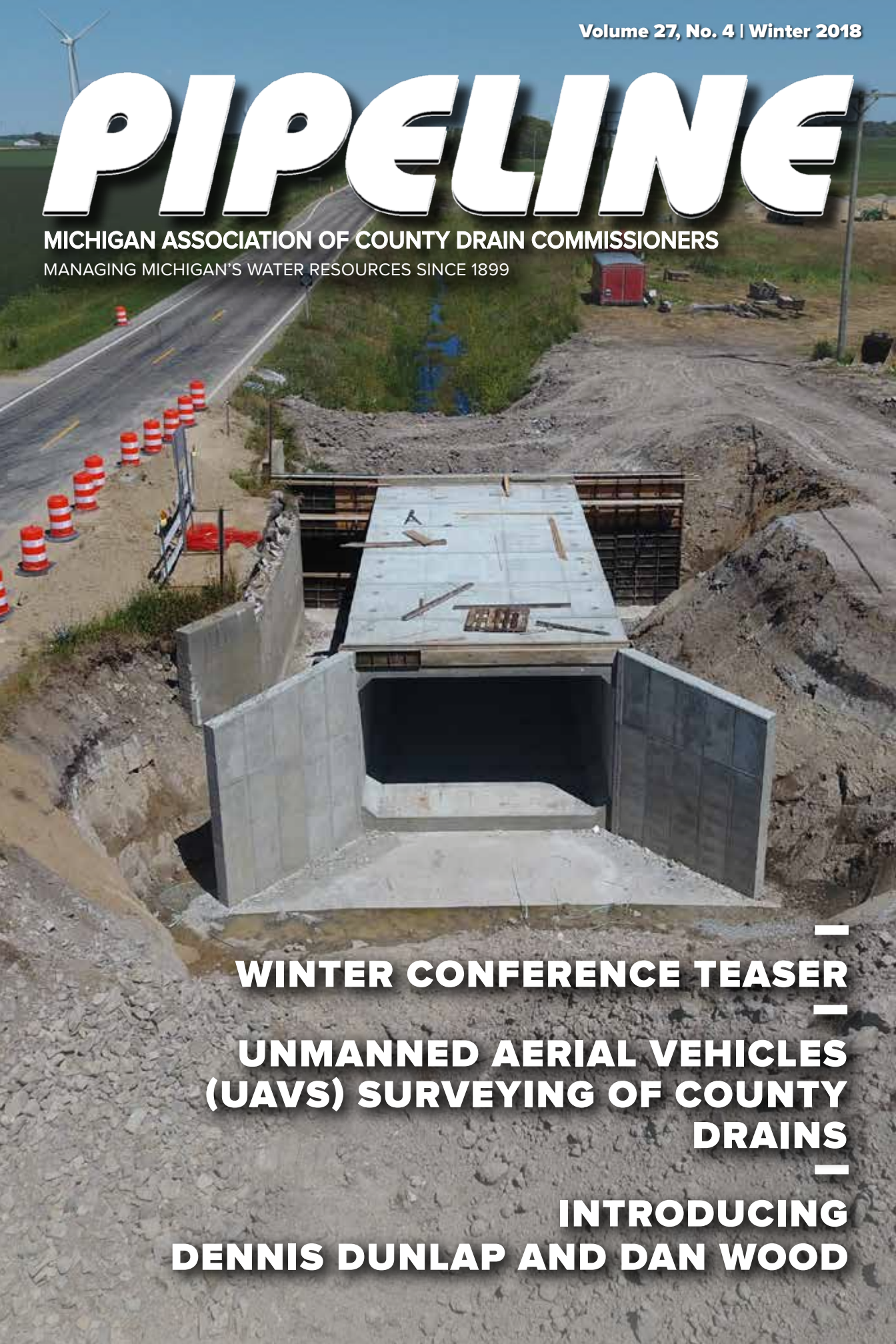


# PIPELINE

MICHIGAN ASSOCIATION OF COUNTY DRAIN COMMISSIONERS

MANAGING MICHIGAN'S WATER RESOURCES SINCE 1899



—  
**WINTER CONFERENCE TEASER**  
—

**UNMANNED AERIAL VEHICLES  
(UAVS) SURVEYING OF COUNTY  
DRAINS**  
—

**INTRODUCING  
DENNIS DUNLAP AND DAN WOOD**



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*“Thank you so much for the tour yesterday. It was very informative and interesting.”*

Rose M. Grinage  
Michigan Department of Transportation



*“The engineering support provided by Northern Concrete Pipe is exceptional.”* Claire E. Schwartz, PE, FTC&H, Inc

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# PRESIDENT'S MESSAGE

## DAVID THOMPSON

Monroe County Drain Commissioner



Hello all,

As we enter the 2018 holiday season, I am reflecting on my time in office and writing my final message as President of our great Association. We have had an extremely rewarding and challenging two years as an Association, and I have been honored to serve in this position as we collectively celebrated the highs and learned from the lows.

Over the past two years, our annual drain conferences have been hugely successful. Each event has afforded its attendees time to strengthen and improve the relationships we have within the Association, as well as those we share with local County Commissioners, Road Commissioners, and Legislators. It is my hope that these opportunities continue to recharge us so we may better serve the public.

In particular, our most recent annual summer drain conference brought us together to collaborate and promote continued education and professional

development. Our Association was tested during that time, but the way we handled the conflict reflected the Association's commitment to our goals and our commitment to moving forward together. Going forward, I believe that we will continue to show respect in our interactions with each other as the year comes to an end.

