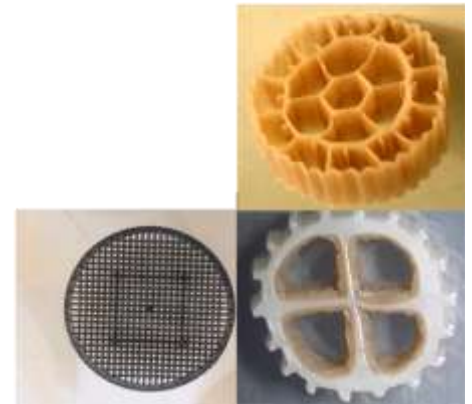


*Full-Scale Use of an IFAS
Process in Kentucky*
(Integrated Fixed Film Activated
Sludge)

Philip F. Wood, P.E., QK4, LLC
Glenn Thesing, P.E., Kruger Inc.





Sherman Tinnell, Mayor

Vernon Clements, Superintendent, WWTP

Why Do Anything?

Some Driving Forces To Take Action:

- Existing WWTP at 92% of 2.2 mgd capacity.
- Population growth: plant capacity exceeded this year.
- USEPA & KY DNR Consent Decree: elimination of SSOs & treatment of wet weather flows.
- Treatment of wastewater from a nearby distillery.

The “No Action” Alternative... NOT an option



Expansion had to move ahead
...just in the nick of time!

*City of Shepherdsville Facilities Plan Update
July 2008*



*Philip F. Wood
7-8-08*



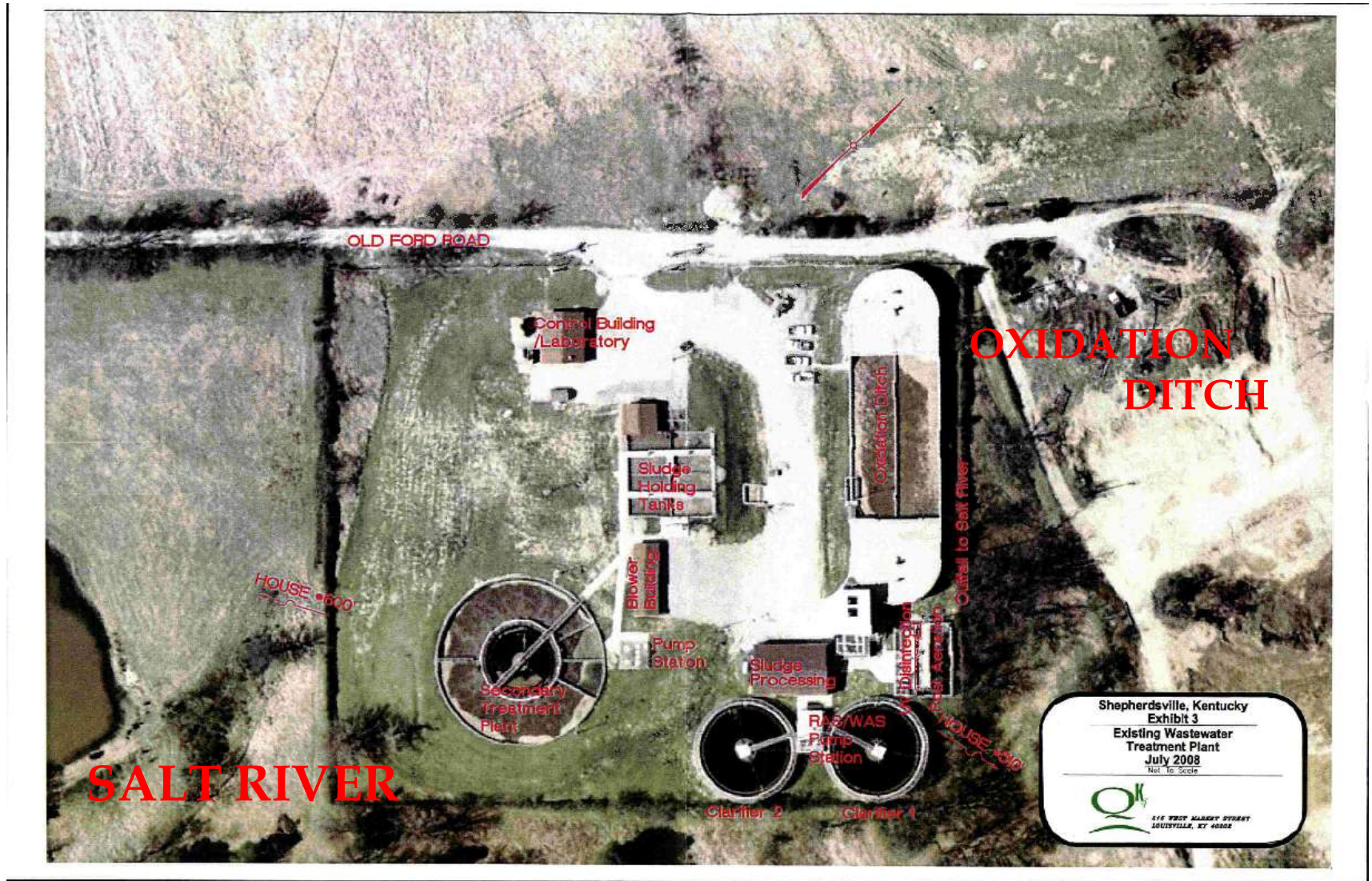
**Shepherdsville is located in Bullitt
County – ~ 20 miles S. of Louisville, KY**

