# Erik R. Coats, P.E., Ph.D. and his research group have constructed a scale-model suspended growth advanced water reclamation research facility (AWRRF) at the Moscow, ID WRF

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The AWRRF is designed to biologically remove carbon, ammonia- and nitrate-nitrogen, and phosphorus from municipal wastewater; **significant flexibility has been integrated into the AWRRF such that new, unproven process configurations can be evaluated**. While the **4,800 gallon AWRRF** (3,000 gallon per day capacity) can be operated in multiple configurations, a 'basic' process overview is as follows (Figure 1).

- Screened/de-gritted municipal wastewater is pumped into a primary solids fermenter/primary clarifier (1°).
- Organic acid-rich wastewater produced in the fermenter system overflows into three anaerobic (AN) basins.
- Two anoxic (AX) basins follow the AN basins; pre- and post-anoxic denitrification can be accomplished.
- Downstream of the AX is an aerobic oxidation ditch (AE); the AE can be operated at half or full volume. Aeration is accomplished with 36 Sanitaire 9-inch diameter Silver Series™ membrane diffusers, while air is provided with a Roots-Dresser rotary lobe blower. Flow through the ditch is induced by paddle mixers.
- A mixed liquor return (MLR) pump recycles nitrate-rich wastewater from the AE to AX basins.
- Reclaimed water recovered from a secondary clarifier (2°) is discharged into the Moscow treatment plant.
- RAS and waste activated sludge (WAS) are obtained from the 2°. RAS can be pumped into any AN basin.

**Legend:**
AN=Anaerobic
AX=Anoxic
AE=Aerobic
1°=Primary Clarifier
FERM: fermenter
2°=Secondary Clarifier
IP:Influent Pump
RAS/WAS:Return Activated Sludge/Waste Activated Sludge Pump
MLR:Mixed Liquor Return Pump

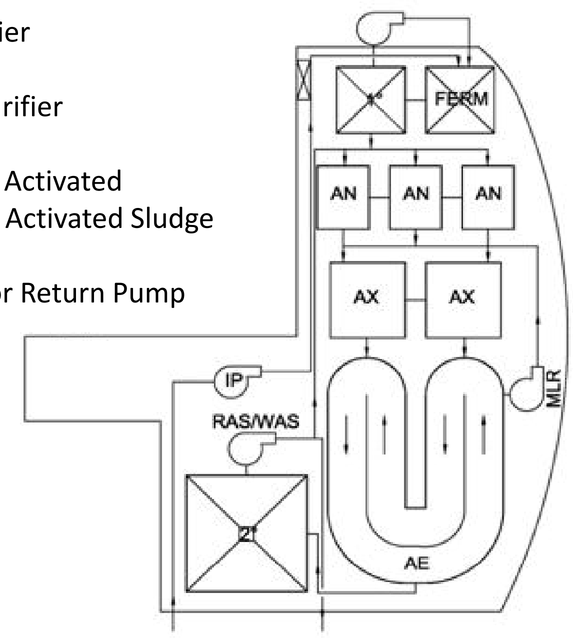



**Figure 1-Schematic Diagram of AWRRF**

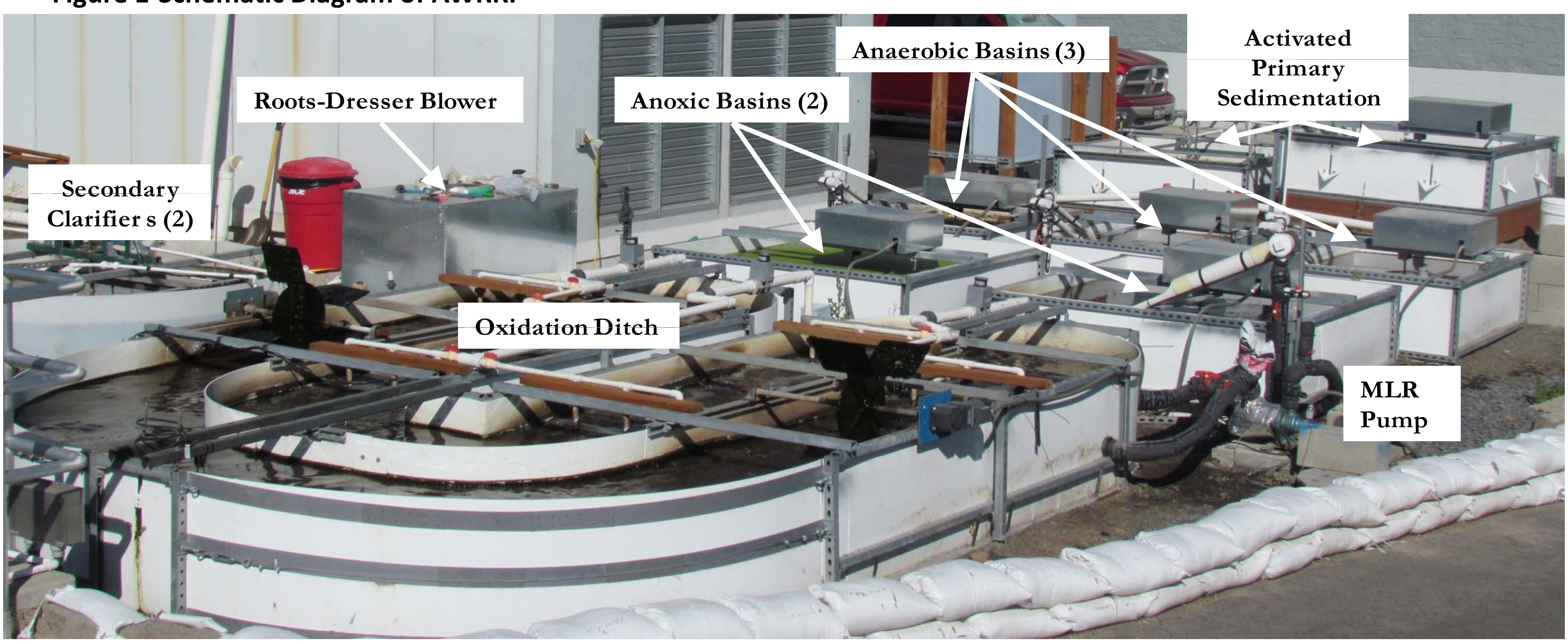
**This AWRRF, which is operated and maintained by UI civil engineering students, provides undergraduates and graduates with unique opportunities to study and research biological wastewater treatment at a scale and level of complexity consistent with real-world systems**. Further, since the AWRRF discharges reclaimed water into the city's treatment facility, **we can evaluate operational scenarios without the risk of violating a discharge permit;** this is a significant benefit to the study of biological wastewater treatment. With this AWRRF, Dr. Coats has created an advanced teaching and learning environment for civil engineers.

