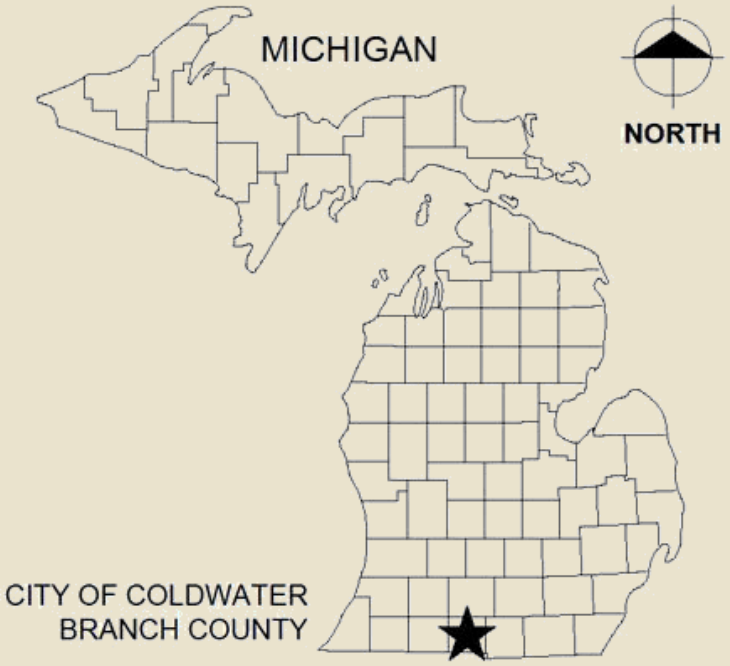
Fishbeck, Thompson, Carr & Huber, Inc.

Integrated Fixed Film Activated Sludge (IFAS) System for Additional Nitrification at the Coldwater WWTP

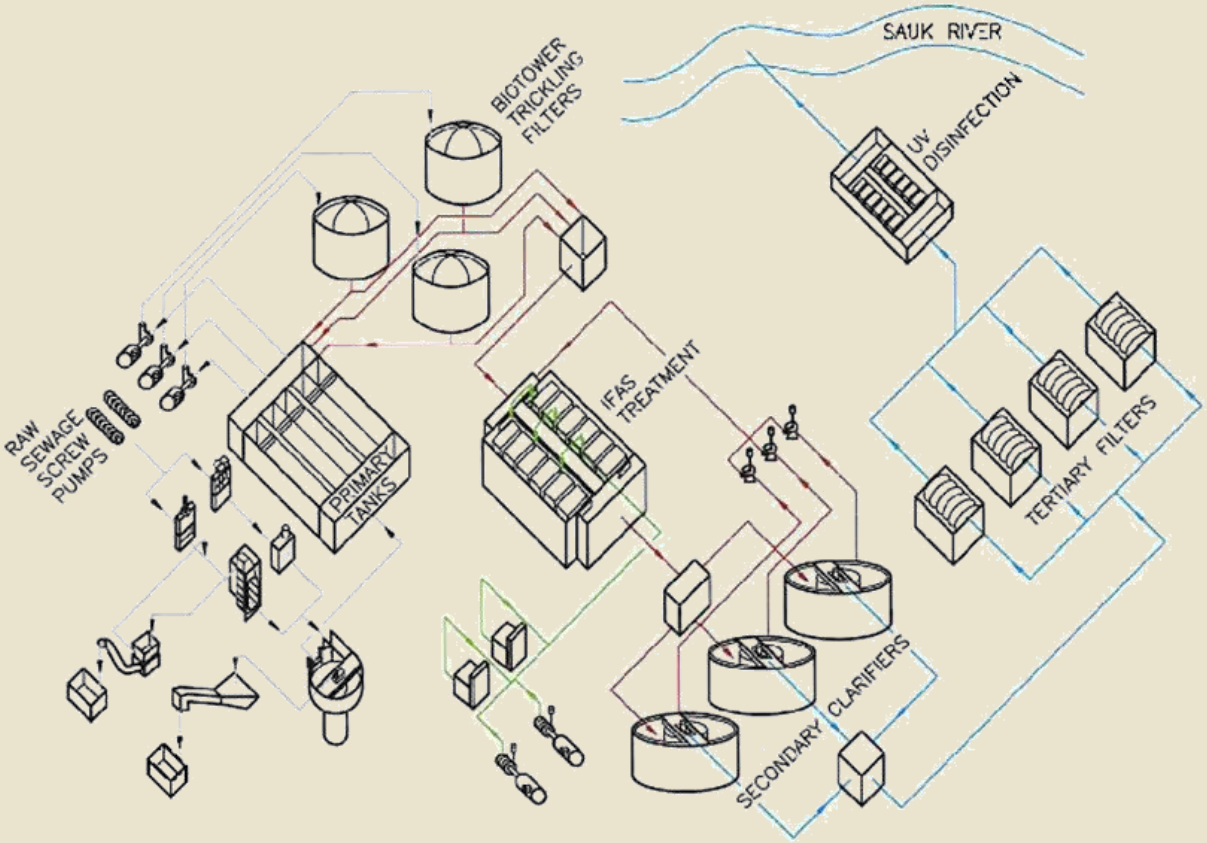
Jim Flamming, P.E., Senior Process Engineer, FTC&H
Dave Woodman, WWTP Supt., CBPU

