

# WATER RESOURCES SCI/TECH (WATR)

## WATR 1301 Introduction to Water Treatment

**Credits:** 3 (3-0-0)

This course provides an introduction to the basic chemical, biological and mechanical processes by which conventional water treatment plants operate. Students will also be introduced to the history and evolution of water treatment technologies, as well as examine emerging trends in treatment. The course will provide an introduction to the study of conventional water treatment plants including an introduction to the various sources and problems associated with raw water. Topics discussed will include the theory, chemistry and practice of pretreatment, purification, process control procedures, chlorination systems, water softening, treatment plant safety procedures, and distribution. Students will be exposed to standard equipment, facilities, water transport, safety, and information technologies. Students will also gain an understanding of plant design, basic operation, management, and instrumentation at treatment plants. Hands-on experience with and observation of standard equipment and processes will be provided through a field experience. Students will tour actual water plant operations and learn about water purification at a local level. TSI Restriction(s): Reading, Math, and Writing

**Restrictions:** Graduate level students may not enroll.

## WATR 1302 Introduction to Wastewater Treatment

**Credits:** 3 (3-0-0)

This course provides an introduction to the basic chemical, biological and mechanical processes by which conventional wastewater treatment plants operate. Students will also be introduced to the history and evolution of wastewater treatment technologies, as well as examine emerging trends in treatment. Students will be exposed to standard equipment, facilities, water transport, chemical injections, safety, information technology, and theory of wastewater treatment systems. Students will also gain an understanding of plant design, basic operation, management, and instrumentation at treatment plants. Hands-on experience with and observation of standard equipment and processes will be provided through a field experience. TSI Restriction(s): Reading, Math, and Writing

**Restrictions:** Graduate level students may not enroll.

## WATR 2350 Topics in Water Resources

**Credits:** 3 (3-0-0)

Lectures, literature investigation, and discussion in selected topics in water resources science. May be repeated for credit once under a different topic. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** A grade of "C" or better in WATR 1301 and WATR 1302.

**Restrictions:**

## WATR 3312 Water Laws, Rules & Policy

**Credits:** 3 (3-0-0)

This course provides an introduction of local, state, and federal rules and regulations relevant to water as a resource. Students will examine federal, state, and local approaches to water allocation, pollution control, and resource management on private and public lands. The roles of science, sanctions, economic incentives, opinion, and other influences will be discussed. TSI Restriction(s): Reading, Math, and Writing

**Restrictions:**

## WATR 3315 Inst & Role in Wtr Resrcr Mgmt

**Credits:** 3 (3-0-0)

In this course students will learn about federal, state, and local institutions and agencies responsible for or advocating management of water resources and the development of the policies, laws and regulations governing water use, distribution, and public health and safety. Each class period students will learn about one or more institutions, with presentations, and detailed review by actual top executive leaders from the institution or agency under discussion. Student projects will involve taking turns researching the presenter's institution and the person's role, and then introducing the presenter to the class. Students will be required to work in groups investigating in detail one institution, a challenging matter currently being addressed by the institution, how the institution has or will solve the challenge, and make a presentation to the class about what they learn. Institutions that students will learn about from the top leadership may include the Texas Water Development Board, San Antonio River Authority, Edward Aquifer Authority, the U.S. Environmental Protection Agency, San Antonio Water Authority, Texas Parks and Wildlife Department, The Nature Conservancy, the Hill Country Alliance, the U.S. Army Corps of Engineers, Underground Water Conservation Districts, U. S. Geological Survey, Texas State Soil and Water Conservation Board, Friends of Blue Hole, and the Natural Resource Conservation Service.

