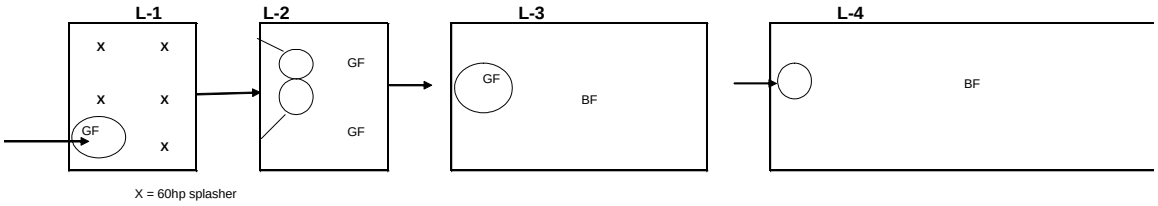
Case Study: Municipal Wastewater

Municipal wastewater is typically treated in large, integrated plants in the developed world and lagoons in small towns and villages. The influent strength is higher in third world countries where fresh water is expensive (and toilets are flushed infrequently).

BFS was asked to deploy its system in Tulare, CA for three years while a new modern plant was designed and built. The influent was a mixture of traditional municipal waste, raw cheese plant effluent and raw dairy processing effluent. The first step in the process was an anaerobic digester followed by splasher-type aerators and then four aerated lagoons in series, each double in HRT versus the one prior lagoon. Flow rate was 1.4MGD per train (7MGD total). The HRT was 40 days.



Objectives

1. No change in BOD results.
2. Reduced energy consumption
    a. Blue Frog was paid a % of the energy savings monthly.

Results

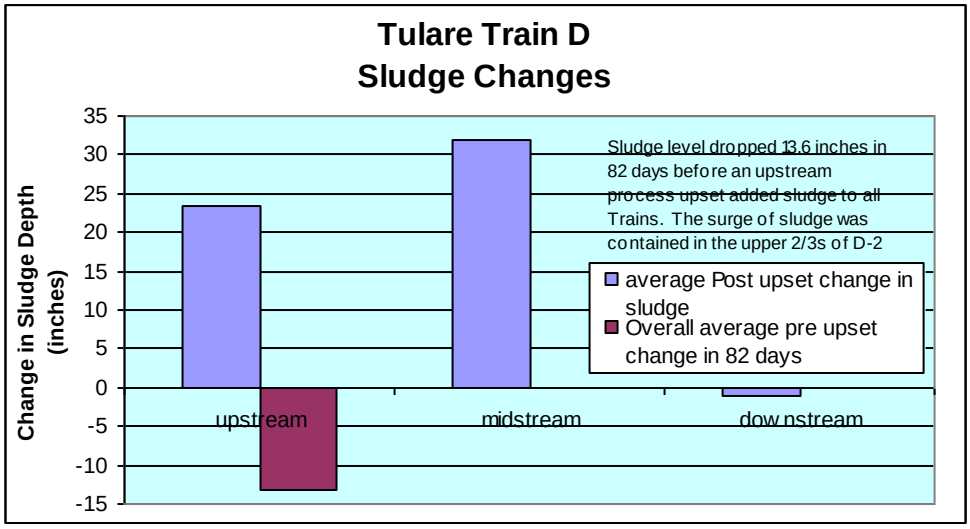
1. There are 5 parallel and identical trains. Trains A, B & C used brush aerators. Train E used Solarbee circulators. Train D used the BFS.

	BOD_{actual}
Average D2 inlet Jun06 thru Jan07	169
Average D3 inlet Jun06 thru Jan07	68
Average D4 inlet Jul06 thru Jan07	35
Average D4 outlet Jul06 thru Jan07	18

	Tulare Results		
	average BOD	Average TSS	average ammonia
Rotary Aerators	28	74	6
Blue Frog	23	42	20
Solarbee	75	100	22

Ammonia increased because sludge was reduced.

A special cause process upset occurred to all trains when the upstream anaerobic digester failed, discharging sludge and high BOD into the lagoon trains.



