Student Design Competition 2022

Sunday, October 9

Ernest N. Morial Convention Center

New Orleans, Louisiana

Water Environment Federation®
the water quality people®

WEF STUDENTS & YOUNG PROFESSIONALS COMMITTEE
SYPC

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CLICK ON A TEAM NAME AND A HYPERLINK WILL TAKE YOU TO THEIR TEAM PAGE.

Welcome to the 2022 WEF Student Design Competitions!

The WEF Student Design Competitions were developed to provide a forum to showcase top students who will be future water quality professionals. The competitions provide university students with an opportunity to highlight their skills and share their enthusiasm for the water environment while addressing real world design challenges. A list of this year's participating teams and each team's abstract are included in this program.

We encourage you to engage with these motivated students during breaks and at the **SYP Networking Reception at 7:30 pm on Monday, Oct. 10 at Barcadia** (601 Tchoupitoulas Street). The Networking Reception will be a great opportunity for further small group interaction with these bright students. There will also be a **Networking and Career Fair with a professional headshot booth in Hall B1, Booth 451 at 1-4 pm Monday, Oct. 10**.

On behalf of WEF and the WEF Students and Young Professionals Committee, we would like to thank: the sponsors of this year's competition - *Tetra Tech, Arcadis, Black & Veatch, Vaughan, CDM Smith, and GHD* for their support of this event; the judges for their time and personal contributions; and the WEF Board of Trustees for their support of the Students and Young Professionals Programs. Aimeé Killeen, 2022-2023 WEF Vice President, will announce this year's winners of the Student Design Competitions. Thank you to the students and their advisors for their motivation and enthusiasm.

The Student Design Competition Sub-Committee supports the design competition at the Member Association (MA) level as well as the national level. Each MA is encouraged to develop their own Student Design Competition based on a chosen design problem or allow student teams to develop their own problems and solutions. The winner of each MA competition will be invited to compete at WEFTEC in that year. If only one school is willing to participate within the MA, that team may compete at WEFTEC assuming they meet the guidelines.

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It is at the discretion of each MA to adopt or change the competition guidelines developed by the WEF Sub-Committee in order to have a successful competition. The guidelines established by WEF shall be followed during the WEFTEC competition. The competitions are designed to emphasize both high quality written and oral technical presentations. Scoring is determined through an evaluation of the teams' written and oral presentation skills, along with the technical content of the design solution. Teams have submitted a design report for review by the judges. At WEFTEC, the teams are required to give an oral presentation of their design project followed by a question and answer period during which only the judges may ask questions. Teams will receive scores based on their design report, presentation, and responses to judges' questions.

We are excited to welcome 25 teams from 21 schools representing 19 member associations and 4 countries who are participating in the water environment and wastewater competitions.

Please contact the SDC sub-committee if your MA is interested in participating in the future!

For more information, please contact:

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WEF Students & Young Professionals Committee

The mission of the WEF Students and Young Professionals Committee (SYPC) is to encourage and facilitate student and young professional involvement in WEF and the Member Associations through professional development and leadership opportunities. One of WEF's strategic initiatives is to encourage the involvement of students and young professionals in the organization. The following programs have been developed to provide opportunities for students and young professionals:

- Student chapters in colleges and universities
- Reduced student and YP membership rates
- Free registration for WEF Student Members attending WEFTEC, WEF conferences, and webcasts
- WEFTEC Student and Young Professionals Career Fair, Student Lounge, Students & Young Professionals Meeting, and Student Design Competition
- WEF Community Service Project and Water Palooza
- YP Summit, a professional development event
- Midyear Springboard Program
- Technical workshop development opportunities
- Stockholm Junior Water Prize
- WEF Canham Graduate Studies Scholarship

The SYPC is made up of students, young professionals, academics, and water quality professionals. We welcome your participation in the WEF SYPC and/or on a student activities or young professional committee at your local member association.

The SYPC and WEF encourage you to take advantage of WEF membership benefits. For more information contact Brad Lovett, WEF Manager, Association Engagement for Students and Young Professionals, at (703) 684-2455 or email: BLovett@wef.org.

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Past WEF Student Design Competition Winners

Year	Water Environment Competition	Wastewater Competition
2021	California State Polytechnic	Clemson University
2020	University of Guelph	Colorado School of Mines
2019	University of British Columbia	University of Colorado - Boulder
2018	University of British Columbia	University of Colorado - Boulder
2017	University of Guelph	University of Colorado - Boulder
2016	University of Minnesota, Twin	Southern Methodist University
2015	North Dakota State University	Southern Methodist University
2014	University of British Columbia and University of North Brit-	University of South Florida
2013	University of British Columbia	University of South Florida
2012	University of South Florida	University of Colorado - Boulder
2011	University of Florida	University of Wyoming
2010	University of Florida	Southern Methodist University
2009	University of Florida	University of Colorado - Boulder
Year	Combined Competition	
2008	University of Florida	
2007	University of Florida & North Dakota State University (tie)	
2006	University of Florida	
2005	University of South Florida	
2004	University of Washington	
2003	University of Central Florida	
2002	University of New York at Buffalo	

