LAGOON ENERGY DEMANDS AND EFFICIENCIES

THE TITTABAWASSEE TOWNSHIP EXPERIENCE

TITTABAWASSEE TOWNSHIP ORIGINAL PLANT 1968

Traditional Facultative Lagoons

- 2 7.5 acre lagoons
- Semi-annual discharge
- Population 3630

Pic of ponds

NEED TO EXPAND RECOGNIZED

- Traditional Facultative Lagoons

1971-72

- 2 7.5 acre lagoons
- semi-annual discharge
- Population growth from
  - 3,630 to 4,031

Nothing like a well stocked pond

FACILITY REACHED DESIGN CAPACITY REQUIRING EXPANSION 1976

OPTIONS CONSIDERED

- Discharge to a regional plant
- Expansion of the existing lagoon system
- Biological/mechanical plant
- Storage and irrigation

FUN FACTS

- Average assessed value of residential property $9,460 - $62,112
- Average per capita income $4,800 - $25,135

AFTER 2 YEARS OF STUDY AND CONSIDERATION

FINAL FACILITIES PLAN
1978

- 10 year design capacity 5,800
- No significant I&I
- No significant or categorical industrial users

FUN FACTS

- Population now at 5031
- Average income $17,000
- Price of a gallon of gas $0.63

1982 UPGRADE

SPECS

- Design flow of 0.58 MGD
- Storage capacity 132.82MG
- D.T. 229.5 days

NOT SO FUN FACTS

- Mysterious new disease reported to kill 40% of it's victims "AIDS"
- Unemployment rate 9.7%
- Dec-2012 8.9%

AND THE WINNER IS

Expansion of the existing lagoon facility

- 8 Treatment Cells
  - 4 Primary Cells — Total of 31.56 acres
  - 2 Secondary Cells — Total of 16.50 acres
  - 2 Final Cells — Total of 17.54 acres
  - 2 Clarifiers with chemical feed for phosphorus removal and solids precipitation
    (1st significant use of energy other than Lift Stations)

- Total Volume of 62.538 MG
- Total Acreage 65.6

1993

Prison opens in October

Flow at 0.54 MGD – design 0.58 MGD

Plant still meeting NPDES permit

4 primary cells

2 secondary cells

2 storage cells

1995 LAGOON CAPACITY EXPANSION STUDY

ALTERNATIVES

1. Increased lagoon volume
2. Increased discharge periods/modified Operational procedures
3. Continuous discharge and conversion to Activated Sludge

PROS AND CONS

1. Maximum storage/land acquisition costs
2. Low cost/modification of NPDES permit
3. Minimal land/high capital & operation cost

AND THE WINNER IS

INCREASED DISCHARGE PERIODS – MODIFIED OPERATING STRATEGY

Still no significant energy consumption

2 clarifiers drives, sludge pumps, polymer pumps and 1 ferric chloride pump

2001 POND DOCTOR / SOLAR BEE

A Low Energy Partial Mix Treatment Process

Population served 5,500

Influent BOD 1300 lbs./day

Surface load of 50 – 70 lbs. of BOD/acre/day

Problem to be addressed

- Odor issues
- "unable to meet permit limits without continual adjustment or management involvement"

Original installation 2001

- (13) Pond Doctor Mixing Units
  - $317,539 (includes a performance bond)

PERFORMANCE OBJECTIVES

BOD/TSS removal 80 – 90%

Eliminate the need for typical aeration

Reduce ammonia-nitrogen levels

Stabilize the sludge layer

Increase the treatment capacity to treat BOD of 1800 to 2000 lbs./day

Eliminate short circuiting

In July of 2002 an operating performance report indicated that objectives were not being met

Manufacturer responded with operational modifications and an extension of performance guarantee

PERFORMANCE OBJECTIVES

In September of 2003 performance analysis indicated the objectives were still not being met.

October of 2003 motors added to Pond Doctors

- all 13 units were reconditioned with new motors and electronic controllers at no cost
- 24hr circulation rather than day-light operation

Mixing vs. aeration

Population growth

2004 WASTEWATER LAGOON IMPROVEMENT PROJECT

Increase size of outfall pipe to 18” and disconnected storm sewers from system

Lagoon sludge removal just 1 cell

Aeration System (Bio-lac)

Construction of Blower Building

Influent flow structure with sampling and metering

Clarifier equipment redesign; center feed to perimeter feed

Generator and three phase electrical

$2.3 million

POSSIBLY MEANINGLESS NUMBERS

	Pre-Aeration	Post-Aeration/ 3phase	Post head works	
	Jan 98	Jan 06	Jan 12	
	KWH	KWH	KWH	
	3199	3589	4942	

2009 HEAD WORKS ADDITION

Influent Structure

Parshall Flume

- Ultra sonic and stick measurement

Automatic Sampling

WesTech Perforated Screen

- Manual bar screen
- Bagger

Atmospheric Testing

- Oxygen and Hydrogen Sulfide
- Power ventilation

Cost $200,000

CURRENT ISSUES

- Our receiving water has always been the Tittabawassee River via the Ralph Drain.
- In last permit cycle, the MDEQ, denied us our mixing zone and designated the Ralph Drain as a water of the State.
- Resulting in lower ammonia toxicity limits.
- The Ralph Drain has no demonstrated source of water other than our effluent, snow melt and or rain events.
- We are disputing this change, in our current permit application.

POSSIBLE SOLUTIONS

SOLUTIONS	PROS AND CONS
Costly improvements mechanical treatment	Poor economic timing – energy consumption
Changing operational strategies	Low cost/questionable success
Enclosing drain.	Intermediate cost
	Will destroy the aquatic life it is attempting to protect.