**Restrictions:**

## WATR 3317 Water Sust Use & Conserv Policy

**Credits:** 3 (3-0-0)

This a general course investigating water resources science and resource management from the perspective of its value to human society and sustainability. Water has unique properties that make it essential for sustaining all life on Earth, which gives this natural resource a major historic and future role in development of society. The hydrologic cycle is explored as it exists from high above the Earth's surface to miles beneath it. The geology of water's availability to human society is explored, as well as the role of surface water and aquifers in shaping landscapes and human inhabitation. Students explore the influence of climate on water, distribution and availability of safe drinking water, and pollution of water in the past and current social and economic context of meeting current and future needs of society. Where possible, examples relevant to Texas will be emphasized.

**Restrictions:**

## WATR 3320 Pollutants in Environmental System

**Credits:** 3 (3-0-0)

This course is the study of the fate of contaminants in natural, disturbed, and man-made water systems. Study will focus on pollutants of concern to public and environmental health, including toxic chemicals, industrial discharges and spills, endocrine disruptor chemicals, methyl mercury, pesticides, sediment-borne contaminants, and other contaminants. Impacts, emergency response, safety advisories, impact on water supplies, and natural remediation processes will be explored, including biodegradation, thermodynamics, aeration, bioaccumulation, state change reactions, acid-base equilibria, speciation, solubility, redox chemistry, dilution, and sequestration. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** CHEM 2371, CHEM 2171.

**Restrictions:** Graduate level students may not enroll.

**WATR 3325 Aquatic System Science****Credits:** 3 (3-0-0)

Aquatic science is covered comprehensively, with relevant principles of biology, chemistry, physics, geology, geography, hydrology, and ecology highlighted. Students explore aquatic systems from aquifer/headwaters to ocean with emphasis on Texas ecosystems. Students also are presented an introduction to the laws, policies and environmental perturbations impacting aquatic ecosystems and what citizens and governments are doing to manage these systems. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** BIOL 1307, BIOL 1107.**Restrictions:** Graduate level students may not enroll.**WATR 3330 Green Systems for Wastewater Management****Credits:** 3 (3-0-0)

Students will learn about using constructed green biological systems to manage raw and treated waste streams from runoff, combined sewer overflows, and treatment facilities across urban and rural landscapes. Students will examine best practices in restoration of wetlands, riparian zones, and other natural areas in a watershed that may function in bioremediation of wastes and augment municipal and industrial treatment. Work will include assessing the effectiveness and value of natural ecologic functions in maintenance of healthy watershed systems and water sustainability. Students will learn from practicing professionals about recent advances in urban and multiple use planning that incorporate extensive use of greenways and other green infrastructure for management of water distribution, wastes, and sustainable water systems, as well as support local agriculture and industry. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** WATR 3325.**Restrictions:** Enrollment limited to students with a semester level of Junior or Senior. Graduate level students may not enroll.**WATR 3331 Hydrology****Credits:** 3 (3-0-0)**Restrictions:** Graduate level students may not enroll.**WATR 3340 Water Resources Science and Technology Internship****Credits:** 3 (0-0-3)

Students taking this course conduct specialized work on an individual basis, that includes training and actual practice working in a water resources science or water technology related for profit business, government agency, municipal agency, or nonprofit organization in the area of industrial water technology or water resource management. Students will be engaged in supervised experiential learning, under the direction of a university faculty member and employees of participating organizations. Students will have the opportunity to be involved in activities such as data collection, analysis, report writing, and plant, field or laboratory experiences. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** POLS 3315; junior standing.**Restrictions:** Graduate level students may not enroll.**WATR 4181 Research****Credit:** 1 (1-0-0)

This course provides an independent research opportunity that will allow undergraduates majoring in Water Resources Science and Technology to make an original intellectual contribution to the subject. The research will be conducted in collaboration with a faculty mentor. Students may repeat the course once as an elective for additional credit. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** a grade of "C" or better in WATR 1301, WATR 1302, CHEM 2371, CHEM 2171.**Restrictions:****WATR 4191 Water Resources Science and Technology Seminar****Credit:** 1 (0-0-1)

