



University of Texas Permian Basin Capability Statement

Institution: The University of Texas Permian Basin

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Introduction

The University of Texas Permian Basin (UTPB) is a comprehensive university serving West Texas for the last 50 years. The University's prestige is based, in large part, on the exceptional teaching and research being carried out by UTPB faculty in every discipline. In particular, faculty members are working at the cutting edge of nearly every facet of research being undertaken in the world today. For many UTPB students, the experience of working with UTPB faculty solving some of the world's most pressing challenges and answering questions at the leading edge of knowledge will fundamentally shape their career paths, their ways of thinking, and even their core values.

Goals

Scientific, engineering, education, liberal arts, health and human services, and education and behavioral science research, instruction and public service projects involve faculty, staff and students in strengthening and extending UTPB's curriculum and community activities while improving the public good. Researchers continued to study the impact of new technologies on the environment and how to disseminate their findings. To achieve their goals they often entered into research and economic development partnerships with industries, universities and communities.

Research Programs

In order to meet the research mission, UTPB created and established several research centers/facilities to ensure the delivery of meaningful and competitive research outcomes in the diverse research disciplines while providing a robust atmosphere to train scientists, professionals, and workforce for the state of Texas and beyond.

Biomedical Research Center

The Biomedical Research Center (BRC) is a new aspect of UTPB that focuses on areas such as cardiovascular disease, neuron- degenerative disease, selective drug delivery mechanisms, and CO releasing molecules as pharmaceutical drug systems. The BRC is housed within the College of Arts and Sciences where researchers have access to a large variety of resources. The mission of the research center is to promote and support research capacity at The University of Texas Permian Basin. In doing so, ensure the delivery of meaningful, and competitive research outcomes in the biomedical field while providing a robust atmosphere to train scientists, biomedical professionals, and healthcare workforce for the Permian Basin. In addition, the center will promote external collaborations with existing biomedical stakeholders throughout the Permian Basin.

Facilities at BRC

- Four newly remodeled laboratories in the Science and Technology building at UTPB
- Offices for faculty, staff and students
- Animal facility - current facility for animals is in the ST building
- Biology common equipment room - a common room that houses expensive equipment and/or shared equipment. A few examples include ultracentrifuge, autoclave, cell sorter,
- Q-PCR equipment and fluorescence microscope
- Common equipment room in chemistry, ICP, IC, GCMS, AA, DSC, UV, IR,
- Specialty rooms and equipment such as SEM, NMR, X-Ray and Confocal Microscope

Natural Resource Center

The Natural Resource Center (NRC) provides contracting, consulting, method development, services and collaborative research project opportunities between The University of Texas Permian Basin, regional industry and stakeholders. The NRC facility particularly benefits companies abundant in the chemical and petroleum industry in the West Texas region by providing extensive expertise in petroleum geology, petroleum chemistry and analytical chemical methods. The center not only provides an array of services, collaborative research and expertise, but it is also provides opportunities to place interns in regional companies. In addition, the collaborations are beneficial to students, and faculty, The University of Texas Permian Basin (UTPB) and industry will collaborate to provide economic development opportunities for the region.

Workforce Development at NRC

The research projects, faculty mentors and instrumentation utilized by the NRC strengthens their knowledge and proficiency. Further, it will provide a real world training platform to train students in research methods, data analysis, problem-solving, project-management, time-management, and communication skills. These transferable skills will make UTPB science students competitive, and qualified for high-level employment in regional companies or excellent graduate and professional school candidates.

Why NRC?

The NRC provides consulting, method development, training, analytical and customized services for biological, chemical and geological issues including,



- Natural Resource Management
- Hydrogeology
- Paleoecology
- Analytical method development
- Water analysis, chemical & biological
- Petroleum Chemistry
- Environmental toxicology
- Petroleum Geology
- Microbiology
 - Microbiology analysis of E. coli, fecal coliform and total coli form
 - Analysis of E. coli, fecal coliform and total coliform (drinking water, well and groundwater, waste water, recreational waters, chemical processing applications)
 - Hourly Instrument use and training
 - Monitoring volatiles, SO₂, allergens, and airborne particles

Collaboration through NRC

Collaborate with industry on research projects and assist with chemical element analysis and organic compounds (volatile/nonvolatile) in water sample from private wells, oil field, soils for a variety of metals, fluoride, chloride, sulfate, nitrite, nitrate, arsenide and arsenate, and in crude oil, natural gas, for sulfur and other physical and chemical characteristic components.

Facilities at NRC

XRF, ICP, AA, EDX, TOC/TN, UV-vis, IC, Mercury analyzer, GFAA, CA610 Fluoride Analyzer, EZ6000 Series Analyzers use voltammetry to determine Arsenic species, EZ7750 for nitrogen, nitrite, nitrate analyzer. TGA, millipore milli-Q Direct 8 Ultrapure Water system, Buchi 410 Hg analyzer, X-ray, ICP– EOS, Confocal microscope, and others.

Cyber Security Center

Odessa-Midland has a rapidly growing population and a robust economy fueled by the oil and gas industry. With unemployment at 50 year lows and a growing demand for skilled workers, Odessa/Midland finds it ever more difficult to support its dynamic economy with a technical workforce. The Cyber Security Center (CSC) proposed above will provide the infrastructure for UTPB to train hundreds of cyber professionals in cybersecurity & privacy, computer science, network administration & security, information technology, machine learning (AI), software engineering/development, and data science. This Center will provide programming at the certificate, associate, bachelor and master's level to supply the workforce and collaborate with industry to help West Texas thrive and attract technical professionals. The Center will provide a hub of applied research to support regional industry. The UTPB center will support and promote economic development and economic diversification in West Texas.