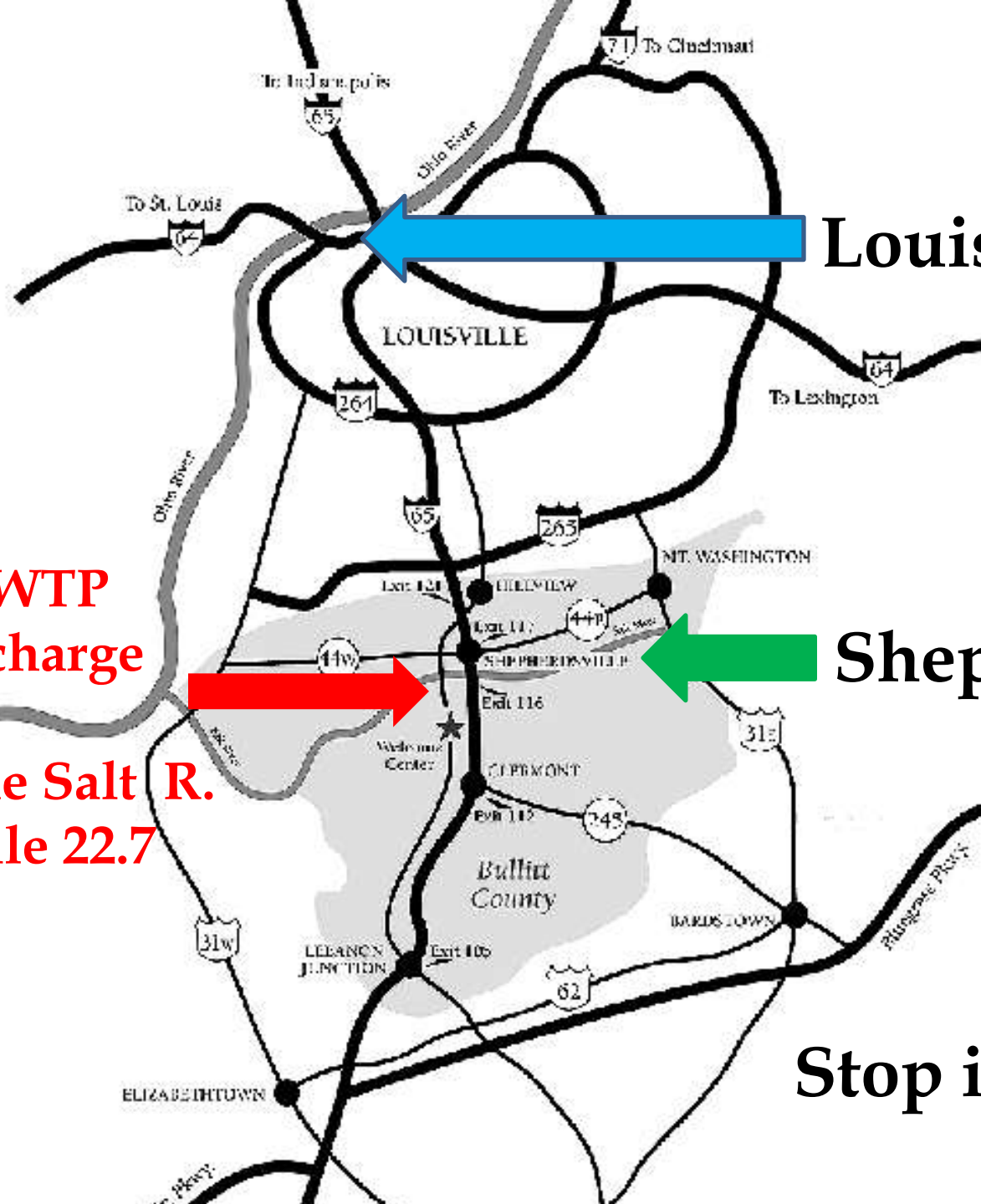
History of the WWTP



- 1967 – original 0.3 mgd “package” WWTP
- 1981 – upgrade/expansion to 1.0 mgd
- 1998 – addition of a belt filter press
- 2002 – upgrade/expansion to a single 2.2 mgd oxidation ditch

Existing Oxidation Ditch Wastewater Treatment Plant





Louisville

Shepherdsville

**WWTP
Discharge
into the Salt R.
@ mile 22.7**

Stop in for a visit !