Serving as your President for the past two years has been an absolute privilege. I would like to thank my office staff and all the board members for all your help during my term. I feel that we handled the particularly challenging past two years with professionalism and grace under fire.

Thank you for allowing me to serve you and to grow with you.

All the very best,

David

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## DELIVERIES



# OF TRUCKS\* 14

- HP Storm uses less trucks
- Self unloading - no lifting required



# OF TRUCKS\* 49

- RCP uses more trucks
- Machinery required to unload

\* Based on 5,000 feet of 30" diameter pipe.

## STAGING

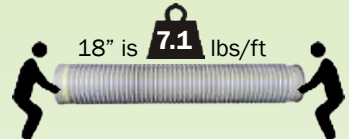


- HP Storm is able to be stacked high
- Nest smaller diameters



- RCP stacks two high

## STRINGING



- HP Storm can be moved quicker
- Handle safer



- RCP is moved two at a time
- Requires machinery

## INSTALLATION

A typical project with 5,000 ft specified on the plans will net you:

- 25 days using HP Storm (56 days with RCP)
- 250 joints using HP Storm (625 joints with RCP)



**30" HP Storm:**  
Installation Rate  
of 200 ft per day\*



**30" RCP:**  
Installation Rate  
of 88 ft per day\*

\*Data compiled from RSMeans

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# Michigan Association of County Drain Commissioners 120<sup>th</sup> Annual Winter Conference

## SCHEDULE AT A GLANCE

### Tuesday, February 12

- 1:30 - 3:30 PM **Legislative Meeting**  
*Gilmore Boardroom*
- 3:30 - 5:00 PM **Board of Directors Meeting**  
*Gilmore Boardroom*
- 12:00 - 6:00 PM **Exhibitor Set-up**  
*Kalamazoo Room*

### Wednesday, February 13

- 8:00 AM - 2:00 PM **Exhibitor Set-up**  
*Kalamazoo Room*
- 10:00 AM **Registration Opens**  
*Kalamazoo Pre-Function*
- 12:00 PM **Lunch on your own**
- 1:10 PM **Call to Order and Welcome**  
*Arcadia Ballroom*
- 1:15 - 3:00 PM **Educational Sessions**  
*Arcadia Ballroom*
- 3:00 - 3:30 PM **Break/View Exhibits**  
*Kalamazoo Room*
- 3:30 - 5:00 PM **Educational Sessions**  
*Arcadia Ballroom*
- 5:00 PM **Associate Member Meeting**  
*Arcadia Ballroom*
- 6:00 - 7:00 PM **Reception/View Exhibits**  
*Kalamazoo Room*
- 7:00 - 8:30 PM **Strolling Dinner/View Exhibits**  
*Kalamazoo Room*
- 8:30 PM **After Dinner Activities**

### Thursday, February 14

- 7:30 - 9:00 AM **Breakfast**  
*The Great Lakes 1-3*
- 8:30 AM **Exhibit Area Open**  
*Kalamazoo Room*
- 9:15 - 10:30 AM **Educational Sessions**  
*Arcadia Ballroom*
- 10:30 - 11:00 AM **Break/View Exhibits**  
*Kalamazoo Room*
- 11:00 - 12:15 PM **Educational Session**  
*Arcadia Ballroom*
- 12:15 - 2:15 PM **Lunch/2018 Awards Program**  
*Arcadia Ballroom*
- 2:15 - 3:15 PM **Educational Sessions**  
*Arcadia Ballroom*
- 3:15 - 3:45 PM **Break/View Exhibits**  
*Kalamazoo Room*
- 3:45 PM **Exhibitor Tear-down**  
*Kalamazoo Room*

- 3:45 - 4:45 PM **Educational Sessions**  
*Arcadia Ballroom*
- 6:00 - 7:00 PM **Reception**  
*Arcadia Ballroom*
- 7:00 PM **Dinner**  
*Arcadia Ballroom*
- 8:30 PM **After Dinner Activities**  
Euchre Tournament

### Friday, February 15

- 7:30 - 9:30 AM **Breakfast**  
*The Great Lakes 1-3*
- 9:30 AM **MACDC District Meetings**  
*Arcadia Ballroom*
- 10:00 AM **Business Meeting/  
Committee Reports**  
*Arcadia Ballroom*
- 11:00 AM **Adjourn**

## CONFERENCE SESSIONS

### Wednesday, February 13

#### 1:15 - 2:00 PM Drainage Law Playbooks; Two Different Teams, Same Endgame!

*Jarrod Hahn, Wells County, Indiana Surveyor*

A brief discussion of the history, similarities, and differences between Michigan and Indiana public drain laws. How these laws can be used to implement and allow innovative solutions to drainage problems.

#### 2:00 - 2:30 PM Smart Water Systems

*Branko Kerkez, University of Michigan*

The talk will describe the role of "smart" water technologies in reshaping the management of water resources. We will discuss how open source sensor technologies are being used throughout Michigan enable watersheds that autonomously control themselves in response to changing weather and land uses.

#### 2:30 - 3:00 PM USFWS and MACDC: Wetland Restoration Partnership Opportunities

*Jim Hazelman, USFWS-Partners for Fish and Wildlife (PFW) Program*

The MACDC Soil Erosion and Sedimentation Control (SESC) Authorized Public Agency (APA) Procedures Manual has been an accessible and thorough reference document since it was first drafted in 2006. With updates to MDEQ permitting requirements and the advance of new technologies and methods, a committee was formed to review and update the current manual. This session will review the process and recommendations by the Committee for revisions to the MACDC SESC APA manual.