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Competition Schedule

Start Time	Water Environment Competition (Room 279)	Wastewater Competition (Room 272)
8:00	***Teams Arrive for Check-In***	
8:15	***Opening Welcome (Rooms 279 & 272)***	
8:35	Georgia Institute of Technology	Universidad de Monterrey (Panther Creek Resource Recovery Facility Expansion Project)
9:05	University of South Florida	Costa Rica Institute of Technology
9:35	Old Dominion University	Florida Gulf Coast University
10:05	University of Nevada, Las Vegas	The University of Texas at Austin
10:35	***Break***	
10:45	SUNY Environmental Science and Forestry College	University of Akron
11:15	Cal Poly Pomona	George Mason University
11:45	North Carolina State University	The University of British Columbia
12:15	Illinois Institute of Technology (Water Reuse Design at It Takes a Village Farm)	***Lunch***
12:45	***Lunch***	SUNY Environmental Science and Forestry College
1:15	Northeastern University	North Carolina State University
1:45	University of Waterloo	Johns Hopkins University
2:15	University of Tennessee, Knoxville	Universidad de Monterrey (Global Water Stewardship: Montezuma, Costa Rica)
2:45	Illinois Institute of Technology (Water Quality Improvements for Harvey, IL)	Milwaukee School of Engineering
3:15	-	Colorado State
4:00	***Process Challenge (Room 276)***	
5:15	***Networking Dessert Reception & Team Photos (Room 272)***	
6:00	***WEF Address & Awards Ceremony (Room 272)***	

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California State Polytechnic University, Pomona

COMPETITION: Water Environment

A Hydrological Analysis of the Ballona Creek Watershed - Striving for Environmental Prosperity

Team Members:

Noah Emerson
Guadalupe Luna
Robert Casanave
Nicole Jimenez
Juliana Gonzalez
Carolina Corona
Emily Chaverry
Magvern By
Samantha Alfonzo
Nelson Diep
Jaime Herrera
Emmily Lariz
Brittany Mejia
Rene Navarrete
Jazzlyn Pasion-Saflor
Yesenia Mendoza

Faculty Advisor:

Monica Palomo, PhD, PE, BCEE

Member Association:

California Water Environment Association

To evaluate the effects of climate change and sea-level rise, a two-dimensional rainfall on mesh hydrologic/hydraulic model of the 130 square mile Ballona Creek Watershed was developed to assess what flooding may look like in a future storm event. Flood mitigation was the focus of determining strategies/solutions and how those strategies may impact the watershed economically, socially, and environmentally. Recent studies have found that Ballona Creek is prone to flooding during a 100-year or larger storm event, which is becoming less rare of an event. The tools used for the analysis included pre-processing using ArcGIS, hydrologic modeling using the Hydrologic Engineering Centers Hydrologic Modeling System (HEC-HMS) and hydraulic modeling using the Hydrologic Engineering Center's River Analysis System (HEC-RAS) software platforms. The analysis was based on the Federal Emergency Management Agency 2D Base Level Engineering program for floodplain modeling and mapping. Design proposals and analyses for flood mitigation include low impact development coupled with green streets and regional best management practices structural controls as defined in the Enhanced Watershed Management Plan for Ballona Creek Watershed, classical flood mitigation solutions such as, floodwalls and the placement of pump stations.

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Colorado State University

***COMPETITION*: Wastewater**

Laramie Wastewater Treatment Plant Energy Upgrade

Team Members:

Emily Godi
Kira Cunniff
Kamryn Steel
Robert Vaccaro
Swee Tee
Garrett Glaspy

Faculty Advisor:

Rachel Knobbs, EIT

Member Association:

Rocky Mountain Water Environment Association

Ram Wastewater Solutions (RWS) has developed 15% design for an energy efficiency upgrade at the Laramie Wastewater Treatment Plant (LWWTP) to reduce monthly energy consumption by a minimum of 20%. The design report herein presents the methodology in developing three design alternatives to investigate the multiple ways in which energy could be conserved at the LWWTP. The RWS team evaluated the design alternatives based on the following criterion: capital cost, practicality of implementation, and total energy savings for selecting the highest ranked alternative for the LWWTP. The final design incorporates both equipment upgrades and process changes by replacing two of the blowers feeding air to the aerobic digester tanks, installing two new top-entry mechanical mixers in the digester tanks, and replacing the coarse-bubble diffusers with fine-bubble diffusers. These changes were intended to significantly reduce aeration time while maintaining digester efficiency to reduce energy consumption at the plant up to a projected 27%. This design has been developed with the intention for submission to the 2022 RMWEA/ WEFTEC Student Design Competition in conjunction with Senior Design at Colorado State University.

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Costa Rica Institute of Technology

***COMPETITION*: Wastewater**

Integral Wastewater Treatment Design for Montezuma, Cóbano, Costa Rica

Team Members:

Maricel Chaves
Melany Trujillo
Adriana Rojas
Valeria Castillo
Denisse Saborío
Fabiola Pérez
Sol Carpio

Faculty Advisor:

Mary Luz Barrios, PhD

Member Association:

Costa Rica

Based on the problem statement provided by the 501(c)(3) non-profit organization, Global Water Stewardship, a Wastewater Treatment design was proposed for the community of Montezuma, Costa Rica. Tourism is the main economic income in the region due to it being among the five most visited destinations in Costa Rica. Currently, most users are connected to private septic tanks, however, recent studies suggest that there is evidence of malfunction, leading to contamination of superficial and underground waters. Due to its proximity to the sea, this is a concerning issue for the community. In this project, five different wastewater treatment designs were proposed. The recommended treatment was a Sequencing Batch Reactor, according to a decision matrix based on the community's priorities. The proposed design, determined to meet the established effluent limits of the Costa Rican law and the problem statement, includes preliminary treatment, one equalization tank, two sequencing batch reactors, a subsequent disinfection tank, and two sludge drying beds. For a design flow and period of 14.3 gal/s and 24 years, respectively, the estimated cost for this project is $376,128.60. The annual operation and maintenance cost is of $28,800 which results in a user fee of $7.57 per month.

