Augmented Aerobic Digestion

A Case History Review

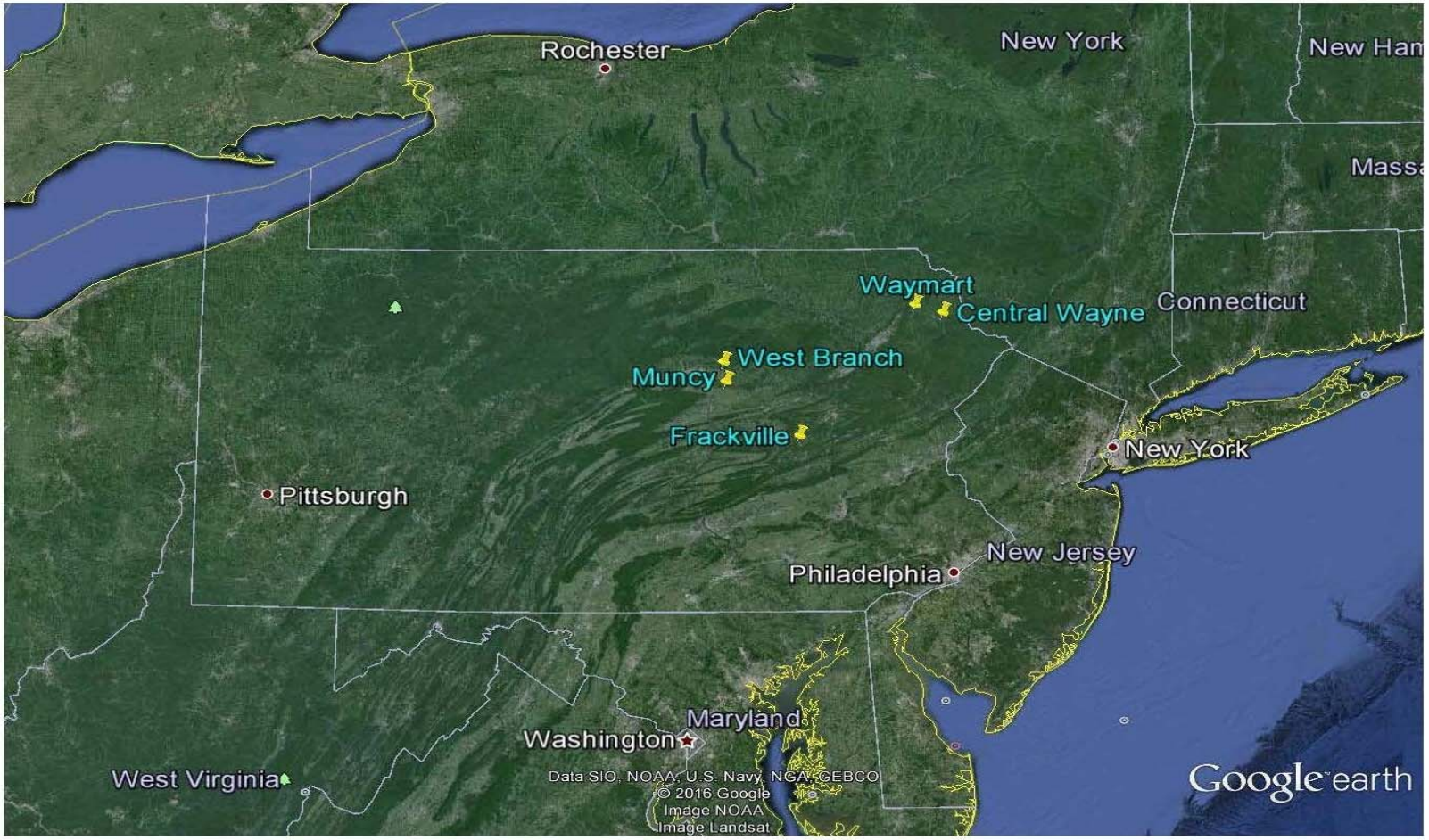
Edward J. Pietroski, PE
685 South Mountain Blvd.
Mountaintop, PA 18707
570-868-0275
epietroski@entecheng.com