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**3:30 - 4:15 PM Test Your Drain Code Knowledge!**

*Stacy Hissong and John Brennan, Fahey Schultz Burzych Rhodes PLC*

Get ready! This interactive presentation involves a multiple-choice quiz and allows audience members to test their knowledge of important Drain Code requirements.

**4:15 - 5:00 PM Legislative Update**

*Deena Bosworth, Michigan Association of Counties*  
MACDC lobbyist Deena Bosworth will discuss the bills that have been introduced this legislative session that affect the work of county drain offices.

**Thursday, February 14**

**9:15 - 9:45 AM The Power of the Value Methodology for Drain Projects**

*Stephen Kirk and Greg Lamkin, LSG; Christopher Quattrin, Berrien County Drain Commissioner*

During the past year, Berrien County applied Value-Based Decision Making Methods to enhance the value of Drain improvements to the end-user while reducing projected capital and life cycle costs. Value Methods apply to project scoping, selection of the preferred design concept and refining the engineering solution. Techniques to be illustrated include life cycle costing, risk analysis, choosing by advantages, and others.

**9:45 - 10:30 AM Continuing the MACDC and DEQ Relationship**

*Michigan Department of Environmental Quality Leadership*  
Hear about the new DEQ administration, upcoming priorities, and organizational news, as well as reflections on the relationship between DEQ and MACDC.

**11:00 - 11:30 AM Floating Treatment Islands**

*Tim Inman and Emily Short, Spicer Group, Inc.*  
Floating Treatment Islands offer an opportunity to add or enhance water quality treatment to wet ponds in an innovative way that not only boosts water quality but can also provide habitat for small animals and fish, biodiversity of native plants and appealing aesthetics for public spaces. We will discuss applications, different island configurations, installation practices, pollutant load estimates and planting techniques.

**11:30 AM - 12:15 PM Drain BMPS and Watershed Management Certification**

*Christine Kosmowski, MDARD; Joe Bush, Ottawa County Water Resources Commissioner; Jamie Burton, Hubbell, Roth & Clark*

Building on a previous presentation about the Drain and Water Resources Work Group (DWRW), information will be presented about the efforts the Drain Maintenance BMP Subcommittee to help fulfill two objectives of the DWRW:

- Develop Best Management Practices (BMPs) for use by drain and water resources commissioners that achieve drainage needs while protecting the resource.

- Develop a training program for drain and water resources commissioners, agency personnel, landowners and other stakeholders that will ultimately aid in the protection of the resource.

The Drain Maintenance BMP Subcommittee, comprised of MACDC members and MDEQ, MDARD, and MDNR representatives, is developing a module focused on Best Management Practices for county and intercounty drains. This module will be added to the existing online Watershed Management Certificate Program developed by the Michigan Water Environment Association (MWEA) and the Institute of Water Resources at Michigan State University (IWR-MSU).

This presentation will focus on the status of the status of the module development and content.

**2:15 - 2:45 PM RE Trivia**

*Robert Vertalka, Vertalka & Vertalka; Alexis Vlahakis Cole, Vlahakis Cole Law Firm*

Every MACDC member and associate member tackles real estate legal and valuation issues as part of their job responsibilities. Combining the necessity of real estate education with the fun of your local pub's "DJ Trivia" game, this fully interactive session will test your knowledge while engaging your competitive spirit. Leading the session and providing color commentary are two presenters who are both attorneys and licensed realtors. Get your team together to play for prizes and bragging rights!

**2:45 - 3:15 PM Right to Farm and GAAMPS: Partners in Protecting Michigan's Water Quality**

*Ben Tirrel, Michigan Department of Agricultural and Rural Development*

This session will provide overview of the Right to Farm Act and Generally Accepted Agricultural and Management Practices (GAAMPS), and how they relate to drainage water management. Understanding the guidelines for farm practices will allow participants to better understand how to work with both farmers and MDARD to promote water quality in agricultural areas.

**3:45 - 4:15 PM Get To Know Knotweed: A Destructive Alien Commandeering Your Drain**

*Hannah Hudson, KnowKnotweed.org*

Japanese knotweed is an infrastructure destroying alien plant that uses waterways- including YOUR drain- to further its world-conquering agenda. Learn how to identify this fast-growing menace, and how you can slow down its "unstoppable" advance, which in its wake will raise taxes, lower property values, and crowd out native wildlife. It has done these things in the UK and we will explore their 'Lessons Learned' to prevent it from happening here.

**4:15 - 4:45 PM Drain Commissioner Panel**

A panel of drain commissioners will spend time discussing various topics of interest or concern.

Please note: A follow up email for suggested topics will be sent out a month before the conference.

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## DENNIS DUNLAP, MASON COUNTY



Dunlap

Dennis graduated from Michigan Technological University in 1969 with a BSCE (Civil Engineering) and became a licensed engineer in 1974 and a registered surveyor in 1975. He attended West Shore Community College pursuing a business management degree.

He is the past president and CEO of Westshore Consulting, a civil engineering, land surveying, planning and environmental consulting firm located in Muskegon, Michigan, retiring in 2016 after a 45 year career.

Dennis has extensive county drain experience including lake level controls, flood control studies and designs, drain extensions, drain boundary determinations, assessments, technical reports prepared for Board of Determinations, construction plan preparation, construction management, and the design of environmental controls for sedimentation, nutrients and thermal pollution parameters.

Dennis' appointment as the Mason County Drain Commissioner took effect November 1, 2018.