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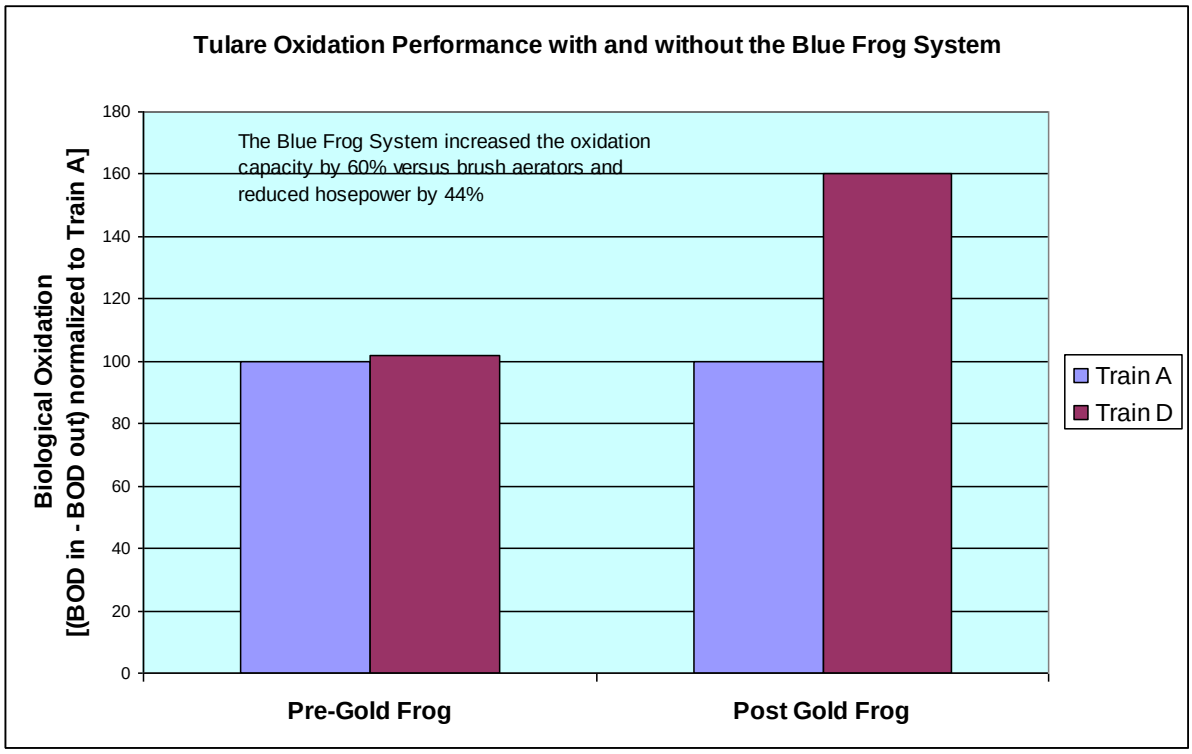
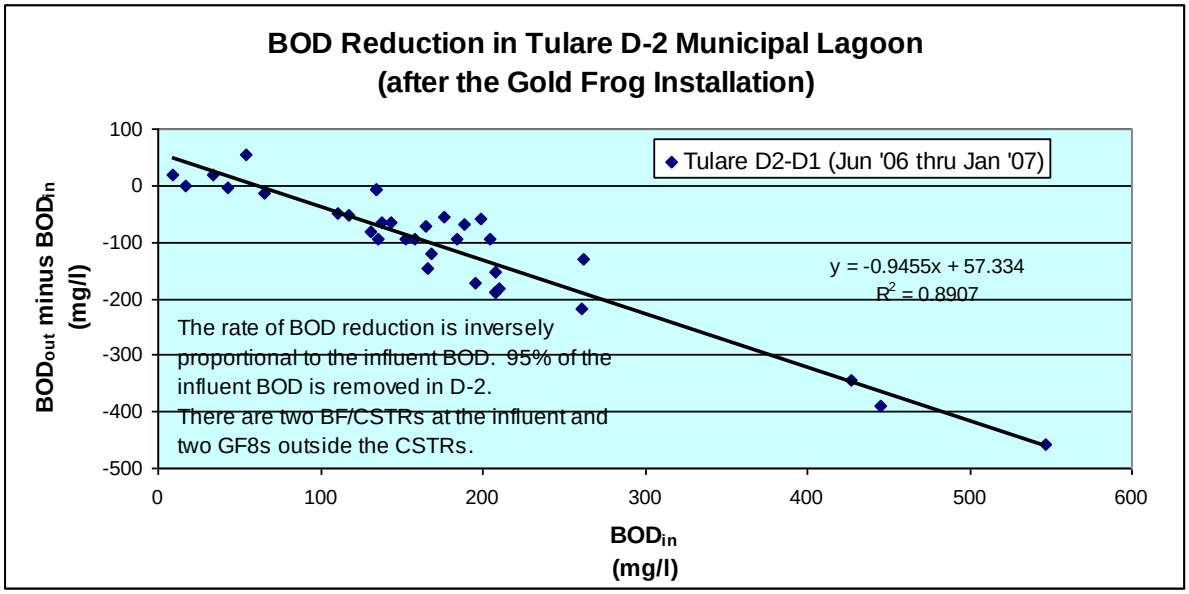
2. The energy consumption was reduced 44%.

