Student-Led Wastewater Design Strengthened by Professional Engineer Collaboration

Chincoteague Wastewater Treatment Plant Improvements

2026 NCEES Engineering Education Award

Students did not just complete a wastewater design assignment; they worked with licensed Professional Engineers, HRSD reviewers, construction professionals, and technical mentors on a real coastal wastewater treatment plant problem. That collaboration changed the technical solution, improved public protection, and created professional-level student learning. More importantly, the collaboration changed the students: they began the project as capable classroom problem-solvers and left understanding how engineers defend recommendations under owner standards, permit requirements, constructability constraints, cost limitations, operational realities, and public-welfare obligations.

A twelve-member senior capstone team developed a Preliminary Engineering Report (PER) for the Hampton Roads Sanitation District (HRSD) recommending the upgrade and expansion of the Chincoteague Wastewater Treatment Plant (CTP) in Chincoteague, Virginia. The plant currently operates as an Extended Aeration Activated Sludge facility permitted to treat 39,500 gallons per day (gpd). The project goal was to design an expanded facility capable of treating 130,000 gpd average daily flow and 260,000 gpd peak flow while maintaining full compliance with the existing VPDES permit throughout every phase of construction.

The team evaluated four biological treatment technologies - Moving Bed Biofilm Reactor, Membrane Bioreactor, Sequencing Batch Reactor, and Extended Aeration Activated Sludge - using BioWin modeling and a Multi-Attribute Decision Model that weighted capital cost, life-cycle cost, footprint, operational complexity, coastal resilience, constructability, effluent quality, and load variability. A Sequencing Batch Reactor system was selected for its compact footprint, operational flexibility, maintainability, and lower capital cost relative to membrane-based alternatives. The recommended design includes two SBR basins, post-SBR equalization, cloth disc filtration, upgraded chlorination and dechlorination, new influent and effluent pumping improvements, a relocated outfall, and flood-resilient electrical and mechanical infrastructure. The estimated construction cost is $2.41 million, with a projected 50-year life-cycle cost of $7.37 million, and the project earned a projected Silver rating under the ISI Envision sustainable infrastructure framework.

Professional involvement was discipline-specific and changed both the design and the students' judgment. Matthew Doyle, P.E., coordinated the educational framework and primary technical review; Ag Fallon, P.E., supported the alternative analysis; Pete Loomis, P.E., provided detailed process-flow review; David Binning, P.E., required alignment with HRSD owner standards; Kayla Stephens helped refine the SBR cycle strategy; Bob Fairweather reviewed pumping-system assumptions; Kevin Ritchie shifted the structural and constructability discussion toward precast and prefabricated concrete where appropriate; Scott Crowder strengthened the MOPO sequencing; and Dan Hingley, P.E., Lara Grotz, P.E., Priyanka Mohandoss, P.E., and Jim Pyne, P.E., provided final professional feedback on the integrated design package.

The project integrated environmental, water resources, structural, geotechnical, mechanical/electrical/controls, construction engineering, regulatory compliance, sustainability assessment, cost engineering, and project management. The project gave students direct experience with the obligations that define professional practice: maintaining permit compliance during construction, protecting public health and Chincoteague Bay water quality, evaluating life-cycle cost and constructability, and making engineering decisions that affect a real community. The result was both a credible engineering deliverable and a formative professional experience: the design changed, but more importantly, the students changed.