## DAN WOOD, GOGEBIC COUNTY



Wood

Dan was born and raised in Wayne County, but moved to Gogebic County in 2012. Since a young age he has been interested in local politics and remembers "legendary Drain Commissioner Bob Tisch and how important the job seemed to be." Since moving to the U.P. Dan has kept informed

on the local issues. When the office for Drain Commissioner became vacant due to a resignation he decided to run as a write-in candidate. Dan was elected in a special election this November to fulfill the remainder of the term until 2020. He took office November 20, 2018.

Dan has a diverse background in Theology, Geology and Social Science, along with owning his own business. Since his election he has been studying up on the Drain Code and is reviewing areas prone to flooding in the county. One of his primary goals is to make the drain office more visible and educate residents about its importance.

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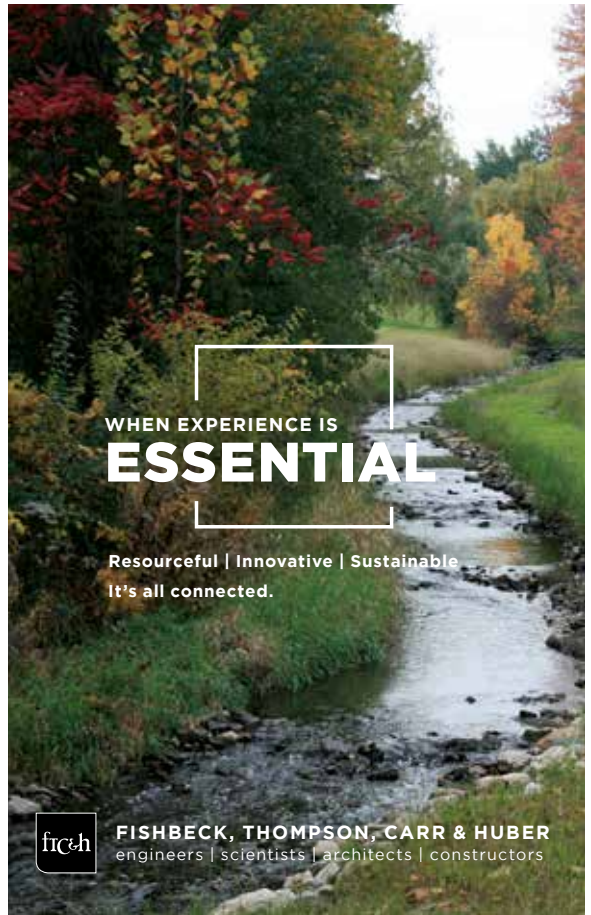


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# UNMANNED AERIAL VEHICLES (UAVS) SURVEYING OF COUNTY DRAINS

By: Michael Quaine, P.E., BMJ Engineers & Surveyors, Inc.

UAVs, commonly referred to as Drones, are remotely controlled small aircraft, that have found popularity in today's engineering and surveying markets. Drain surveying has begun to see their use as of late with varying application and utility. UAVs have been used commercially since the early 1980s. Practical applications for UAVs are expanding faster than ever in a variety of industries, due to accelerating investments and the relaxation of Federal Aviation Regulations, governing their use. Responding to swiftly evolving hardware and data processing capabilities, companies are creating new business and operating models for UAVs.

With a few exceptions, the use of UAVs for drain operations has been strictly visual by an on-board camera. The use of imaging products was valuable only if a clear line of sight could be secured and the operation of the UAV platform could be safe to deploy and return for battery changeout. In a field where the environment of interest is often highly obscured by heavy vegetation, obstructions and enclosures, remote sensing of this technology is quite limited by the challenges found in the field.

Two projects completed in differing eras which illustrate the best use of visual information gathering and the limitations of the strategy are the Hecht Drain and Weaver Drain. In 2015, the Hecht Drain was in need of light maintenance as a response to agriculture needs in southwest Tuscola County. Reconnaissance indicated that grades were preserved in the channel but sediment accumulations in culverts and in the zone where tile outlets discharged, blocked subsurface drainage. Heavy vegetation obstructions in various locations also created backwater conditions during spring runoff and flooding events.

Given the identified conditions, overall facility condition and the availability of drain records and drawings, we judged a visual inventory supplemented with contract documents would be appropriate to provide contractors to accomplish maintenance operations.



BL DENMAN Enterprises utilizes UAV overflight of drains to obtain visual inventory of vegetation conditions of county drains

A UAV overflight and video were completed by Detroit Drone. BMJ provided an overlay of inventory work items, directive notes and reference points. The video information was distributed to the contractors by a private YouTube link.

The response by the contractors was predominantly positive. Most commented on the time saving in site review to compile their bid proposal. While the presentation of the project was somewhat different from the conventional approach, contract proposals didn't vary significantly from the normal unit price averages. The contracted company was able to perform the maintenance satisfactorily and no problems were encountered in communicating the work. Ultimately, because of the relatively open nature of the facility and availability of records, the strategy was cost effective and did save the project on engineering costs.

A second project was performed on the seven-mile-long Weaver Drain in Northern Lapeer County in 2018. BMJ again partnered with Detroit Drone to inventory the facility condition and prepare a maintenance plan with contract stipulations for bidding and construction.

Sediment accumulations and deterioration of side drainage inlets had been identified as a limiting

deficiency in the facility. Once again, the corridor was not overly obscured by trees or brush.

Drain records were not comprehensive, but no alteration of grade is planned. Spot removal of sediment at intervals is needed. A UAV overflight was completed and shown in a video with geotagging. The geotagging gives an accurate indication of the UAV location while the video plays.