Coldwater WWTP

- Owned by Coldwater BPU
- Design Average Flow is 3.2 MGD
  Peak Flow is 8 MGD
- BOD, TSS, Ammonia, Phosphorus, and Pathogen Removal
- Surface Water Discharge



Coldwater WWTP



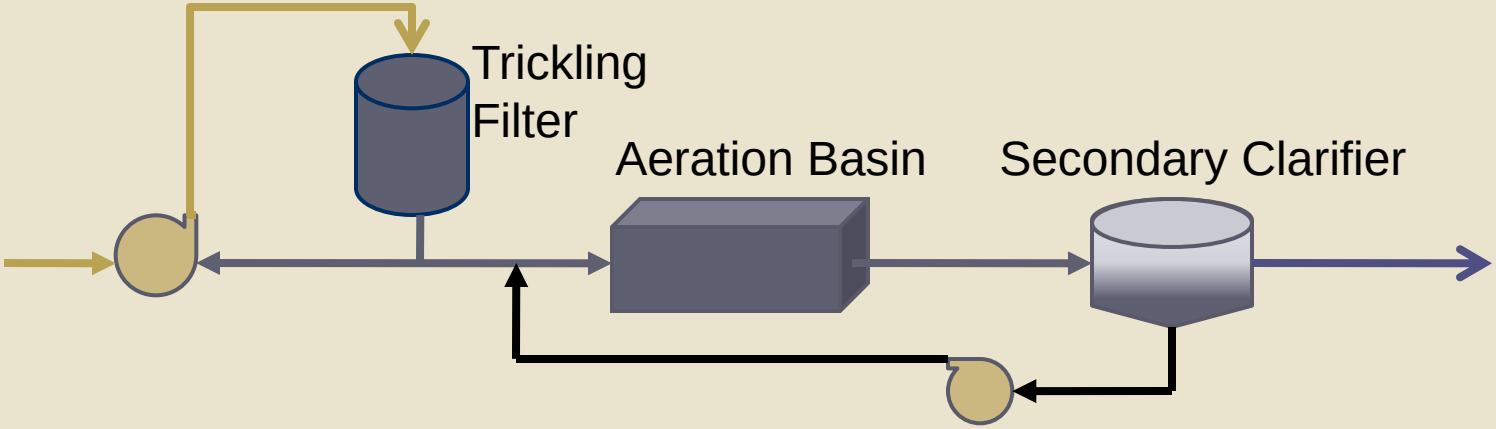
fr&h

What Drove Project?

- New discharge permit issued August 2007
- Included seasonal ammonia limits
  - 2 mg/l from May through November
  - Previously was report only
- Routine violations through spring and summer 2007
- BPU hired FTC&H to investigate possible solutions

Engineering Review and Problem Solving

- Reviewed secondary treatment system
  - Trickling Filter/Solids Contact (TF/SC) process



  - Three, 115 ft. dia X trickling filters filled with 7 ft. of cross flow plastic media
  - Followed by two parallel 152,000-gallon aeration basins (each 70’ X 20’ X 14.5’ deep)

Engineering Review and Problem Solving

- Expansion of aeration basins difficult due to high groundwater level at site.
- Evaluated expansion of trickling filters
  - Discussed options with Brentwood Industries
  - Concrete tanks with aluminum domes
  - 4th trickling filter would be expensive
- Investigated potential for upgrading aeration basins with IFAS media

