nitrogenous Oxygen Demand
Solids Yield
Carbon Oxygen Requirement
Low
MCRT and HRT
High
2. Intro to Biological Treatment
7. New & Emerging Technology
MBBR & IFAS
AS
TF
20
40
60
80
100
120
hpmgd
3. Activated Sludge Operation
8. Aeration & Power Consumption
4. Trickling Filter & Related Proc.
9. Foam & Bulking Sludge Control
TRAINING CENTER
5. Biological Nutrient Removal
10. Certification Review