Again, work item inventory identification, notes, and directives were overlaid on the video. This time, the lack of accurate records necessitated the inclusion of stationed features, connecting drains, roads and utilities to be included adding detail that would ordinarily be available elsewhere. The video is to be distributed by a private YouTube link along with paper contract and bid documents.

Maintenance scoping with UAV overflight is not limited to channel operations exclusively. Brian Denman of BL Denman Enterprises is utilizing a UAV to review vegetation management scoping and effectiveness by using UAV overflight. Lapeer County Drains have been inspected for herbicide application over the interval of Brian's involvement with Joe Suma.



Croswell Drain Reach adjacent to M-90 Drone view looking west

As long as UAV use remains a visual review platform, it will be of only limited value. The measurement of the platform, dimension and profile of the drain is necessary for detailed decision-making regarding comprehensive drain maintenance and design.

Presently, there are two approaches for remote sensing and measurement of landform topography; photogrammetry and LiDAR. Photogrammetry has been a well worked technology practiced through overflight. Development of camera technologies beginning in the nineteenth century and applications for military use in the early twentieth century culminated in a reliable and widely used earth measuring technology beginning in the 1990's.

LiDAR, or light detection and ranging is a relatively newer technology developed to "scan" the world. First developments came in the 60s and 70s with the first laser remote sensing instruments. In the 1980s laser altimetry systems were created at NASA for oceanographic and landform research. The first commercial system was available in 1995. The Mars rover utilized a LiDAR altimeter function in 1996. In the past ten years LiDAR has seen development of public and private applications. Statewide and regional consortiums have been developing standards for the management and use of large volume LiDAR data beginning with the statewide coverage of North Carolina in the early 2000s.

LiDAR equipment has recently been mounted and used on UAVs which have been effective for scanning and detection of hidden surface features. Aerial LiDAR imagery is produced through light-based sensors, which bounce waves across the surface of the terrain below. Due to the way this type of imaging is completed, it can pass through

A vertical advertisement for Tetra Tech. The top left features a circular inset showing hands holding water. Below it are several other circular insets showing various water-related scenes: a dam, a water treatment facility, a river, and a person in a boat. The background is a blue sky with a body of water at the bottom. The Tetra Tech logo is at the top right, followed by the headline "Clean, Safe Water for a Complex World". Below the headline is a paragraph describing their services. At the bottom, there are contact numbers for four locations: Ann Arbor, Brighton, Detroit, and Lansing.



Environeagle photo of Stocks Creek Detention



Quanicassee Road Bridge adjacent to M-138 Project from UAV overflight of Centerline Drain

don't have RTK GPS. This means that surveyors will have to choose between affordability and accuracy.

The second factor is imprecise angular measurements. Even with state-of-the-art military LiDAR sensors, the best angular accuracy you can get is in the range of 1/100th of a degree. That sounds quite accurate, and is often sufficient for ground-based LiDAR. However, when the sensor is on an aircraft high above the site, it can result in large errors.

For instance, a manned aircraft at 3,000 ft. with an offset of 1/100th of a degree means a 16 cm sample distance on the ground. UAVs have the advantage of being able to fly lower, but the lightweight sensors that can be mounted on them are also a lot less accurate, with errors on the order of 1/10th of a degree. The issue is being researched and some progress is indicated in industry white papers from various manufacturers.

Due to these factors, aerial LiDAR often produces data with lower accuracy than ground-based LiDAR, possibly ranging from 15 cm to 35 cm. UAV-based LiDAR can often compound this problem due to having less precision equipment.

objects such as brush or bramble, creating an accurate image of terrain that may not be visible.

LiDAR is not necessarily highly accurate without a large amount of processing time. Particularly, with flight collected information. Several factors become a concern when you start to move the sensors. The first factor is imprecise positional information. In order to get accurate LiDAR measurements, you need to know the exact position of the emitting sensor and the point being measured. This is relatively simple in ground-based LiDAR, since the points are usually reasonably close and completely stationary. In aerial LiDAR, however, the emitting sensor is much farther away, and there is often some degree of motion. It can often be hard to tell exactly where you are, and this can distort your measurements significantly. Solutions to this include surveying aircraft which often comes equipped with Real-Time Kinematic (RTK) GPS systems that improve the accuracy of positioning information. While this technology is starting to be included in high-end UAVs, most commercially-available UAVs

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UAV Looking East at view over Quanicassee Road Bridge showing Centerline Drain Project Area



Weaver Drain UAV Inventory Excerpt from Lapeer County Maintenance Program

Photogrammetric imaging is based on photographic imagery. This type of imaging takes large numbers of snapshots to render a two-dimensional or three-dimensional version of the terrain. There are limitations to this system: it is unable to penetrate below even thin brush and consequently may have a skewed perception of the actual ground terrain. On the other hand, photogrammetry can preserve the color of the

terrain, which can make it easier for processors to interpret the data.

It should be noted that photogrammetric imaging depends a great deal on light and shadows to identify areas of terrain. It may fail in areas that are not lit properly. As an example, photogrammetric imagery has a very difficult time with things such as sand, because the sand will reflect an even surface even if the surface isn't even. The best time of day to collect data is mid-day, between 10 am and 2 pm when the sun is high in the sky. Note also that photogrammetry imaging is subject to the same type of distortion error from altitude and motion.