Shepherdsville, KY KPDES KY0027359

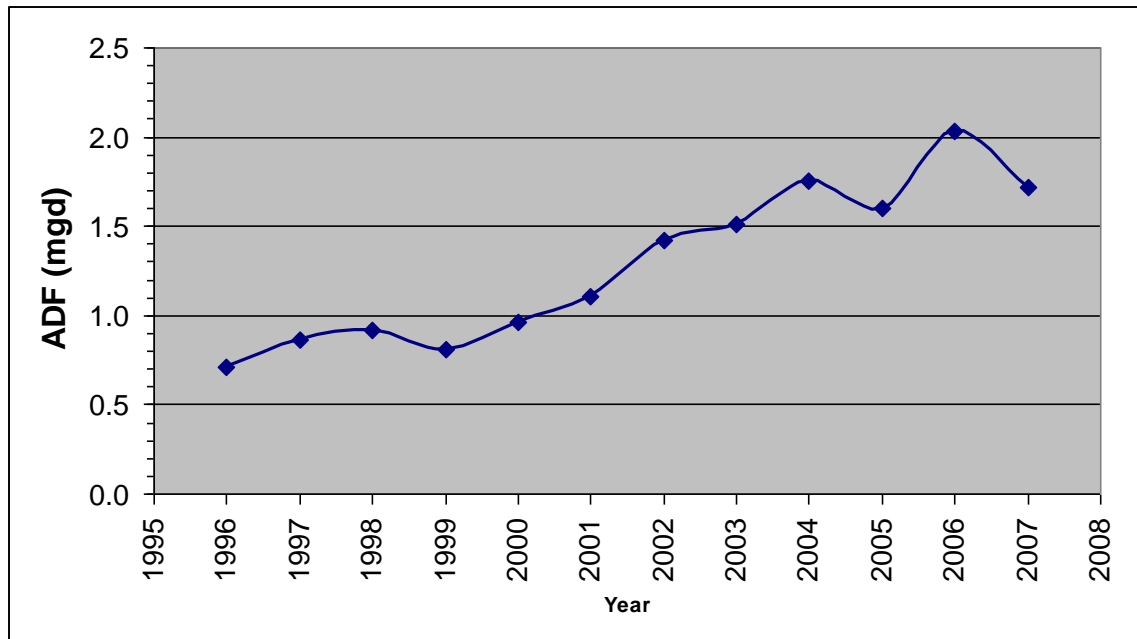
Permit Limits

Parameter	Final Effluent Limit
Ammonia Nitrogen	Current: 10.0 mg/L year round Future: 4.0 mg/L Summer / 10 mg/L Winter
CBOD5	25
TSS	30
Dissolved Oxygen	7.0
Total Phosphorous	Monitor
Total Nitrogen	Monitor

Shepherdsville, KY WWTP Historical Flows

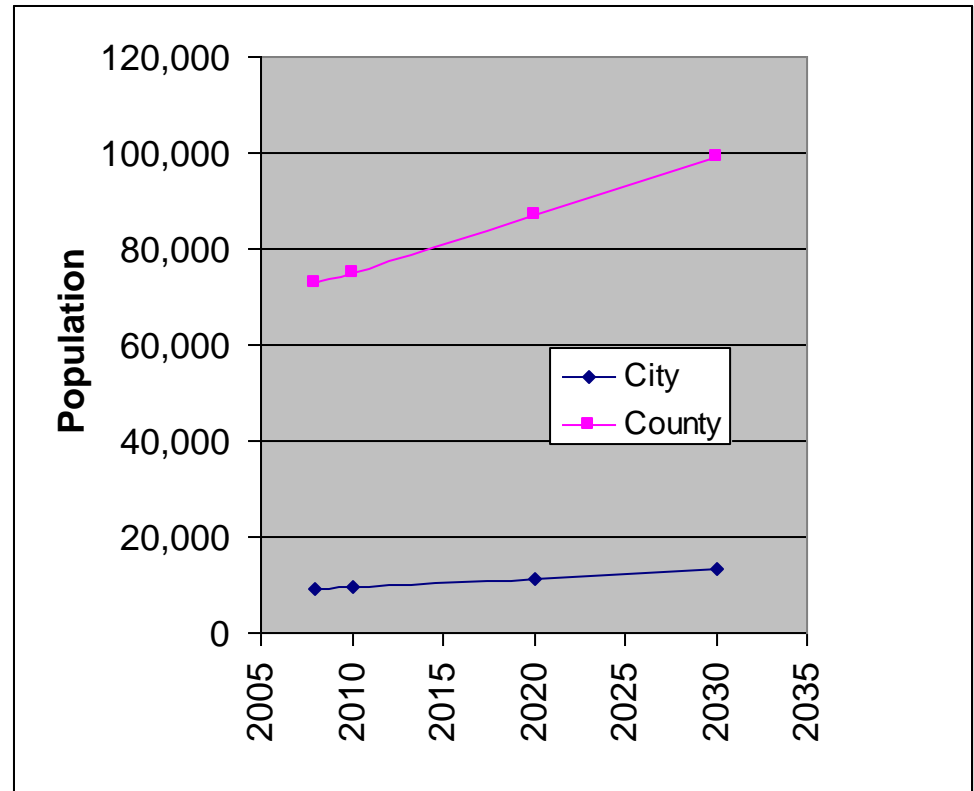


<u>Year</u>	<u>ADF</u> (mgd)
1996	0.71
1997	0.86
1998	0.92
1999	0.81
2000	0.96
2001	1.11
2002	1.42
2003	1.51
2004	1.75
2005	1.60
2006	2.03
2007	1.72



Shepherdsville, KY Population Projections

<u>Year</u>	<u>City</u>	<u>County</u>
	<u>Population</u>	<u>Population</u>
2008	9,219	72,783
2010	9,574	75,184
2020	11,351	87,186
2030	13,127	99,189



Shepherdsville, KY WWTP Future Flows

<u>Year</u>	<u>ADF</u>	<u>Peak</u>
	(mgd)	(mgd)
Present Actual	2.03	11.00
Future Domestic	5.21	11.71
Future Combined	7.50	22.71



Jim Beam Brands Co

1st Phase includes treatment of distillery wastewater from Jim Beam.

Jim Beam will pump 1.6 mgd of equivalent strength wastewater for treatment (0.26 mgd actual flow).

Plan to build new visitor center at the Clermont distillery, once the WWTP is decommissioned. Present SBR & Lagoon site will be transformed to natural wildlife setting, pleasant backdrop for the Jim Beam visitor's experience.

Alternatives Analysis



Alternative #1: Add 1 IFAS Basin on the existing site:

- ✓ Identical size, shape & configuration as the existing Carrousel® ditch basin
- ✓ Adjacent to the existing Carrousel® ditch basin
- ✓ New IFAS + existing ditch capable of treating
 - projected 20-30 year domestic flow from Shepherdsville & Bullitt Co.
 - Jim Beam Distillery flow @ 0.26 mgd w/ BOD₅=1,500 mg/l ~ 1.6 mgd
 - I/I & SSO flows
- ✓ Expansion confined to existing site east of Old Ford Road
- ✓ New mechanically cleaned fine screen with 1/4 " openings
- ✓ RAS returned upstream of influent fine screens to control odors
- ✓ Existing UV system to be replaced w/ one that works to disinfect 24 mgd PHF

Alternatives Analysis, cont'd

Alternative #2: Add 5 new Oxidation Ditches (OD) & 1 Equalization Basin:

- One Oxidation Ditch on the existing site
- Four Oxidation Ditches & Equalization Basin on adjacent site across the street.

