



City of Jackson, Ohio

# Blending Conventional Treatment & Membranes

June 16, 2010



# History

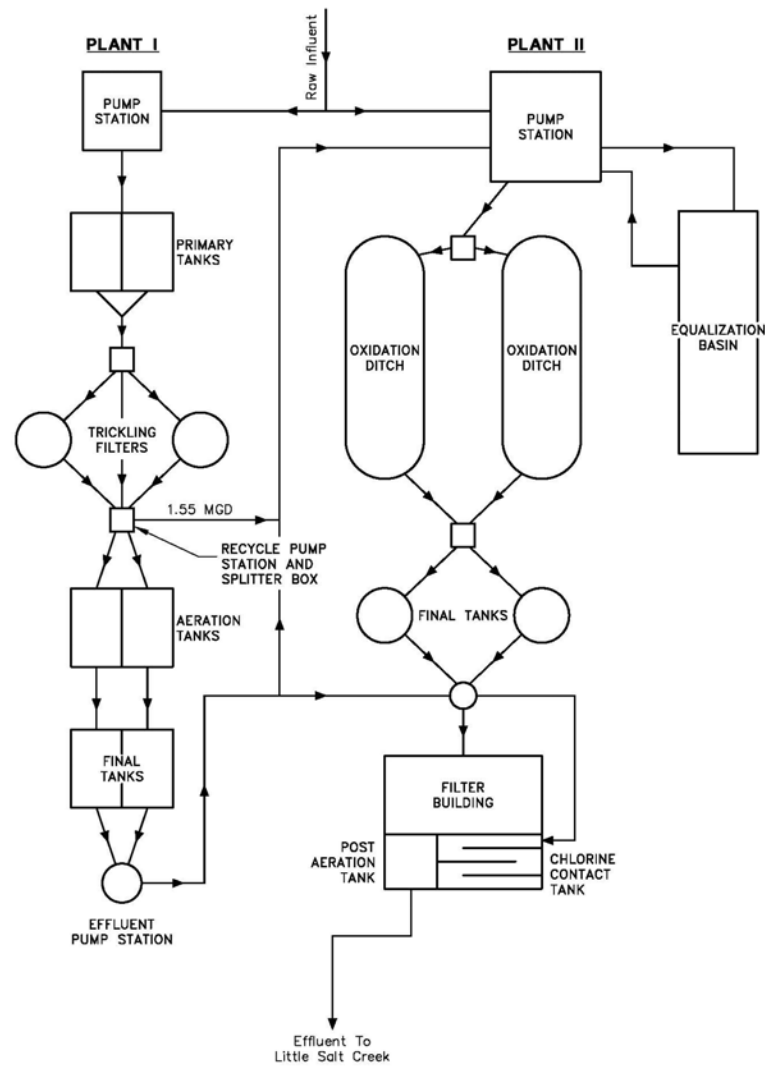
- Jackson has a Large Frozen Food Manufacturer in Town
- Created Huge Biological and Solid Loadings, Violations Occurred
- Older Town → Older Sewers → High I & I
- As the Manufacturer Continued to Grow, Additional Upgrades Were Necessary

# Current Facility - Wet Stream

- Plant I – Older 0.5 mgd Plant
  - Basically fell Apart, but Utilized the Trickling Filters as a Roughing Filter
- Plant II – 1.79 Oxidation Ditches



# Flow Treatment Schematic



# Current Facility – Oxidation Ditches

- Design Flow
  - 1.79 mgd
  - Utilized Trickling Filter as “Roughing Filters”
- 1.2 Million Gallon Equalization Basin
- Plant Performance has Shown Capabilities to Handle
  - 9,100 lbs/day  $\cong$  493 mg/L BOD
- Current average Flows
  - 2.3 – 2.5 mgd
  - High Peaks due to Inflow & Infiltration as High as 10.0 – 12.0 mgd

