CENTRAL STATES WATER

The Official Magazine of the Central States Water Environment Association, Inc.

PFAS: Are These 'Forever' Chemicals Here to Stay in Our Waters and Regulations?

PLUS:

- WEFTEC 2022 Highlights
- MSDC 2022 Student Design Winner: Illinois Institute of Technology
- GWS 2023 Problem Statement Bijagua, Costa Rica

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Taking Time to Reflect

By Tracy Hodel

It's 2023, a brand-new year filled with tremendous opportunities and new beginnings. It's that time of year to reset, refocus, and realign with your purpose and develop your goals or action plan for the future. This is a great time to think about the upcoming year, but it is just as important to reflect upon the previous year. I like to keep a summary of the highlights from the previous year and review this list at the end of the year, as I am developing my next year's goals. These highlights include accomplishments and successes for the organizations I am involved with and those of my colleagues. We all are so busy checking items off our to do list and moving on to the next big task that most often we don't take the time to recognize what we have done and the impact we are making on those around us. Recognize and celebrate your successes, take the time to reach out to a colleague and thank them for their efforts and congratulate them on their successes. This is an example of how you can "take action", one of our key focus areas for the organization. This one small action can make a huge impact.

The motto for one of our key focus areas for our organization this year is "Big Goals – One Step at a Time." I encourage you to think BIG and BOLD when developing your 2023 goals. There are many strategies towards goal development. Many use the SMART goal system which stands for Specific, Measurable, Achievable, Relevant and Time-Bound. For me, the three most important things when developing goals is writing them down. Just by writing them down, it creates this momentum for actions, sometimes even subconsciously.

"Recognize and celebrate your successes, take the time to reach out to a colleague and thank them for their efforts and congratulate them on their successes."

The second most important thing to do is to identify actionable steps that need to be taken to make progress on that goal. Break it down into little steps and before you know it, those actions make great things happen. The third key to accomplishing your goals is to be passionate about your goal and the potential impact.

One example of one big goal that has avalanched into an incredible success is Global Water Stewardship. This was one big goal by our very own Executive Director, Mohammed Haque. Through passion, dedication, taking action and inspiring others, Global Water Stewardship has impacted so many lives. It has impacted those that are volunteering their time, the emerging leaders who are involved in the program and those that are benefitting from having access to clean water because of the efforts by so many.

A huge thank you to all who planned for and participated in events at WEFTEC in October and other CSWEA events throughout the remainder of 2022. And congratulations to the CSWEA Operations Challenge teams. Once again, our teams came home with hardware. The Pumpers took 3rd in the safety event and the Shovelers took 1st for the process control event and 3rd place for the lab event. Well done to all for taking action and being an active part of our amazing organization!

Liz Kramer, the Local Arrangements Chair, and the LAC committee members have been busy planning for the upcoming 2023 Annual Meeting. The meeting will be held on May 22-24, 2023 at the St. Paul RiverCentre. The theme of the meeting is "Inspiring Action." The Technical Program Committee efforts are already underway and by the time you are reading this, they will be reviewing over 100 abstracts. These abstracts are scored, and the successful submittals will be placed in the technical program. The Annual Meeting provides a technical program that is second to none, networking opportunities, inspiring speakers, and the chance to explore local exhibitors. We look forward to seeing you all there this spring!

Happy goal setting and wishing everyone a successful and impactful 2023. CS

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Post-WEFTEC 2022 Updates

By WEF Delegates Tracy Ekola, David Arnott, and Rich Hussey

David Arnott

Rich Hussey

As your WEF delegates, we strive to keep you up to date and provide resources and connection to WEF. This article is focused on updates from the September WEF Business and House of Delegates Meetings, WEF's new Strategic Plan, a new MA Resource Center, the 2022/2023 HOD Workgroups, and the 2023 WEFMAX events.

WEF BUSINESS MEETING AND HOUSE OF DELEGATES MEETING

September 29, 2022

WEF's financial status is healthy and growing. While the pandemic had negative impacts on WEF's financial health, the organization has rebounded and is working on setting new direction for the future. WEF's goal is to have 100% reserve funds available in order to better position themselves for future disruptions (e.g. a pandemic). In addition to a new strategic plan, WEF has a new campaign focused on the circular water economy. There will be more to come on this topic in future updates. WEF continues to invest in leadership training programs, DEI initiatives, updating manual(s) of practice and other standard publications, and has increased MA grant program funds to $125k.

WEF's incoming Vice President is Howard Carter. New board of trustee members are Stephen Sanders and Corey Williams. New HOD Speaker-Elect and committee assignments were also announced at the HOD meeting. As the incoming 2022-2023 Speaker of the HOD, Donnell Duncan shared his vision for the HOD 2023 goals, including 1) improving delegate participation 2) changing member association needs, 3) implementing a new WEF strategic plan. The HOD of the future will be 1) structured and in alignment with the new strategic plan; 2) 100% active delegate participation; and 3) relevant, visible, and valued by the WEF community.

WEF's MA Grant Award Program has three categories: MA Operations, Seed Grants, and Planning and Training. Grant applications and award summary is listed in the table below. The monetary range of grant awards is $1,500 to $25,2700. Example grant awards are on the WEF website in the MA Resource Center section. As noted previously, the Board of Trustees has approved an increase the 2023 MA Grant Award budget to $125,000. The first round of applications is due January 2023. Figure 1 shows the progression of the MA Grant program since 2019.

As this is my last communication as WEF delegate to CSWEA, I want to take this time to thank all of you for your work on behalf of Central States WEA. As volunteers, we pour our passion into making our industry and our world a better place. Central States is dear to me as I have spent many years in various roles throughout the MN Section, CSWEA, as well as WEF. While I will remain active in CSWEA and WEF, I have truly enjoyed my time working with the CSWEA executive committee as a WEF Delegate! ***CSWEA is true leader in this business, and it is a testament to all of you.***

Best Regards,
Tracy Ekola

WEF'S NEW STRATEGIC PLAN

WEF released its new Strategic Plan to the public at WEFTEC 2022 this October in New Orleans. Two new teaser videos discuss the upcoming debut of the plan. The first video features current WEF President Jamie Eichenberger (*https://bit.ly/3Fwfebr*) and the second video features WEF President-Elect Ifetayo Venner (*https://bit.ly/3FwEDl9*).

Fiscal Year	Number of Applications	Funds Requested	Number of Awards	Funds Awarded
2019	27	$326,844	10	$100,000
2020	13	$156,275	5	$61,275
2022	33	$318,785	13	$100,000
Total	**73**	**$801,904**	**28**	**$261,275**

Figure 1: The progression of the MA Grant program since 2019.

WEF is setting its sights on new horizons in preparing to lead the journey toward a "Life Free of Water Challenges."

Three main goals of the new WEF strategic plan include:

1. Attract and develop a diverse and passionate water workforce.
2. Cultivate a purpose-driven community to sustainably solve water challenges for all.
3. Lead the transformation to the Circular Water Economy.

As part of WEF's Strategic Plan, they have clarified their values. Below are the values that are the foundation to the plan.

1. Collaboration – working *together* to improve our water environment.
2. Customer Service – keeping all stakeholders and customers in mind at all times.
3. Bold Leadership – being brave, trying new things, being growth-oriented.
4. DE&I – continuing to promote and live by standards of diversity, equity, and inclusion.

MA RESOURCE CENTER

The Nebraska Water Environment Association (NWEA) has developed a NWEA 101 Webcast (*https://bit.ly/3No19Ph*) that provides their members an overview of WEF and NWEA to encourage member engagement. It focuses on mission, vision, organizational structure, history of the organization and where they are today, introducing their board and committee liaisons and future objectives and deliverables. NWEA offers this as a resource for all MAs. If you have questions, please contact Nebraska WEA WEF Delegate Scott Aurit at *scott.aurit@hdrinc.com*.

2022/2023 HOD WORKGROUPS

The 2022/2023 HOD Workgroups are set. These were announced at WEFTEC in October. The new HOD workgroups will be focused on:

- **HOD of the Future**
  How can the HOD be more relevant? What, if any, structural changes are needed to the HOD?
- **Water Advocacy at State/Local Level**
  How can we as WEF members promote water advocacy and the state and local level? What are the key action items and who are the key stakeholders?
- **WEF Strategic Plan Rollout.**
  How can MAs implement the new Strategic Plan? How do we carry this out?

Rich Hussey is on the Water Advocacy at State/Local Level workgroup. Dave Arnott is on the HOD of the Future workgroup. The final objectives of each workgroup are being finalized. Stay tuned for more details and activities from these workgroups.

2023 WEFMAX

The 2023 WEFMAX events dates and locations are set. At these events, MAs come together along with WEF officials, to share best practices, exchange ideas, and network.

The dates, locations, and themes for 2023 are shown below.

- Improving MAs Through Collaboration and Partnerships
  April 12-14, 2023, in St. Louis, MI
- Improving MAs Through Engagement and Service
  May 3-5, 2023, in Denver, CO
- Improving MAs through Leadership and Innovation
  May 24-26, 2023, Charlottetown, PEI, Canada

In addition, there will be a **virtual WEFMAX** in 2023. The date and time for this WEFMAX is still being finalized.

As WEF Delegates, we are here to support you and represent the interests of the CSWEA to the House of Delegates and WEF. If something is on your mind, please feel free to call or email. We are here to serve you/CSWEA and be a liaison to WEF leadership. A sincere thank you from Tracy, for allowing me to serve as your WEF delegate these past three years.

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Winter is Coming

By Jacqueline Strait

As I write this, we are entering the start of the chilly season. For many of us in the upper Midwest, this is a critical time for wrapping up key phases of our construction projects, striving to get that pavement down or that building enclosed. Sometimes the weather supports us and gives us a bit more time to get things done than we expected; but as mother nature has shown us time and again, big changes can happen in a blink of an eye and a snowy 30-degree day can suddenly appear after a sunny 60-degree day.

In anticipation of the coming change of season, the MN section has been very active this fall by holding in-person events and committee meetings. On September 28, the Collections Committee held the 2022 Fall Collections Workshop with MWOA in-person in Duluth. The workshop topics included utility locating, MH rehab options, pipe bursting, and odor control. Planning for the 2023 Innovative Conference by the Operations, Lab, and Safety committee is underway.

On October 20, the R2E group toured the VIRESCO Anaerobic Digestion Facility in Turtle Lake, WI. The facility was originally built for dairy waste digestion, but it has rapidly expanded and introduced innovative new processes that enable the facility to accept multiple, different food and beverage waste products. I was personally able to attend the tour with the group. It was exciting to get a close-up view of the anaerobic digestion process and it was interesting to hear how they adapt the process to accommodate the different carbon contents of the waste sources. However, the process that grabbed everyone the most was how they de-package or prepare the different food sources prior to entering the digester. They use multiple methods that vary from crushing the packages to having an employee manually cut away the packaging. While the carbon source content matters, the key question they ask new customers is what type of packing the waste will come in. In addition to producing renewable energy, they also recycle everything they can that can't be fed to the digester.