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Florida Gulf Coast University

***COMPETITION:* Wastewater**

Preliminary Design, Analysis, and Implication of Upgrading the Golden Gate Wastewater Treatment Plant in Naples, FL to High-Level Disinfection

Team Members:

Kaylei Kambak Brendan Zwiefel

Alexis Scheele

Faculty Advisor:

Jong-Yeop Kim, PhD, PE

Member Association:

Florida Water Environment Association

Wastewater treatment plants (WWTP) are a necessity for human existence. As time persists and research builds, there is always a need to improve these treatment systems. Consistent with technological advancements, policies are continuously updated to reflect the improvements in treatment methods. Recently, the FDEP raised the standards regarding wastewater effluent. The Golden Gate WWTP located in Naples, Florida is governed by the regulations set by the FDEP. Currently, the WWTP discards the effluent water through deep well injection. To comply with the new regulations set forth by the FDEP and to better serve the growing needs of the community, the existing WWTP must undergo improvements to meet the higher quality effluent standards prior to deep well injection. The plant will be upgraded to a high-level disinfection which will consist of the addition of a chlorine contact chamber, rotating disk filters, sodium hypochlorite feed and storage facilities, and a pump station. The purpose of this project is to optimize the performance of these new additions by minimizing energy consumption, cost, and environmental impacts. Through research and data analysis, the additions will be designed to achieve maximum efficiency, meet the FDEP requirements, and serve the needs of the community.

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George Mason University

***COMPETITION*: Wastewater**

Plant Expansion & Biological Treatment Improvements - King William Treatment Plant

Team Members:

Nicolas Tenorio

Anthony Vecchio

Usama Tanveer

Kyler Resnick

Seif Ali

Sofia Da Silva

Abdirahman Abdullahi

Crystal Bowers

Rayan Elmisurati

Faculty Advisor:

Matthew Doyle, PE, CCM

Member Association:

Virginia Water Environment Association

The King William Treatment Plant (KWTP), operated by Hampton Roads Sanitation District (HRSD), serves King William County's current wastewater demands. Located on a 5.5-acre lot surrounded by five adjoining farms, the KWTP is designed to treat and discharge an average of 100,000 gallons per day (GPD) to the Moncuin Creek. Based on the expected growth in population and development within the county, HRSD seeks upgrades to address treatment performance and capacity needs to accommodate future development. An increase in the facility's wastewater treatment capacity from 100,000 GPD to 300,000 GPD is required, alongside a new biological treatment system to replace the existing MBR process. George Mason University's design team has assessed the existing treatment system, daily plant operations and performance data to prepare a preliminary engineering report (PER). The PER addresses the recommended improvements to the KWTP in accordance with Federal, State, and Local requirements alongside HRSD Design and Construction Standards. The proposed strategies considered future growth and expansion, while providing rendered final design documentation to facilitate expansion and manufacturer cost estimates. The final recommendation was determined by a decision matrix analyzing life cycle costs (NPV), expansion capabilities, space requirements, operator favorability and safety, while also incorporating ISI Envision practices.

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Georgia Institute of Technology

COMPETITION: **Water Environment**

Malawi Sanitation Solutions

Team Members:

Lydia El-Sayegh
Annie Ballou
Mark Leggiero
Shreya Terala
Priyali Bandla
Emily Heckard
Talia Segal
Devasena Sitaram

Faculty Advisor:

Hermann Fritz, PhD

Member Association:

Georgia Association of Water Professionals

The aim of the Malawi Sanitation Solutions project is to the improve sanitation infrastructure at Mpitilira Primary School in rural Malawi. The school is burdened with dilapidated latrines, a lack of menstrual hygiene facilities, an immensely high student-to-latrine ratio of 100 to 1. There has been an increase in the spread of diseases such as dysentery and cholera and a decrease in student attendance and pass rates even as enrollment grows. To address these challenges and the needs expressed by the school community, the Engineers Without Borders - Georgia Tech Team designed a set of double-pit, VIP latrine blocks to expand capacity and enhance sanitation to reduce the spread of disease. A set of 2 blocks (1 for girls and one for boys) of 4 latrine stalls, complete with handwashing stations, urinals, and menstrual changing rooms, have been constructed through a local contractor and are now in-use. Designs for additional latrines are now underway as the team monitors and evaluates the current blocks and raises funds for implementation. This project has and will continue to keep sight of the UN Sustainable Development Goals including that of good health and wellbeing.

