Dewatering Case Study
Rotary Press Versus Screw Press

OWEA 2012 Annual Conference

June 20, 2012

HAZEN AND SAWYER
Environmental Engineers & Scientists

Kyle Novak, P.E.

Presentation Overview

- Project Background
- Onsite Dewatering Consideration
- Case Study: Rotary Press vs Screw Press
- Pilot Results
- Summary

Southwest Regional WWTP (SRWWTP)

- Located in Medway, OH (Clark County)
- 2 MGD, expanding to 4 MGD by 2014
- Liquid Stream Treatment:
  - Screening/Grit Removal, Oxidation Ditch, Final Clarifiers, Tertiary Sand Filters, Chlorination & Dechlorination, Post Aeration
- Solid Stream Treatment:
  - Aerobic Digesters, Mobile Belt Filter Press, Onsite Drying Beds

SWRWRF Planning Study

- Mobile belt filter press is owned and operated by an outside contractor
  - On-call dewatering service on an as needed basis
- Advantage: No manpower or capital required to operate or maintain the equipment
- Disadvantage: Dependence on service provider and potential lead time for mobile press

Problem – Solids Inventory

- When dewatering service is not available, they are forced to store solids in the digesters and the outer ring of the oxidation ditch
  - Gone up to 3 months without dewatering
- Infrequent dewatering causes highly variable MLSS concentrations and low volume, highly concentrated filtrate to be discharged back to the liquid stream, creating operational challenges.

Problem – Solids Settleability

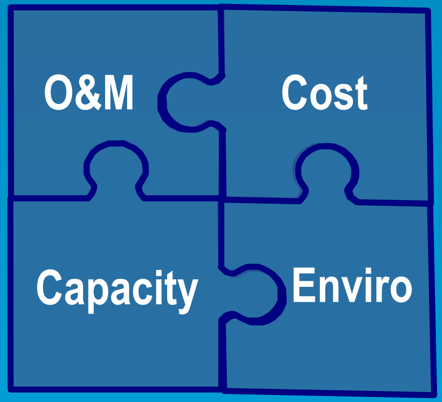
- Poor solids settleability due to inconsistent liquid stream operation
  - Variable MLSS = poor settling solids
  - SVI has routinely >200 mL/g
- Tertiary filters were often necessary to keep the SRWWTP in compliance with TSS permit limit
  - 18 mg/L (weekly), 12 mg/L (monthly)

Project Objective

- Objective was to give Clark County more control over getting the solids out of the liquid stream
  - More consistent MLSS in the oxidation ditch
  - Better settling in the final clarifiers
- Clark County/Hazen and Sawyer also received approval from OEPA to discontinue the use of the tertiary filters if they can prove final clarifier effluent meets current permit limits

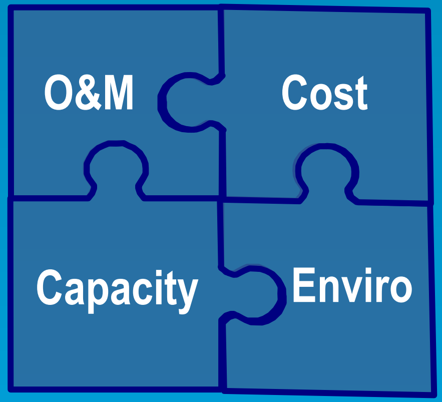
Onsite Dewatering Considerations

- Require relatively large capital investment
  - Site constraints / available space
- Substantial share of annual O&M budget
  - Chemical addition
  - Wash water
  - Electricity
  - Labor



Onsite Dewatering Considerations (Cont.)

- Dewaterability (sludge characteristics)
- Consider impacts on treatment train
  - Sidestream treatment
  - Odor control
  - Future capacity / adaptability
- End-use
  - Further treatment
  - Disposal requirements



Different Viewpoints

Cost

How much does it cost to build?
How much will it cost for O&M?

- Utilities
- Labor, Training
- Chemicals, Supplies, Equipment
- Maintenance

Non-Cost

How am I going to operate this?
How am I going to maintain this?
What about the environment?