In the near-term, **Dr. Coats' research group will be conducting the following investigations at this AWRRF:**

- In-line primary solids fermentation and biological phosphorus removal.
- Post-anoxic denitrification and biological phosphorus removal.
- Bacterial metabolisms applying proteomic and transcriptomic techniques, with the objective of identifying and defining critical metabolisms associated with biological phosphorus removal.

**Project Sponsors:** This project could not have been completed without the financial assistance from:

- City of Moscow, Idaho
- J-U-B Engineers, Inc.
- Murray, Smith & Associates, Inc.
- Sanitaire, Inc./Beaver Equipment, Inc.
- Rogers Machinery Company, Inc.
- Idaho SBOE, Higher Education Research Council

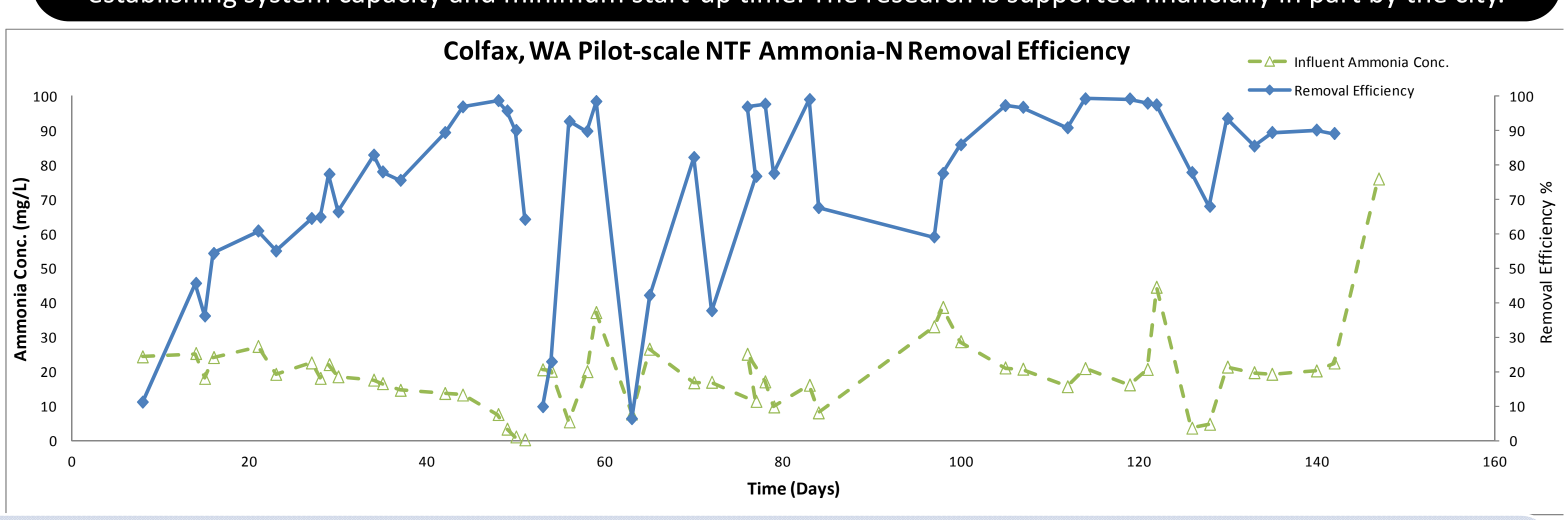



Dr. Coats' 5,000 gallon scale model EBPR system (located at the Moscow, Idaho WWTP)

## Pilot Scale 2-stage Nitrifying Trickling Filter (NTF) – located in Colfax, WA

Distribution System

The city of Colfax, WA operates an aerated lagoon wastewater treatment system. An impending TMDL process may yield ammonia-N removal limits on the city's WWTP. Recognizing that the lagoons have significant BOD capacity, Dr. Coats and his research team are conducting ongoing studies of a NTF to target ammonia-N removal. The NTF has been operating during the period of April-October since 2010. We first evaluated performance in accordance with "typical" design standards and observed that the NTF was significantly underloaded; subsequent investigations have focused on establishing system capacity and minimum start-up time. The research is supported financially in part by the city.




Our investigations have (1) confirmed the potential for this technology to consistently treat lagoon effluent and achieve effluent ammonia-N concentrations < 1 mg/L, (2) demonstrated the viability of this technology for Colfax (in lieu of replacing their lagoons with a substantially more expensive activated sludge system), and (3) generated critical data for ultimate scale-up. We are finalizing our data analyses, with an emphasis on extracting kinetic parameters on the rate of ammonia-N removal, and will be summarizing our results in both a preliminary design report to Colfax and in a peer-reviewed journal (tentatively targeting Water Environment Research).