Full Presentation Available at www.entecheng.com

Project Overview Locations

- Muncy Boro Municipal Authority, Muncy PA
- Waymart Area Authority, Waymart PA
- Frackville Area Municipal Authority, Frackville PA
- Central Wayne Regional Authority, Honesdale PA
- West Branch Regional Authority, Montgomery PA

Project Overview Locations



Google earth

miles 200
km 400

Muncy Eliminate Anaerobic Digestion

- Anaerobic Single Stage
- Worn Out Equipment
- Costly Repairs
- Poor Digestion
- Fuel (Natural Gas) Cost

Muncy Plant Background

Caption 1

- 1.4 MGD Trickling Filter
- 500Lbs/day BOD bakery, Kellogg
- Crude Headworks, Manual Bar Rack
- Belt Filter Press, solids to landfill

Muncy Project Details

- Convert Anaerobic Digester to Aerobic
  - Draft Tube Diffuser
- Convert abandoned Imhoff Tank to Aerobic Digester
  - Provided Additional Solids Detention Time
  - Provided Series Operation
- Add PD Blowers
- PA Dept. Environmental Protection – Class B Issues
  - Part of Solids Disposal Regulations
  - Reduced Freeboard for additional Volume
  - Series Operation
    - Reduced Required Detention Time

Muncy Project Details

Muncy Converted Imhoff Tank

Muncy Aerobic Digester Operation Data

(January 2003 – April 2004)

Parameters	Warm Season	Cold Season
Monthly average SRT (days)	29 – 54	32 – 75
Temperature (^{o}C)	22.5 – 30.5	15.5 – 22.5
Dissolved oxygen (mg/L)	0.3 – 2.1	0.5-3.4
VS reduction – Class B $\geq$ 38%	69% – 84%	62% – 84%
SOUR – Class B $\leq$ 1.5 mg/g/hr	0.60	0.62
F. Coliform – Class B $\leq$ 2 million/g TS		80,000
Average NH_3-N (mg/L)	1.1 – 10	1.1 – 8.5
Average NO_3/NO_2-N (mg/L)	0 – 7	0 – 8.5
pH range	6.5 – 8.1	6.7 – 7.6
Average alkalinity (mg/L)	79 – 140	100 – 275

Muncy Aerobic Digester Operation Data

(January Thru December 2007)

Parameters	Primary Digester	Secondary Digester
Monthly average SRT (days)	40 days Annual	Avg. Combined
Temperature (^oC)	12 – 20	14 – 25
VS reduction – Class B $\geq$ 38%	77.8%	Annual Average
Average NH_3-N (mg/L)	1.6 – 12	0.3 – 2.5
Average NO_3/NO_2-N (mg/L)	0 – 9.36	4.66 – 9.36
pH range	7 – 7.2	6.9 – 7.1
Average alkalinity (mg/L)	120 – 480	90 – 560
Pounds Dry Solids Disposed per Pound BOD Influent	Avg. 2005, 06, 07 Range	0.378 0.27 – 0.47

Muncy Results

- Reduced Sludge to Landfill by 50%
- Met Class B Requirements
- Much Easier for Operators to operate & maintain
- Non-clogging diffusers (hasn't clogged yet !)
- Pre-thickening – NOT BY DESIGN
  - Primary and Secondary Clarifiers
  - Daily Wasting from "Sludge Pockets"
- Aerobic/Anaerobic Cycling 6 hr. On / 6 hr. Off
  - Summer Heat Control
- Briefly (2 yr.) a Regional Sludge Processing Facility