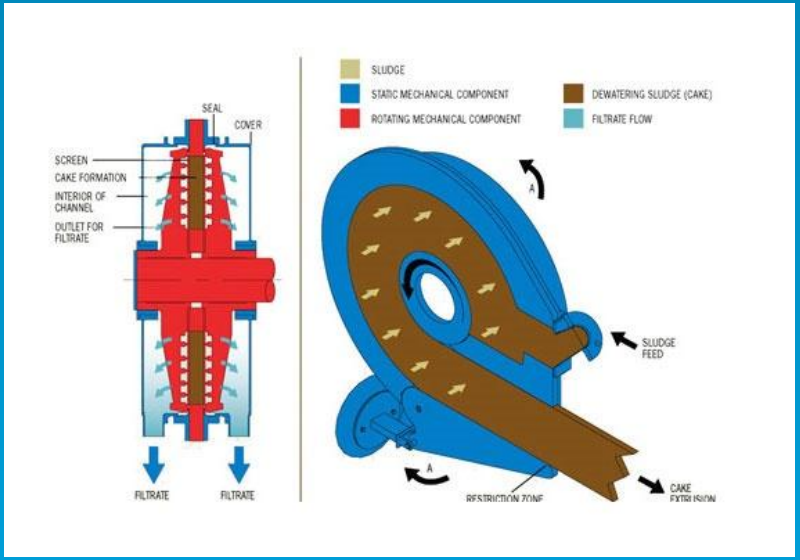
- Performance, Sidestreams, Odor
- Ease of Use, Flexibility, Adaption
- Environmental Impacts, Noise Level

Dewatering Technologies

Thickening	Stabilization	Dewatering	Post Treatment
Centrifuges	Aerobic Digestion	Centrifuges	Microwave Drying
GBTs	Anaerobic Digestion	Belt Filter Press	Conventional Drying
Gravity Thickeners	ATAD	Rotary Press	Composting
	TPAD	Screw Press	Lime Stabilization
			Incineration

How Does a Rotary Press Work?

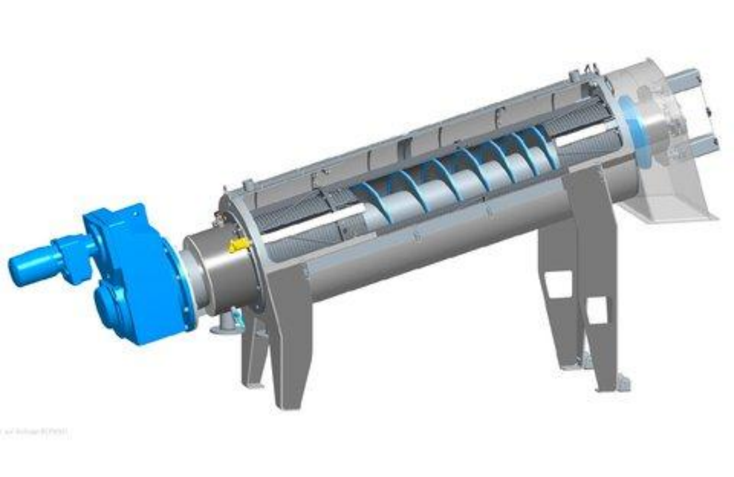
- Sludge is fed into a rectangular channel and rotated between two parallel revolving screens
- Water leaves the sludge through the screens, eventually forming a cake at the discharge end of the press
- The frictional force of the slow moving screens and the controlled outlet restriction (gate) generate enough backpressure for optimum cake thickness



Rotary Press Image Courtesy of Fournier Industries, Inc.

How Does a Screw Press Work?

- Water is pressed out of the sludge by a rotating auger through a cylindrical screen basket
- As sludge moves along the basket, the pressure increases as a result of:
  - The auger diameter increasing
  - The gap between the flights decreasing
  - The screen openings decreasing
- Pnuematic cylinders maintain the desired backpressure for optimum cake thickness
- A brush and spray cleans the screen periodically



Screw Press Image Courtesy of Huber Technology, Inc.

Rotary and Screw Press

Advantages	Disadvantages
• Low speed, low power • High solids capture rate • Low water requirements • Automated operations • Ease of maintenance	• Better with primary solids (piloting recommended)

Rotary Press Image Courtesy of Fournier Industries, Inc.

Screw Press Image Courtesy of Huber Technology, Inc.

