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).

**Legend:**
- AN=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

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

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

**Figure 1-Schematic Diagram of AWRRF**

**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**

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.

![Colfax, WA Pilot-scale NTF Ammonia-N Removal Efficiency Graph](image)

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).