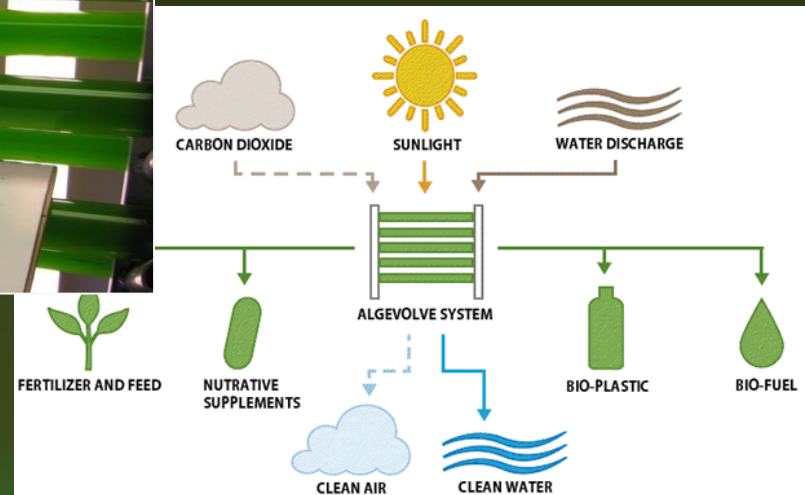
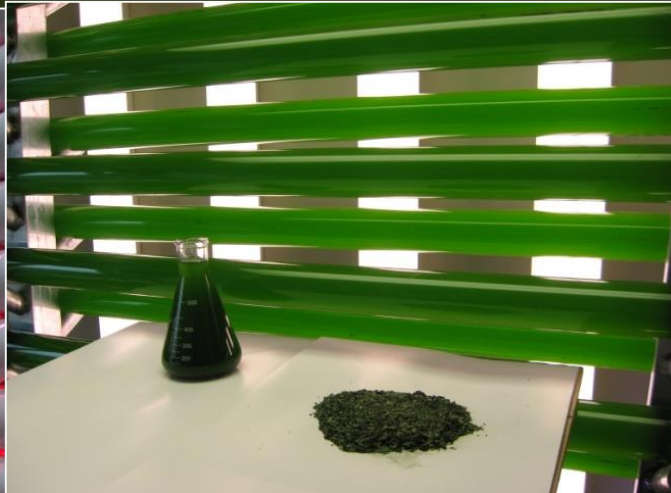