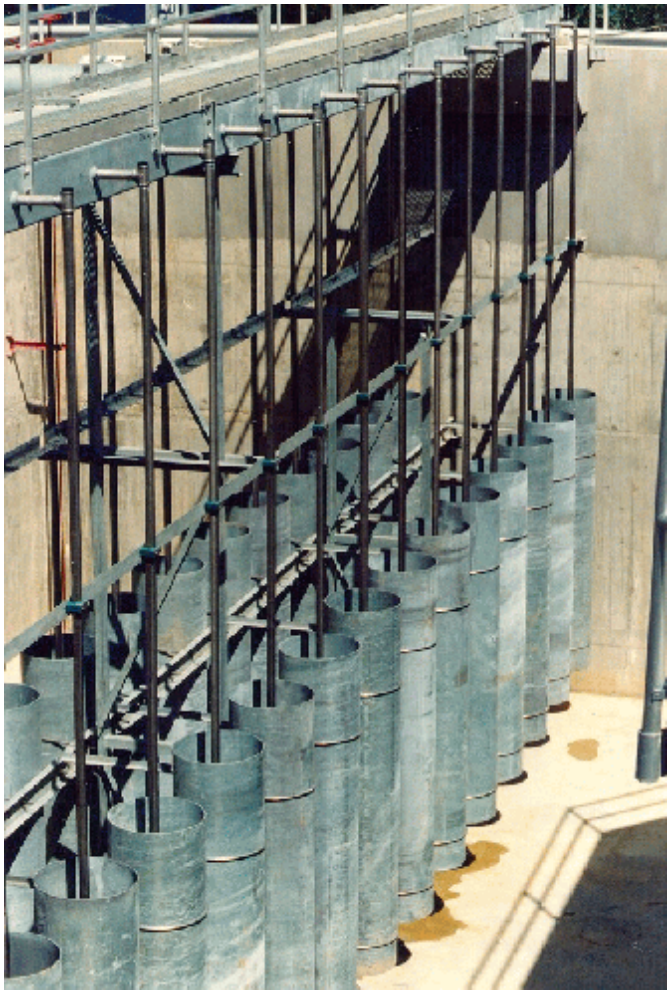
Waymart Triple WWTP Capacity

- Plant Upgrade to Include Federal and State Prison Connection
- SBR, Intermittent Thin Waste Sludge
- Class B Sludge
- Minimize Sludge Production
- Winter Operations

Waymart Plant Background

- 0.2 MGD Rotating Biological Contractor
- Agricultural Utilization of Biosolids
- Upgrade to 0.715 SBR, High BOD Load
- Upgrade to Grind Influent NOT SCREEN

Waymart Project Details



- Construct 0.715 SBR
- Upgrade 3 Tank Aerobic Digesters (22,000 Gal. each) to Gravity Thickening / Holding
- Two New Aerobic Digestion Tanks
- Ovivo Cover with Air Beams
  - Shear Diffusers
- Belt Filter Press
  - Biosolids to Landfill

Waymart Aerobic Digester

2004 Operation Data

Parameters	Warm Season
Monthly average SRT (days)	168 - 200
Temperature (^oC)	24 – 32
Dissolved oxygen (mg/L)	0.05 – 1.73
VS reduction – Class B $\geq$ 38%	$\geq$ 55%
SOUR – Class B $\leq$ 1.5 mg/g/hr	1.8
F. Coliform – Class B $\leq$ 2 million / g TS	4,000
Average NH_3-N (mg/L)	7.6 – 43.2
Average NO_3/NO_2-N (mg/L)	10.4 – 92.1
pH range	6.2 – 7.3
Average alkalinity (mg/L)	162 – 188

Waymart Aerobic Digester Operation Data

(January 2006 Thru December 2007)

Parameters	Primary Digester	Secondary Digester
Monthly average SRT (days)	56 days Annual	Avg. Combined
Temperature (^oC)	12 – 32	14.67 – 35
F. Coliform – Class B $\leq$ 2 million / g TS	9,000,000	2,400,000
Date Fecal Sample, Feb. 13, 2008		
Average NH_3-N (mg/L)	0.02 – 40	
Average NO_3/NO_2-N (mg/L)	0.3 – 75	
pH range	6.4 – 7.4	5.2 – 8.1
Average alkalinity (mg/L)	100 – 310	
Pounds Dry Solids Disposed per Pound BOD Influent	Avg. 2007	0.348

Waymart Results

- Meets Class B
- Excellent Dewatering
  - 18-22% Belt Press
- No Odors (Including Cake)
- Excellent Winter Operations
- Non-Clog Diffusers (2004 thru today)
- Dry Solids/BOD
  - 2013 - 2014 Average = 0.41