In addition to bundling up for winter and preparing for the holidays, there are many events to look forward to as we wrap up a great year. Upcoming events include the 2022 MN Conference on the Environment which will be in person this year on November 10th at the Minneapolis Convention Center. There is a CSWEA wide virtual stormwater webinar planned for November 17, and a 2023 winter collections workshop planned for January 25. Also, while the MN Section Business Meeting has historically been held the morning of the Conference on the Environment, in 2022 it will be held the day before, Wednesday November 9 from 3:00 to 4:00 pm. All members are welcome and encouraged to attend. If you are interested in attending in person at the HR Green St. Paul office or virtually, please RSVP to me at *jstrait@hrgreen.com*.

As we close out 2022, I hope everyone has a chance to reflect over the holidays on what a tremendous year it has been for our industry. We have been busier than ever and with COVID-19 better understood, tracked, and monitored, we have been able to return to offering more in-person social and professional development opportunities. I don't know what 2023 has in store for us, but I know it's nothing we can't handle. CS

The R2E group on a tour of the VIRESCO AD facility.

Water Workforce for the Future

By Jillian Kiss

Ensuring that all Americans have safe water to drink and essential wastewater services is a top priority for our industry. Each day communities and businesses depend on the water infrastructure we support for their daily routines. Behind each of these daily routines are the hundreds of thousands of skilled workers that comprise the water workforce.

Currently, water utilities face challenges in recruiting, training, and retaining employees. These challenges are exacerbated with roughly one-third of the water sector workforce eligible to retire in the next 10 years.

The country's water infrastructure is representative of this significant opportunity. From pipes and pumps to rivers and lakes, water systems are in urgent need of repair, maintenance, and restoration. The country's infrastructure assets are at the end of their useful life. At the same time, water professionals are in relatively short supply, for public utilities, private engineering firms, and a wide range of other employers. Signaling that while infrastructure jobs offer considerable promise, the supply of workers doesn't match the demand.

There are likely hundreds of thousands to millions of water professionals directly involved in designing, constructing, operating and governing US water infrastructure. From water utilities, to specialty trade contractors, to heavy and civil engineering construction, these workers carry out specialized activities crucial to the long-term operation and maintenance of the country's drinking water, wastewater, stormwater, and green infrastructure facilities.

Workers in these jobs earn competitive wages and, in some cases, face lower educational barriers for entry. They develop extensive knowledge and transferable skills that cut across multiple disciplines. And the coming wave of retirements and other employment shifts in the infrastructure sector means a huge gap to fill for utilities and other water employers, and prospective workers can find long-term careers.

At WEFTEC, I participated in a round table discussion on workforce issues. While understanding the consultant's side of the issue I was introduced to the same recruitment issues being faced by utilities. Of my round table's eight participants, seven were representing a public utility. This distribution was similar at most of the other dozen or so tables. We discussed how the traditional system of hiring, taking several weeks to months to onboard a new hire, is not sustainable anymore in this competitive environment when several offers are on the table. We discussed how utility wages were not competitive with other low skill jobs.

Just as it is difficult to recruit new staff, it is just as difficult to retain existing staff in this environment. We discussed the difficulties of hybrid work where certain white-collar staff could work from home and blue-collar staff have to be onsite and causing a general displeasure between groups. And we discussed the need to break down "silos" of particular groups of people within an organization that from an outsider's perspective is unreachable due to position or age or gender so there is a sense of a unified council and a feeling of belonging. Without that, a staff member could be very easily exit your organization. In cases where compensation or benefits weren't competitive, an employee stayed with their employer because of the welcoming environment, the sense of intentionality, and their clear vision of advancement opportunities.

Utilities and other water employers need to empower staff, adjust existing procedures, and pilot new efforts in support of the water workforce. Employers need to develop platforms for a broad range of employees to become partners and hold consistent dialogues so that feedback between "silos" can be exchanged.

WEF and other industry advocate organizations have sponsored workforce-related research initiatives. Some common themes being identified and acted on include:

- Developing a better public understanding of engineering and the water sector.
- Offering funding and other incentives for students and faculty studying water topics.
- Sharing research findings across groups and encouraging collaboration to improve the workforce situation. CS

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WATER'S WORTH IT

CSWEA ESSAY CONTEST

Central States Water Environment Association of Illinois Invites you to join the WATER'S WORTH IT campaign by writing a short essay about the Clean Water Act.

Guidelines:

- **Students must reside in Illinois and be in grades 6-8th.**
- Select a Prompt for your essay: **research or creative writing**. Students may only submit one essay for the 2023 contest.
- Essays must be between 400-800 words. Source citations are suggested but not required. Citations do not count towards essay word count.
- Font size should be between 10-12 and font should be legible (ex: Arial or Times New Roman)
- **Essays must include a cover page containing: Essay Title, Student's Name, grade, school, and which prompt the student chose.**
- Essays must be submitted in Word or PDF format by the end of the day, April 15th, 2023.

Over $1000 in Cash & Prizes!

Essay Submission Link:

https://cswea.wufoo.com/forms/il-2023-waters-worth-it-essay-competition/

Essay Topic: The Clean Water Act

The Clean Water Act (CWA), one of the first big US environmental laws, was enacted in 1972 to restore and protect United States waters. As the main law governing US water pollution, this legislation regulates who can put pollutants into our waters, what kind and what quantity of pollutants they can put into our waters, and what quality standards must be upheld for our waters. In recognition of the 50th anniversary of the Clean Water Act, October 18th, 2022, the President of the United States stated, "I call upon all Americans to observe this milestone, recognize the significant contribution the Clean Water Act has made to restoring our Nation's waters, consider the crucial role clean water plays in each of our lives, and recommit to protecting our shared water resources."

Research Prompt

Research the Clean Water Act. Summarize the CWA and give specific examples of how US waters have changed in the 50 years since it's enactment. Conclude by reflecting on the successes and failures of this legislation and ways you think it could be improved upon in the future.

Questions to consider while researching:

- Why was the CWA created?
- Has the CWA made any impacts to the Environment? The lives of US people? How?
- Are there examples of impacts made by the CWA in your own town? County? State?

Creative Writing Prompt

Life as we know it today would be quite different if the Clean Water Act was not enacted. **Imagine there were no laws governing the pollution of our waters.** Write a first-person essay highlighting your life without water pollution control.

Questions to consider while writing:

- How is life at home? Food preparation? personal hygiene?
- How does your environment look? Cities? Natural areas? Wildlife?
- How is day to day life impacted?
- What is society like?
- How has our lack of water pollution control affected other parts of the world?

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Questions? contact Stephanie Cioni at scioni@dgsd.org

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WATER'S WORTH IT®
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Submissions due April 15th, 2023

Regional Winners

Winning essays will be selected for both the Research and Creative Writing Categories! **Winners will receive a cash prize of $50, gift bag, certificate of achievement, and will move on as finalists for the state-wide grand prize!**

State Winners

State-wide winners for both the Research and Creative Writing Categories will be selected from the three regional winners. Grand prize winners in each category will receive:

- **$300 cash prize + a gift bag!**
- **Certificate of Achievement!**
- **Their essay published in Central States Water Magazine!**

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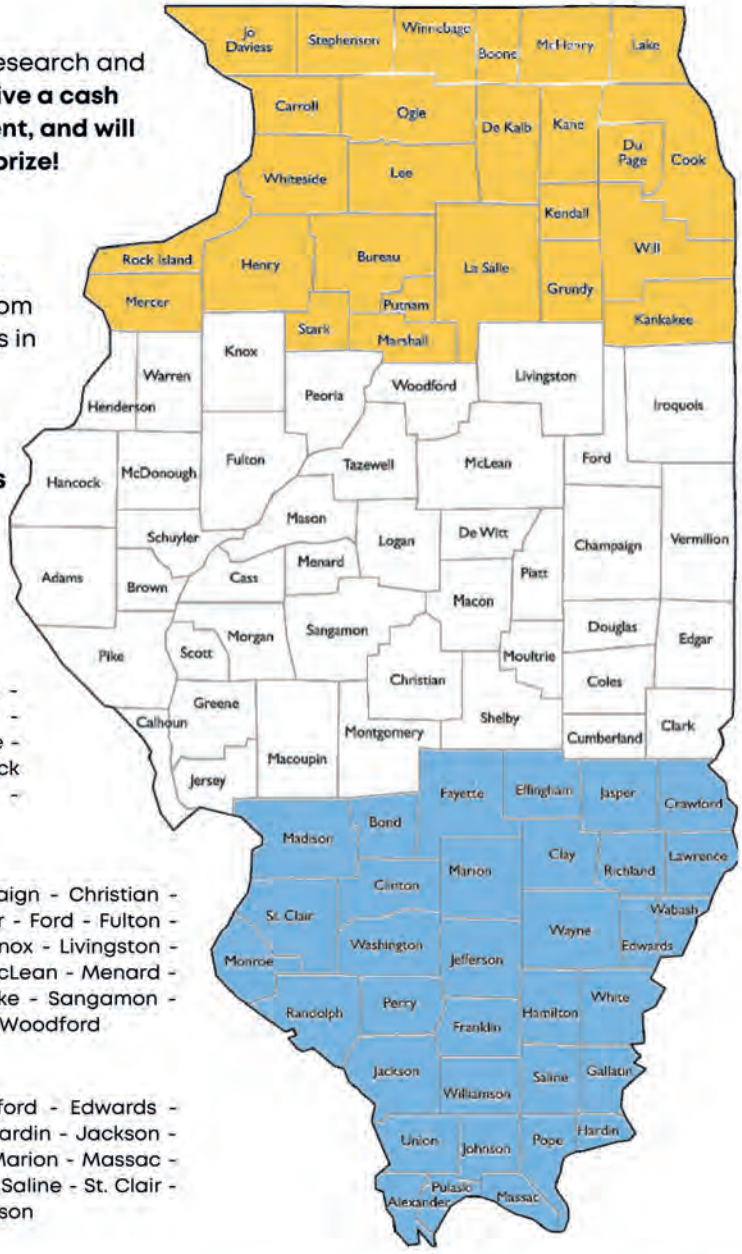
Central Illinois

Counties: Adams - Brown - Calhoun - Cass - Champaign - Christian - Clark - Coles - Cumberland - DeWitt - Douglas - Edgar - Ford - Fulton - Greene - Hancock - Henderson - Iroquois - Jersey - Knox - Livingston - Logan - Macon - Macoupin - Mason - McDonough - McLean - Menard - Montgomery - Morgan - Moultrie - Peoria - Piatt - Pike - Sangamon - Schuyler - Scott - Shelby - Tazewell - Vermilion - Warren - Woodford

Southern Illinois

Counties: Alexander - Bond - Clay - Clinton - Crawford - Edwards - Effingham - Fayette - Franklin - Gallatin - Hamilton - Hardin - Jackson - Jasper - Jefferson - Johnson - Lawrence - Madison - Marion - Massac - Monroe - Perry - Pope - Pulaski - Randolph - Richland - Saline - St. Clair - Union - Wabash - Washington - Wayne - White - Williamson



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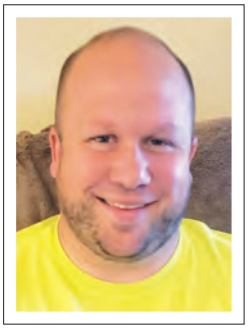
Consistent Small Actions Can Make a Big Difference

By Jake Becken



I will be taking a little different approach with this message than the past few I have written, as I think we all can use a little positive thinking and motivation. So, let's talk about how small actions can make big change, one of Tracy Hodel's goals for our association this year.