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Illinois Institute of Technology

COMPETITION: Water Environment

Water Quality Improvements for Residential Area in Harvey, IL

Team Members:

Greta Vasiliauskaite

Briar Moore

Lout Verder

Faculty Advisor:

David Lampert, PE, PhD

Member Association:

Illinois Water Environment Association

As areas become more densely populated, water quality concerns increase. A report by the Illinois EPA indicates that the main stream of the Little Calumet River is impaired (water quality standards are not being met) and is one of the most polluted rivers in the United States. One of the major sources of pollution associated with the impairments is stormwater runoff. The City of Harvey has a desire to create a Central Park which will include a wet extended detention pond that will eventually discharge water to the Little Calumet River. This project will focus on adding BMP components to the proposed Central Park that will act as a treatment train for stormwater runoff before it is discharged into the downstream sewer system and then to the Little Calumet River. The proposed solution will treat and detain the stormwater captured by the City of Harvey's proposed storm sewer system. These BMP additions to the Central Park will improve water quality by a minimum reduction of 50% of the nitrogen, phosphorus, and metal pollutant levels. Through the reduction of pollutants, the Central Park will achieve a water quality that is safe for aquatic life to live in.

Illinois Institute of Technology

COMPETITION: Water Environment

Water Reuse Design at It Takes a Village Farm

Team Members:

Anna Slominski

Emma Dutkiewicz

Cornelio Estrella

Nevin Abdelghani

Faculty Advisor:

David Lampert, PE, PhD

Member Association:

Central States Water Environment Association

This project is a collaboration between students at the Illinois Institute of Technology and Just Roots, a Chicago-based non-profit organization that owns and operates community gardens. The design takes place at the It Takes a Village Farm in Sauk Village, Illinois which is a 2.7-acre plot that once complete will yield 25 tons of annual fresh produce and space for community gatherings. Throughout the farm, there are issues with long-term standing water and oversaturated soil that must be remediated before planting and harvesting. The Sauk Village farm also has goals of sustainability through runoff mitigation and reuse combined with increased community involvement. Through these developed problems the design team's goals are to develop a water management and reuse system on the farm while maintaining low costs and easy implementation of the design. Three alternative solutions were created that were evaluated based on water reuse abilities, cost, ease of implementation, and factors with the organization's culture. The chosen solution encompasses a drainage ditch with a series of cisterns that would be used to collect, store, and redistribute water for the farm. The students also designed a community space for each alternative to better work within the organization's needs and culture.

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Johns Hopkins University

COMPETITION: **Wastewater**

Developing a Phosphorus Recovery System for WSSC Water

Team Members:

Mitchell Kleckner Ella Baran

Madi Miro Hana Escovar

Faculty Advisor:

Ciaran Harman, PhD

Member Association:

Chesapeake Water Environment Association

WSSC (Washington Suburban Sanitary Commission) Water is designing a biogas facility in Piscataway, Maryland to generate renewable electricity from the waste streams of five treatment plants. As part of this project, our team has been tasked with investigating methods to control the buildup of struvite—a tough mineral formed of magnesium, ammonium, and phosphorus. Reducing struvite through the process of wastewater recovery increases the efficiency of the process and prevents costly blockages. As a result, there is a potential for less phosphorus released into the environment and a reduced carbon footprint. Phosphorus recovery can also yield fertilizer, which can be sold at a profit. The addition of this system to the treatment plant at one facility will hopefully encourage the addition to other facilities primarily within WSSC, but has the potential to influence national and worldwide outcomes. Throughout this project, our team has determined that Centrisys's MagPrex reactor would be best for WSSC. This reactor uses the pH control and the addition of magnesium chloride to precipitate struvite in a controlled environment. This report details the decision process, preliminary design calculations, and lifecycle cost analysis in order to provide a complete picture for WSSC in moving forward with implementation.

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Milwaukee School of Engineering

COMPETITION: **Wastewater**

Village of Raymond Sanitary Sewer Main Design

Team Members:

Alexis Countryman
Josh Kleinschmidt
Jack Ferrante
Bennett Harris
Grace Cushing
Brandon Garrido

Faculty Advisor:

William Krill, PE

Member Association:

Central States Water Environment Association

The Village of Raymond is located just off Interstate 94 and approximately 20 miles south of the City of Milwaukee, WI. The current wastewater treatment systems within the Village limits are all individual septic and holding tanks. The Village is the only municipality in Southeastern Wisconsin without a centralized sanitary sewer system in place, which the Village Board believes puts the municipality at a competitive disadvantage. This project aims to determine the best wastewater treatment design to address the client's objectives and use the best treatment alternative. The most ideal option used a decision matrix that ranked each alternative on the categories of expansion potential, operation and maintenance simplicity, construction simplicity, and level of environmental protection. The best alternative was determined to be the pump-assisted sanitary sewer with flow to an MMSD connection point. The preliminary design of the sanitary sewer used existing topographical data and land use maps to determine a profile and calculate flow along the length of the main. Afterward, the sanitary sewer line was sized, and six lift stations were designed. The Village's best wastewater treatment option is a pump-assisted system with six lift stations to accommodate the elevation changes and flow of the region.

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North Carolina State University

***COMPETITION:* Water Environment**

Design of an Anaerobic Digester for Food Waste in Wake County, NC

Team Members:

Sarah Coull

Vega Sproul

Nadia Sheppard

Sharanya Ananth

Elliott Hall

Faculty Advisor:

Francis L. de los Reyes III, PhD

Member Association:

North Carolina Water Environment Association

The goal for this project is to create a Preliminary Engineering Design for a proposed anaerobic digester for food waste in Wake County, North Carolina by optimizing cost-effectiveness, sustainability, and feasibility for both the collection and digestion processes. As there is not an existing food waste collection and digestion system currently being utilized by the Wake County Solid Waste Management Division (WCSWMD), we designed and sized the reactor based on food waste generated in Wake County and considered the entire process flow, which includes waste collection, gas cleaning and utilization, biosolids treatment, and odor control. First, we examined the feasibility of collecting both commercial and residential waste, and determined that our system would benefit from co-digestion with grease interceptor waste. We also performed a siting evaluation using geospatial tools and existing information from WCSWMD regarding current facilities. Based on our design decisions, we performed a cost estimation for the final design iteration and determined if the system design will be cost-effective while also meeting performance standards and considering social and environmental sustainability. Finally, to consider social and environmental sustainability, we performed an ENVISION rating for the facility and used EPA's EJScreen tool to include environmental justice impacts in our report.