Waymart Update

- Installing Ovivo Membrane Thickening
  - Consistent Thickening, Lower Manpower
  - Ease Wintertime Thickening Duties
  - Possible Hauled in Waste Liquid Sludge

Frackville Energy Efficient Time Saver

- Operators wanted larger BFP
- Reduce Dewatering Time
- Reduce Biosolids thru VSS Destruction
- Reduce Energy

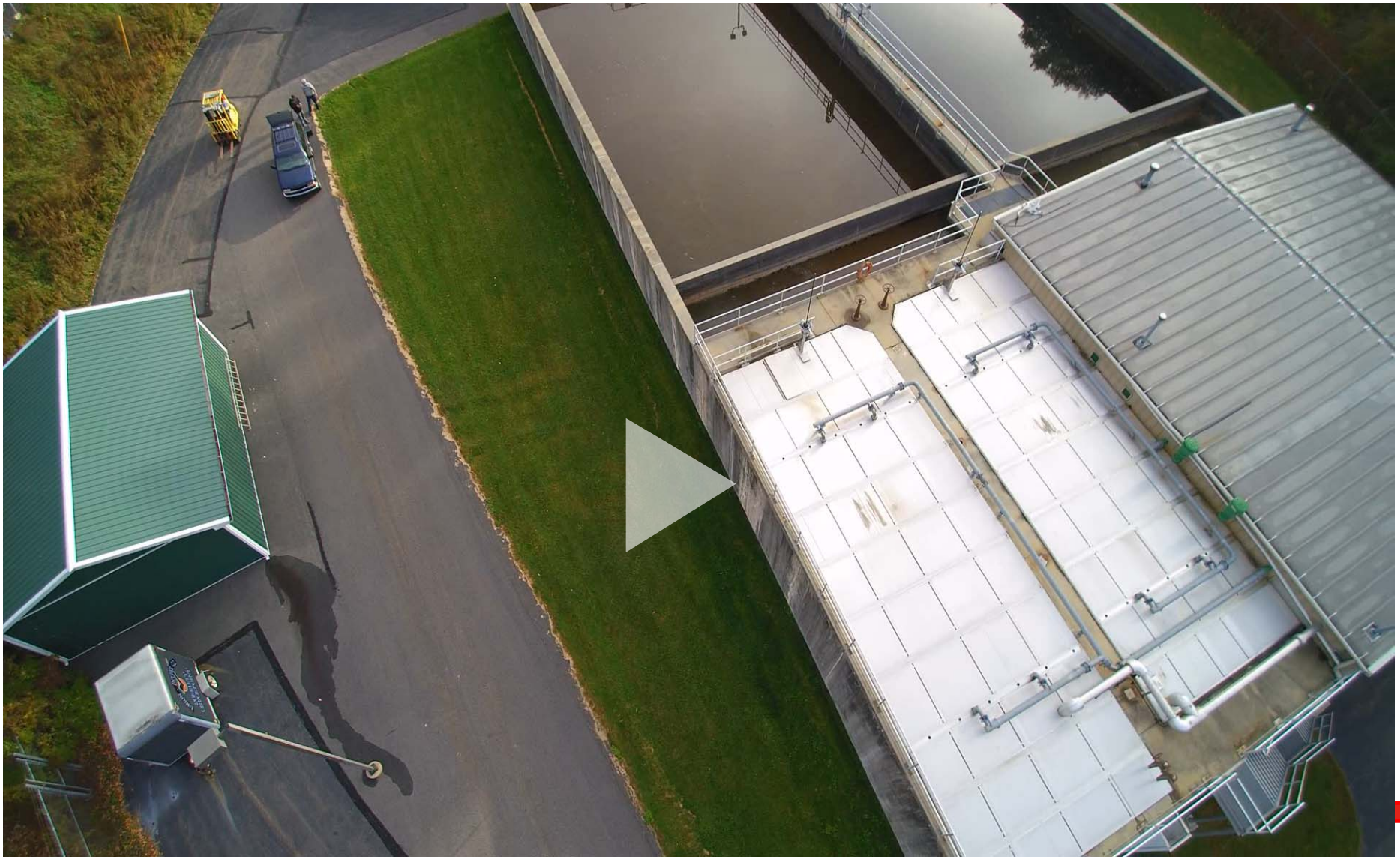
Frackville Plant Background

- 1.4 MGD – SBR (ICEAS)
  - Total Phosphorus Limit
  - Ferric Chloride Addition
- Open Top Aerobic Digesters
  - Corse Bubble Diffusers, Tank Bottom
- Belt Filter Press
- Biosolids to Land Reclamation
  - Hydrated Lime, 50 lb. bags