When I was younger, we took numerous family camping trips, not only in Wisconsin, but across the US. We would often stay at National Forest or National Park campgrounds, where we had the opportunity to see some amazing natural wonders this country has to offer. One life lesson that really stuck with me came from my dad, and I am sure it is very similar to lessons your parents offered. At every campsite we were at my dad would tell us that we needed to leave the campsite better than we found it. This often meant cleaning up the trash left by a previous camper or general organization of the site. Some sites needed a lot of work, but some not so much – it all depended on the previous occupant. Did it take a lot of effort and time to clean the trash from the campsites and the hiking trails that we walked? Absolutely not. After some complaining to my mom and dad, we did the work and you could certainly see improvements. I remember asking, "Why we need to do this? No one else is." If you think about it, that's exactly why. What a strong message.

This lesson has stuck with me over the years, to my days growing up on the family farm to now in wastewater, as the lesson really is universal and goes beyond just simply picking up trash. I had a great trainer when I started my first full time job in wastewater. He went out of his way to not just teach us wastewater, but also how to conduct ourselves as professionals. One of the things he stressed was that a few small actions each day can make a huge difference. If you see something that needs doing,

"If you have a huge project that seems overwhelming, just start chipping away at it a little each day."

don't just walk by, take action. If you have a huge project that seems overwhelming, just start chipping away at it a little each day. Regardless of what task it is, we all have things in our daily lives that we could be doing. With a slight change in mindset and focus on doing the little things right, we can all make a big difference. Maybe the small task involves stepping outside of your comfort zone, maybe you think you are unqualified and underprepared. It doesn't matter; if you go into the task with work ethic and a drive to succeed more often than not you will. And if you do fail, get right back up, learn from the shortcomings and start working hard again by doing the small things right.

Don't just take it from me, a few years ago someone pointed me in the direction of this speech by Admiral McRaven of the United States Navy and I found it very powerful. If you have not watched it, I think it's worth the 16 minutes of time, and can be found on YouTube by searching Admiral McRaven Leaves the Audience Speechless. This talk drives home how small things can add up to big things. Give it a watch if you have some time.

One of the hardest things for most people is to engage in these extra tasks, even when no one is looking. The selfless act of doing what's right can be hard to master, but doing these things for the right reasons can bring great intrinsic reward. Drive to make those around you and the organization better even when no one is looking. You don't need a title to be a leader and you can be the change that rubs off on others.

Our industry often flies under the radar, unless something goes horribly wrong. This constant underappreciation can sometimes lull us into a sense of routine or mundane existence. The reality is that what we do is so important for our community and environment surrounding us. As we march forward, we need to remember we are carrying the baton that we will eventually pass to future generations. I hope we can say that we passed things on in better condition than when we took the baton and I hope the next generation strives for the same. Remember, it starts with the little things. Little things, over time, done by all creates major change. My challenge to you is to pick up one small task each day and stick with it.

As always, reach out with any ideas, comments, or questions at *jbecken@newwater.us* or 920-438-1004. Please check the *www.cswea.org* for upcoming CSWEA events. CS

"If you do fail, get right back up, learn from the shortcomings and start working hard again by doing the small things right."

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WEFTEC 2022 HIGHLIGHTS

WEFTEC 2022, the 95th Annual Technical Exhibition and Conference, took place in New Orleans, LA at the Ernest N. Morial Convention Center on October 8-12, 2022. The theme was Create Connections, Transform Tomorrow.

CSWEA/IWEA WEFTEC WELCOME RECEPTION

By Mike Holland

The 2022 CSWEA/IWEA WEFTEC Welcome Reception in New Orleans was held at The Chicory on Sunday, October 9 from 5:30 PM to 8:00 PM. Attendees were asked to sign in at the door and the event included appetizers/hors d'oeuvres and bar service. From the sign-in sheets and pre-registrations there were well over 300 attendees.

Consistent with the previous year's event, drink tickets were distributed to attendees, rather than providing an open bar service. Thanks to the generous donations from the 38 sponsors (listed below) we were able to raise nearly $15,000 for this year's event.

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THE WEFTEC OPERATIONS CHALLENGE

By Matt Streicher

For those of you who are not familiar with the Operations Challenge at WEFTEC, it's one of the most exciting and rewarding events that occur at the conference. The competition is a chance for wastewater collection and treatment personnel from around the world to display their skills.

In the competition, teams compete to earn the highest score in five different events. Each team includes four members and a coach. Each event is designed to test the diverse skills required for the operation and maintenance of water resource recovery facilities. The five events are collections systems, laboratory, process control, maintenance and safety. Winners are determined by a weighted points system.

The CSWEA team members for this years competition were as follows; Shovelers: Chris Lefebvre (Captain), Stevens Point Public Utilities, WI; Wade Lagle, Urbana & Champaign Sanitary District, IL; Brent Perz, Baxter & Woodman, IL; Cody Schoepke, Fond du Lac WTRRF, WI; and Tom Dickson (Coach), City of Oconomowoc, WI. Pumpers: Dennis Haile (Captain), Wheaton Sanitary District, IL; Kate Despinoy, Stanley Consultants, IL; Ethan Perrine, Village of Spencer, WI; Jeff Severson, Fox Metro Water Reclamation District, IL; and Chris Kleist (Coach), City of Duluth, MN.

This years competition consisted of seven Division One teams, 25 Division Two teams, and 13 Division Three teams (including three international teams). Division One is defined as returning teams that were in the top nine overall winning positions in division one the previous year. This also includes any returning team that competed in the previous year's division two competition and placed in the top three positions overall. Division Two, which is the division the CSWEA Shovelers participated in, consists of returning teams who do not qualify for division one. Finally, division three, which is where the CSWEA Pumpers competed, is defined as new teams whose members have never competed at WEFTEC.

Most other teams have members who all come from the same state, or even in some cases, the same facility.

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This gives us a disadvantage; our teams only meet to practice together twice. But, with our team members coming from different states and facilities, it also offers a great experience for team building and networking. The teams practice vigorously at practices, with long days, and strategizing going late into the evening. The dedication and passion show through strongly at these practices. It would also be appropriate to thank all of the gracious sponsors who make it possible for these practices to occur through their support.

When the competitions were complete at WEFTEC this year, all the competitors waited anxiously to hear the official results at the annual Operations Challenge Awards Banquet on Tuesday evening. No results are given ahead of time, so there was a tremendous amount of speculation and nervousness.

During announcements for the first event, the process control event, the top three teams in division two were called to the stage, and as the Shovelers team name was announced the nervousness went to excitement. Finally, after some suspense, the first-place winner was announced as the Shovelers, and the team got to walk the stage and accept a large trophy. The next event to be announced was the laboratory, and once again, the Shovelers were called to the stage as one of the top three teams. This time they were able to take away the third-place trophy. As the evening progressed, the Pumpers were called to the stage as one of the top three teams in the safety event. The team of all rookies, who had never competed before, took home third place. When the evening was concluding, the top three teams overall for each division were announced. The Shovelers fell just short of going to the stage and finished fourth overall in their division, which is still the best that any CSWEA team had done in history. The Pumpers competed exceptionally well too, finishing fifth overall in their division. It was amazing to see both teams rank so well.

After the awards banquet, competitors stuck together, displaying their trophies at various social events, proud of their hard work and determination. With a new PWO Representative in place next year, we hope to see some of the team members back, but until then they can hang this year's trophies on their walls.

The Illinois Institute of Technology (IIT) team.

The Milwaukee School of Engineering (MSOE) team.

The Instituto Tecnologico de Costa Rica (TEC) and the Universidad de Monterrey (UDEM) teams both competed using the GWS Problem Statement.

The Instituto Tecnologico de Costa Rica (TEC) team.

The Universidad de Monterrey (UDEM) team.

The top four teams for both categories of the WEFTEC Student Design Competion.

WEFTEC STUDENT DESIGN COMPETITION

By Joe Lapastora and Jonessa Haas

The Central States Water Environment Association (CSWEA) and Global Water Stewardship (GWS) were represented well at this year's WEFTEC Student Design Competition hosted by the Water Environment Federation (WEF). Overall, 23 teams from many states across the US, as well as Canada, Costa Rica, and Mexico, participated in the international competition.

CSWEA provided stipends to the winning teams who won the WEF Categories at the Midwest Student Design Competition (MSDC) last April. The Illinois Institute of Technology (IIT) competed in the WEF Water Environment category, and their design was presented by Nevin Abdelghani, Emma Dutkiewicz, Cornelio Estrella, and Anna Slominski. IIT collaborated with Just Roots, a Chicago based non-profit organization that owns and operates community gardens, to develop a water management and reuse system for a small, local farm. The students' goals were to address the current drainage issues of the farm while maintaining low costs and easy implementation of the design. The chosen solution encompassed a drainage ditch with a series of cisterns that would be used to collect, store, and redistribute water for the farm.

Additionally, The Milwaukee School of Engineering (MSOE) competed in the WEF Wastewater category, and their design was presented by Jack Ferrante and Brandon Garrido. Their team worked with The Village of Raymond in Southeast Wisconsin to design a collection system for a new centralized wastewater treatment plant. The best alternative was determined to be a pump-assisted system with six lift stations to accommodate the elevation changes and flow of the region.

GWS possesses a shared interest with WEF to maintain increased international participation in their respective student design competitions and that sentiment was reinforced this year as two international teams who competed in the GWS category of the MSDC last April received invitations to compete at the WEFTEC Student Design Competition. This marks a few "firsts" for Global Water Stewardship, as this was the first year that a Costa Rican team competed in-person at WEFTEC. Similarly, this was the first year that GWS sent two teams to compete at WEFTEC for designs based on the GWS Problem Statement for the community of Montezuma, Costa Rica.

This year, Alejandro Montoya, Luis Pérez, and Saul Rodríguez from Universidad de Monterrey (UDEM) competed out of Mexico. Also, Sol Carpio, Valeria Castillo, Maricel Chaves, Fabiola Pérez, Denisse Saborío, and Melany Trujillo from Instituto Tecnologico de Costa Rica (TEC) competed out of Costa Rica and represented two of the three international countries in attendance at the WEFTEC Student Design Competition. The Montezuma, Costa Rica Problem Statement tasked students to design a centralized wastewater treatment system and collection system for the coastal community of Montezuma Costa Rica.

UDEM proposed the use of two up flow anaerobic sludge blanket reactor (UASB) followed by three anaerobic filters. They included a collection system design along with overall project cost estimates.