North Carolina State University

***COMPETITION*: Wastewater**

Graham County Wastewater Treatment Plant Expansion

Team Members:

Shubhesh Mahadeo
Nathan Ellis
Vie Villafuerte
B Deveau
Ashlyn Wilson
Jack Christie

Faculty Advisor:

Francis L. de los Reyes III, PhD

Member Association:

North Carolina Water Environment Association

This project is an expansion of the Graham Wastewater Treatment Plantfrom 3.5MGD to 5MGD and aims to enhance the plant's current equipment and processes from primary treatment through tertiary treatment with an emphasis on the biological nutrient removal processes, which include the implementation of three 1.67MGD5-stage Barden phosystems. The NPDES permit limits have become more stringent upon expansion; therefore, upgraded processes must treat the wastewater to meet the new standards to protect human health and the surrounding environment. The city of Graham is facing an annual 3.46% population growth rate and maybe taking on an additional flow of 0.75 MGD from the city of Mebane. Thus, this project addresses the challenges that come with the increasing influent flow and loading concentrations at the plant. Wastewater treatment is a crucial component of the protection of human and environmental health as it removes pollutants and bacteria from sources such as homes, industries, and agriculture. Removing these pollutants and bacteria allows for the plant to discharge the treated water back into the Haw River. The expansion of this plant is imperative to mitigate the risk contaminated water would bring to the surrounding area.

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Northeastern University

***COMPETITION:* Water Environment**

Climate Change Resiliency Plan Across the Charles River Watershed

Team Members:

Dillon McCormick
Lauren Howe
Matthew Biega
Jacob Wasserman
Daniel Diament
Evan Anderson

Faculty Advisor:

Annalisa Onnis-Hayden, PhD

Member Association:

New England Water Environment Association

Planning for more intense precipitation based flooding in the Upper Charles River watershed will contribute increase climate resiliency for the 23 communities the Charles River impacts. Our team from Northeastern University in Boston, in collaboration with the Charles River Watershed Association, have created a model for mitigating flooding at the watershed scale using green stormwater infrastructure in preparation for the consequences of climate change. This was accomplished first by creating a site selection prioritization method to choose sites within the watershed that have the greatest potential to store runoff at the sub-watershed scale. Sites were chosen from a list of potential sites brought forth by towns in the upper Charles River Watershed. Using this selection method, the highest priority sites chosen were designed with green stormwater infrastructure that could store differences in current and expected stormwater flows. Three sites were designed to 25% and the technologies placed on the sites can be used as examples for how similar sites across the watershed can also store large quantities of stormwater. All sites have been designed to store their parcel's climate change predicted runoff volume, as well as exhibit co-benefits that will aid in the project construction feasibility.

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Old Dominion University

***COMPETITION:* Water Environment**

Larchmont Pump Station Site
Redevelopment: Hanover Avenue

Team Members:

Sutherlyn Brinn

Jack Kidd

Patrick Ngabo

Nshimilimana Wiston

De'Leon La Fleur

Faculty Advisor:

Mujde Erten-Unal, PhD

Member Association:

Virginia Water Environment Association

This project redevelops an abandoned wastewater pump station site at the end of Hanover Avenue in the Larchmont community adjacent to the Lafayette River. The goal of the project is to create a solution to naturally treat and manage the runoff coming from the Larchmont community so that it doe not negatively affect the Lafayette River and its connecting water bodies. Before the discharge of stormwater runoff to Lafayette River, our team implemented a design of a swale and living shoreline. The stormwater runoff coming from the Larchmont community is treated in an environmentally conscious way. The cost of construction is kept to a minimum. In addition, the design decreases flooding on the site by absorbing some of the runoff and decreasing the environmental pollution. Although the design cannot eliminate stormwater runoff on-site, it improves the state of the environment and surrounding community. The execution of this project has a positive environmental impact on the community because visitors will observe the design as they use the site as a kayak launch. The design of this project is sustainable and will have an impact on the Lafayette River and its connecting water bodies for years to come.

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SUNY College of Environmental Science and Forestry

***COMPETITION:* Water Environment**

Daylighting Harbor Brook

Team Members:

Jane Clark

Katherine Flores

Shelby Martin

Makayla Gallegos

Bethany Atkins

Katherine Gannon

Kyra Jacobson-Evans

Maya Wells

Kerby Nulud

Ziaul Joy

Lauren Henkler

Faculty Advisor:

Doug Daley

Member Association:

New York Water Environment Association

Harbor Brook is a stream in Syracuse, NY that is culverted for flood control. It is heavily impacted during wet weather events from combined sewer outflows (CSOs). The burial of the stream restricts public access, recreation, and habitat. A daylighting opportunity for Harbor Brook has been presented at Frazer Park, which is adjacent to an elementary school. This location allows for significant educational and community recreation opportunities. This project delves into the flood control analysis of daylighting and evaluates alternatives for channel design and stormwater and bioengineering techniques. It will also serve as a demonstration project for future daylighting opportunities in Syracuse.