"Desperation" Alternative #3: Add 1 conventional activated sludge basin & 1 new Equalization Basin

- Activated Sludge Basin on existing site
- Equalization Basin on adjacent site across the street
- Design capacity is limited to = 4.4 mgd & not comparable



Cost Comparison

ADDITIONAL COST FOR USING CONVENTIONAL TECHNOLOGY RELATIVE TO IFAS EXPANDING TO 7.50 MGD

ITEM	ESTIMATED ADDITIONAL COST
New Influent Flow Distribution Chamber	\$250,000
Influent Flow Meter Modifications	\$100,000
Screens	\$480,000
Aeration Tanks	\$3,500,000
Clarifiers	\$850,000
Clarifier Splitter Box	\$250,000
New Return Sludge Pumping Station	\$360,000
Disinfection	\$800,000
Yard Piping	\$300,000
Site Lighting & Site Work	\$400,000

SUBTOTAL	\$7,290,000
TOTAL BID FOR WWTP AS DESIGNED	\$15,300,000
TOTAL FOR CONVENTIOANL TECHNOLOGY	\$22,590,000




Net Savings



What is IFAS?

- Integrated Fixed-Film Activated Sludge
- Conventional Activated Sludge plus one or more basins containing media that carries a population of attached-growth biomass
- Increases biomass inventory in aerobic zones
- Nitrifiers can grow on the media, avoiding washout in high flow or cold temp.

Advantages of the IFAS Method of Treatment

-  The IFAS fits wide range of basin shapes - in this case building an identical basin adjacent to the existing one.
-  IFAS allows treatment of higher strength wastewater using a smaller footprint – only 1 basin is needed compared to 5 more oxidation ditches, 4 of which have to be built across the road.
-  IFAS provides added stability & dependable wet weather treatment – an EQ basin is not required and bugs aren't washed out.