IFAS Systems

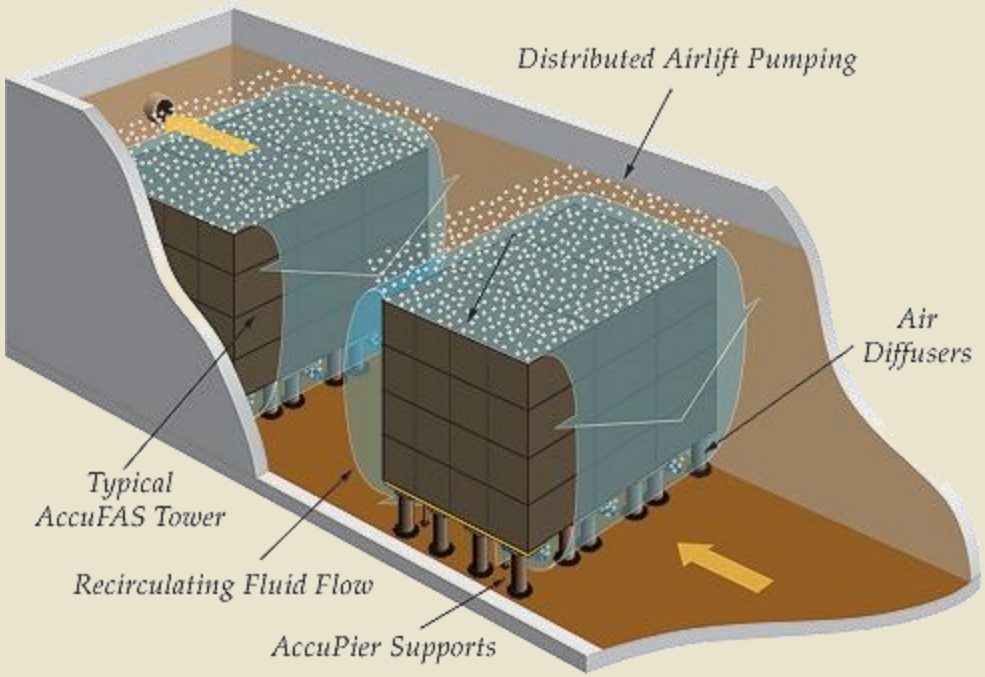
- Submerged media carriers added to activated sludge aeration basins
- Significantly increases biomass inventory
- Little to no increase in solids loading to final clarifiers
- Increases sludge age – good for nitrifying bacteria
- Come in different varieties

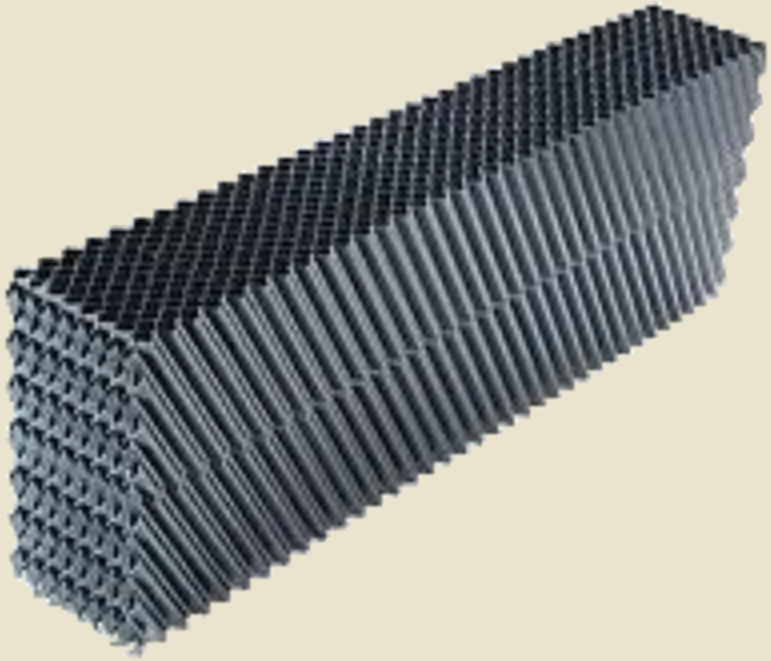
IFAS Systems

- Suspended media
  - Poured into aeration basin
  - Moves freely in mixed liquor
  - Retained in basin typically with in-basin screens
  - Various manufacturers