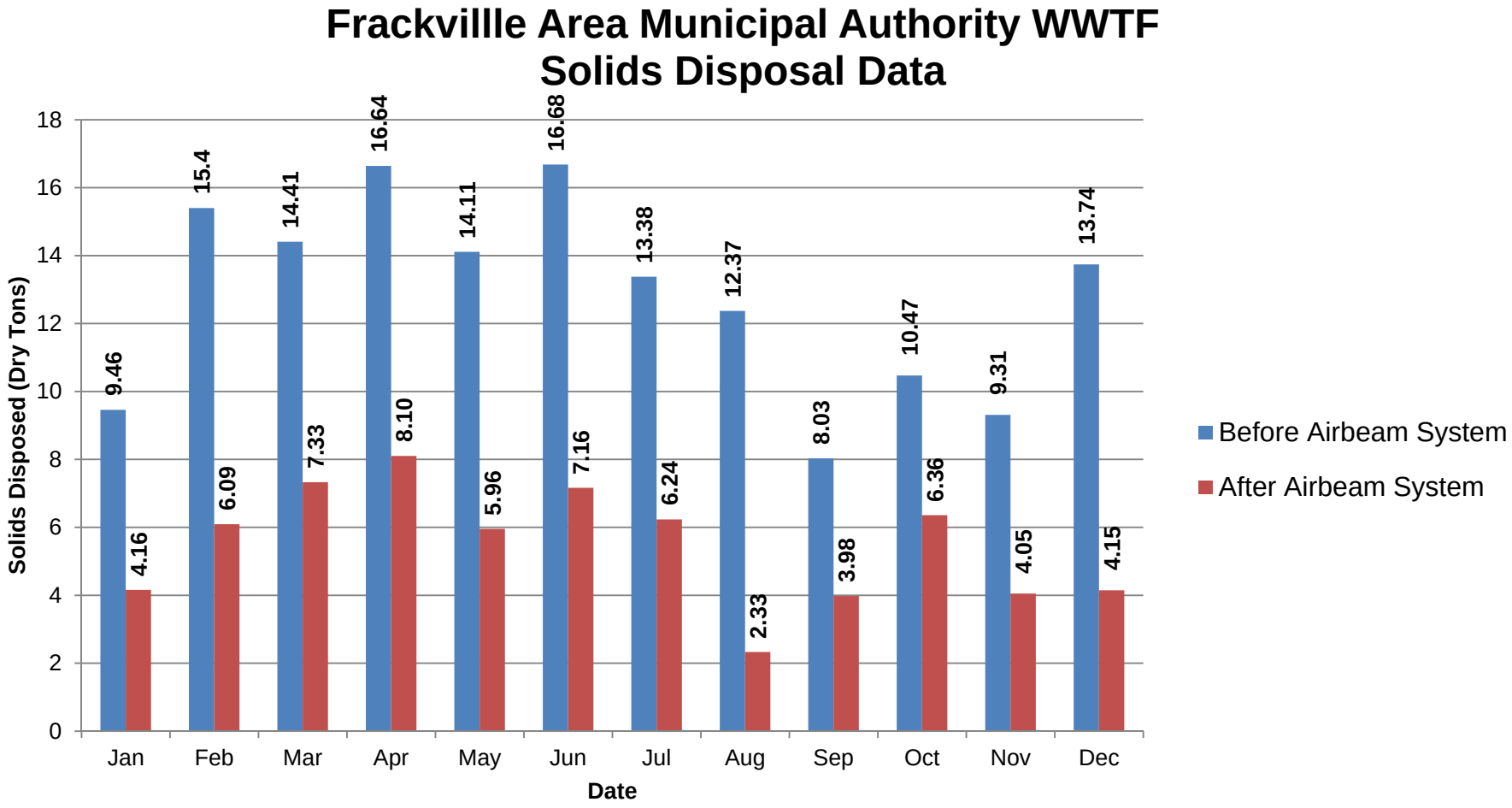
Frackville Project Details

- Cover Aerobic Digesters Ovivo Air Beam
  - Shear Tube Diffusers
- High Efficiency Blowers w/V.F.D.
- New BFP Sludge Conveyor

Frackville Project Details



Frackville Results



Frackville Results

- Sludge Disposal Reduced 57%
  - $17,000 Annual Savings
- Energy Rebate $27,503
- Annual Energy Savings $18,000
- Chemical Savings
  - Lime for Land Application
  - Polymer for Dewatering
  - Ferric for P removal in SBR Eliminated
    - Aerobic / Anaerobic Cycling
- Manpower Reduced
- Dry Solids/BOD
    - 2012 - 2013 Average = 0.36

Central Wayne Capacity Upgrade

- Consent Order from PaDEP
  - CSO Issues
  - Connection Moratorium
- 1.18 MGD Trickling Filter to 2.2 MGD SBR
- Most Equipment in need of repair

Central Wayne Plant Background

- Primary Clarification, Trickling Filters, Final Clarifiers
  - Secondary Limits
- Existing Aerobic Digesters
  - Converted from Anaerobic 18 years prior
- Existing Belt Filter Press 18 years old
  - Minimal Sludge Issues

Central Wayne Project Details

- Upgrade to 3 tank, 2.2 MGD SBR
  - Strict Effluent Limits = Greater removals
  - SBR and Strict Limits = MORE BIOSOLIDS !
- Repurpose Final Clarifier to Sludge Holding
  - Equalize SBR Sludge Wasting
  - New Belt Filter Press
    - Gravity Drainage Belt (3 decks)
    - Intermittent Operation

Central Wayne Project Details

- Cover Aerobic Digesters with Ovivo Airbeam Covers
  - Honesdale Winters
  - Draft Tube Diffuser
- Mechanical Thickening
  - Transfer Waste Sludge at 5 to 6% solids
  - Increase Solids Detention Time
  - Fit Existing Tank Size
    - Third Digester not required