A Two Phase WWTP Upgrade & Expansion

- **1st Phase:**

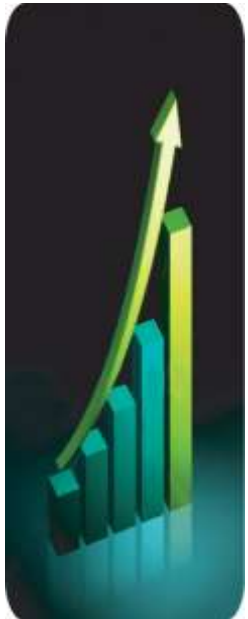
2.20 to 5.043 mgd ADF

6.0 to 18.0 mgd peak hourly rate

- **2nd Phase:**

5.043 to 7.5 mgd ADF

18.0 to 23.0 mgd peak hourly rate



IFAS Train Design

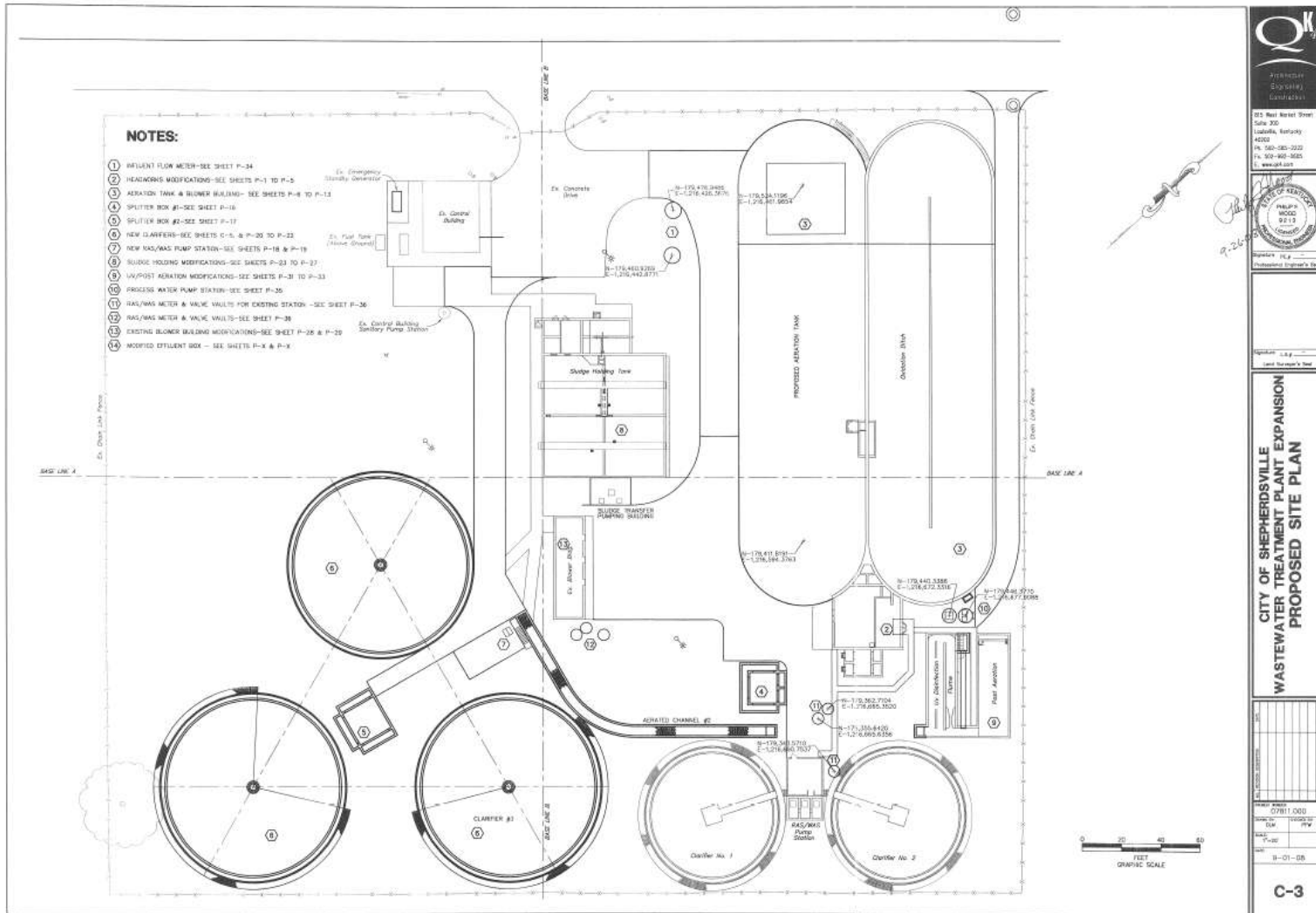
Parameters - Phase 1

- BOD5 = 295 mg/l
- TSS = 245 mg/l
- Ammonia = 27 mg/l

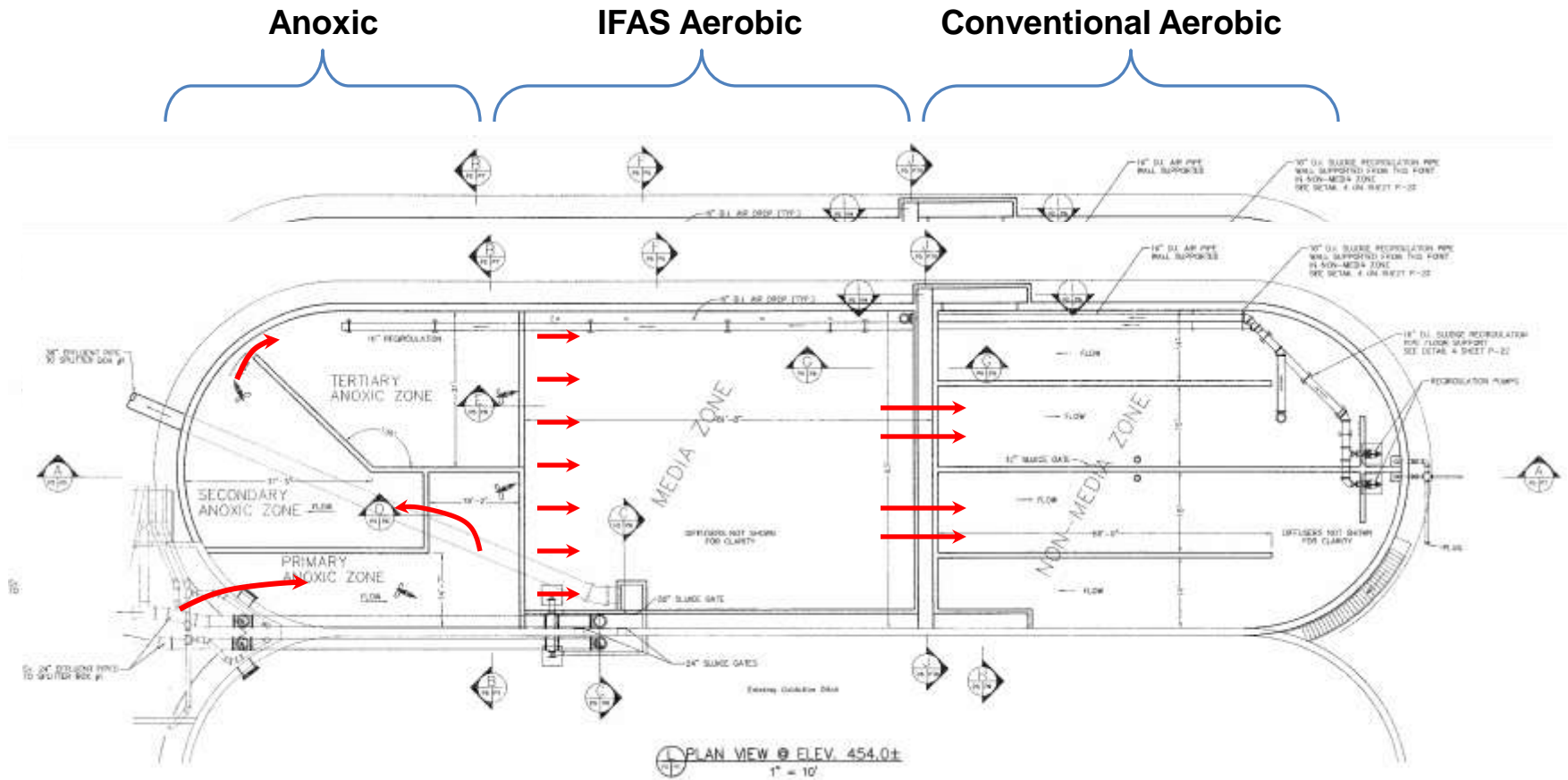
Unit process components include:

- new influent and effluent magnetic flow meters
- new mechanically-cleaned fine screen
- new Kruger HYBAS (IFAS) system
(FIRST IN KENTUCKY)
- new secondary clarifiers
- new RAS pumping facilities
- new Trojan self cleaning UV disinfection system
- new solids processing facilities