TEC's design included preliminary treatment, one equalization tank, two sequencing batch reactors, a subsequent disinfection tank, and two sludge drying beds. They included a thorough collection system design and life-cycle cost analysis in their presentation. The Costa Rican team's exemplary design and excellent presentation skills won them 4th place in the wastewater competition. Both CSWEA and GWS are extremely pleased with the outcome of this year's design competition and are looking forward to returning a CSWEA/GWS team to the podium! CS

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96TH ANNUAL MEETING

MAY 22-24, 2023 | ST. PAUL RIVERCENTRE, MN

Inspiring Action

Central States Water Environment Association
1021 Alexandra Blvd, Crystal Lake, IL 60014
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SAINT PAUL RIVERCENTRE

96th Annual Meeting Highlights

The 96th Annual Meeting of the Central States Water Environment Association will be held May 22-24, 2023 at Saint Paul RiverCentre in St. Paul, MN. This year, we are maintaining both an in-person and online format, and offering utility pricing, leadership and ethics sessions, operations track, resource recovery track, and utility management track. Technical topics may include:

OPERATIONS and MAINTENANCE by OPERATORS and MAINTENANCE:

- Time management or new process startup
- Efficiency (pumps, motors, lights, UV disinfection, HVAC, etc.)
- Technology/SCADA/Web-Based maintenance programs/ GIS applications
- Troubleshooting – Traditional facilities (activated sludge, BNR), new processes (nutrient recovery) etc.
- Case studies of retrofitted facilities
- Startup Case Studies
- Optimization

ADVANCEMENTS in LIQUIDS TREATMENT

- Enhanced primary treatment
- Secondary treatment advancements and intensification
- Nutrient removal
- Tertiary treatment
- Alternative disinfectants

WATERSHEDS and STORMWATER MANAGEMENT:

- Implementing new MS4 permit requirements
- Adopt a storm drain, pond etc. program case studies
- Anti-degradation and other regulatory issues
- Using grants and other funding sources to implement stormwater management as part of CIP projects
- Habitat or groundwater protection or restoration
- Non-point pollution source modeling
- Water quality trading and watershed management issues and initiatives, including adaptive management
- Green infrastructure solutions and best management practices
- Total maximum daily loads involving point and non-point sources
- Education and outreach

UTILITY MANAGEMENT:

- Communications
- Employee retention and development
- Succession planning
- Project funding
- Utility rate development and reviews
- The *Infrastructure Investment and Jobs Act*
- Significant industrial users and industrial pretreatment
- Emergency response/repairs

ENHANCED RESOURCE and ENERGY RECOVERY:

- Resource recovery – sourcing raw materials, nutrient recovery
- High strength waste and pretreatment programs
- Digester gas production and treatment technologies
- Lessons learnt from co-digestion
- Heat recovery case studies
- Alternative energy use
- Energy management and savings to utility management or enhanced RER

COLLECTION SYSTEMS:

- Collection system rehabilitation technologies/methods
- Collection system rehabilitation case studies
- Educating the public on how to protect the system
- CMOM program development and implementation
- Collection system design and operation
- Green infrastructure case studies
- Infiltration/inflow management case studies
- Stormwater and combined sewer overflow management
- Stormwater conveyance

RESEARCH and DESIGN:

- New/innovative technology research and application
- Nutrient removal technologies
- Sustainability in Design and construction
- Toxics/emerging pollutants monitoring and control
- Treatment design
- Wastewater reuse, applications, technology and regulatory issues
- Wastewater surveillance

RESIDUALS, SOLIDS and BIOSOLIDS:

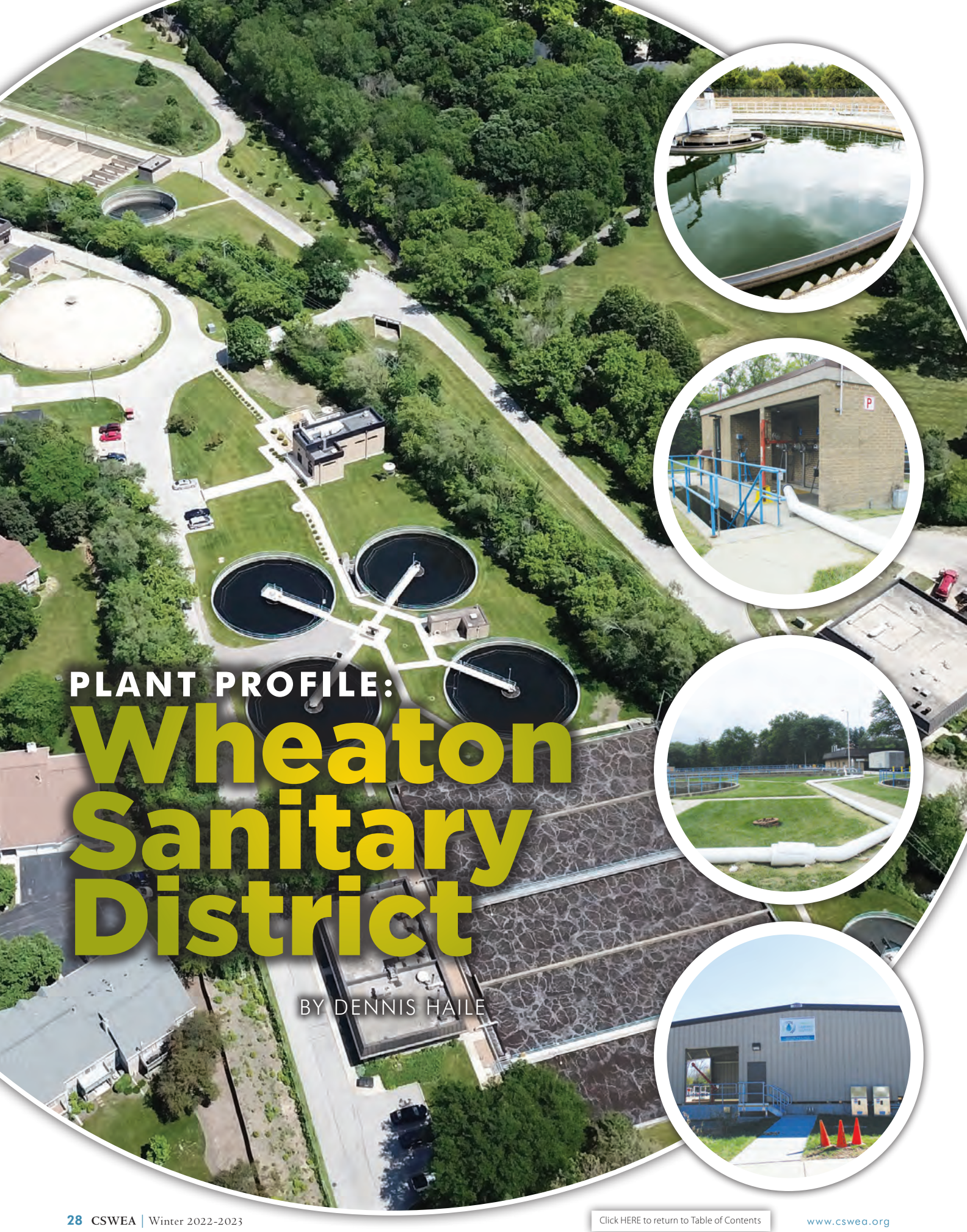
- Pollutants of Emerging Concern – PFAS
- Environmental management systems – National Biosolids Partnership
- Public education and awareness, case studies
- Fertilizer production – Class A case studies
- Standard or advanced treatment and stabilization

GENERAL:

- Laboratory issues and bench-scale studies
- Pretreatment, industrial treatment, and pollution prevention
- Pollutants of emerging concern – PFAS, chlorides etc.
- Public education to address emerging concerns – chlorides, water softener use, leachate, flushable wipes, etc.
- Regulatory issues
- Security issues
- Engineering ethics training
- Collection system/treatment plant odor control

SOFT SKILLS/LEADERSHIP:

- Leadership skills
- Managing the ill or injured employee
- Generational integration
- Anti-harassment and discrimination training for managers
- Getting the most out of employee performance evaluations
- Union negotiations
- Handling the grievance and arbitration process
- Managing in a union environment
- Labor Law
- Management rights for Managers
- Social media and the workplace CS



PLANT PROFILE: Wheaton Sanitary District

BY DENNIS HAILE

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Sitting 25 miles west of Chicago, Wheaton Sanitary District (WSD) is located on a beautiful 35-acre site on Shaffner Road in Wheaton, IL. The plant was established in 1925 and has been in operation since 1926, now receiving flow from most of Wheaton, southern Carol Stream, and part of Glen Ellyn, Winfield, and unincorporated DuPage County. WSD services a population of around 57,000 people and treats 5-9 MGD a day.

Over the years, the plant has seen several upgrades. In the late 1970s, WSD was upgraded to include a single-stage Nitrification Activated Sludge System. The activated sludge plant originally consisted of three aeration basins and two aerobic digesters. However, in 2001 and 2010, the aerobic digesters were converted into aeration basins. Not only did this improve day-to-day operations, it also expanded the designed average flow to 8.9 MGD and a designed max flow of 19.1, with a peak instantaneous flow of 45 mgd. After grit removal, any flows over 19.1 MGD can be diverted to repurposed primary tanks and to an excess flow holding pond to be slowly reintroduced to the plant when conditions improve. If flows exceed 30 MGD a portion of the flow can be diverted straight to our 003 tank for primary treatment and disinfection.

Staffed with 16 full-time employees in administration, maintenance, and operations, team effort is a huge factor in maintaining the quality and efficiency of the plant. Recent upgrades to Wheaton Sanitary District include new fine screens in the preliminary treatment building that were installed in 2016. As well, a new intermediate pump building with four new Archimedes screw pumps was constructed from July of 2015 to August of 2016. In 2019 the eight tertiary sand filters were replaced with five Kruger disc-filters to improve tertiary treatment. Then, in 2020, the chlorine contact tank was retrofitted into two Trojan UV channels for disinfection. Not only did this make routine operations easier and more efficient, it also eliminated certain chemicals from being discharged into Springbrook Creek. The plant is currently in the middle of a biological Phosphorus removal pilot project. This project uses return activated sludge fermentation for biological phosphorus removal, and all tank and piping modifications were performed by the maintenance staff at a reduced cost for the district.

Today, Wheaton Sanitary District is a four-stage treatment facility consisting of preliminary, primary, secondary, and tertiary treatment, and maintains approximately 67 miles of sewer mains, with an additional 120 miles owned and maintained by our service communities. WSD also currently sends samples to Wastewater Scan in San Francisco three times a week to monitor COVID-19 levels in wastewater.

Flow enters WSD through one of three interceptor sewer lines. The Southside, a 48-inch interceptor that was rehabilitated from 2009 through 2012. The Northside interceptor ranges in size from 24 to 60 inches in diameter. The district started a rehabilitation project of the northside interceptor in 2021 and is expecting completion in 2023. The arrowhead interceptor is an 18-inch interceptor sewer main.