Current topics in water resources science and technology are explored by students, along with guest presentations by experts in the field. Students may engage in "Point-Counter Point" debates. Students will research topics before class and participate in discussions. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** Senior standing.**Restrictions:** Enrollment limited to students with a semester level of Senior. Graduate level students may not enroll.**WATR 4305 US-Mex Borderlands Wtr Issues****Credits:** 3 (3-0-0)

Students will study interjurisdictional policy and scientific water management issues in the U.S.-Mexico border region. Water there are shared bi-nationally, with rivers flowing from one county to the other or forming the international boundary. Students will learn about efforts protecting and restoring watersheds and water quality in these rivers. Adequate drinking water and basic sanitation services requires collaborative bi-national, multi-jurisdictional planning efforts. They will examine the significant and complex challenges in shared watersheds that are exacerbated by high population growth rates and impacts from climate change. Students will explore the full range of water-related issues along the border and compare them with interjurisdictional water and transboundary lakes issues elsewhere in the world.

**Restrictions:****WATR 4310 Desalination and Emerging Technologies****Credits:** 3 (3-0-0)

This course takes advantage of close proximity to one of the first inland desalination plants that uses saline groundwater for freshwater production. Students will learn about the full range of desalination technologies in use and under development. Instruction will include membrane systems, microfiltration, distillation, atmospheric water generation, reverse osmosis, forward osmosis, brine disposal, electrodialysis, solar desalination, and small-scale desalination solutions. Students will participate in a field trip to a production-scale desalination facility where they will discuss desalination technologies and plant operations with practicing operators and technical experts. Students will also participate in a small-group cooperative research project from which a scientific report will be written. Results of the research will be orally presented to the class as a scientific report/paper. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** CHEM 2371, CHEM 2171, WATR 1301.**Restrictions:** Graduate level students may not enroll.

**WATR 4315 Advanced Wastewater Recycling Systems****Credits:** 3 (3-0-0)

This course is about water treatment technologies that are rapidly advancing the state of the art in pollution control. Taking advantage of San Antonio's proximity to oil fields, students will be exposed to innovative technologies coming into use through research and proof of concept testing directed at finding solutions to water resource impacts and usage during energy extraction, especially resulting from hydrologic fracturing processes. They will have an opportunity to explore compact modular treatment works now addressing unique pollution treatment requirements of specific industries and locations where a "one size fits all" approach to treatment of effluents no longer exists. New strategies for advanced recycling of gray water wastes, as well as innovative uses of black water and industrial effluents will be explored. Students will have an opportunity to visit field locations where new oilfield and industrial directed technologies are being used. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** CHEM 2371, CHEM 2171, WATR 1302.**Restrictions:** Graduate level students may not enroll.**WATR 4330 Water Management and Field Investigations****Credits:** 3 (3-0-0)

This course provides an introductory course on the chemical and biological characteristics of groundwater, groundwater assessment and management, aquifer storage technologies, life underground, value to society, and the interactions of surface water and groundwater with the geologic environment. Topics include microbial processes, water quality sampling techniques, capacity, flow rates, living communities, aquifer mapping and modeling, recharge rates and projections, remote sensing techniques, impact of energy production activities, uses, role in society and economic value, and the fate of chemicals, contaminants, and dissolved components in water. Students will have an opportunity to explore groundwater through use of simple demonstration models and field visits to locations where groundwater management activities are currently underway. The course will include field activities, and students will participate in a small-group research project from which a scientific report will be written. Results of the research will be orally presented to the class as a scientific report/paper. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** WATR 3325.**Restrictions:** Graduate level students may not enroll.**WATR 4350 Adv Topics in Water Sciences****Credits:** 3 (3-0-0)

Lectures, literature investigation, and design in selected topics of water resources science, technology, and management. May be repeated for credit once under a different topic. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** A grade of "C" or better in WATR 1301 and WATR 1302.**Restrictions:**