Inland Empire Paper Company



DO TMDL Advisory Committee Update

Ryan Ekre, PhD

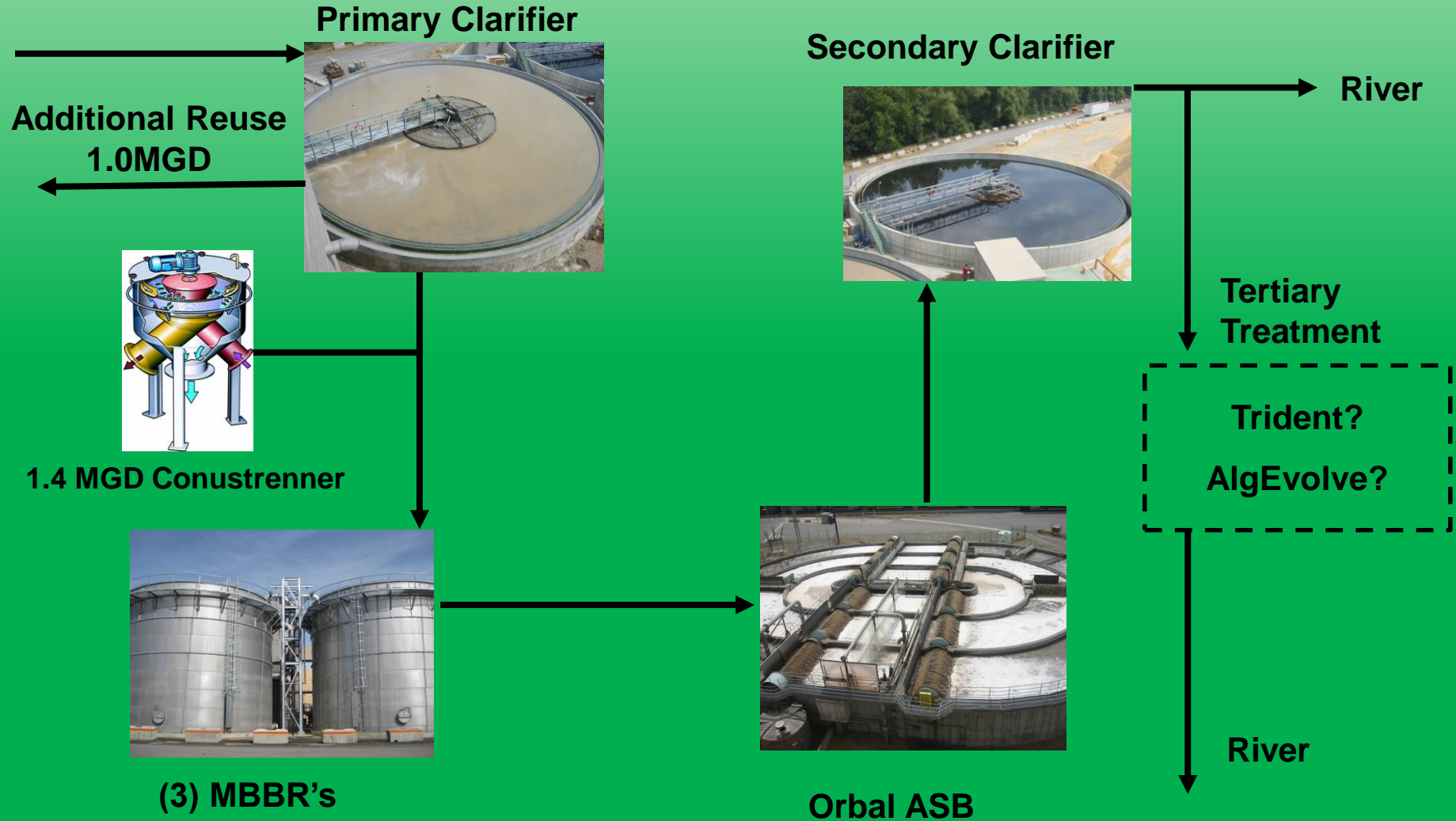
May 18, 2015



Overview of Update

- Overview of Wastewater Treatment System
- Current DOTMDL work to Date
 - Effluent nutrient concentrations over Time
- AlgEvolve System
- Piloting Membranes
 - Membrane Systems
 - Upcoming and Future Work