WSD also owns and maintains two lift stations to help convey wastewater to the plant. As wastewater enters the plant, it is conveyed by one of four Archimedes screw pumps into the preliminary treatment building. Each screw pump is rated to pump 15 million gallons per day. From there, the wastewater flows through one of four fine screens to remove larger debris from the flow stream. The screens work automatically by influent and effluent level differential. The fine screen has improved in debris removal and has been an asset to downstream treatment. Continuing on, the water enters one of two aerated grit chambers for the removal of heavier solids that would be abrasive to downstream equipment. It is after this process and composite sampling that a portion of the flow can be diverted in high flow situations to our excess flow tanks and sent to the pond, entering the four primary settling tanks, where approximately 3500 lbs. of primary biosolids are pumped daily to two anerobic digesters. Primary effluent is then conveyed to the intermediate pump building to be pumped to our four remaining aeration basins along with return activated sludge. Presently, we are trying to maintain a mixed liquor suspended solids concentration of around 2000 mgl and a return sludge suspended solids concentration of around 7000 mgl. We try to maintain these levels to maximize RASS Fermentation. The mixed liquor flows through a main diversion structure where it flows to the four secondary clarifiers. Solids are removed from the bottom of the tank by adjusting telescoping valves to control flow. From here, we are pumping 400 gallons per minute to the fermentation tank and wasting approximately 90,000 gallons per day. The remainder is returned to the aeration basins. The fermented RASS flows back to the intermediate building and is pumped to the aeration tanks for phosphorus removal. The waste activated sludge is pumped to a gravity thickener tank to be thickened before pumping to the digesters. When digestion is complete, WSD dewaters the bio-solids in one of two centrifuges to 27% solids, before being hauled to our storage building. Three to four times a year we have the biosolids hauled and land applied to area farm fields. The secondary effluent then flows to the disc-filter building to filter any remaining solids out of the effluent. The final step is disinfection, where the effluent flows through the UV disinfection channels. WSD is on a seasonal disinfection schedule disinfecting May through October.

One of the concerns WSD has encountered is the proximity of residential properties. Every effort is made to always keep all odors and noise to a minimum. WSD is also very diligent at keeping costs to a minimum to keep our user rates low.

The resolute staff at Wheaton Sanitary District take great pride in achieving an exceptional effluent quality, earning gold awards from The National Association of Clean Water Agencies in 2014, 2015, 2018, 2019, 2020, 2021, and silver awards in 2016 and 2017. Other recent awards include:

- The 2022 GFOA certificate of achievement for excellence in financial planning for fiscal year ending April 30, 2021
- CSWEA's 2022 Treatment Facility Operations Award (Illinois)
- WEF's 2019 Outstanding Lab Analyst Award
- 2016 Clean Water Award
- WEF's 2016 William B Hatfield Award.
- The Illinois Association of Water Pollution Control Operators' 2014 Outstanding Wastewater Treatment Plant Operator of the Year.

Wheaton Sanitary District's staff is always looking for improved methods for the treatment of wastewater, while keeping user rates reasonable for the district's stakeholders. CS

PFAS:

Are These 'Forever' Chemicals Here to Stay in Our Waters and Regulations?

By Patrick McNamara,[1,2,3] Fabrizio Sabba[1], Lynne Moss[1]

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Per-and polyfluoroalkyl substances, better known by their acronym "PFAS," have seemingly taken over the water world. You cannot attend a drinking water or wastewater conference without hearing about PFAS. They are considered 'forever' chemicals because of their strong carbon-fluorine bonds. Indeed, it should come as no surprise that compounds used in fire-fighting foam and non-stick cookware are hard to degrade. Their persistence has rendered them ubiquitous in wastewater and the environment. At times, wastewater treatment plants have been labelled as sources, or hotspots, for PFAS. The concentrations in wastewater effluent and biosolids though pales in comparison to concentrations of PFAS found in our everyday consumer products. The concentrations of PFAS in food packaging, sunscreen, lipstick, and even daycare center dust are orders of magnitude higher than what is found in wastewater effluent. It is important to note the sources of PFAS because source reduction is one of the primary ways PFAS can be reduced in treatment plant effluents. Before we talk about regulations and treatment technologies, it is important to unpack the specific PFAS of greatest concern.

While there are literally thousands of chemicals classified as PFAS, two in particular have received the greatest attention: perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). A 2016 EPA interim drinking water advisory of 70 parts per trillion (ppt) for PFOA and PFOS (separately or combined) began a chain of events that expanded the focus on these contaminants – and has now impacted biosolids programs. Soon after the 2016 advisory, a few states adopted the 70 ppt limit as a drinking water standard; in one case, a lower standard of 20 ppt was adopted, and the number of states establishing drinking water limits for PFOA and PFOS (and in some cases, other PFAS) continue to increase. Since that time, some other states have established drinking water standards in the ppt range. The EPA recently issued lower drinking water health advisories for PFOA (0.004 ppt) and PFOS (0.02 ppt) and finalized new advisories for other PFAS (GenX at 10 ppt and PFBS at 2,000 ppt). The inclusion of GenX and PFBS is noteworthy. PFOA and PFOS have been banned from being manufactured in the US, and their trends in blood samples have gone down since the ban. GenX and PFBS are still manufactured. It will be worth following cases and studies on any links between PFAS concentrations in land applied biosolids and PFAS in aquifers.

The EPA has also advanced its overarching plans to control PFAS first through its PFAS Action Plan (issued in 2019 and updated in 2020), which was followed by 2021's PFAS Strategic Roadmap, Commitments to Action 2021-2024. The roadmap provided deadlines for some actions originally proposed in the Action Plan. Just recently, PFOS and PFOA were designated as hazardous substances under the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA), and a final rule is expected in Summer 2023. Efforts to control PFAS are not limited to the EPA; while waiting for federal guidance, some states have moved forward with PFAS control measures for biosolids. In April 2022, the governor of Maine signed into law, "An Act to Prevent the Further Contamination of the Soils and Waters of the State with So-called Forever Chemicals," which bans the land application, sale, and distribution of biosolids-based soil amendments.

Other states have taken state-level approaches to control PFAS. Wisconsin has set surface water quality standards for PFOA and PFOS. Their approach includes monitoring, source reduction plans, and ultimately technology implementation plans if needed, but it's noted that new technology implementation to reduce PFAS in wastewater effluent would be years away and likely unnecessary following source reduction strategies. Wisconsin also intends to follow an interim biosolids strategy until the EPA completes its risk assessment for PFAS in biosolids. The strategy intends to prevent further land application of biosolids that have been industrially impacted by PFAS,

and >150 µg/kg PFOA+PFOS has been set as the threshold for defining biosolids as "industrially-impacted" by PFAS. Sampling, source reduction, and communication to land owners are also part of the strategy. In Michigan, land application programs were impacted while the state environmental agency developed and implemented a plan to address PFAS. Michigan implemented an industrial discharge-focused program that appears to potentially be a model for other states, including Colorado. The Michigan plan was founded on the results of effluent sampling at WRFs around the state. This provided the basis for a statewide industrial pretreatment program initiative and, after subsequent biosolids investigations, a new biosolids interim strategy also focused on industrial source control for PFOS. Some states are focusing on source reduction to manage these compounds. For example, Washington State has passed bills eliminating PFAS in food packaging, and New York, Rhode Island, and New Jersey are considering similar measures. Additionally, Michigan and New York are banning PFAS in firefighting foams.

With respect to biosolids, it is critical to note that there is not yet an approved analytical method for PFAS. A draft isotope dilution method (Method 1633) has been developed and has passed through single-laboratory validation and is expected to receive multi-lab validation (the final step in the approval process) in 2022. The new method tests for 40 PFAS compounds in wastewater, surface water, groundwater, soil, biosolids, sediment, landfill leachate, and fish tissue.

The EPA is also pursuing efforts to include PFOA and PFOS under the *Clean Water Act*. They are aiming to publish final ambient water quality criteria for PFOA and PFOS for aquatic life by Winter 2022 and for human health by Fall 2024. These efforts could lead to effluent concentration requirements for wastewater treatment plants. The most direct way to reduce these concentrations will be through pretreatment programs.

Technology Check – What Happens to PFAS in the Liquid Phase at a WRF?

In general, PFAS are not removed or degraded by conventional wastewater treatment plants. In fact, precursor compounds can be transformed into PFAS and the concentrations in the effluent are actually higher than concentration in the influent. Broadly speaking, PFAS treatment technologies can be grouped into two categories: non-destructive and destructive technologies.

Non-destructive technologies remove PFAS from the liquid phase and concentrate the PFAS after separation. Liquid phase separation and concentration processes leverage the unique properties of PFAS such as ionic character, molecular size, hydrophobicity, and surfactant capabilities. Separation and concentration methods can occur via membrane separation (e.g., reverse osmosis), liquid-liquid separation (e.g., foam fractionation), and packed bed separation (e.g., adsorption via activated carbon or anion-exchange resins). This separation and concentration is critical for a more efficient and feasible destruction step. Once PFAS are separated from the liquid phase and concentrated they can be further processed via destructive processes.

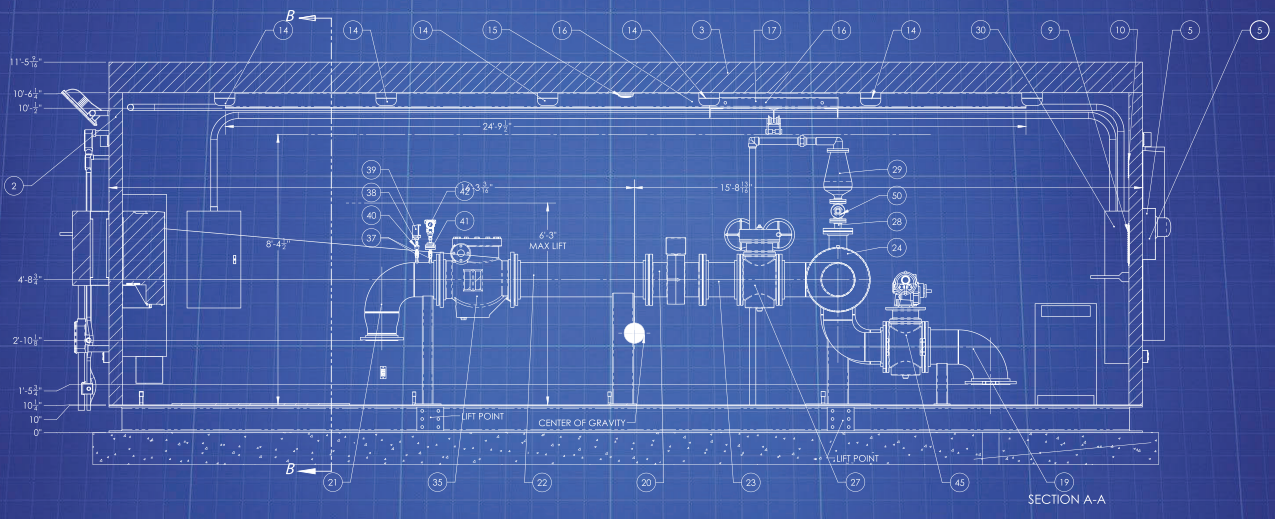
> With respect to biosolids, it is critical to note that there is not yet an approved analytical method for PFAS.

Destructive technologies include both redox-based and thermal-based processes. Examples of redox-based technologies are supercritical water oxidation, electrochemical oxidation, and plasma. These processes usually provide a good balance between high treatment efficiency and minimal formation of unwanted gaseous and aqueous PFAS byproducts, though energy demand can be high. High temperature thermal processes can, in theory, be employed to destroy PFAS. Thermal-based technology options in the wastewater industry consist of heat-degradation units that might require oxygen (e.g., incineration and gasification) or might not (e.g., pyrolysis). While these processes can volatilize the PFAS away from the material to which they were attached, they might be responsible for toxic gas emissions and byproducts formation from incomplete combustion. More research is still needed in this area to understand the fate of PFAS through these processes.