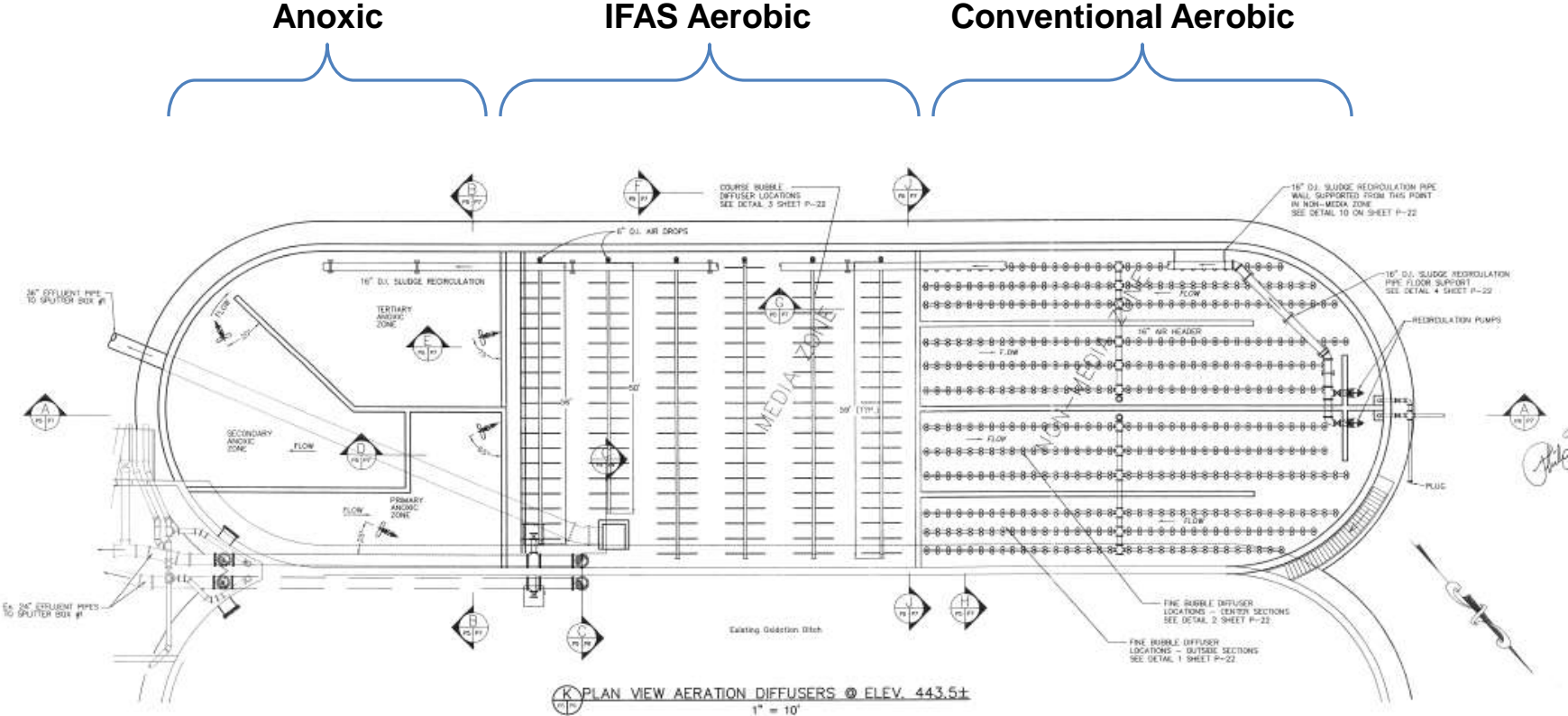
Plant Upgrade Layout



IFAS Basin Layout



IFAS Basin Layout



Kruger Scope of Supply

AnoxKaldnes Biological Process

- **Process design of the biological system**
- **DO Control for the aeration system**
- **IFAS Media**
- **IFAS zone aeration grids**
- **IFAS zone media retention screens**
- **Anoxic zone submersible mixers**
- **Internal recirculation pumps**
- **(Process air blower station by Contractor)**

Components of the AnoxKaldnes System

- IFAS Media
- Stainless Steel Aeration System
- Stainless Steel Sieve Assemblies
- DO Control System