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SUNY College of Environmental Science and Forestry

***COMPETITION:* Wastewater**

Preliminary Design of the New Parish Water Resource Recovery Facility

Team Members:

Danara Dormaeva
Cameron Daley
Theresa Lahood
Sam Hollister
Matt Talarsky
Kalyani Mer
Mary Cassans
Teresa Werbowsky

Faculty Advisor:

Doug Daley

Member Association:

New York Water Environment Association

The Village of Parish owns an activated sludge wastewater treatment facility in Oswego County, New York that has not had any upgrades in over 40 years. The facility is permitted to treat a monthly average of 140,000 gallons per day. Parish regularly exceeds this limit due to significant inflow and infiltration, which results in peak hourly flow of 425,000 GPD. The WWTF is operated by Camden Group Inc., a private contract operations company. In 2020 and 2021, they reported numerous exceedances of their State Pollutant Discharge Elimination System permit due to failing equipment. The New York State Department of Environmental Conservation is preparing an Order on Consent to the Village for violations. The project scope focused on preliminary design of a new water resource recovery facility. The design objectives were to repurpose existing infrastructure; evaluate new efficient technologies for solids and grit removal, biological treatment, and disinfection; and use automation where possible to lower operation and maintenance requirements. Recommended unit processes include a new headworks building; biological treatment using SBR; UV disinfection; expanded sludge drying capacity; and re-use of existing treatment tanks for flow equalization and sludge holding. The capital cost of the project is estimated to be $5.6 million.

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The University of British Columbia

***COMPETITION*: Wastewater**

New Biosolids Management Strategy for the Regional District of Nanaimo

Team Members:

Parsa Mivehchi

Ben Alberga

Caelan Accilli

Ramzi Hijazi

Mohamed El Badrawy

Faculty Advisor:

Madjid Mohseni, PhD, P.Eng

Member Association:

British Columbia Water and Waste Association

The Regional District of Nanaimo (RDN) in British Columbia, Canada is investigating options for a new biosolids management strategy. This study aims to propose a solution to the RDN that consists of a thermal hydrolysis unit, a biogas upgrade and a composting system. All three units are to be erected at the Greater Nanaimo Pollution Control Center (GNPCC). Thermal hydrolysis is to be placed prior to anaerobic digestion at GNPCC and modifies the sludge properties. It decreases the required digester volume by 70% and increases anaerobic digestion rate by a factor of 2.3. The GNPCC anaerobic digester biogas undergoes water scrubbing to be upgraded to biomethane. A compost and curing facility is proposed to treat Class A and Class B biosolids from GNPCC and FCPCC to produce Class A compost. The proposed solution has an estimated capital cost of 31.2 million USD and an annual operating cost of 3.2 million USD. The products of the operation include about 10,500 yards of compost and over 27,000,000 kWh annually. The proposed solution has an annual revenue of 2.3 million USD.

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The University of Texas at Austin

***COMPETITION*: Wastewater**

Panther Creek Wastewater Treatment Plant Expansion Project

Team Members:

Himanshu Sail

Shivani Katkar

Jacob Goodman

Faculty Advisor:

Manish Kumar, PhD

Member Association:

Water Environment Association of Texas

The Panther Creek Wastewater Treatment Plant (PCWWTP) is a 10 MGD Annual Average Daily Flow (AADF) plant with a peak two-hour flow capacity of 30 MGD (peaking factor of 3). The report proposes a design to expand the capacity of the plant to 15 MGD AADF and a peak two-hour flow capacity of 52.5 MGD (peaking factor of 3.5). The key factors that have been addressed in the report are dampening the increased peaking factor, improving secondary treatment to meet the nitrogen and phosphorus permits completely through biological treatment, a better infrastructure and process for handling of biosolids, and prevention of foul odors. Since the plant is located near a golf course and a residential neighborhood, aesthetic improvements have also been a focus of the design. An Opinion of Probable Construction Costs (OPCC) for the design with the analysis of capital and operational costs is provided in the report. In addition to the current expansion, the report also provides a high-level layout for expansion to 35 MGD AADF. The proposed alternative will enable PCWWTP to comply with the discharge permits of the Texas Pollutant Discharge Elimination System (TPDES) and Texas Commission on Environmental Quality (TCEQ).

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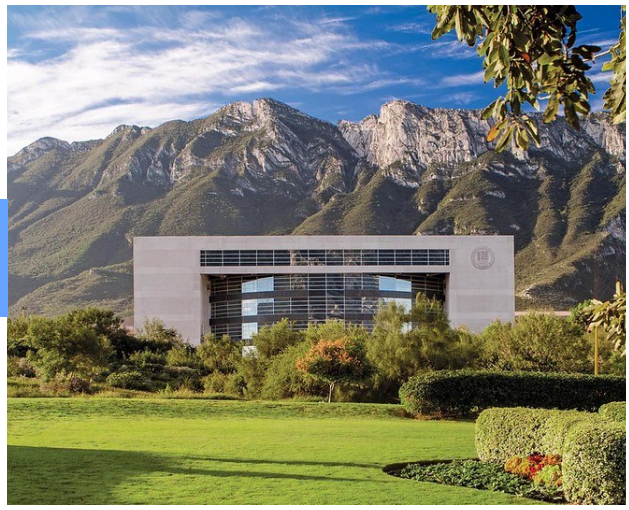
Universidad de Monterrey



***COMPETITION*: Wastewater**

Global Water Stewardship: Montezuma, Costa Rica

Team Members:

Luis Pérez

Alejandro Vergara

Saúl Sánchez

Faculty Advisor:

Santos Saenz Delgado

Member Association:

Sociedad Mexicana de Aguas, A.C.