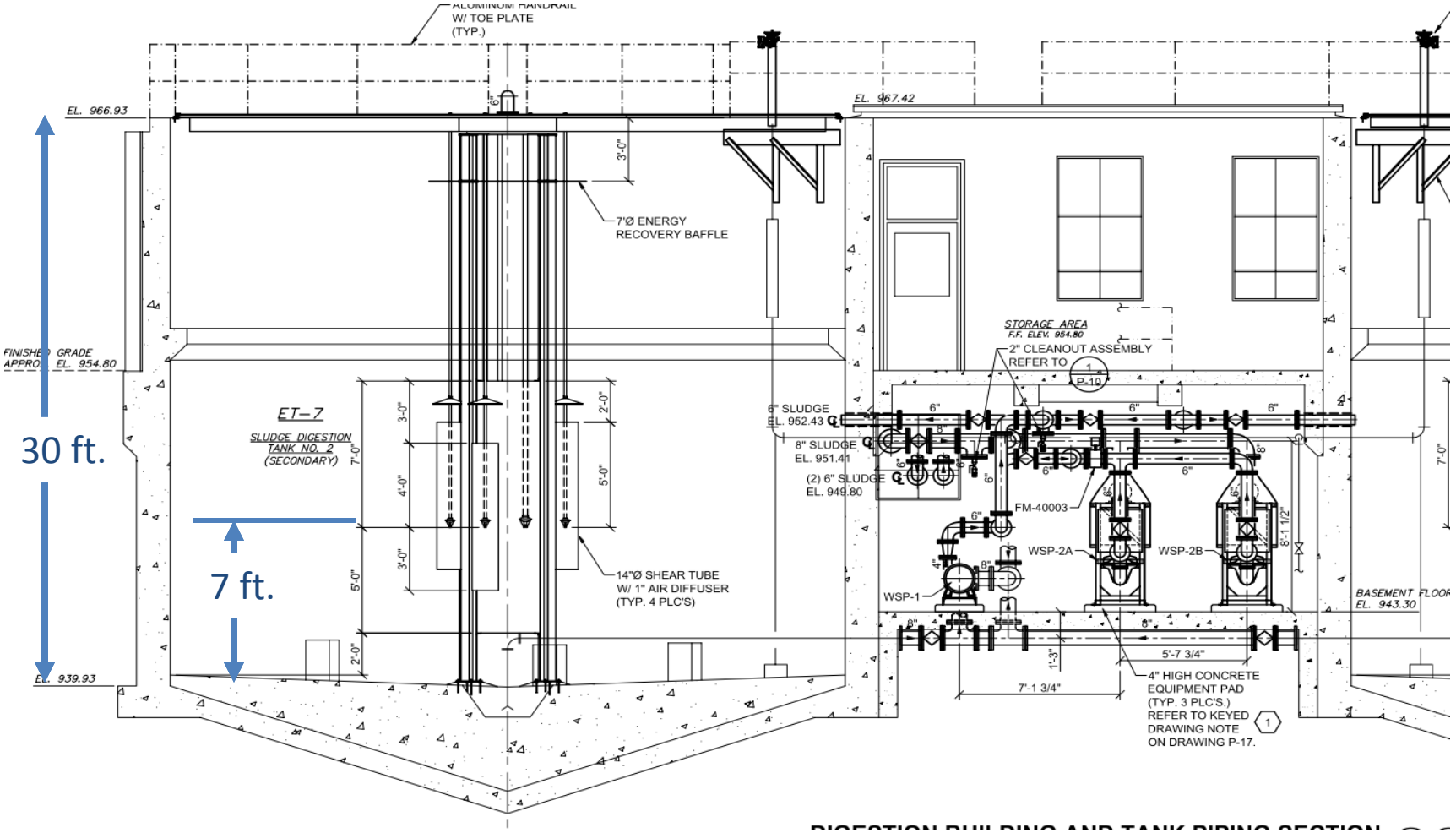
Central Wayne Project Details

Central Wayne Project Details

Central Wayne Project Details

Central Wayne Project Details

Central Wayne Project Details



Central Wayne Project Details

Central Wayne Results

- Class B Requirements
- Much Easier for Operators to Operate & Maintain
- Non-Clogging Diffusers (hasn't clogged yet !) 5 years.
- Mechanical Pre-thickening
  - 5% Solids to Primary Digester
- Dry Solids/BOD
  - 2013 - 2014 Average = 0.34
  - April 2013 VSS Reduction = 77%

West Branch Design of New Regional WWTP

- Replaced Muncy PA WWTP
- Replaced Montgomery PA WWTP
  - Hauled Liquid Sludge to Muncy
- 2.4 MGD SBR
- Owner and Operator Input Solicited
  - Followed Central Wayne Concept