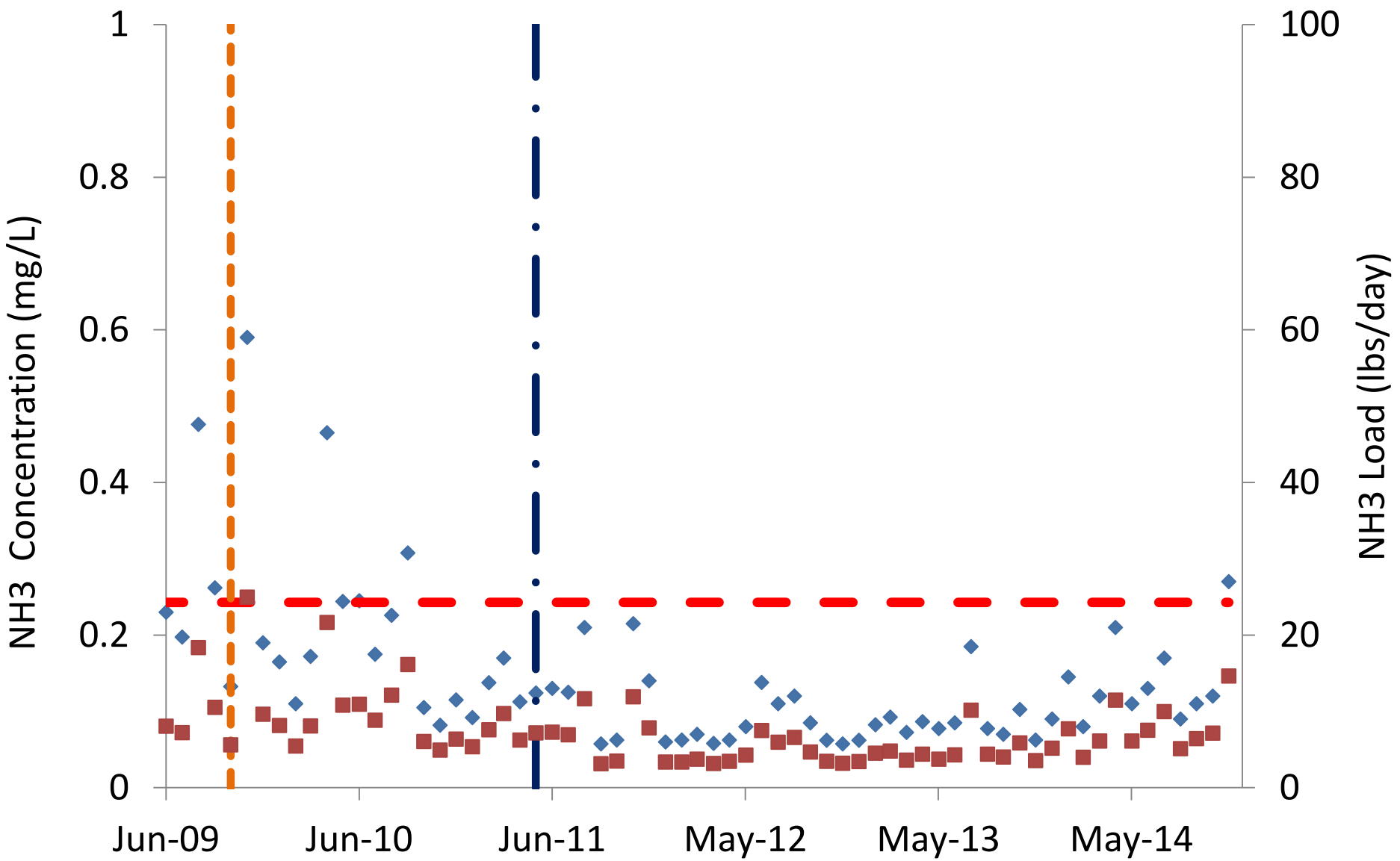
IEP's "New & Improved" WWTS



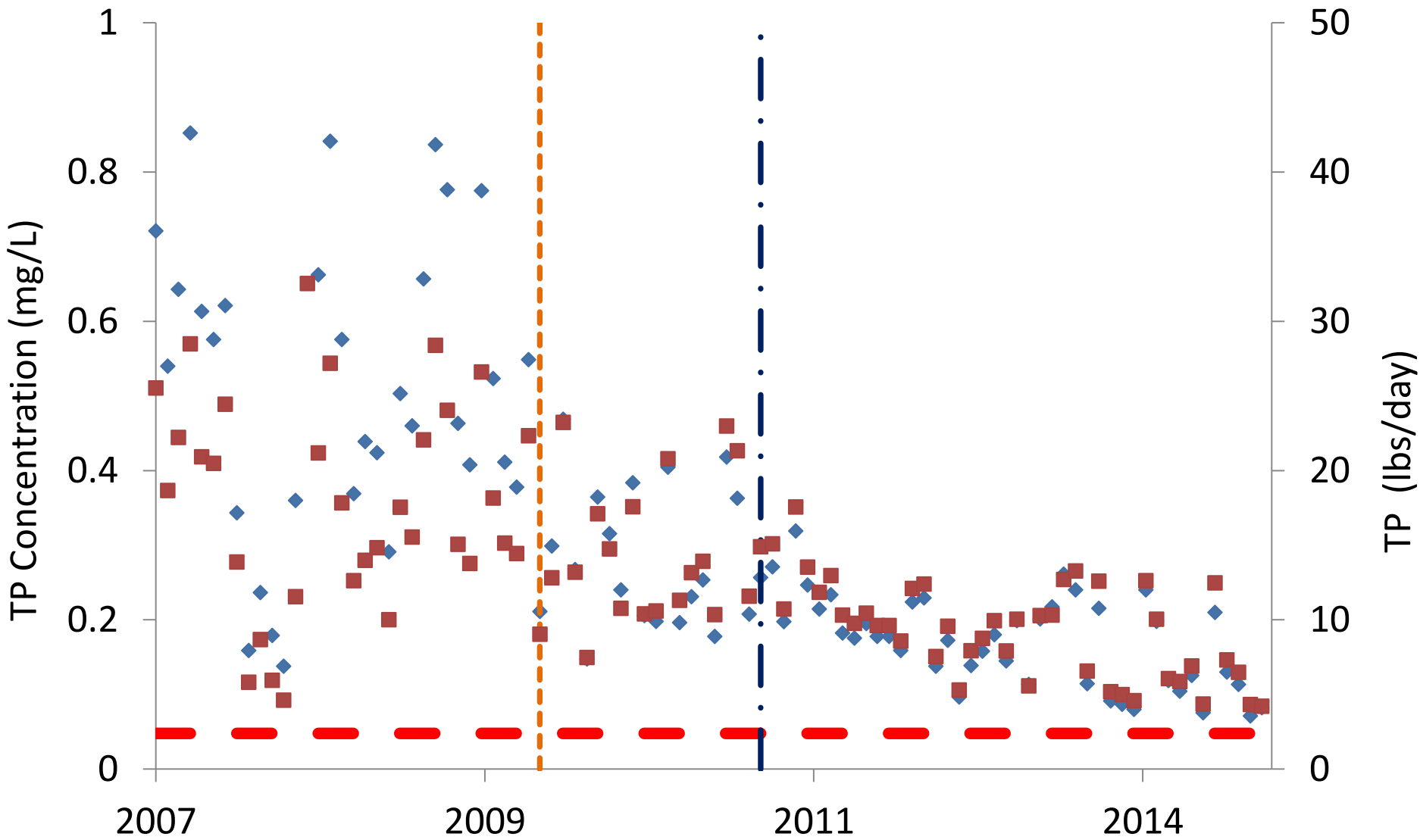


Current DOTMDL work to Date

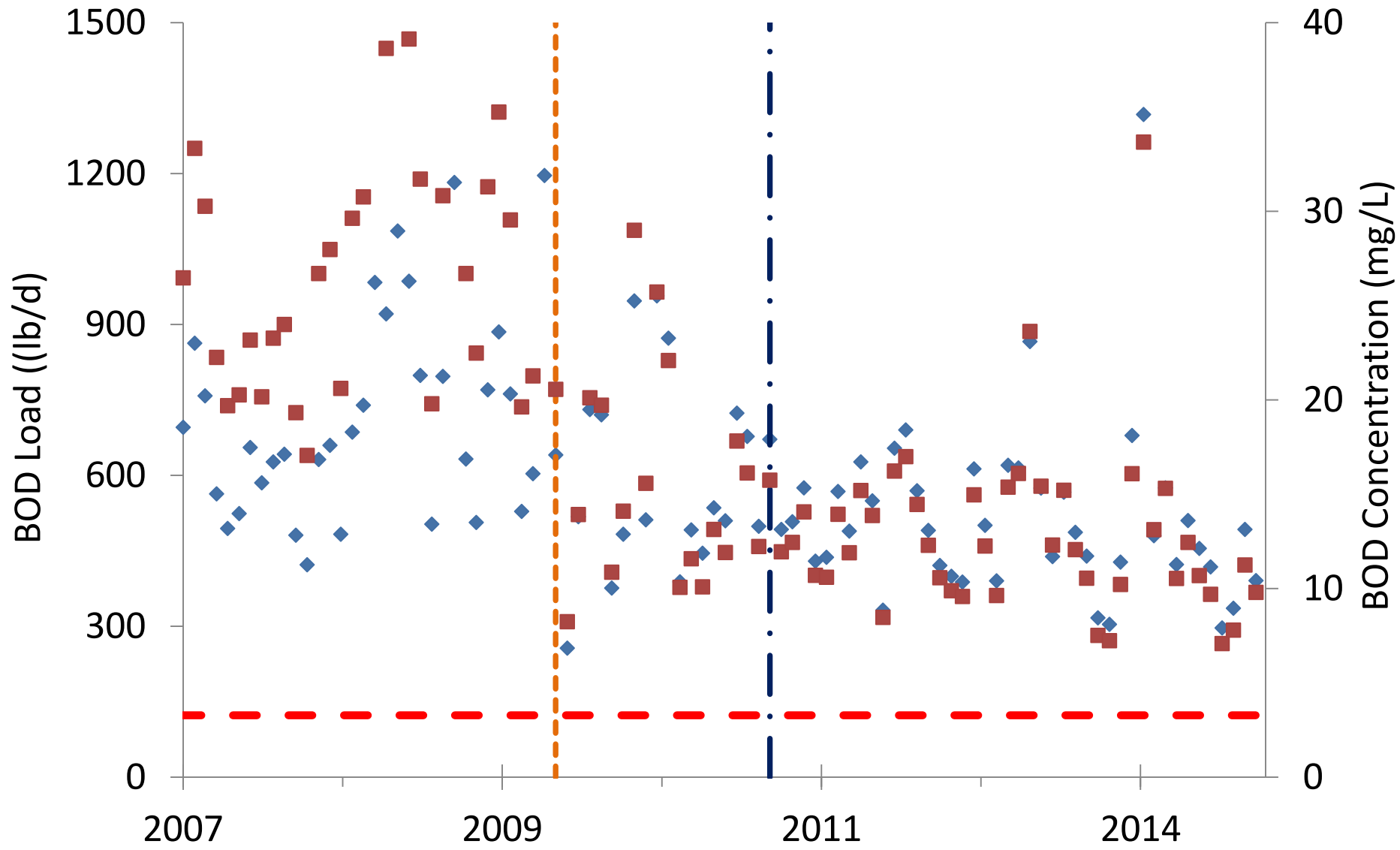
- Paper Machine #5 (2001) – Newest paper machine in North America.
- Water Conservation Projects (2004 to present)
 - Conustrenner (2004) – Water reclamation and reuse
 - Pump Seals (2005 to 2007) – Flow limiting devices installed
 - Retention Aid Carrier Water (2012) – Began using reclaimed water saving 100gal/min
 - Disk Filter Shower Water (2014) – Began using reclaimed water saving 200gal/min
- MBBR #1 (2006) – Increased BOD removal via additional aerobic treatment
- MBBR's #2 and #3 (2009) – Increased BOD removal via additional aerobic treatment
- Surge control (2009) – Flow equalization
- Elimination of Starch (2010) – Reduction in BOD loading
- Chip segregation (2011) – Reduced chemical usage rates and lowered BOD loading
- Nutrient Optimization (2012 to present) – Additions of nutrients (N and P) to optimize BOD removal
- Stock Blending (2013) – Major flow reconfiguration allowing reduced chemical usage rates and lowering BOD loading
- Trident HS – Ongoing trials with chemical precipitation system to remove BOD and TP from effluent (1MGD)
- AlgEvolve – Novel biological process for removing nutrients and BOD from wastewater and sequestering CO₂