Costa Rica has just a few centralized wastewater treatment systems. Commonly, septic tanks are used for treating wastewater, while greywater is poured directly overland. Besides, shallow bedrock, poor soils, poor cleaning practices, and poor designs contribute to improper treatment of the septic tanks effluent. Furthermore, it is common that sludge cisterns dump the collected material in rural areas, polluting in consequence. Due to the above, Montezuma, a mainly residential zone but one of the five most visited tourist destinations in Costa Rica, located in the Puntarenas canton, in Puntarenas province of the Nicoya Peninsula, is seeking for a centralized sanitary wastewater solution as well as a reliable collection system.

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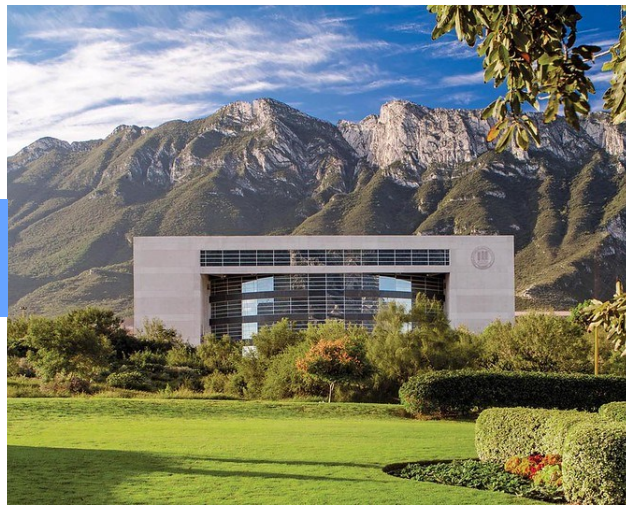
Universidad de Monterrey



***COMPETITION*: Wastewater**

Panther Creek Water Resource Recovery Facility Expansion Project

Team Members:

Arturo Zertuche Camporredondo

Bruno Julio Enrique Herrada Santos

Jorge Eduardo Salinas Aguirre

Raymundo Zertuche Camporredondo

Faculty Advisor:

Roberto Carlos Gallo Villanueva, PhD

Member Association:

Water Environment Association of Texas

The Panther Creek WWTP, located in Frisco, Texas, is an activated sludge plant that will increase its capacity from 10 mgd to 15 mgd AADF and the wet weather peaking factor from 3.0 to 3.5, resulting in a P2H capacity increase from 30 to 52.5 mgd. Our proposal is to conduct this expansion with a minimal footprint increment and to include a biosolids treatment since the plant currently only dewaters and thickens. Thus, we evaluated different alternatives on each process. For primary treatment we considered adding an additional clarifier or installing a Drum Screen instead, considering the necessary civil work. On the biological treatment, we evaluated two alternatives which would increase the treatment capacity of the existing basins: the MBBR system and a similar one using polypropylene fibers. For secondary clarification and disinfection we considered different configurations for expanding the existing clarifiers and UV system. On the sludges train we considered building a thermophilic digestion system, considering THP and HTC as alternatives for energy recovery and producing fertilizer or biochar. Our aim is to comply with the new requirements and to improve the operational efficiency of the plant while keeping it operational during the construction/renovation process.

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University of Akron

***COMPETITION*: Wastewater**

A Comprehensive Assessment of the Akron Water Reclamation Facility

Team Members:

Anna Soehnlen

McCallah Ferry

Noor Fahoum

Faculty Advisor:

Christopher M. Miller, PhD, PE

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Ohio Water Environment Association

The Great Lakes are an essential freshwater resource that have led the nation in developing effective nutrient removal in efforts to improve water quality. Some water body quality issues are caused by excess nutrients entering waterways from agricultural runoff and combined sewer overflows. In the City of Akron, Ohio, this is a concern regarding the Cuyahoga River – a major tributary to Lake Erie. Stormwater retention projects and the expansion of the Akron Water Reclamation Facility (AWRF) have helped to manage flows while maintaining EPA (Environmental Protection Agency) compliance. The AWRF was interested in improving their aeration treatment. With the use of a BIOWIN model of the AWRF, the team ran an analysis and evaluated potential alkalinity adjustments, supplemental carbon sources, and new step feed flow splits. The model showed that there is enough BOD in the raw wastewater to provide a carbon source. Micro C, a sustainable byproduct of the biodiesel industry, is recommended as an additional source. Any improvements found were negligible and did not warrant additional capital improvement. The AWRF will not have to make changes as the current process is working efficiently while ensuring the quality of the effluent is safe to enter the Cuyahoga River.