IFAS Systems

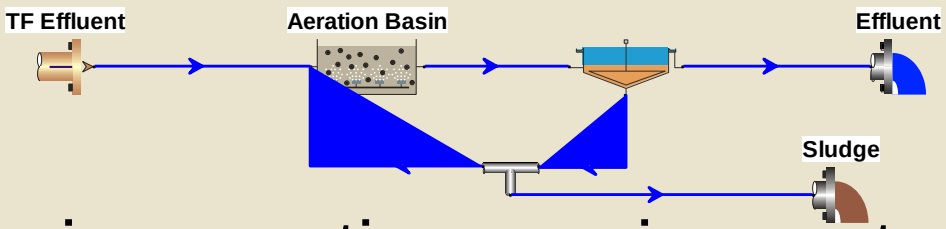
- Fixed Media – i.e. AccuFAS IFAS (Brentwood Industries)





Preliminary Design

- BioWin Modeling



- Used to size aeration requirements and predict effluent quality under various flow scenarios.
  - Both basins in operation
  - One aeration grid out of service
  - One basin in operation,one out of service

BioWin Results

	Two Basins - Both at Full Capacity	One Basin at Full Capacity; One Basin with One Aeration Grid Out-of-Service		One Basin Only (To Meet Winter Requirements)
Basin Number(s)	#1 and #2	#1 (Full Capacity)	#2 (Reduced Capacity)	Either #1 or #2 (not both, one out of service)
Maximum Influent Ammonia Load per Basin, ppd	280	280	170	NA
Total Maximum Influent Ammonia Load, ppd	560	450		400
Effluent Ammonia per Basin, mg/l	1.3	1.3	2.8	NA
Combined Effluent Ammonia, mg/l	1.3	2.0		12.0
Effluent Ammonia Load per Basin, ppd	17	17	37	NA
Total Effluent Ammonia Load, ppd	34	54		320
Air Supply Rate per Basin, scfm	1,269	1,269	1,990	NA
Total Air Supply Rate, scfm	2,538	3,259		1,410

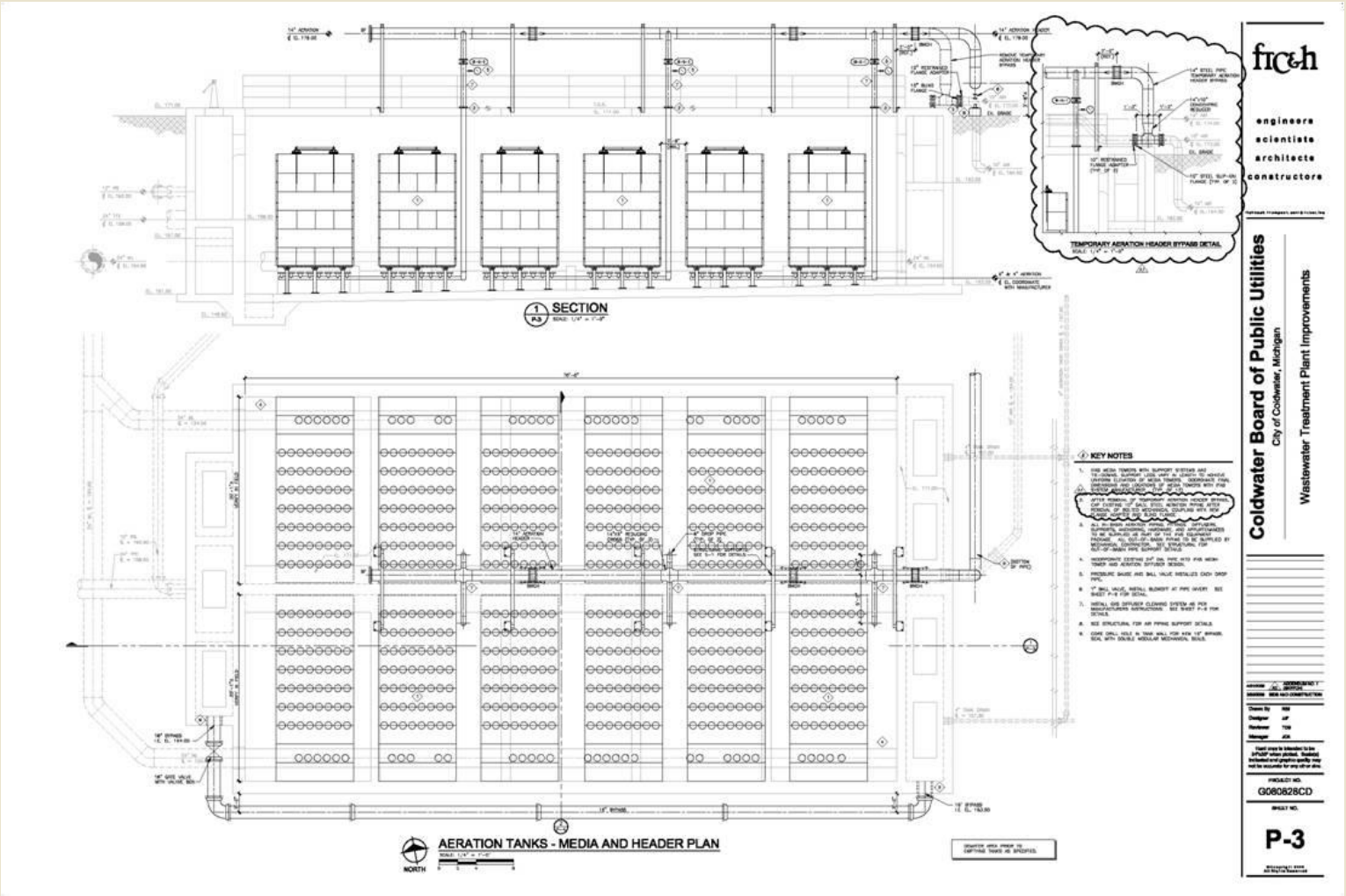
* - Assuming the following trickling filter effluent characteristics and operating conditions: Flowrate = 3.2 mgd; Total BOD = 40 mg/l; TSS = 165 mg/l; Alkalinity (as $CaCO_3$) = 5 mmol/l; Temperature = 18 degrees C; MLSS = 4,000 – 4,250 mg/l; RAS/Q = 65%