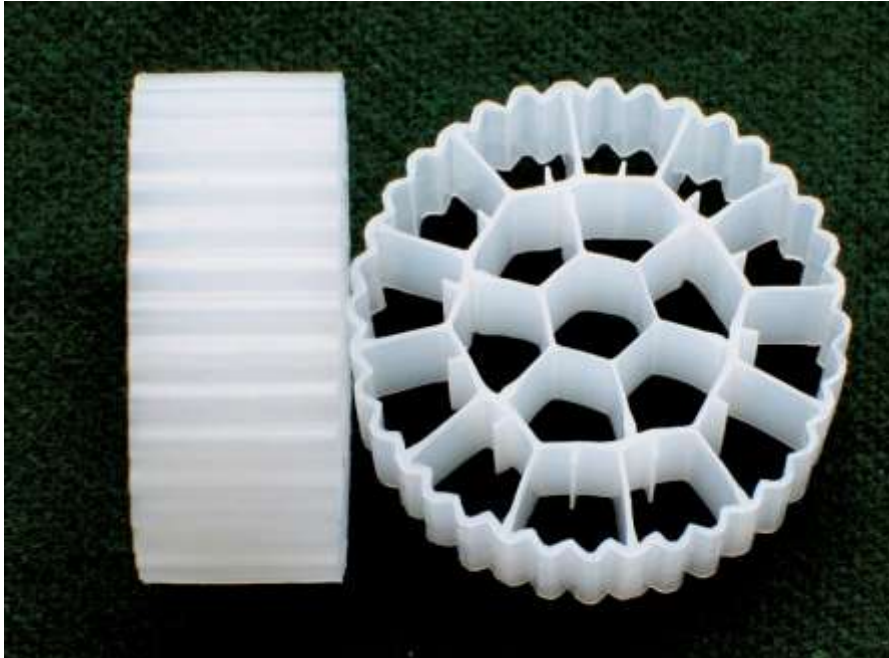
Biofilm Carrier Elements

K3™

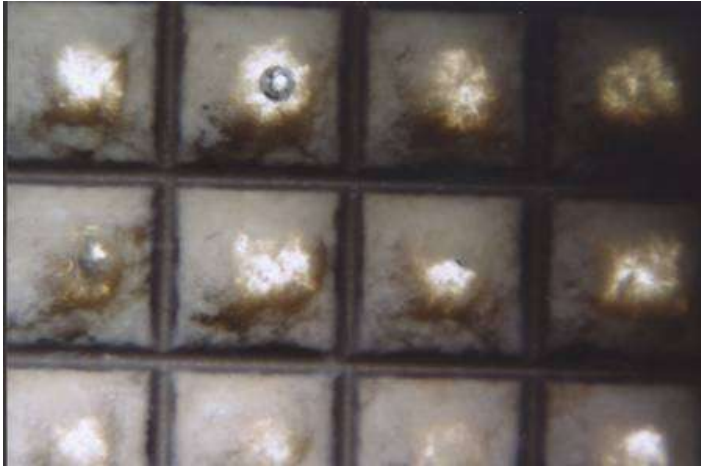
500 m²/m³ in bulk
(152.4 ft²/ft³)

25 mm (~1") diam

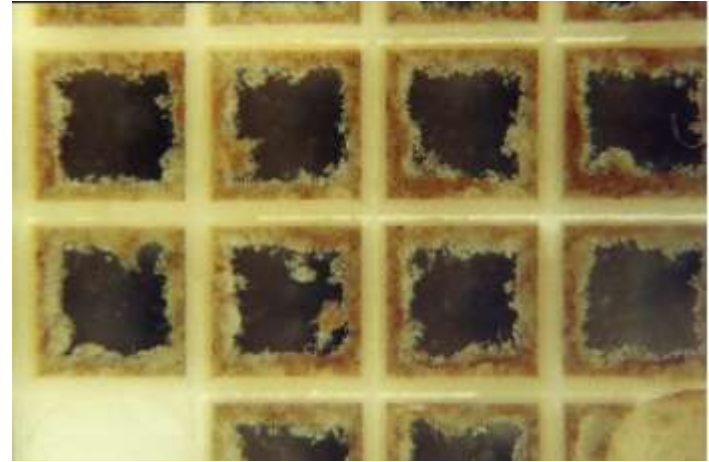
10 mm (>0.33") length



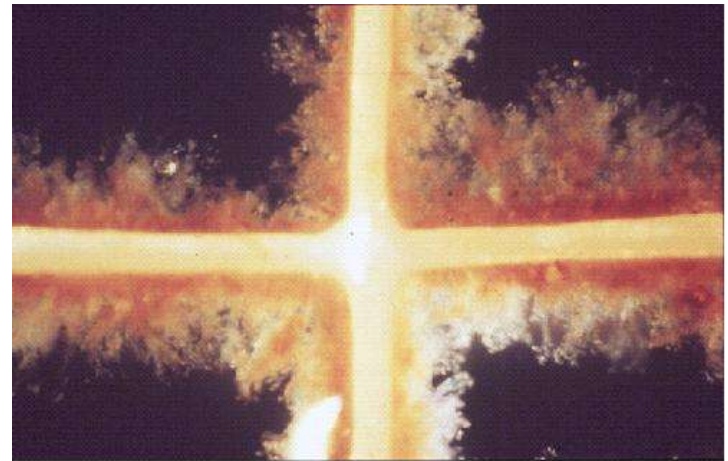
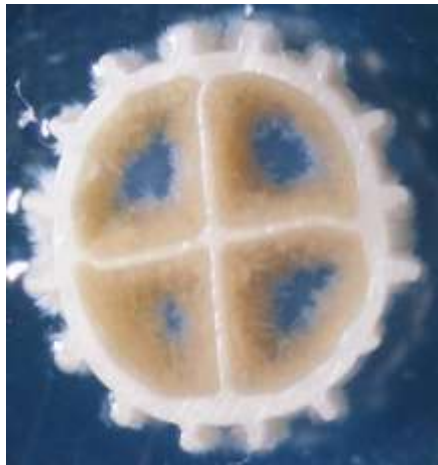
Biofilm on Carrier Elements



BOD



Nitrification



Maintenance-Free Aeration Grids

Fixed-in place stainless steel aeration system.