Technology Check – What Happens to PFAS in the Solid Phase at a Treatment Plant?

Conventional solids stabilization technologies including anaerobic digestion, composting, thermal drying, thickening and dewatering, do not destroy PFAS. The actual concentration of PFAS can increase when water is removed or solids are destroyed because the mass of PFAS remains the same. Higher temperatures employed during incineration, pyrolysis, or gasification can volatilize PFAS out of the wastewater solids. The fate of PFAS during these processes remains unknown because we lack analytical methods to quantify PFAS and the transformation products in the gas phase. The Water Research Foundation is funding research led by Brown & Caldwell specifically to investigate the fate of PFAS through incinerators (Project #5111). There are newer thermal processes being investigated as well. Pyrolysis generates a solid known as biochar that can be a beneficial soil amendment. Our recent pyrolysis research revealed that PFAS are removed from the biosolids, rendering the biochar essentially void of PFAS. The pyrolysis-liquid that is produced can still contain PFAS, including PFAS that were not present in the influent biosolids. PFAS analytical methods will need to be developed prior to any air permit regulations. These methods can also be used to assess the impact of thermal technologies. We are excited about a new WRF project to investigate PFAS of biosolids through torrefaction, pyrolysis, and gasification. The other solids handling process that could impact the fate of PFAS is supercritical water oxidation, a newer process being investigated for its impact on PFAS. Overall, it's likely that these processes could be used to remove PFAS from the solid phase if that is the primary goal. If the primary goal is complete PFAS destruction, i.e., splitting of the carbon-fluorine bond, more energy intensive technologies (or higher temperatures) would likely be needed.

While there are innovative technologies available to remove and/or destroy PFAS, there is hope that PFAS concentrations will decrease in wastewater effluent and biosolids without high-energy technologies. With more consumer information that everyday products are our greatest exposure route to PFAS we might shy away from these products similar to how we stopped drinking from plastic water bottles made with BPA. With more pre-treatment programs where necessary, PFAS levels into, and therefore out of, our treatment facilities could also decrease. Hopefully, forever. CS



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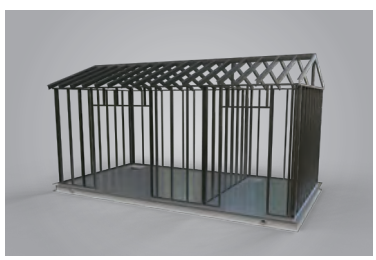

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ILLINOIS TECH

MIDWEST DESIGN COMPETITION

MIDWEST STUDENT DESIGN WINNER –

WEF – Water Environment Category: Illinois Institute of Technology Water Reuse Design at *It Takes A Village Farm*

By Anna Slominski, Emma Dutkiewicz, Nevin Abdelghani, Kane Liu, and Cornelio Estrella

Pictured Left to Right: Dr. David Lampert, Kane Liu, Cornelio Estrella, Emma Dutkiewicz, Anna Slominski, and Nevin Abdelghani

> The purpose of this project is to create a comprehensive water management system for the 'It Takes a Village Farm' that successfully collects and distributes water to needed locations.

The student team from the Illinois Institute of Technology (IIT) competed in the CSWEA region WEF Water Environment Student Design Competition on April 11, 2022. The team consisted of Nevin Abdelghani, fourth-year architecture student; Kane Liu, a third-year biomedical student; Cornelio Estrella and Anna Slominski, both third-year civil engineering students; and Emma Dutkiewicz, a second-year civil engineering student. Dr. David Lampert served as the primary university advisor for the project.

The project is a collaboration between the IIT team, and the Chicago-based non-profit organization Just Roots Cultivated. Just Roots aims to work with communities to provide access to local, sustainably grown foods through education, farming, and community engagement. This project focuses on the 'It Takes a Village Farm' in Sauk Village, IL. The farm was first acquired in 2019 and, due to the COVID-19 pandemic, was not opened for a growing season until 2022. Over the next five years the farm will provide approximately 50,000 lbs of produce, educational programming, job training, and natural spaces for the surrounding community. The IIT team aims to create a water management system design that will provide for the water needs of the farm currently and in all future use.

Site Considerations

The site is a 2.7-acre plot that is made up of mostly previous farmland. The Grace United Church of Christ and its connecting parking lot are located on the northwest corner of the property. The site is approximately 30 miles from the Chicago city center. The soil composition is high in clay content and due to the distance between the site and the city, Just Roots has chosen not to do soil remediation. The organization plans to construct 17 garden plots integrating various rain and pollinator gardens within the scope of the farm. Figure 1 shows the full plan of the farm upon completion. As of the summer of 2022, Just Roots has completed stage one of its construction, which includes the first three growing plots closest to the partnering church. Subsequent stages of construction are stage two being 10 growing plots, pollinator gardens, planting of surrounding Dwarf Fruit trees, beehives, three greenhouses of varying sizes, and a tool shed. Stage three includes the last four growing plots, pollinator gardens, Dwarf Fruit trees, and the rain garden in the southeast corner. These phases are set to be completed in 2025. Because the space has not been fully constructed it provided the Illinois Tech team with a unique opportunity to be able to work the design in with the planned construction instead of designing around an already existing space. The water issues on the farm mostly involve inadequate drainage around where the greenhouses will be built. From gathered topographic maps shown in Figure 2 the area drains from west to east with the highest point being in the middle of the west side of the property. Based on the natural grading of the land, the water should easily move off the property but due to preparation of the ground for the greenhouses and erosion, the water has been able to collect in inconvenient places. This creates a challenge to Just Roots as they plan to hold events and educational programming in and near the greenhouses, so they wish to make the area around a convenient place to walk and gather. The organization also has a desire to streamline water use on the farm as hand watering all 17 growing plots would be too long of a job for their volunteer team.

Figure 1

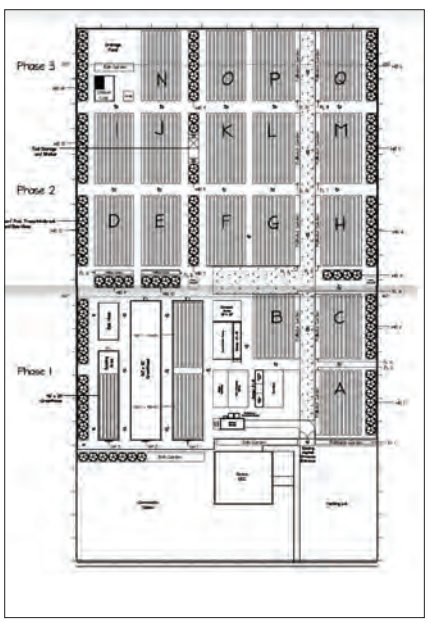

Figure 2: Site Plan.

Objective

The purpose of this project is to create a comprehensive water management system for the 'It Takes a Village Farm' that successfully collects and distributes water to needed locations.

Criteria

There are four essential factors used in this project to determine which alternative is a best fit for the site and Just Roots. In order of importance in the project the criteria are as follows: ability to collect and reuse water, cost, ease of maintenance, and how well it fits into the organization's aesthetics. These criteria were formed based on preliminary meetings with Just Roots leadership and discussions between team members on the values of the project. The team determined set standards for each criterion that would have to be met for the alternative to be accepted. The team set a water reuse goal of providing 40% of the farm's water needs from collected runoff. The cheapest alternative would meet the cost goal. The design must be maintainable by a team of unskilled volunteer workers to meet the maintainability criteria and lastly, to meet community goals the design must incorporate a design element that adds to the natural beauty of the landscape. Using these guidelines, the alternatives were evaluated to decide the best fit for the farm and Just Root's goals for the future.

The site is a 2.7-acre plot that is made up of mostly previous farmland. The Grace United Church of Christ and its connecting parking lot are located on the northwest corner of the property.

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Alternative 1: Piping System

The first alternative developed by the team uses a system of 8-inch and 12-inch schedule 40 PVC piping to collect and move water off high-risk areas to the southeast corner of the property. This design was developed with the primary goal of diverting water away from the high-risk areas around the planned greenhouses. Figure 4 shows the design with the 8-inch pipe in red and 12-inch pipe in green. The construction of this design would require earthwork to create the space necessary for the PVC pipe then followed by re-stabilization of the soil and reseeding after installation. This solution integrates catch basins and underground pipes to collect and move the water away from the problem areas of the site and into the better-equipped wetland area off the property. The basins are placed where the water pools around the buildings, specifically the operational buildings. Using the GIS data of the elevations of the property, the water should continue running off the buildings and towards the wetland in the southeast but based on Just Root's experience on the farm this is incorrect. This discrepancy informed the team's placement of the catch basins. The sizing of the pipes was calculated based on an estimated tributary area and a 25-year rainstorm for 60 minutes in Northeast Illinois. The total tributary area size was determined to be 5.45 acres and of that area, 4.80 acres is pervious, while 0.65 acres was designated as impervious. The intensity of the rainfall was used to calculate maximum flow rate across the property with the Rational Method. Because the site contains both pervious and impervious land cover the method was done twice with the runoff coefficient being 1.0 for impervious and 0.6 for pervious surfaces. We chose 0.6 to best calculate runoff with mostly clay soil with light vegetation. Those two flow rates were then summed together to create a total flow rate of 0.15 cubic feet per second (cfs). An iterative process between Bernoulli's, Von Karman, and Darcy-Weisbach equations were used to calculate total and allowable head, friction factor, and diameter of the pipes. Starting with Bernoulli's equation a diameter was assumed to then calculate friction factor, finally calculating pipe diameter till the needed pipe size is found. The pipe material selected by the team was schedule 40 PVC pipe due to its cost and its durability. The final pipe diameter determined was 8 inches for the northern piping and 12 inches for the southern. These are rounded up values to the closest commercially available pipe size. The reason for this increase in diameters is due to the two diameters is due to the two parallel red pipes converging therefore combining the flow of the two systems into the 12-inch pipe.

Figure 3: Topographic Map

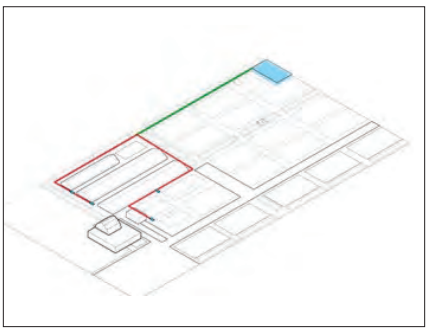

Figure 4: Alternative 1 Design

Alternative 2: Cistern

The second alternative adds onto the first by installing two underground cisterns on the southern end of the property. The proposed location is underneath growing plot N, which the team found to be the least intrusive of the primary goals of the farm. This would require that plot N would be removed from the plan to allow for access to the cisterns for maintenance purposes. To mitigate the loss of the growing space the team designed a community gathering area on the southeast end that will use the rain garden as well to create an

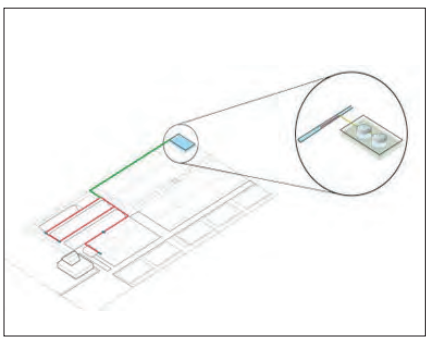

Figure 5: Alternative 2 Design.