frc&h

Final Design

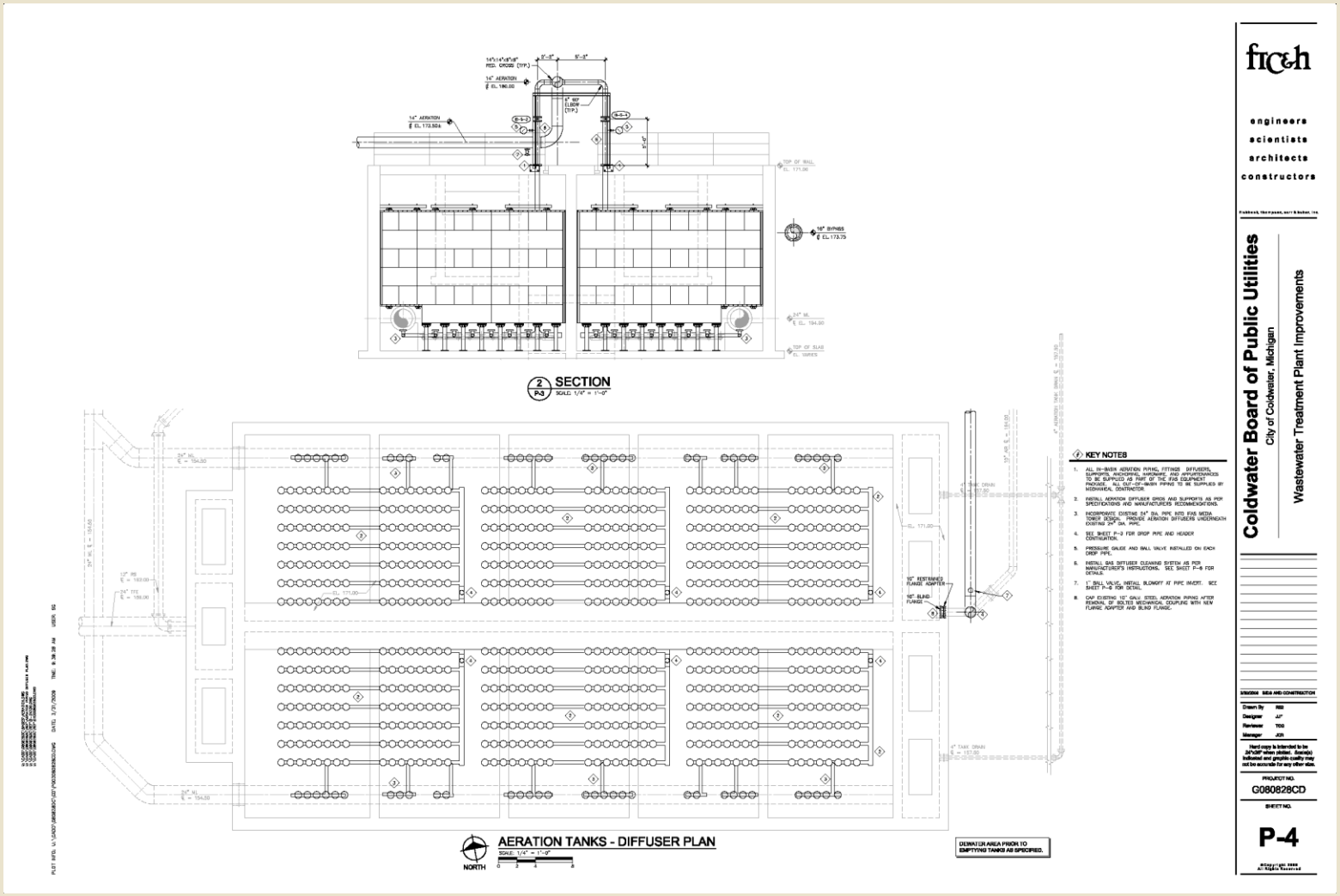
- Tank volume was fixed and maximum media fill possible was 60%
- Existing blowers had a firm capacity of 900 scfm ; firm capacity required = 2,538 scfm
- Redundancy requirements needed to be met for both diffuser and blower capacity.
- Additional blower capacity required – presentation Session 2 at 2:30 pm today