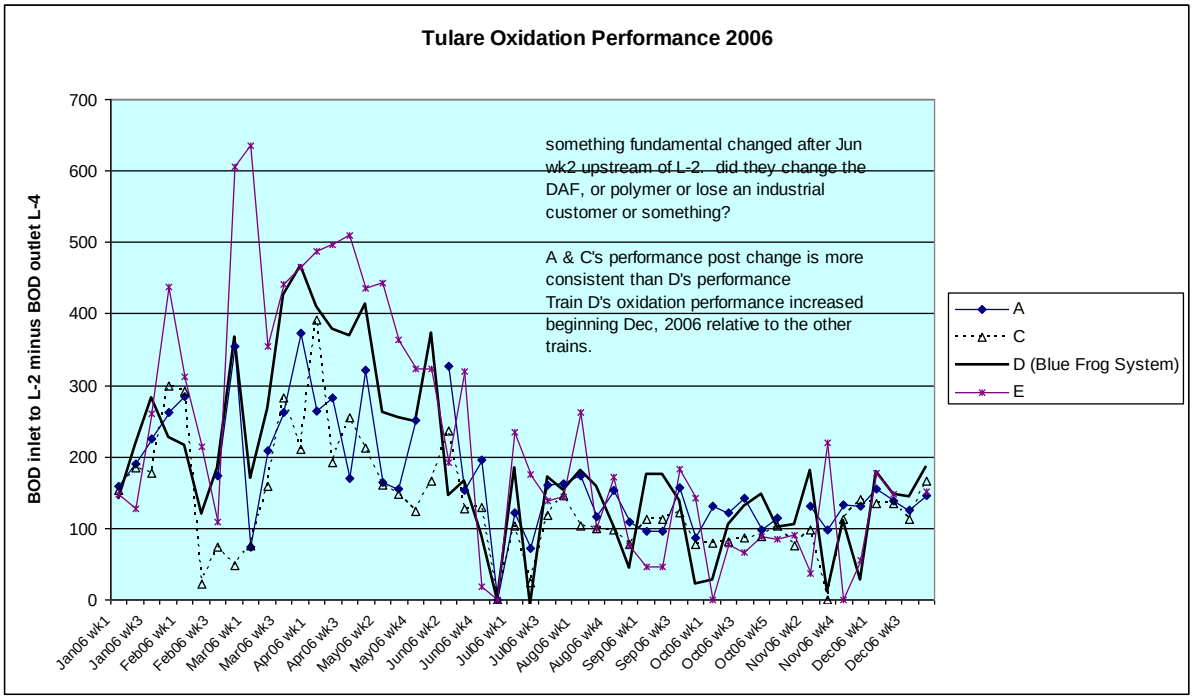


3. The BOD-reduction efficiency of the BFS is inversely proportional to the incoming BOD. That is, when an upset occurs and BOD $_{influent}$ increases, the anaerobic population increases to match the food stuff available.



4. There was no apparent change in performance between summer and winter.

    a. The test site is in the Central Valley of California and the water temperature does not get very cold.



Design Basis

1. Maximum flow per BF/CSTR is .75MGD
    a. If the flow exceeds .75MGD, install multiple BF/CSTRs in parallel
2. Design the number of aerators such that the oxygen-added is 3x the soluble BOD.
    a. See attached calculation spreadsheet.
3. Provide 10days HRT for settling solids (polishing) after clarification.
    a. 30days HRT is a conservative design basis for cleaning the water.
    b. Add a free standing BF for every 600ft of lagoon length.
4. This project did not address N& P as the effluent was used for agricultural irrigation.
5. This project did not address algae as there were very little algae produced (especially compared to the brush aerators.)