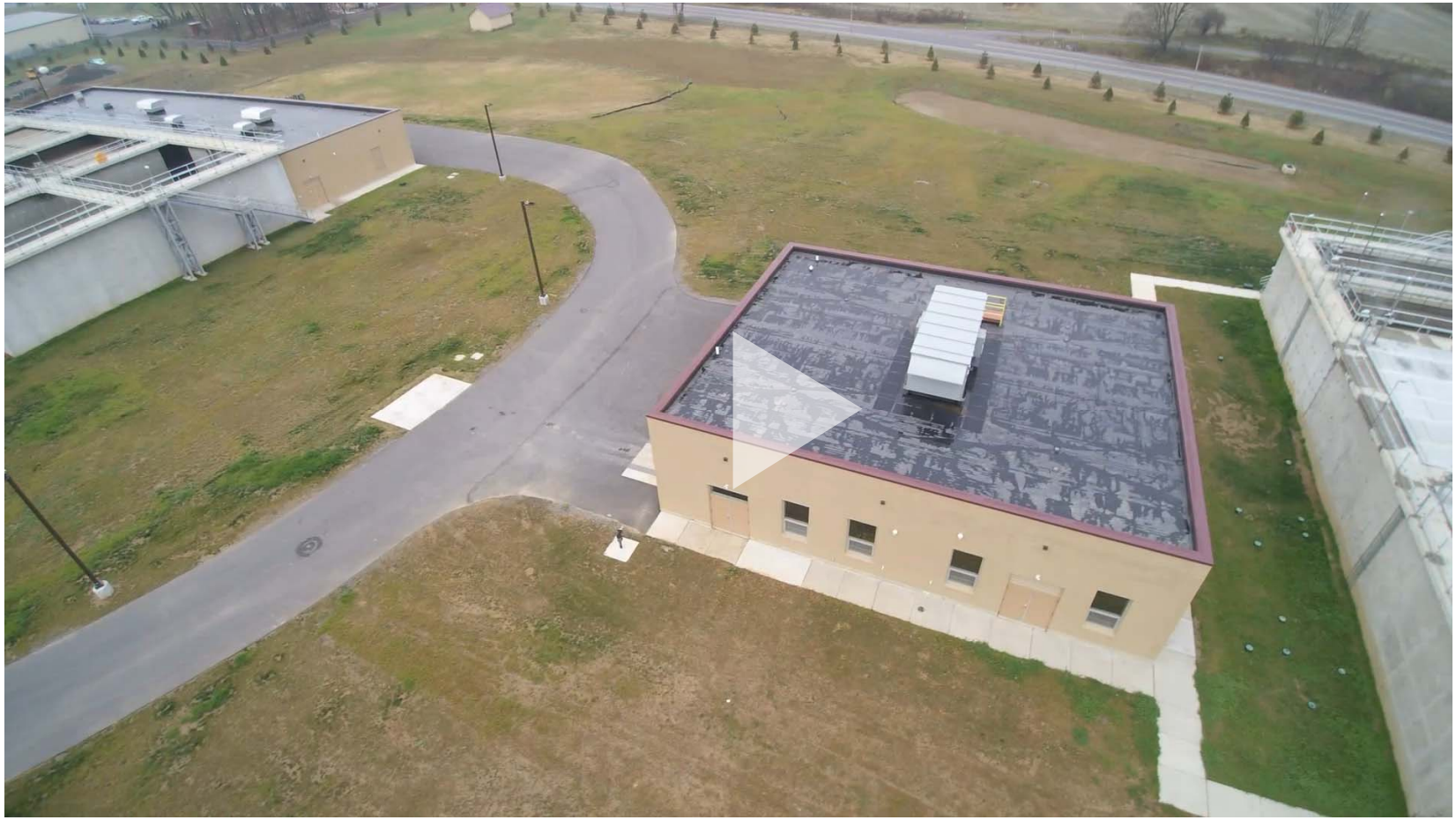
West Branch Plant Background

- 2.4 MGD SBR
- 500Lbs/day BOD from large bakery, Kellogg
- Untreated Landfill Leachate
- Belt Filter Press, solids to landfill

West Branch Project Details

- Sludge Holding Tanks
  - Ovivo Diffusers
- Square Aerobic Tanks
  - Draft Tube Diffusers
- New Belt Filter Press
  - Gravity Drainage Belt (3 decks)

West Branch Project Details



West Branch Results

- Met Class B Requirements
  - VSS Reduction
    - August 2015 44.7%
    - November 2015 61.3%
  - Fecal Coliform 343,000 MPN/ g dry
  - Dry Solids/BOD
    - August 2015 0.69
    - November 2015 0.17

Summation

- Class B Performance
- Excellent VSS Reduction
- Energy Savings
- Ease of Operation
  - Non-Clog Diffusers
  - Excellent Winter Operation
- Filtrate/Decant Quality
  - Low Nitrogen
  - Lower Phosphorous
- Easy Retrofit to Various Tank Configurations

Questions

Thank You