◆ Monthly Average Ammonia (mg/L) ■ Monthly Average Ammonia Load (lbs/day)
 - - - MBBR's Installed — Chip Segregation



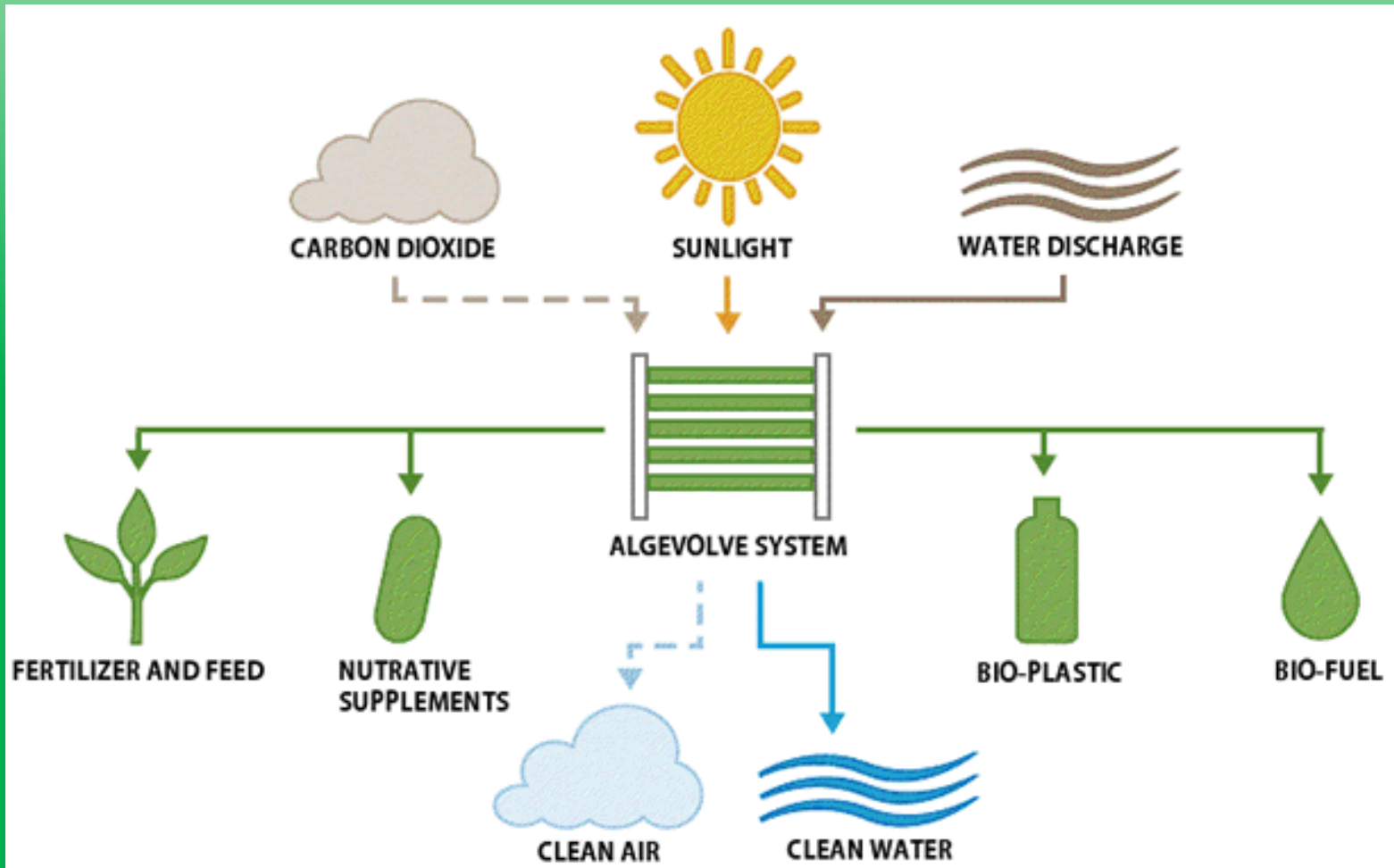
- ◆ Monthly Average TP (mg/L)
- Monthly Average TP Load (lbs/day)
- - New Paper Machine
- - - MBBR's Installed
- Chip Segregation