Final Design



fr&h

Final Design



fr&h

Installation

fr&h

Installation

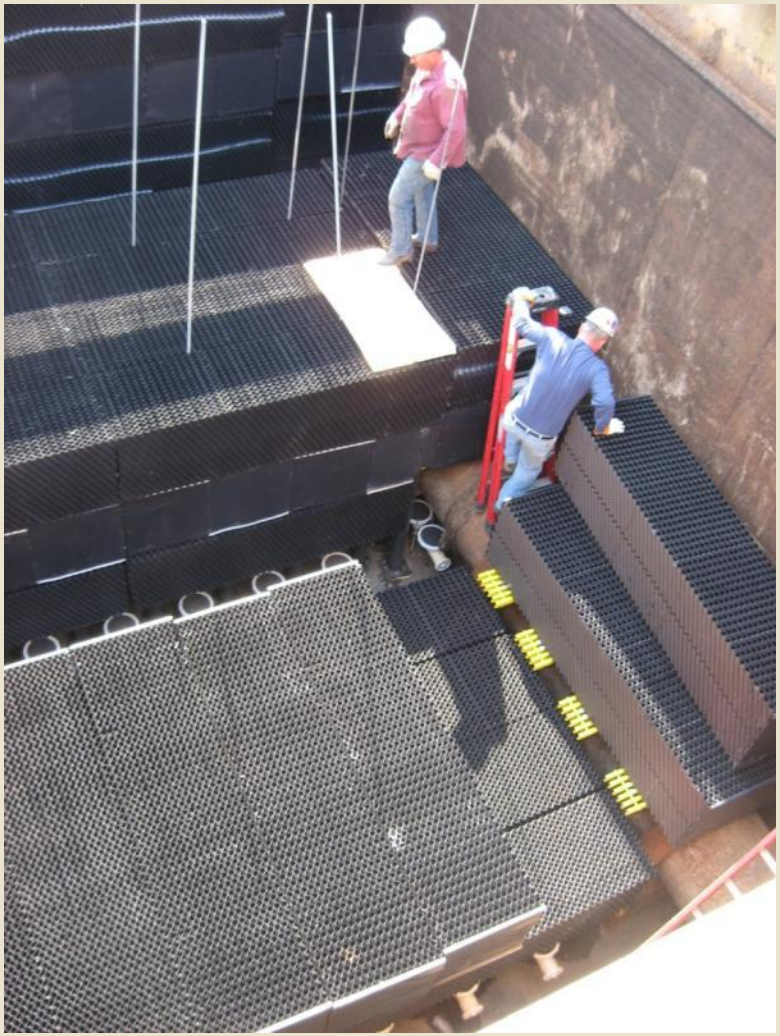
Installation

fr&h

Installation

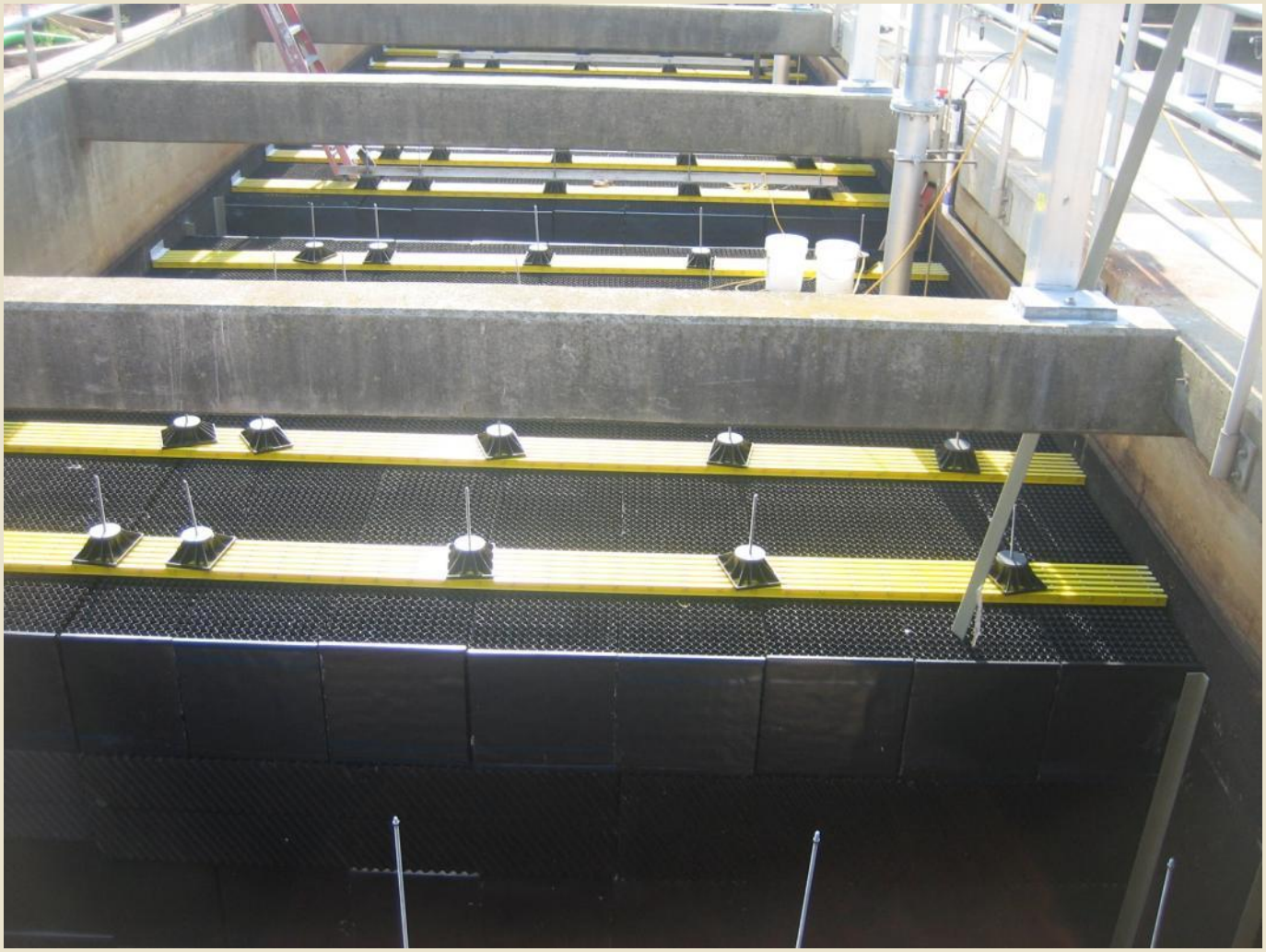
fr&h

Installation



fr&h

Installation

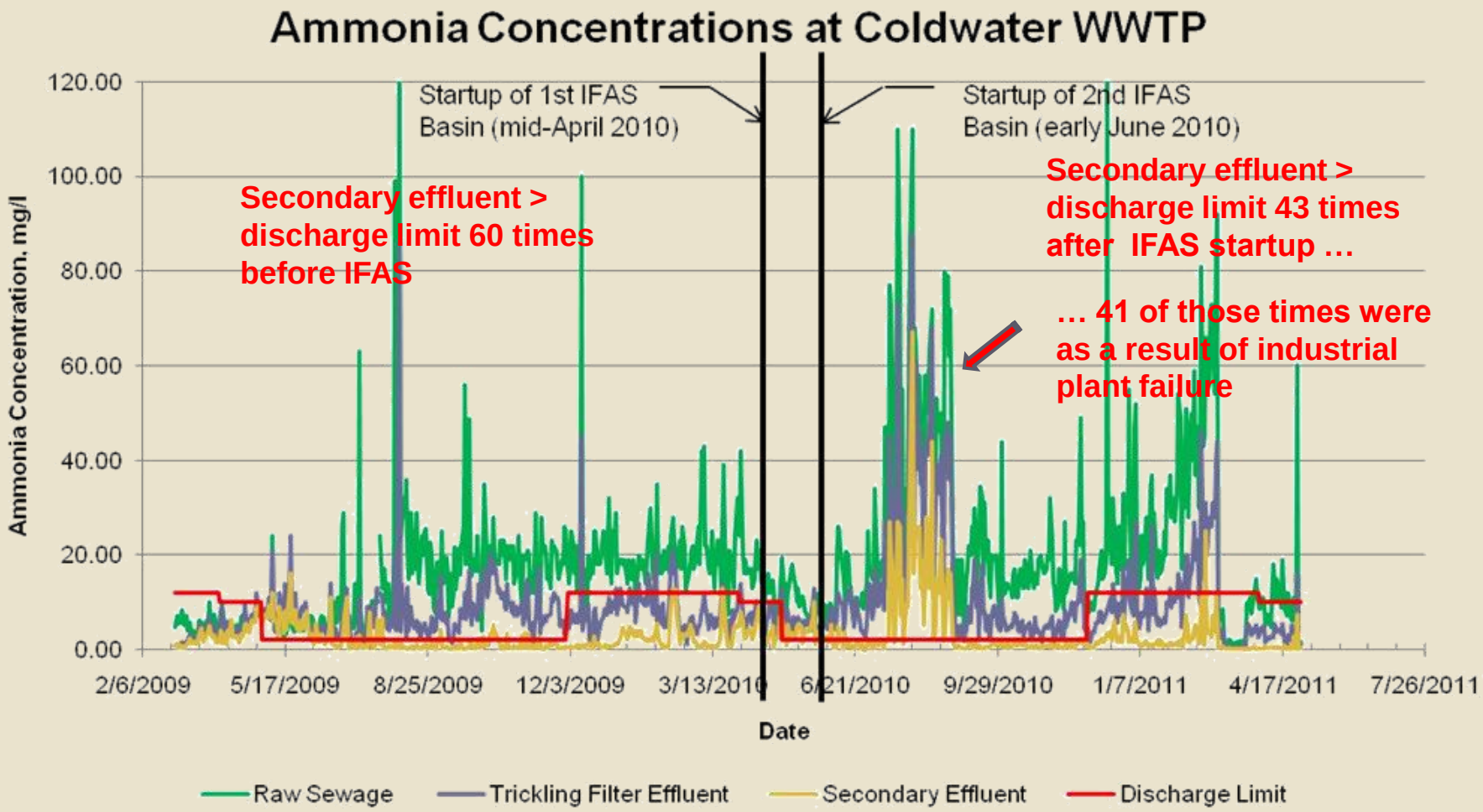


Installation

fr&h

Installation

Results


Ammonia Concentrations at Coldwater WWTP
Startup of 1st IFAS Basin (mid-April 2010)
Startup of 2nd IFAS Basin (early June 2010)
Secondary effluent > discharge limit 60 times before IFAS
Secondary effluent > discharge limit 43 times after IFAS startup …
… 41 of those times were as a result of industrial plant failure
Ammonia Concentration, mg/l
120.00
100.00
80.00
60.00
40.00
20.00
0.00
2/6/2009
5/17/2009
8/25/2009
12/3/2009
3/13/2010
6/21/2010
9/29/2010
1/7/2011
4/17/2011
7/26/2011
Date
Raw Sewage
Trickling Filter Effluent
Secondary Effluent
Discharge Limit

fr&h

Conclusions

- IFAS can be applied to existing secondary systems to reduce effluent ammonia concentrations.
- IFAS increases sludge age, increasing the total inventory of nitrifiers, without increasing loads to secondary clafifiers.
- These systems are very robust.
- Fixed media IFAS systems (such as the AccuFAS system) can be added without affecting existing hydraulic profiles.

THANK YOU!

Any Questions?