CSC Excellence in the following multidisciplinary support including in:

- Cybersecurity & privacy
- AI based cyber defense



- Anomaly/Intrusion detection
- Analytics & statistics
- Data Sciences
- Network admin & security
- Software development
- Internet of things security
- Vehicular network security

CSC Expertise

The centralized cyber center will provide:

- cyber expertise, external consulting
- external and internal training and workshop opportunities
- cyber workforce development for Permian Basin
- industry engagement and collaboration on projects
- solutions to real world cybersecurity problems through multidisciplinary approach

Texas Water and Energy Institute (TWEI)

The Texas Water and Energy Institute provides a multi-disciplinary and multi-institutional approach to complex issues dealing with produced water, wastewater, and drinking water. The work includes: water quality, water-energy interdependencies, water security, water infrastructure protection, and related social and policy issues. The Institute is envisioned to develop fit-for-purpose energy efficient and cost-effective advanced technologies that are critical for the treatment of produced water to minimize adverse environmental impacts including groundwater depletion and induced seismicity. The treated water will be recycled and reused for hydraulic fracturing, irrigation, and municipal use to benefit the state and the nation. TWEI aims to develop a multi-institutional curriculum to educate a wide array of students in a broad range of related disciplines. This entails collaborative efforts with stakeholder entities including engineers, soil and biology scientists, social scientists, students, tribal nations, regulators, and policy makers.

Why TWEI?

The Permian Basin Petroplex is the most active oil producer in the U.S. (accounting for about a third of U.S. crude oil production), and it is also the largest unconventional oil play globally. Located in west Texas, the region's arid conditions was exacerbated by severe drought. Moreover, unconventional oil production requires large volumes (17 million gallons per well) of water to hydraulically fracture the low permeability shales to release oil and gas. During oil and gas production, one barrel of oil generated results in several barrels of flow back/produced water. Conventional wastewater plants are inadequate to treat produced water due to high dissolved solids (170,000 mg/l), naturally occurring radioactive materials, heavy metals, oil and grease, and microbes, hence, produced water are discharged to the subsurface.

The challenges with produced water treatment methods are economics of scale, reliability, waste and product generation, and energy consumption. Current industry practice is the subsurface disposal of produced water which leads to increased pressures that can contaminate overlying aquifers



and may also result in induced seismicity. A global grand challenge is the management of produced water and reuse. One of the major threats to wastewater reuse is public perception. The Institute will develop strategies to overcome social barriers of adoption and acceptance of using brackish water amongst different groups, from farmers to consumers.

Goals of TWEI

The Texas Water and Energy Institute provides a multi-disciplinary and multi-institutional approach to complex issues dealing with produced water, wastewater and drinking water, ranging from water quality, water-energy interdependencies, water security, water infrastructure protection, and related social and policy issues. The Institute is envisioned to develop fit-for-purpose energy efficient and cost-effective advanced technologies that are critical for the treatment of produced water to minimize adverse environmental impacts (groundwater depletion, induced seismicity). The treated water will be recycled and reused for hydraulic fracturing, irrigation, and municipal for the benefit of the state and nation.

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Outcomes of TWEI

Texas Water and Energy Institute will promote convergent research by integrating expertise, knowledge, and tools from various disciplines of academia, industry, and government agencies to form a coherent innovation ecosystem, and develop a productive workforce. Expertise and resources from multiple academic institutions will be leveraged to address research problems in water intelligence, machine learning and data analytics, users and ground water banking, recycle and reuse water treatment technologies, recycling options, chemical and physical characterization, renewable energy based water technologies, energy assessments, and performance evaluation of sustainable water treatment technologies, socio-economic issues.

Facilities and Equipment

The Texas Water and Energy Institute (TWEI) at The University of Texas Permian Basin will be co-located in the UT Permian Basin Engineering Building and in the adjacent Center for Energy and Economic Development (CEED) building. The UTPB Engineering Building officially opened in October 2019. The state-of-the-art building is three stories, covers 105,801 square feet, and cost \$55 million. This facility is equipped with UV-Vis spectrophotometer, centrifuge, high temperature oven and exhaust system, optical microscope, bactiquant-water, density meter, total organic carbon analyzer, ion chromatography system, inductively coupled plasma optical emission spectrometry, scanning Electron microscope with energy dispersive spectrometry (SEM-EDS).



Industry/University Advisory Board Members

- ExxonMobil Upstream Research Company
- NGL Water Solutions
- Environmental Defense Fund
- VEOLIA WATER TECHNOLOGIES
- Texas A&M University, College Station,
- H2O Midstream LLC
- Texas Pacific Water Resources
- HYPERION WATER TECHNOLOGIES
- Oilfield Water Logistics
- Parsley Energy Water
- B3 Data. Insight. Outcomes.
- University of Oklahoma (Senior Research Fellow)
- Apache Cooperation (Non-Disclosure Agreement)

Advanced Manufacturing Center

In response to the health and socioeconomic impact of COVID-19, and the regional economic downturn associated with the oil and gas industry, UTPB will establish a WT-AMC to provide a short-term retraining and training in AutoCAD, Solidworks/Autodesk Inventor, computer-aided design, and project management to dislocated workers. The WT-AMC will also offer a variety of services to support community projects, senior student design projects, engineering competitions, research and hands-on experiential learning projects, course requirements, and student organizations. The enhanced multi-purpose AMC facility will be equipped with additional machines, including a computer numerical controlled (CNC) lathe and mill, a manual lathe and mill, a vertical and horizontal saw, a tooling estimator, and a 3-D printer. The CNC machining will utilize software that can convert SolidWorks and AutoCAD data to meet design requirements. The facility will support both faculty and students in design, fabrication, and assembly of testing fixtures and prototypes.

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