- ◆ Monthly Average BOD5 (mg/L)
 - - New Paper Machine
 - Surge Control
- Monthly Average BOD5 Load (lbs/day)
 - - - MBBR Installation



AlgEvolve Process



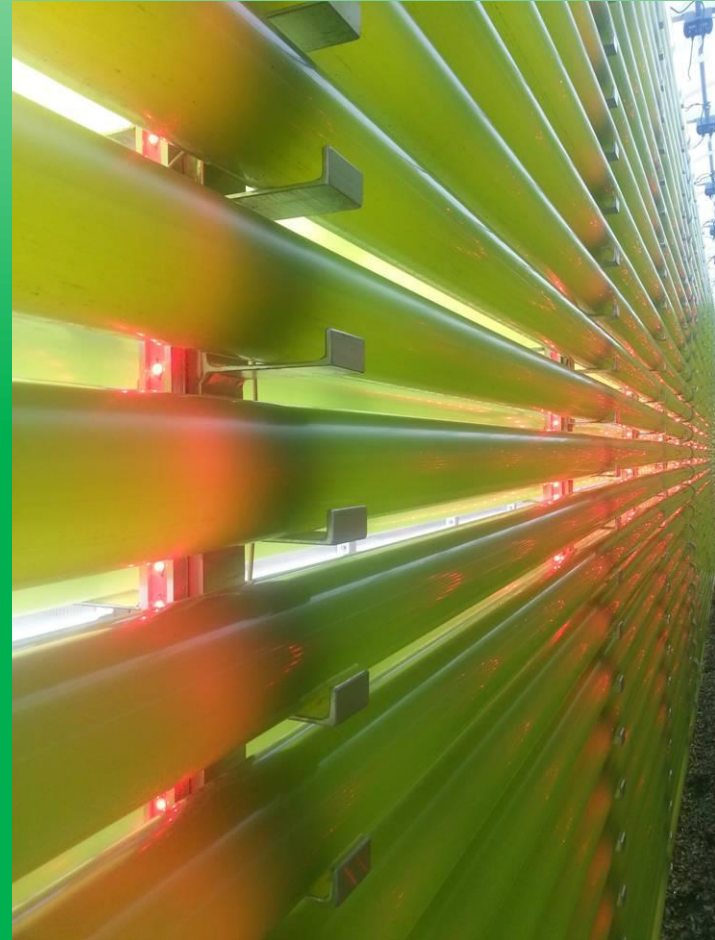


Demo Scale System





Photobioreactor





AlgEvolve: Membrane Trials

Westech - Toray
Membrane Specialists - PCI
Oxlow - Biotec





AlgEvolve: Work in Progress

- Prep for custom Koch system
- Optimized biological process
 - CO₂ use
 - Optimal pH
 - Lighting
- System modifications
 - Increase automation
 - Simplify control structure
 - Additional instrumentation





AlgEvolve: Upcoming Work

- Can we lower effluent BOD concentrations?
- PCB removal?
- Use Stack gases for CO₂?
- How to dewater/harvest algae?
- Uses for algae
 - Bio-diesel?
 - Bio-plastics?
 - FBC – on-site steam generation?
 - Other?



Dried Algae

Questions?