# Oxidation Ditches



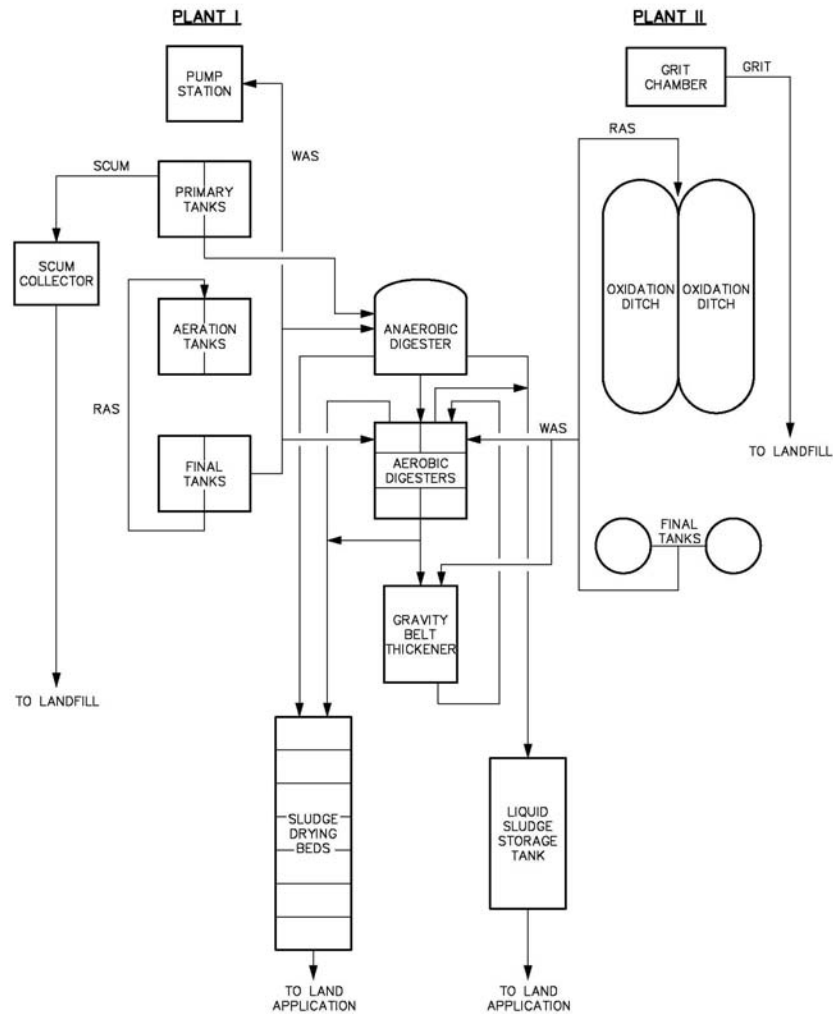
# Current Facility – Solids Stream

- Aerobic Digestion
  - 6 Digesters → 53,000 gallons each
- Anaerobic Digester
  - 50 foot Diameter with External Draft Tube Mixers
- Solids are Thickened on a 1.7-meter Gravity Belt Thickener to Approximately 4%
- Liquid Sludge Storage Tank
  - 863,000 gallons

# Current Facility – Solids Stream

- 1 Plastic Media Drying Bed & 15 Sand Beds
  - Basically not Utilized
- Spreader and 4,000 gallon Tanker Truck and Haul Their Own Solids
- Hauling and Spreading a Year Round Job

# Solids Treatment Schematic



# Alternatives

- Two-Fold Approach
  - Increase Capacity and/or Equalization Capacity
  - Reduce Inflow & Infiltration (I/I)

# Alternatives

- Six Projects Developed
  1. Transport and Treat I/I at Existing Plant Site
  2. Transport and Treat I/I with Existing and new Off-Site Plant
  3. Transport and Treat I/I with Existing Plant and new Off-Site Storage
  4. Reduce I/I and Treat at Expanded Existing Plant Site
  5. Reduce I/I and Treat at the Existing and Off-Site New Plant
  6. Reduce I/I and Treat at Expanded Existing Plant with a new Off-Site Storage Facility