The second alternative adds onto the first by installing two underground cisterns on the southern end of the property.

aesthetic space flexible enough for Just Roots to hold many kinds of events. The community space has been integrated into the design of all three alternatives. Further description of the community space design is found later in this project description. Figure 2 indicates the placement of the design on the farm with a close of the cisterns connection to the pipe system. Calculations for pipe diameter leading into the cisterns remain the same from alternative 1. The pipe routing from the 12-inch pipe on the eastern front of the property to the cisterns will be perforated pipe to allow for more infiltration into the soil below. The sizing of the cisterns was based on project goals for supplying a certain percentage of water for the farm to use. For this project, our goal is to be able to have the capacity to provide 40% of the water required for the in-ground beds on the farm. The total required water for in-ground beds is estimated to be 0.623 gallons per square foot of bed.[1] This number was used in conjunction with the total area of in-ground beds (43,157.28 sq ft) to calculate the amount of water required to service the farm. The design height was chosen to be six feet for a cylindrical cistern. This is because with a recommended two feet of ground cover above the cisterns the overflow drainpipe can discharge in the southeast corner of the site if the pipe is placed 1 foot on center above the bottom of the cistern. Solving for the diameter of the cistern the calculated diameter should be 12.35 feet. Cisterns are typically not sized to this level of precision, so the design diameter will be rounded up to 14 feet, which also gives enough clearance for the overflow pipe.

Alternative 3: Vegetative Ditch

The last alternative developed by the team is a trapezoidal shaped 0.5-foot-deep vegetative ditch that would be placed on the east perimeter of the property to collect and carry water from the site into cisterns placed on the southeast corner like the second alternative. Figure 6 gives a detailed look at what the vegetative swale would look like. The key management tool used in this solution is adding a vegetative swale to

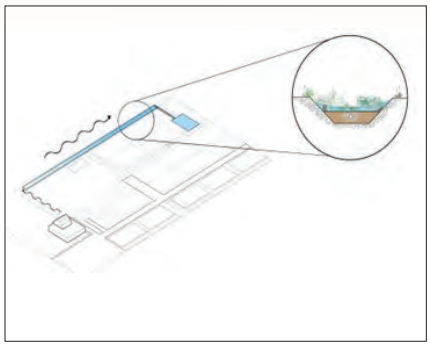

Figure 6: Alternative 3 Design.

the trench to help filter out sediments and any pollutants to slow the amount of water being moved into the wetland. An open trench requires that the incline is at least 1% to make sure the water flows towards the desired location. Inclines less than that can increase the chances of still water, which goes against the purpose of the solution.

Vegetative swales are a common stormwater management tool for many industries like agriculture and off transportation infrastructure. The swales act as a buffer zone between the pollutant producing size (such as pesticides in agriculture) and the location where water accumulates (such as creeks, lakes, or rivers). These zones use a wide range of shrubs and shrubs to mitigate erosion, create habitats for wildlife, slow runoff, and reduce sediments and nutrients being moved into larger water sources. At this location, the swale would be used to slow rates off the property as well as add to the aesthetics of the farm by adding more green spaces. The filter does add some friction in the water's movement therefore the incline needs to be increased to 2%. It is recommended that the buffers use native plants with deeper root systems as to not bring in invasive species onto the property and to optimize the amount of runoff being filtered. In northern Illinois, the best plants to use would include rice cutgrass, common beggar-ticks, nodding wild rye for their extensive roots systems and bringing native plants to the area.[2] The size of the ditch was determined by using Manning's Equation in an iterative process. Because a vegetative swale is in place, the slope is assumed to be 2% to prevent standing water and potential mosquito breeding. Between the eastern tree line and the closest growing plots there is 7 feet of space. For this design, a bottom width was assumed to be 0.5 feet wide with 1:2 slopes so that there is still ease of access for any maintenance. Using these parameters, the height of the trapezoidal ditch was determined to only be 0.03 feet. This value is rather low however the flow rate used is the same for solutions one and two of 0.15 cfs, so with such a low flow rate and a long channel length, this value is correct. For this application however it is being recommended that the design depth of the vegetative swale be increased to 0.5 feet. This is to account for the flowrate being an average maximum value instead of the ultimate maximum and the storage capacity lost due to the actual vegetation in the swale.

Cost Analysis

Cost estimates for the three designs were done using online resources like Home Depot and Mulch Center for material objects such as cisterns, vegetation, and furniture used in the community space. Costs for all earthworks done were calculated based on price per cubic yard for projects similar in size to this. The community space and irrigation system are added onto the three basic designs.

Vegetative swales are a common stormwater management tool for many industries like agriculture and off transportation infrastructure.

The community space total costs came out to be approximately $3119. The cost of the irrigation system includes the pump, pump building, and the pipe system that carries water to a majority of the farm's growing plots is approximately $10,000. The most cost-effective alternative is design one, as it does not include cisterns or the available addition of an irrigation system with the total for the design coming in at $6,834 without the community space cost. Alternative two includes the cisterns as well as alternative one's pipe. The final cost of all materials and earthwork not including irrigation or community space is $14,394. Finally, the vegetative ditch design includes mostly earthwork and cisterns cost. The estimate for design three is $7,326.

Irrigation System

The main component of the site runoff management system in design three is the vegetated ditch running north and south along the eastern edge of the farm. The capacity of this system allows for a 25-year rain event over a 60-minute duration that then primarily discharges into a system of two cisterns that have a total capacity of 51% of the total required water that is required for one irrigation cycle. To transport the water from the underground storage tanks two centrifugal pumps will be installed, though only one will be in operation at a single time. The pumps will be placed in an above ground pump room on a covered concrete pad on top of the cistern system with maintenance hatches

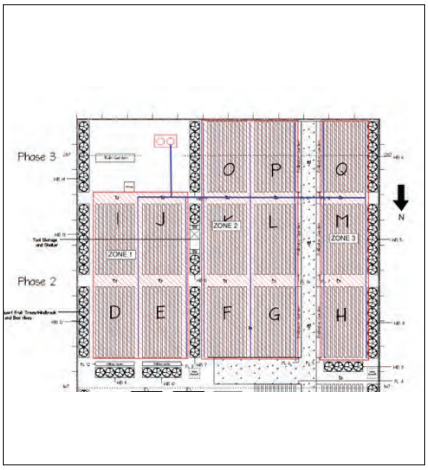

Figure 8: Irrigation Plan.

The most cost-effective alternative is design one, as it does not include cisterns or the available addition of an irrigation system with the total for the design coming in at $6,834 without the community space cost. Alternative two includes the cisterns as well as alternative one's pipe. The final cost of all materials and earthwork not including irrigation or community space is $14,394.

to access the inside of the cisterns. The choice to place the pumps above ground was made to ensure easier maintenance/installation of the pumps along with avoiding possible Occupational Health and Safety Administration (OSHA) violation issues that could arise with placing the pumps underground. Using this method also creates a covered space that is inside of the designated community area, meaning that the space can be used in mild inclement weather conditions as well as offer shade in the southern portion of the farm for workers. Figure 8 outlines the proposed design with the blue lines representing the lines of sprinklers. The design is separated into three zones as a way of reducing operating flow and pressure on the entire system. The team chose to use a sprinkler system on the farm after looking at many options like drip irrigation, underground sub-irrigation, and solid set irrigation. This was chosen due to having more control in the use of water being able to control which plots are watered at different times. Also, it was chosen because of its durability. The irrigation system will be an addition to both alternatives two and three due to their use of cisterns. The team recommends that the system be an addition or future builds due to the high cost of the pump and piping systems that irrigation requires.

Community Space

In preliminary meetings between the IIT group and Just Roots leadership emphasized a strong sense of community and drive to provide space for community residence. To fully provide for this goal the IIT team, led by architect Nevin Abdelghani, designed a community space to be placed in the southeast corner surrounding the rain garden specified. This space would be over the underground cisterns, making sure to allow access for maintenance purposes. Figure 7 outlines the space as it would be used complete with small garden spaces for individual use, stone walkways, fire pit, and storage for the irrigation system outlined previously. The vegetation used in the area is native plants that are known to have deeper roots systems to better filter runoff water that comes off

Figure 7: Community Space Rendering.

the farm. The selected vegetation includes Swamp Milkweed, Golden Alexanders, Black-Eyed Susan, and Big Bluestems to provide aesthetic value to the space while also providing needed stormwater management. The system allows for water to infiltrate into the soil to reduce pollutants and capture sediments before they move downstream. In addition, the design adds seating, small garden plots for educational purposes, storage, and a mural to allow Just Roots message to be advertised across the property.

Recommended Solution

The recommended solution based on the team's criteria is alternative three, the vegetative ditch. This is due to its ability to convey runoff water collected by the ditch to be reused on the farm with the designed irrigation system while also not adding gray infrastructure to the site. The solution outlined above allows the farm to grow with an easily expandable design. In comparison to alternatives one and two, design three adds more vegetation to the site, something the Just Roots organization prioritized in early discussions. The native plants in the ditch will provide a habitat to native species of bees and butterflies. The design succeeds in collecting 40% of the needed water on the farm thus completing the requirements for the water reuse category. The solution does not have the lowest cost but its successes in water reuse and community goals categories outweighs the higher cost. The maintenance of the facility plays well into the organization's strengths as the vegetation in the ditch can be maintained with their volunteer base. The cisterns have been placed in an area easily accessible thus allowing easier maintenance. Overall, this solution provides the organization with a complete design that allows for all operational goals to be achieved.

References

1 Zaworski, Karen. "How to Water Wisely This Summer." *Plant Information*. Chicago Botanical Garden. 2022. *www.chicagobotanic.org/plantinfo/smart_gardener/how_water_wisely_summer*.

2 USDA Natural Resources Conservation Service's, Chicago Metro Urban and Community Assistance Office. 2004 "Native Plant Guide for Streams and Stormwater Facilities in Northeastern Illinois." CS

In preliminary meetings between the IIT group and Just Roots leadership emphasized a strong sense of community and drive to provide space for community residence.

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2023

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GLOBAL WATER STEWARDSHIP

GWS 2022-2023 Problem Statement

Bijagua, Costa Rica

Greetings,

On behalf of Global Water Stewardship (GWS), I would like to introduce you to the GWS Category of the Midwest Student Design Competition (MSDC). The GWS Category presents a unique opportunity for students at the college level to demonstrate their engineering skills and practices by researching and preparing a design for a real-world sanitation project in a Costa Rican community and to present their project to water industry professionals. This year, the Midwest Student Design Competition will be held on Monday, April 10, 2023.