Orifice size = 4 mm

SOTE = 1.1-1.2% per ft in clean water

SOTE increases with K3 media



Air Distribution



Clean Water Testing, No Media



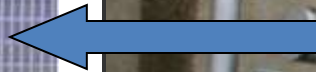
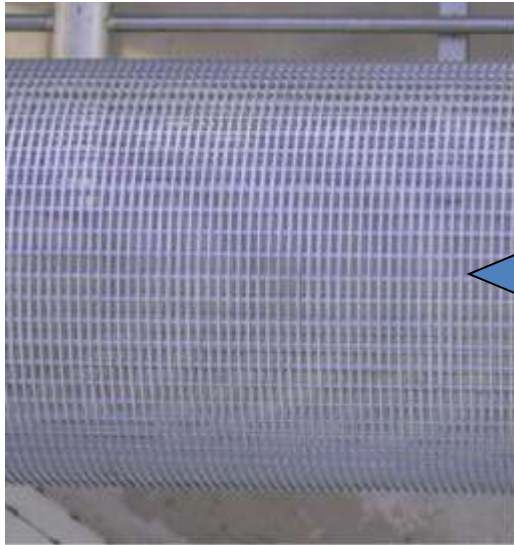
With Media, Normal Operation

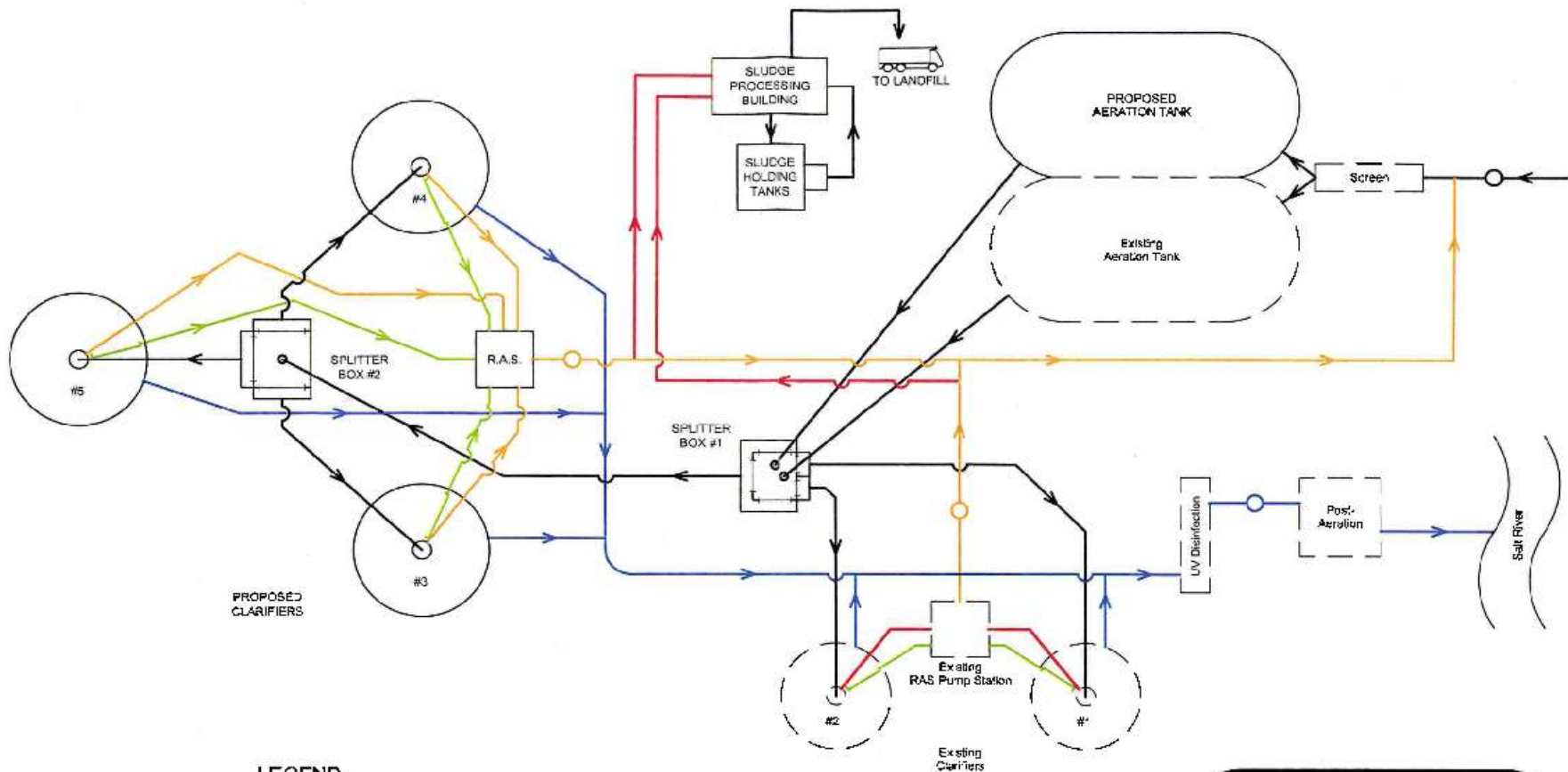
Sieve Assembly - Aeration Reactor

Fixed-in place stainless steel sieve

Wedge-wire construction, 5mm gap typical

Designed for 2 inches head loss at peak flow.





LEGEND

- INFLUENT FLOW
- RETURN ACTIVATED SLUDGE (RAS)
- WASTE ACTIVATED SLUDGE (WAS)
- CLARIFIER EFFLUENT
- SCUM DRAIN
- MAGNETIC FLOW METER
- EXISTING STRUCTURE
- PROPOSED STRUCTURE

Shepherdsville, Kentucky
Exhibit 1
Process Flow
Schematic
July 2008
 Not To Scale

#16 WEST MARKET STREET
 LOUISVILLE, KY 40202



Existing 1 channel ditch





New IFAS System



Existing Ditch





Anoxic Zones







IFAS Zone Influent Distribution Channel





New Clarifier

Existing Clarifier



2nd Phase improvements:

Retrofit the existing OD with HYBAS – 4X capacity

Phase 1 IFAS

Phase 2 IFAS





Dale Wilson, P.E., Project Manager
Kista Thomas, E.I.T., Project Engineer
Guy Waters, Job Superintendent



Gary Lubin, P.E., Vice President
The Henry P. Thompson Company
A Century of Service

Thank You! Any Questions?