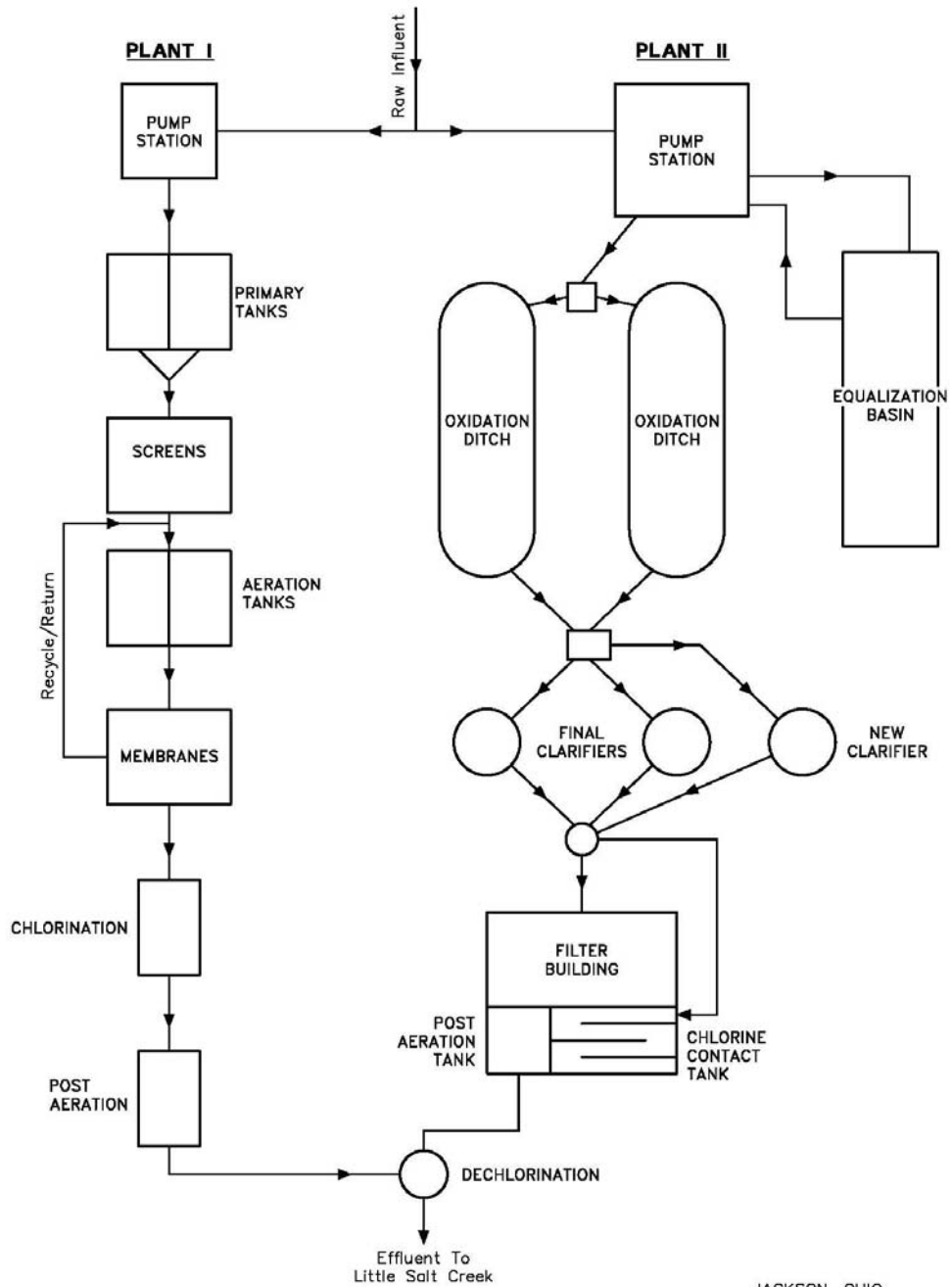
- Project #4 was Selected
  - Reduce I/I and Treat at Expanded Existing Plant Site

# Oxidation Ditches

- Maintain the Existing Oxidation Ditches
  - Average 1.79 mgd
- Increase Wet Weather Capacities Through Hydraulic Improvements and New Clarifier
  - Wet Weather Capacity – 5.4 mgd
- Maintain the Existing 1.2 million gallon Equalization Basin

# New Facilities – Membranes & I/I Improvements

- Add 2.0 mgd Average Daily Flow Capacity
  - Total Plant Capacity – 3.79 mgd Average Flow
- Peak Capacity – 4.0 mgd for 24 hours - Membranes
- Converted Anaerobic Digester to new Aerobic Digester
- Eliminated 9 Connected Catch Basins Downtown
  - Lined Influent Sewer and Manholes