Note that GWS will continue with the competition structure that was used in the 2021 competition that allows for international universities to compete in their own competition (i.e. non-US universities only) with final presentations that took place on November 11, 2022. The international competition will be held in a hybrid in-person/virtual format to accommodate international teams who are unable to travel to the selected venue. The winner of the International Competition would then go on to compete with the US schools in line with the typical MSDC schedule (in-person competition scheduled for April 10, 2023 at Monona Terrace in Madison, WI).

GWS Category: The GWS Category in the MSDC requires design teams to design and present a project meeting the requirements of the real-life problem statement titled *Global Water Stewardship: Bijagua, Costa Rica*. Winning teams will receive a stipend of up to $1,000/ student, for up to four (4) students, for travel and lodging expenses to accompany GWS volunteers and wastewater professionals on their annual August service trip to Costa Rica and to present their project to local community representatives.

We will be as flexible as possible in working with international universities to afford the opportunity to participate in the international competition. Please read over the attached guidelines and let us know if you have any questions.

Should you have any questions or if you need additional information on how to participate in these events, I can be contacted at *communitydesign@globalwaterstewardship.org*.

Best Regards,

Jonessa Haas
Community Design Chair
Global Water Stewardship

Rio Celeste – Bijagua, Costa Rica.

PROJECT UNDERSTANDING

- Location: Bijagua, Costa Rica
- Population: 5,363 (Year 2022)
  [Source: ASADA Bijagua, 2022]
- Number of Water Services: *[Source: ASADA Bijagua, 2022]*
  - Residential – 1,365 services
  - Commercial – 260 services
- Water Usage: *[Source: ASADA Bijagua, 2022]*
  - Residential – 29 m^3 monthly average per household. *3.3 inhabitants per household*.
  - Commercial – 40 m^3 monthly average per property
- Annual Average Precipitation: 3,000 mm
  [*Source: www.climate-data.org*]
- Average Temperature: 23.1 Degrees Celsius
  [*Source: www.climate-data.org*]
- Wastewater production can be estimated assuming 80% of water consumed per person will be sent to the sanitary system
- Infiltration flow for PVC pipe material is 0.25 Liters/sec/km
- Typical **Influent** Characteristics:
  [*Source: ASADA Bijagua, 2022*]
  - BOD5 = 280 mg/L
  - COD = 550 mg/L
  - TSS = 220 mg/L total nitrogen
  - Total Nitrogen = 50 mg/L
  - Total Phosphorous = 20 mg/L
- Required **Effluent** Characteristics; [defined in "Reglamento de Vertido y Reuso de Aguas Residuales (RVRAR)"]
  - BOD5 = 50 mg/L
  - COD = 150 mg/L
  - TSS = 50 mg/L
  - Total Nitrogen= 40 mg/L
  - Total Phosphorous = 10 mg/L
  - Fecal Coliform = 1000 MPN/100 mL (If water is to be reused, effluent fecal coliform must be less than 105 MPN/100 mL)

Costa Rica has very few centralized wastewater treatment systems. In rural areas, septic tanks are a common way of treating wastewater; greywater is often discharged directly overland. The leach fields are very small and shallow and although the law states leach fields must stay within each individual property, they often do not. Shallow bedrock, poor soils, poor cleaning and maintenance practices, and poor designs often contribute to improper treatment of septic tank effluent. Further exasperating the issue, it is not uncommon for sludge cisterns to dump collected material in rural areas and pollute the surrounding environment instead of trucking the sludge to a distant WWTF.

The community of choice for this year's problem statement is Bijagua, Costa Rica. Bijagua is in Northern Costa Rica and sits at the border between the provinces of Guanacaste and Alajuela.

"COSTA RICA HAS VERY FEW CENTRALIZED WASTEWATER TREATMENT SYSTEMS. IN RURAL AREAS, SEPTIC TANKS ARE A COMMON WAY OF TREATING WASTEWATER; GREYWATER IS OFTEN DISCHARGED DIRECTLY OVERLAND."

Set inland, within the Guanacaste Mountain Range, this area stays lush and green year-round. Bijagua is located about 80 miles (four hours of driving) northeast of San Jose. The extents of the project can be seen in *Figure 1* and *Figure 2*.

The residential population is relatively steady with no plans for major developments, or significant residential growth. However, as tourism grows in the region, more businesses and residents may move in. The main attractions are the Tenorio National Park and Rio Celeste waterfall. The number of tourists who visit the area can be estimated quite accurately with the visit to the Tenorio National Park, which has grown over the years and reached 150,000 people in 2019. The pandemic reduced the value for 2020 and 2021, but in the year 2022, 100,000 visitors have been registered between the months of January and June (these months do not represent the high season of visitation). Based on the number of hotel beds found within the study area (450), and according to data from ASADA and the Costa Rican Tourism Institute (ICT), around and 70% of these visitors stay in Bijagua. Residential population data can be found in the Google Drive (*https://bit.ly/3ggFSup*). Use your best engineering judgment regarding projections.

Almost every home and business located within Bijagua is connected to a private septic tank. Recent studies suggest that there is evidence of malfunctioning septic tanks due to negligence of routine maintenance, which causes contamination by septic tank effluents that do not infiltrate the ground but are washed away by runoff. This situation of mismanagement of wastewater has caused concern on the part of its inhabitants, the tourism sector, the Municipality of Upala, AyA, and the local ASADA, all of which advocate for a centralized wastewater treatment system and public collection system.

The local utility has been proactive in seeking a centralized wastewater treatment solution and would like a preliminary conceptual design of a treatment system along with a collection system. **The design team must propose three locations for the treatment site. Additionally, the design team must propose three alternative treatment systems (each system may be one type of treatment or a series of treatment processes). The design must also specify outfall/discharge location.** The community values the great variety of flora and fauna in the area and the design team should hold this community interest in high regard while considering treatment alternatives. The ultimate design should not impede or negatively affect any of the community interests.

Given the complexity and status of the project, the design team must work on **an optimal site selection** and **a preliminary design proposal**. The design should be as intensive as possible. For example, calculate pump power requirements, select pumps to meet the design parameters, size pipes based on anticipated flows, accurate elevations, and stationing through the provided survey information, etc.

The Bijagua ASADA has identified land available for purchase that will act as potential sites for the centralized treatment system. The extents of the available land can be seen in *Figure 3*

Figure 1: Satellite View of Community Extents for Bijagua.

Figure 2: Maps View of Community Extents for Bijagua.

Figure 3: Map displaying potential treatment site.

and *Figure 4*. Note that much of the land is at a lower elevation than the service area and there are many open fields. This will minimize the amount of pump stations and flora removal needed to construct the system. For the design team's final recommendation for ideal site location, one should consider proximity to the Bijagua community while also considering cost to acquire new land.

In Costa Rica, especially in rural areas, toilet paper is not disposed of in the toilet. This is due to low water pressure, smaller pipe sizes and general goal to reduce solids entering septic tanks or treatment systems. Used toilet paper is typically collected in trash cans and is disposed of along with other solid waste. Design of wastewater collection and treatment improvements should follow Costa Rican design standards as much as possible, however most teams will use typical US standards for the basis of their design (for example, NR110, Recommended Standards for Wastewater Facilities, etc.). The collection system should be designed so that the piping size will allow for toilet paper to be flushed.

It is Costa Rican law that the property owner is responsible for their individual connection to the sewer main, however, it is necessary to plan for funding the entire connection. It is also Costa Rican law that if you have water service once a sewer main is constructed in front of a property, the property owner must pay for the service whether they chose to connect to the system or not.

PROJECT APPROACH

For this project, GWS is soliciting designs for a long-term solution to the sanitation problem in this region. In general, the solution approach should be to design a centralized treatment system with a complete collection system.

Additional Information can be found by using the following link: *https://bit.ly/3ggFSup*.

ADDITIONAL PROJECT CONSIDERATIONS

The specific areas of concern with the collection and wastewater treatment system are described as follows:

1. The treatment facility must be adequately sized for anticipated flow, future growth, and with seasonal rainfall variability considered.
2. Seasonal variability of flows due to tourism should also be considered.

Figure 4: Close-up map displaying potential treatment site.

3. Treatment facilities should be designed to be able to treat to the desired effluent limits as described in this document.
4. Due to the socioeconomic status of the community, user fees must be lower than 10,000 Colones (Costa Rican currency) per month. Assume the capital cost is covered by some outside source and the user fee will include O&M costs.
5. The location of the treatment facility must be easily attainable and needs to be in an area that is not at risk of flooding and landslides. Additionally, be aware of and protect existing drinking water sources. Treatment site locations also need to be evaluated for ease of construction and potential impacts on nearby homes and businesses. The average and maximum flows for the proposed collection system need to be determined.

DESIGN OBJECTIVES AND CONSTRAINTS

The following are the items that should be discussed or implemented as part of the design project. The design that best accomplishes these goals will have the highest likelihood of long-term success.

1. The project must take into consideration the local climate (temperature, high water table, heavy rainfall) and high variability due to tourism.
2. Avoid offensive odors and minimize impacts on landscape aesthetics.
3. All equipment must have a level of redundancy to maintain treatment if equipment fails or is under repair.
4. The solution must utilize a minimum of space and energy.
5. The project capital cost must be minimized.
6. The system must be easy to operate and maintain. There is no wastewater training available in the area or wastewater operators' associations. Local staff will have to be trained on the system operation and maintenance, but may be available only on a part-time basis, so the system should be mostly self-operational.
7. The wastewater treatment equipment must be easily replaceable with parts readily available.
8. Treatment equipment must be compatible with the existing electrical system. 120V is readily available but 240V and 480V are not.
9. Consider simplicity (less O&M the better) in design whenever possible.
10. It is recommended that the teams design for the year 2042 (20 years). Provide justification with any variances.

Consideration should be given to future plant process expansions beyond 2042 in the design and site selection.

11. Use best engineering judgment in consideration of separation requirements for potable water and sewer main. Potable water typically runs along the road right-of-way.
12. Designate the following in the report/presentation.
    a. Three proposed treatment plant sites.
    b. Designate one of those three proposed sites as the *recommended* site location.
    c. Three alternate treatment processes.
    d. Designate one of those three proposed treatment processes as the recommended treatment process.
    e. Clearly state the capital cost estimate for full construction of the WWTF and accompanying collection system.
    f. Clearly state the monthly user fees that the community should charge residents that will be a funding source for general O&M of the WWTF and collection system. CS

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Costa Rica's wastewater industry is starting to take off, with projects in final design or underway in Puerto Viejo, Jacó, Golfito, Palmares, Quepos, Limon, and Tortuguero, as well as feasibility and preliminary design studies in Puntarenas, Tamarindo, and Sardinal-El Coco. **Register your company to exhibit or to sponsor at the event to showcase your services**. Connect with local and international technology providers and solution seekers to collaborate on Costa Rica's newly established wastewater initiatives.

The proceeds from TicoSan 2023 will assist Global Water Stewardship in all our efforts to move sanitation forward in Costa Rica, this year in the town of Bijagua. 100% of the sponsorship funding will be allocated to support Global Water Stewardship educational programs. Learn more about what we do at www.globalwaterstewardship.org/ticosan.

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