LiDAR is an expensive technology and consequently, may not be the best choice for every project. Though LiDAR is a more advanced technology, it's also a specialized tool. The primary benefit of LiDAR, is the ability to penetrate to the ground and produce clean, readable, and accurate 3D files. While UAV-based LiDAR isn't as likely to be as precise or accurate as ground-based LiDAR, practicality and economy will dictate the solution. As technology matures, that decision will continue to depend on the type of surveying



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that has to be done as well as the budget. RTK GPS UAVs are available in the \$4,000 to \$10,000 range and higher depending on the technologies.

One thing that LiDAR and photogrammetry both have in common is that they can be utilized in both manned and unmanned aircraft. General aviation mapping tends to be expensive and can also have a long lead time. UAVs tend to be faster and more effective, as they can fly closer to the ground and take higher precision scans, albeit with lighter, less precise equipment. The UAV platform now brings the landform measurement technologies down to closer levels and better economy for small sites.

Eventually, the combination of an improved LiDAR sensor and an industrial grade camera will remove the need to decide between LiDAR and photo altimetry. Photo information and point cloud then can be collected from a single flight course, making landform topography thorough and comprehensive in a fraction of the time needed for ground-based survey. The most necessary component to make this choice real is a lower cost system/software investment. For many surveying applications, photogrammetry may still be the effective choice.

Three county drains that parallel M-138 in western Tuscola County also had an UAV overflight to capture their information. These drains were originally constructed long ago under standards that allowed steep slopes very close to the highway. As the roadway was expanded and modernized for high speed travel, no mandate had emerged to coordinate design concepts between the Michigan Department of Transportation (MDOT) and the Tuscola County Drain Commissioner. As he entered office, Bob Mantey developed a goal to mitigate safety issues among the roadways and drain facilities in his county. Several successful cooperative projects between his office and the Tuscola County Road Commission inspired a meeting between MDOT, Tuscola Drain Commissioner and the Tuscola Road Commission.



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Planning began to re-align the drains adjacent to M-138 with a site meeting in 2016. The Campbell, Centerline and Westend Centerline Drains would be re-worked with improved roadway safety in mind.

Though the first reach was conventionally surveyed, the facility was designed as a three-dimensional model. Once construction was under way, confirmation of grades, drain bank slope and road edge geometry was verified utilizing photogrammetry from a UAV overflight. 2.5 miles of drain channel was inspected in half a day. 2 miles of the next phase was flown for measurement in the remaining portion of the day's work. With some ground-based survey checks, the next phase will be in design during the winter of 2018-19.



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The Stocks Creek project in St. Clair County required an accounting of the amount of material excavated for a wetland detention facility. The contractor had created a model of the site for machine control grading and had acquired pre-project site topography by UAV overflight. Confirmation of project quantities and the constructed facility was undertaken with EnvironEagle, LLC. The site was overflowed for surface data collection within 20 minutes of takeoff. The information was processed and returned to BMJ early the next week with volume calculations verifying quantities and facility geometry. Results were reported to the owner in less than 3 business days. If conducted conventionally, the collection process would have required more than a day with the processed information available within a week. The deliverables from EnvironEagle included a 3D surface model and precise shape file capable of import into the County GIS.

A third UAV survey project is under way in partnership with EnvironEagle to obtain survey grade topography of the Croswell Drain in Sanilac County. The subject reach will be a stream mitigation site for a drain enclosure proposed to improve safety along M-90 on the

south side of the City of Croswell. Deterioration of the channel, the presence of a public bike path on the north side and M-90 on the south side have prompted a cooperative effort among MDOT, the Sanilac County Drain Commissioner and the City of Croswell to make some very important improvements. The survey overflight of approximately one-half mile of the Drain was conducted recently. A surface control survey was conducted to improve accuracy. Field time was significantly shortened with the UAV overflight. Project design is under way and will continue through the winter 2018-19 season.

As with all tools and technology, the use of this tool is subject to evaluating project goals, site difficulty, budget and personnel. There are a number of reasons why UAVs can be a great addition to any drain surveying project and can increase accuracy and economy.

- They help produce accurate, high-definition maps in a fraction of the time that used to be required.
- Data of all sorts can be gathered by the UAV including photography, LiDAR and video.
- All information can be instantly uploaded to a server where it can be accessed for design or evaluation.
- As it becomes easier to reach difficult locations with UAVs, surveys will be significantly safer in certain situations.
- As automation increases, the platform can be accessed, programmed and utilized by more personnel with less uncertainty.
- Construction observation, documentation and quantification become less labor intensive and time consuming, leaving more time to communicate project information.

The problems with the use of UAVs in surveying drains are just as important.

- Over reliance on remote sensing equipment can inure personnel to the need for site awareness. Reliance on the technology to perceive all needed information is not a new phenomenon but can be magnified by the UAV autonomy and expectation that the data processor will have perfect knowledge resulting from the data collection. In the world of drains, that is a false and dangerous illusion.
- The technology is still relatively new. The expense of going “all in” may represent a very large investment in equipment that may become obsolete before a return on

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investment can be realized (one reason photogrammetry is an attractive alternative).

- The UAV, while becoming ever more sophisticated, is still outside physical control and connected by “invisible” radio wave signals and subject to a “dirty” environment. The radioband used for most wireless devices is 2.4Ghz. It gets pretty crowded on that band with WiFi, home devices and other unlicensed radio frequency devices. Great care should be taken to guard against unanticipated interference or loss of control.
- If your UAV crashes or breaks or is shut down for any other reason you should be ready to use other methods...or have a backup.