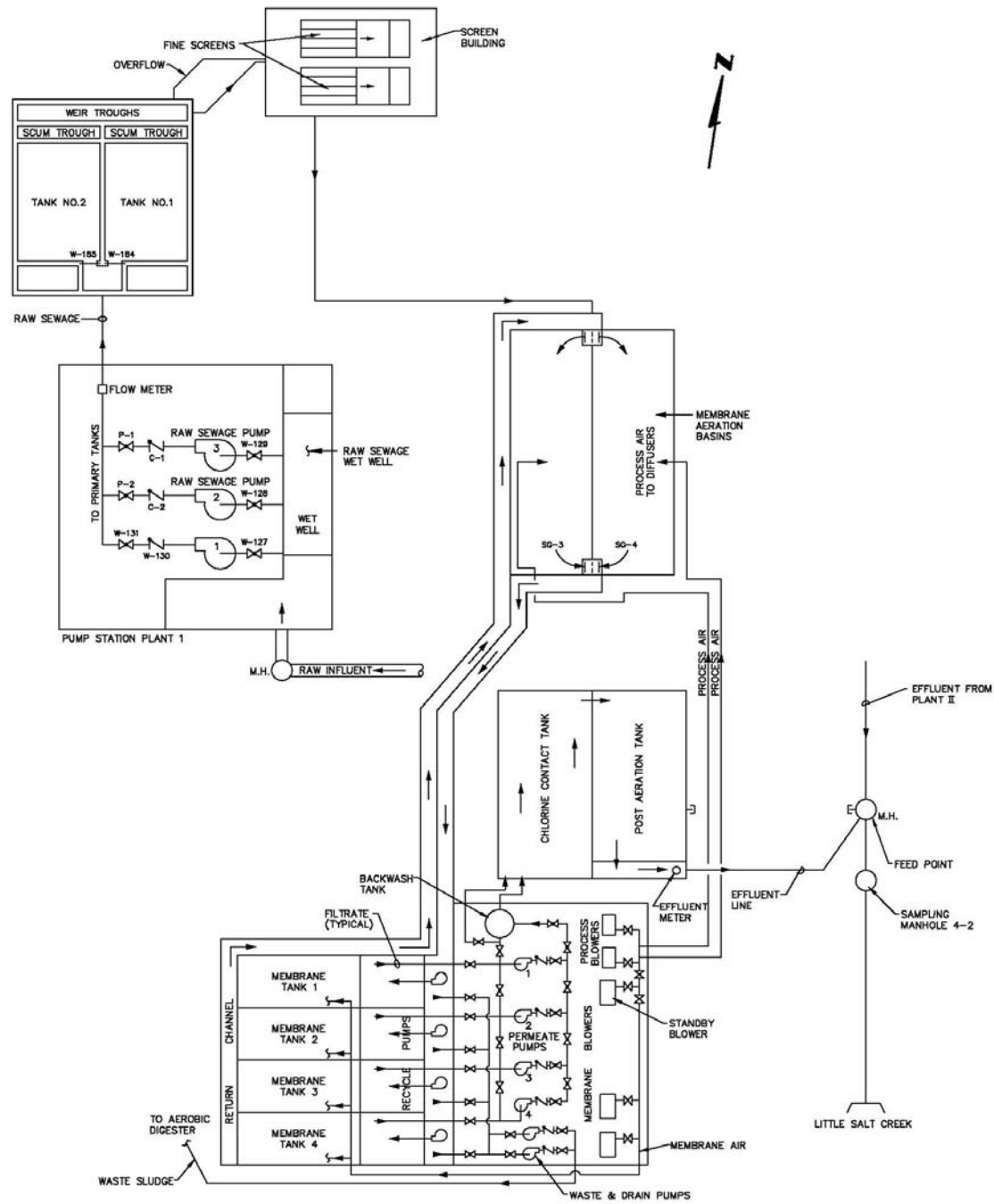
TCL-6058001DM05-Model  
02/09/09 10-V17

# Why Membrane Technology

- Could Utilize Existing Tankage
  - Lower Installation Costs for Membranes
    - Utilized Existing Primary Aeration & Final Tanks
    - \$9.6 million/2.0 mgd = \$4.80/gallon
- Superior Effluent Quality
  - Blended Flows Could Achieve Permit Limits
- Limited Space

# Why Membrane Technology

- Eliminate Need for Tertiary Filter Expansion
  - Filters are a High Cost - \$1-\$2 per mgd
  - High Recycle Flows
- Small Footprint
  - Allows for Future Expansion
- Reduces Process Vulnerability
  - High Feeds Created Filaments and Process Upsets