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University of Nevada, Las Vegas

COMPETITION: Water Environment

Identification and Quantification of Garbage in Las Vegas Valley Stormwater Channels and Improvement of Stormwater Management

Team Members:

Hamed Heidari

Shams Rothee Razzak

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Amit Gajural

Godson Ebenezer Adjovu

Meena Ejjada

Neil Christian Tugadi

Faculty Advisor:

Eakalak Khan

Member Association:

Nevada Water Environment Association

Las Vegas Valley (LVV) is in a desert, and while the rain events in LVV are rare, they come pouring, filling our stormwater channels. The stormwater channels are designed to collect water from the Southwest and Northwest sides of the Valley, redirect the water flow to Las Vegas Wash on the East side of the Valley, and eventually discharge to Lake Mead. The 100-Year flow rates in LVV's stormwater channels range between 6,000 to 14,000 cubic feet per second (cfs). The 100-Year flow rate at Flamingo wash at Nellis boulevard is 11,800 cfs with a gage height of 11.32 feet. For comparison, Clark County Water Reclamation District, Nevada's largest wastewater treatment facility, discharges approximately 162 cfs. Large and small debris and direct littering may block the stormwater channel and prevent the water from flowing to the Las Vegas Wash, causing various health concerns, odor, and overflowing the pavements. In addition, stormwater channels near homeless encampments receive human fecal matter and urine from the homeless. During flash floods or heavy rain events, keeping an eye on the many stormwater channels for any potential blockade is difficult.

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University of South Florida

***COMPETITION:* Water Environment**

Southeast Wastewater Treatment Plant Wetlands Design

Team Members:

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Anwar Alsharaf
Barbara Martinez
Vanessa Adame
Jada Williams

Faculty Advisor:

Sarina J. Ergas, PhD, PE

Member Association:

Florida Water Environment Association

Rocky's Waterworks has designed a free water surface wetland system to treat effluent from the Southeast Wastewater Treatment Plant in Pasco County, FL to reclaim water standards. The design objective is to meet the Weeki Wachee Basin Management Plan's annual average effluent concentrations for Total Nitrogen and Total Phosphorus of 3 mg/L and 1 mg/L, respectively. The plant currently operates at a 3 MGD capacity but will expand to 6 MGD in Summer 2022. Design constraints include existing natural wetlands and wildlife as well as a proposed road extension west of the facility. Rocky's Waterworks proposes a 73.2-ac lined wetland system to treat a 2 MGD flow via the P-k-C* model, utilizing plant effluent data from 2019-2021. The design consists of two parallel trains. Given the presence of natural wetlands and the proposed road extension, Rocky's Waterworks recommends acquiring an additional 95-ac of land west of the plant for development. The design also includes opportunities for recreational and educational activities to serve Pasco County residents. In addition to the P-k-C* model and recreational design, a hydraulic analysis, evaluation of permitting requirements, earthwork calculations, and a cost analysis have been performed.

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University of Tennessee, Knoxville

***COMPETITION:* Water Environment**

Hydroelectric Microgrid Design in Nazarét, Panama

Team Members:

Claudia Bible
Andrew Houser
McKenna Hoag
Jeremiah Pham
Matthew Tolson
Erin Van Hoozier

Faculty Advisor:

Jenny Retherford, PE, PhD

Member Association:

Kentucky-Tennessee Water Environment Association

The University of Tennessee senior design group was tasked with providing civil engineering services to design two hydroelectric power production options and a local, independent electrical grid to produce 10 kW of power for the community in Nazarét, Panama. The in-river turbine system was developed to harness the velocity of the nearby Rio Chico. Feasibility, potential power production, and capacity analyses were used to determine a suitable hydroelectric turbine. Two structural design options were developed using site characteristics to anchor the turbine with flexibility to move the platform offshore during flood events. Construction engineering services were also performed. The penstock system was designed to divert water from the nearby Rio Torcana to a turbine. Hydrologic services were performed to design the infrastructure needed to transport the water to the selected turbine. Structural engineering services included design of an intake pipe anchor, concrete transition tank, and powerhouse. The electrical grid was designed to supply the community with the power produced by the hydroelectric system options. Alternate energy sources were evaluated, and an energy storage system was developed to connect the community to the grid in the future. Possibilities for distribution, monitoring, and metering were evaluated along with financial feasibility.

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University of Waterloo

***COMPETITION:* Water Environment**

Stormwater Retrofit of MacMorrison Park in the City of Barrie, Ontario

Team Members:

Seoyeong Lee

Lee Reck

Mark Lieberman

Adele Watson

Faculty Advisor:

William (Bill) K. Annable, PhD

Member Association:

Water Environment Association of Ontario

Creating and maintaining sustainable stormwater management infrastructure is imperative to building a climate-resilient society. The City of Barrie (located in Ontario, Canada) has identified MacMorrison Park as a potential site for a stormwater retrofit. The park receives water from over 250 hectares of urbanized land via Sophia creek and a stormwater channel. As a result, downstream and surrounding residences of MacMorrison Park experience flash flooding after major rain events. Barrie Good Consulting is proposing to construct two stormwater management ponds in the park to attenuate high volume storm flows, maximize on-site detention and improve water quality downstream.

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Thank you!

JUDGES:

We would like to thank our judges for volunteering their time. We are grateful for their presence and knowledge during the competition.

Dylan Christenson
Dan Christian
Clayton Driggs
Christine Hengel-Prom
Joel Kaatz
Eric Larson
Lena Quackenbush
Arne Swenson
Josh Turner
Haley Voelkers
Tim Ware
Jessica Watts

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Maria Claudia Reed
Vishal Vaidyanathan
Melanie Vines
Caleb Wilson
Guy Yager
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