Dewatering vs Onsite Screw or Rotary Press

- Current solids operations
  - Aerobic sludge digestion
  - Contracted belt press dewatering
  - Contracted storage and land application
- Proposed solids operations
  - Aerobic sludge digestion
  - Onsite dewatering
  - Contracted storage and land application

Factors for Comparison

- On-call Contracted Belt Press

Advantages	Disadvantages
• Current operation / familiarity • No labor required • No capital / maintenance costs	• Cost of contract ($0.0375/gal) • At mercy of contractor’s schedule for dewatering • Odors

- Onsite Screw or Rotary Press

Advantages	Disadvantages
• Remove solids from liquid stream as necessary • Ownership of dewatering process • Low odors / noise	• In-house labor requirements • Capital / maintenance costs

Design Criteria for Onsite Dewatering

- 2% feed solids (aerobically digested)
- Initial criteria was operation during normal business hours (no weekends)

Description	1.3 MGD (Current)	4.0 MGD (Future)
Operating Schedule, days/week	2	5
Operating Hours, hrs/day	6.5	6.5
Hydraulic Loading, gpm	65	80
Mass Loading, dry lbs / hr	660	810

Rotary and Screw Press Design Assumptions

Consumables/Fees	Rotary Press	Screw Press
Normal Connected HP	7	9
Hours of Labor / Week	2 (Current) 5 (Future)	4 (Current) 10 (Future)
Hours of Maintenance / Day	1	
Labor Rate for Operation	$36.00 / hr	
Expected Polymer Usage	15 active lbs / dry ton	
Typical Cake Solids (TS)	15%	
Solids Capture Rate (TS)	95%	
Labor/Chemicals Yearly Increase	2%	
Maintenance Cost (% of Capital)	2%	

25-Year Present Worth Summary

Dewatering Alternatives	Capital Present Worth ($MM)	Average Annual O&M Cost	O&M Present Worth ($MM)	Total Present Worth ($MM)
Contracted Press	$0.00	$186,000	$2.25	$2.25
Rotary Press	$1.19	$57,000	$0.74	$1.93
Screw Press	$2.22	$92,000	$1.21	$3.43

- In addition to present worth, the Rotary and Screw Press also offered the non-cost benefits of consistent solids removal and filtrate load back to the liquid stream
- Both presses easier to operate than belt filter press

Why Did We Pilot?

- Rotary Press had lowest present worth
- However, pilot testing was necessary to verify design criteria assumptions
- All sludge is different, so it's important to see how the equipment will perform with the specific sludge
- It's also a good way for the end user to get an up-close look at the equipment in action

Pilot Testing

- A 3-day pilot test was performed separately for the Rotary and Screw Press
- Aerobically digested sludge was fed at ~1.4% solids (average)
- Polymer type/dosage and equipment speed were varied to optimize performance

Summary of Pilot Results

Pilot Results	Rotary Press	Screw Press
Average Feed Solids	1.4%	1.4%
Polymer Usage, active lbs / dry ton	11-19 Avg = 11	16-24 Avg = 19
Cake Solids	11-14% Avg = 13%	17-22% Avg = 19%

Summary of Pilot Testing Evaluation

Full Scale Operation	Rotary Press	Screw Press
Power Consumption, HP	7	9
Full Scale Hydraulic Capacity, gpm	80	90
Full Scale Solids Capacity, dry lbs/hr	400	900
Equipment Capital Cost	$300,000	$408,000
Yearly O&M Cost	$64,500	$62,100
Installation Cost	$1,000,000	$1,210,000

- Rotary Press had lower capital and installation costs
- Screw Press produced higher cake solids, thus lower disposal costs
- Clark County also felt more comfortable with the operation of the Screw Press

Discussion of Pilot Evaluation

- Rotary Press met the hydraulic loading for current conditions, but not solids loading
- Change in operating schedule philosophy
  - Owner would allow equipment automation and additional hours of operation (unmanned)

Description	1.3 MGD (Current)	4.0 MGD (Future)
Operating Schedule, days/week	5	7
Operating Hours, hrs/day	6.5	12.5
Hydraulic Loading, gpm	26	30
Mass Loading, dry lbs / hr	265	300

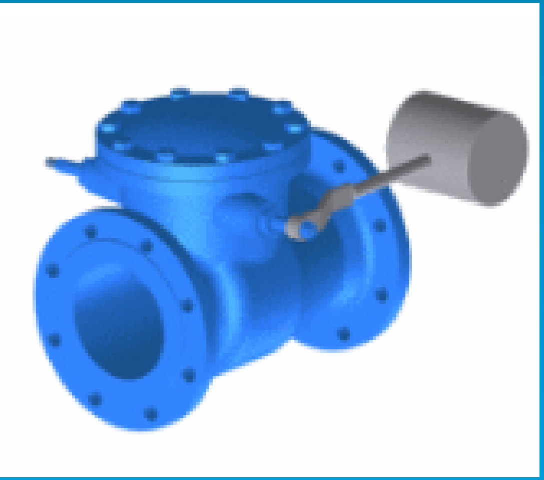
Discussion of Pilot Evaluation (Cont.)