**MEMBRANE SYSTEM**

# MBR's

- 4 – Trains – 1 Redundant/Cleaning
- Each Train – 0.66 mgd Average – 2.0 mgd  
1.33 mgd Peak – 4.0 mgd
- Feed Forward Design
- Permeate Pumps Dual Purpose
  - Permeate
  - Backwash

# Blended Process

- Needs – Keep Both Systems Operating at a Rate to Treat a Rapid Increase to Higher Flows
- Summer Lows – 0.4-1.0 mgd Diurnal Swing
- Maintain 0.5 mgd to Membranes and Rotate Which Tank is in Service
- Remaining Flow to Ditches

# Preliminary Treatment

- All Flows Pass Through an Aerated Grit Tank
- All Flows Pass Through a ¼-inch Fine Screen
- The Previous Primary Tanks were Maintained Prior to the Membranes Even if Undersized.

# Screen Building



- Wastewater is Screened Prior to Entry in Membrane System Aeration Tanks
- Compact and Dewater

# Screens

- Consist of two, 1 mm Mesh Size, Rotating Screen Basket Drums
- Capacity: 4.0 mgd each. One as Back-up



# Aeration Basins

- Converted Previous Basins from 0.5 mgd Plant



# Components of Membrane Aeration System

- Aeration Tanks
  - 2 Tanks, 311,000 Gallons Total
  - Fine Bubble Diffusers Mounted on the Bottom



# Process Blowers

- Located in Membrane Bioreactor Building
- 5 Units
- Rotary Tri-lobe:  
1,900 scfm Each
- Two Sets – Process Aeration & Membrane Cleaning





# MBR Tanks

- Wastewater Fills Tanks and Flows Through Membrane Elements
- Permeate Pumps, Draw Up Wastewater into Hollow Fibers
- Membrane Fibers Backwashed Periodically to Remove any Lodged Particles
- Membranes are Chemically Cleaned

# Membranes



# Return Channel

- Not all Wastewater is Drawn up Through Membrane Filters
- Mixed Liquor Returns Through Return Channel to Influent End of Aeration Basins via Gravity
- The Return Channel Receives Wastewater Flowing over Weirs at North End of Membrane Tanks
- Aerobic State of Organisms Maintained by Air Diffuses Along Length of Channel

# Permeate Pumps

- Draw Permeate Through the Hollow Fibers
- 1 Pump – 1 Tank



# Permeate Pumps



- New Design – Rotary Lobes Rotate in Both Directions
- Serve Now as Backwash Pumps Also

# Membrane Cleaning

- Backpulsing
  - Reverse Permeate Flow through the Membranes to Maintain a Stable Transmembrane Pressure
  - Based on Production, 1/3 of time
- Relax
  - Alternative to Backpulsing
  - No Production, Just Aeration
  - 1 Backpulse Required per 10 Relaxes

# Membrane Cleaning

- Chemical Cleaning
  - Maintenance Cleaning
    - 1 per Day
    - Sodium Hypochlorite Utilized
    - Chemical Pulsed into Cassettes
    - 2 Hours out of Service
  - Recovery Cleaning
    - Every 6 Months
    - Citric Acid Utilized
    - Tank Drained, Membranes Soaked
    - 24 Hours



# Chlorination

- Converted Final Tank



# Chlorination

- Chlorine Solution Distributed to:
  - Plant I Chlorine Contact Tank
  - Plant II Chlorine Contact Tank & RAS
- Chlorine Operations Moved from Administration Building for Safety



# Dechlorination

- Sulfur Dioxide Combines with Water via Automatic Sulfanator in Sulfur Dioxide Feed Building
- Distribution Point Solution is Effluent Manhole

# Post Aeration Plant I

- Minimum DO Level Requirement: 6 mg/L
- Air Diffused into Post Aeration Tank by Coarse Bubble Diffusers
- Converted Old Final Clarifier



# Project Revisions

- Masonry Building in Lieu of Metal
- New Chlorination and Dechlorination Facilities
  - Opened Space in the Administration Building for Storage
- Relocated Alum Tank
  - Opened Space in the Administration Building for Offices & Conference Room
- Additional Aerobic Digester Blower for Back-Up

# How are We Doing?

- Operational Since June/July 2009
- Excellent Effluent
- Last Five Months – Blended Flow

Average Flow	2.4 mgd
TSS	Less than 5 mg/L
BOD	Less than 1 mg/L