FAA Regulation Part 107 was released in June, 2016. Here’s a quick summary of the new rules:

- A pilot’s license is no longer required
- Operators must be 16 yrs or older
- You must obtain a remote pilot certificate with a small UAS rating, or be under the direct supervision of a person who holds such a certificate.
- Always avoid manned aircraft
- Never fly near airports
- All drones must operate under 400 feet; if flying over tall buildings, they may not fly higher than 400 feet above the building
- Maximum speed allowed is 100 mph (87 knots)
- Always fly via line-of-sight (no flying behind buildings or out of your clear eye site, EVER)
- If you use First Person View (FPV) technology, you must also have a separate visual observer watching your aircraft with their unaided eyes at all times
- Neither you nor your visual observer can be responsible for more than one unmanned aircraft at a time
- You may only fly during daylight hours (30 minutes before official sunrise to 30 minutes after official sunset); if flying in twilight, you must have easily visible anti-collision lighting
- You cannot fly a small UAS over anyone who is not:
  - o Directly participating in the operation, or
  - o Under a covered structure, or
  - o Inside a covered stationary vehicle.
- You can carry payloads for hire, as long as the combined weight of the drone + payload is

less than 55 lbs

- No operation from a moving vehicle is allowed, unless you are flying over a sparsely populated area.
- You can apply for a waiver of the restrictions above, but you will have to prove to the FAA that your operation is safe without them
- If you forget to register your drone, you face a civil fine of up to \$27,500 and possibly criminal penalties of up to \$250,000 and imprisonment for three years.

For more details on Part 107, visit the FAA website.



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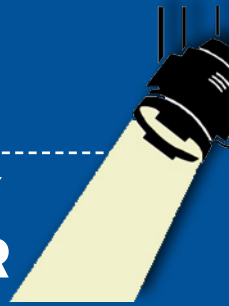
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# STAFF SPOTLIGHT

## EVAN PRATT, WASHTENAW COUNTY WATER RESOURCES COMMISSIONER AND DIRECTOR OF PUBLIC WORKS



Pratt

Following the Michigan Association County Drain Commissioner's (MACDC) nomination to the Michigan Infrastructure Council, Evan Pratt, Washtenaw County Water Resources Commissioner and Director of Public Works has been named to the Water Asset Management Council as a voting member. Under PA 324, which went into effect on July 2, 2018, the Water Asset Management Council will advise the Michigan Infrastructure Council on a statewide water asset management strategy and the process and tools needed to implement a strategy for all "asset owners," defined in PA 324 as one who owns or operates an asset that serves 1,000 or more individuals and is required to have an asset management plan under a national pollutant discharge elimination system permit or the Safe Drinking Water Act.

Evan, a 1987 graduate of MIT's Civil and Environmental Engineering program, was recently appointed by Gov. Rick Snyder to the state's new Environmental Permit Review Commission as well. When needed, the MDEQ director may call a panel of three commission members to form an Environmental Permit Panel to review and advise on permit applications. "It is an honor to serve the public and MACDC through state policy recommendations that can help taxpayers and ratepayers get the most for their money in the long run," said Evan. "It's taken us 70 or more years to get where we are today with neglected infrastructure, so I expect it to take time and many small steps to right the ship."



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# 7 QUESTIONS TO ASK YOUR GEOPOLYMER SUPPLIER

By: Joe Royer, PhD, Development Manager for Milliken Infrastructure Solutions

A geopolymer can provide enhanced physical performance to traditional cementitious binders but with the added advantages of significantly reduced greenhouse emissions, increased fire resistance and superior chemical resistance. Geopolymers rapidly create a new structural pipe inside of the old pipe, with little to no public disruption. Common applications for a geopolymer mortar would be the repair or rehabilitation of concrete or brick sanitary and storm sewers, manholes and culverts.

The first commercially available geopolymer mortar for sewer and storm water rehabilitation was introduced in 2011. Since then, “geopolymer” has become a bit of a buzzword in the trenchless industry, and several companies have introduced so-called “geopolymer” products. Some of these companies have just rebranded the products they were selling as portland cement mortars once the key aspects of geopolymer chemistry (i.e. chemical resistance, no cold-joints and enhanced structural properties) became widely recognized as advantages in the trenchless industry. Be sure the product you are buying has a history in the marketplace.



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When you are deciding on what geopolymer to use for your next project, before you make any final decisions or specifications, ask your supplier the following seven questions to ensure you are getting the qualified, quality product you are expecting.

## 1. HOW DO YOU KNOW YOU ARE REALLY GETTING A GEOPOLYMER AND NOT JUST A FORMULATED PORTLAND CEMENT?

This is a key question because there is misinformation within the industry about what qualifies as a geopolymer. In strict terms, a geopolymer is a network of mineral-based elements linked with covalent bonds, but that explanation is a hard definition to quantify. Typically, in the trenchless market, geopolymers are aluminosilicates, which have a high percentage of Si-O-Al-O bonds. While there are several detailed techniques that can be used to quantify the chemical composition of a mortar, none are perfect at assuring that the mortar is a geopolymer. The best option currently available is X-ray fluorescence (XRF). XRF can be measured using ASTM C114 and helps determine the actual composition of the material. A geopolymer material formulation should contain at least 70 percent of raw materials that can react in the correct way (also called pozzolanic material); these raw materials include SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub> and MgO. If someone asks for a specification of an exact ratio or percentage of chemistry or more exotic testing, he or she is trying to get you to sole source the product without knowing it. This XRF test ensures that one of the main components of portland cements—CaO—which can come from other sources as well, is below 30 percent. This value minimizes the chance that the product is a portland cement mortar with some pozzolanic filler material thrown in claiming to be a geopolymer.