- A smaller Screw Press was selected based on pilot results and revised operation
  - Lower capital and O&M cost than Rotary Press
  - Smaller footprint
  - Higher cake solids

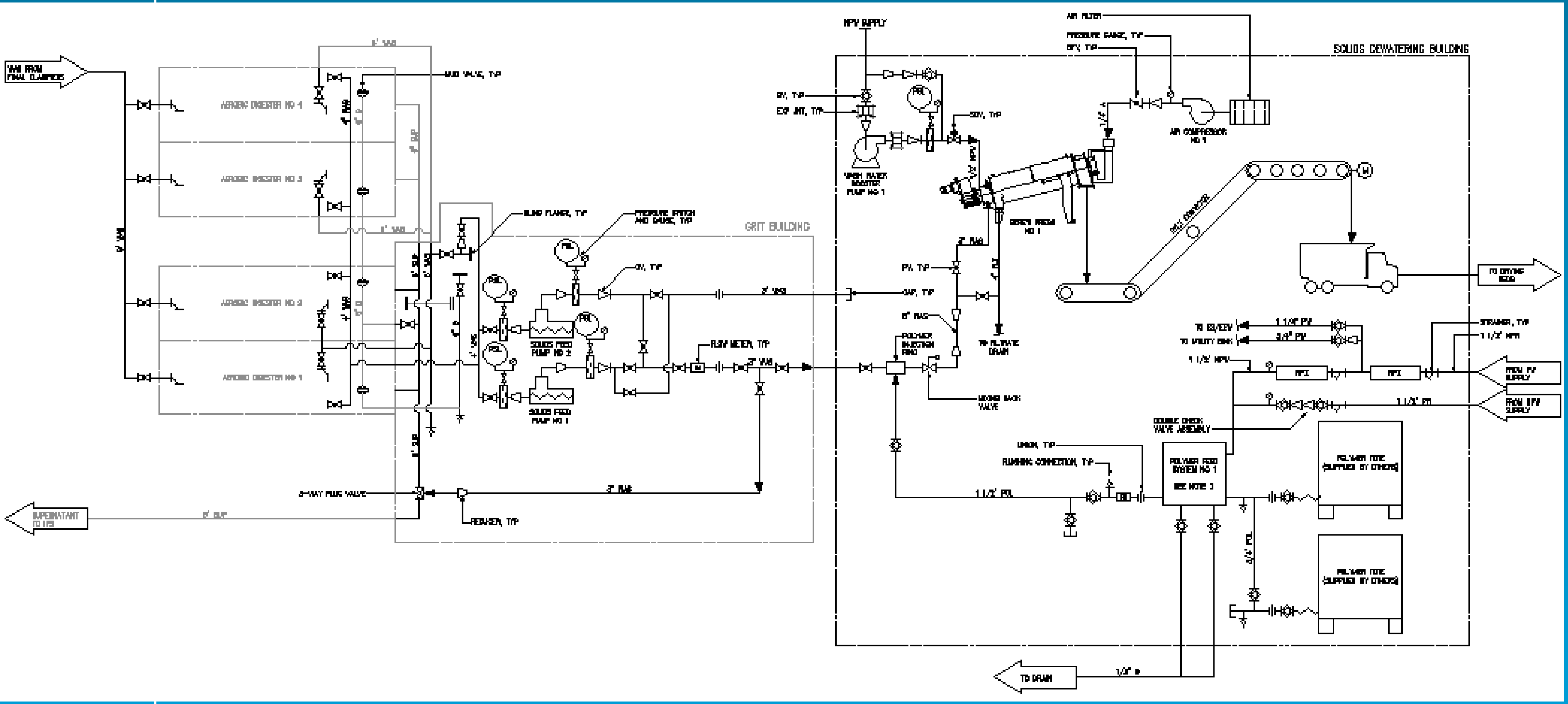
Full Scale Operation	Screw Press
Power Consumption, HP	5
Full Scale Hydraulic Capacity, gpm	40
Full Scale Solids Capacity, dry lbs/hr	300
Equipment Capital Cost	$231,000
Yearly O&M Cost	$55,400
Installation Cost	$870,000

Screw Press Design Considerations

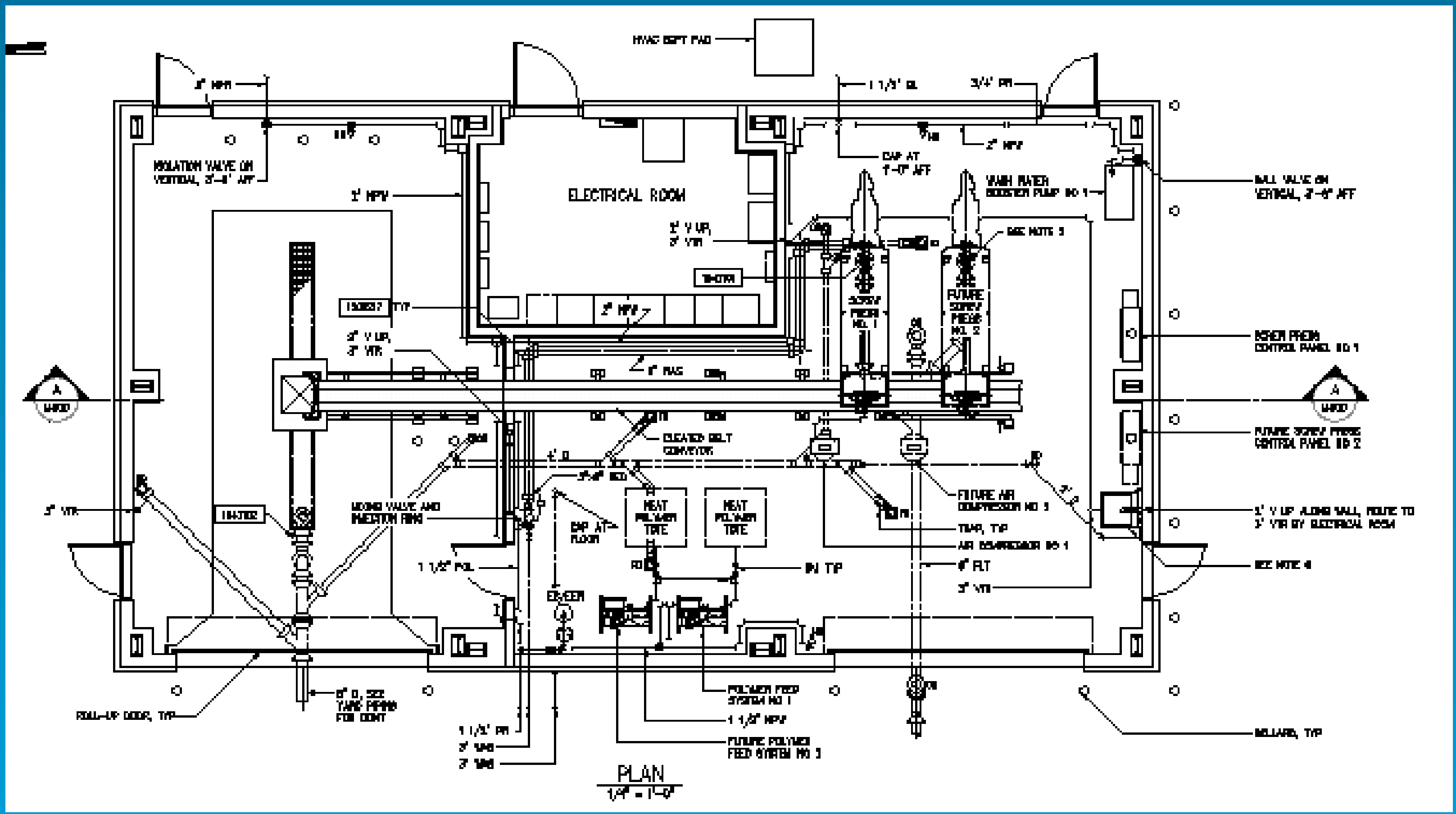
- Two progressive cavity feed pumps
- Liquid polymer feed system
- Polymer mixing valve and
  30 second retention time
- Wash water booster pump
- Solids conveyor



Dewatering Facility Design



Dewatering Facility Design



Summary

- On-site dewatering was found to be best solution for cost and non-cost factors
- Two technologies were piloted to verify performance and operational considerations
- Result – A cost effective and simple to operate dewatering facility (under construction)

Acknowledgements

- Alice Godsey, P.E., Clark County Dept. of Utilities
- Chuck Bauer, P.E., Clark County Dept. of Utilities
- Kevin Krejny, Montgomery County (formerly with Clark County Dept. of Utilities)
- Huber Technology, Inc.
- Fournier Industries, Inc.

knovak@hazenandsawyer.com