## 2. HOW MANY PROJECTS HAVE BEEN COMPLETED WITH YOUR GEOPOLYMER MATERIAL?

It is always important that any product you buy has a reliable history in the marketplace. You should ask how many projects your contractor has been involved with using the geopolymer.

A reliable provider should have more than 100 projects completed within the past 5-10 years.

### **3. HOW MUCH PIPE HAS BEEN REPAIRED WITH YOUR GEOPOLYMER MATERIAL?**

Since 2011, it is estimated that more than 100,000 linear ft of large diameter pipe has been structurally repaired with geopolymer mortars, including pipes as small as 24" to greater than 17' in diameter. Material suppliers with genuine geopolymer experience should be able to provide project lists for significant amounts of this work.

### **4. HAS YOUR GEOPOLYMER BEEN TESTED IN PIPE FORM?**

Testing and data are critical to ensuring the product you buy is truly suited for your trenchless application. Currently, only one geopolymer mortar has been fully tested and validated for structural performance in pipe configurations by third-party labs. Two of the most respected civil engineering labs in North America have done extensive tests on pipes repaired with a geopolymer mortar. Both the Trenchless Technology Center (TTC) at Louisiana Tech University, as well as Dr. Ian Moore's laboratory at Queens University in London, Ontario, have characterized the structural performance of actual pipes rehabilitated with a geopolymer mortar, and full reports of the testing are available to customers interested in understanding the structural performance.

### **5. HAS YOUR GEOPOLYMER DESIGN MODEL BEEN VERIFIED BY PIPE TESTING?**

Because only one geopolymer mortar has been third-party tested in both standard physical properties as well as full pipe testing, it is critical to investigate the design method used in determining the liner thickness is appropriate. Using design methods for flexible pipes does not accurately predict the behavior of geopolymer mortars. The material supplier should be able to provide you data on how his or her materials perform in a full pipe and align it with the design method. This data can help assure the engineers and asset owners that the design thickness calculated using this validated methodology will stand up to



Geopolymers can be centrifugally cast to create a new structural pipe inside of the old pipe.

rigorous engineering standards.

### **6. WHAT IS THE FLEX STRENGTH OF YOUR GEOPOLYMER PRODUCT AND WHY IS IT IMPORTANT?**

The rigorous third-party testing conducted in pipe form confirms that the failure mode of cementitious and geopolymer mortars will be longitudinal cracking in the crown of the pipe under excess load. This failure is different from flexible pipes, which can fail by buckling. This longitudinal crack will form when the tensile forces on the interior surface of the pipe exceed the tensile strength of the material, but because this load is applied perpendicular to the tensile face, the critical physical property of the material failure mode is flexural strength or flexural modulus. This result means that for any given load configuration, geopolymers with a higher flexural strength will have the minimum required structural thickness.

### **7. WHAT TEST METHOD IS USED TO DETERMINE THE FLEXURAL MODULUS OF YOUR GEOPOLYMER?**

Not all test methods are created equal. In fact, just because a company says it measures a certain physical property, it does not ensure that the company provides the proper conservative engineering value. For flexural strength, there are several methods that suppliers are using to report their values: ASTM C293, ASTM C348 and ASTM C78. Which one is right? Which one

is conservative? ASTM C293 and ASTM C348 both use center point loading, which loads the beam from a single central point across a known span, while ASTM C78 loads a beam at two equidistant points across the span, or in what is called “third-point loading.” Third-point loading is more conservative and produces a lower value when the same material is tested, thus ASTM C78 will give you a more conservative value versus ASTM C293 and C348 respectively.

Therefore, all values of flexural strength do not conservatively predict the material behavior in actual loading conditions. The full-scale pipe testing confirms that the third-point loading method as outlined in ASTM C78 is an appropriate measurement for predicting pipe performance. Using less conservative test methods in the same model will under-predict the required design thickness and should not be considered conservative engineering.

The necessity of chemical resistance, no cold-joints and enhanced structural properties as key aspects in the trenchless industry combined with the rise in popularity from multiple introductions of geopolymer products in the trenchless industry, increases the requirement of adequate data. Any legitimate geopolymer mortar supplier should be able to confidently answer every question with data, research and testing to back up his or her claims. Only then should you consider your supplied for future projects that call for geopolymer mortars.




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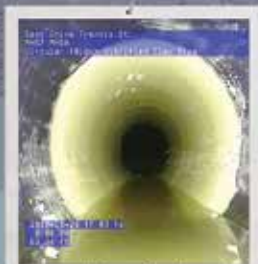
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## OHM ADVISORS V.P. DAN FREDENDALL APPOINTED TO INAUGURAL MICHIGAN INFRASTRUCTURE COUNCIL



Fredendall

OHM Advisors is pleased to announce the appointment of Vice President Dan Fredendall, PE, to the newly-formed Michigan Infrastructure Council.

This summer, the state of Michigan took action to address aging infrastructure and lack of funding when Governor Rick

Snyder signed legislation creating the Michigan Infrastructure Council—the first of its kind in the nation. Fredendall brings over 40 years of hands-on engineering experience and broad leadership of state infrastructure projects to the council.

Formed within the Michigan Department of Treasury and consisting of nine appointed voting members, the council is intended as an expert think-tank and action planning body, tasked with developing a long-term investment and management strategy for Michigan's infrastructure assets.

The council includes local utility and infrastructure owners, regional representatives, finance and policy experts, and state department leaders—all experts in their field with deep working knowledge of Michigan's infrastructure challenges.

In the case of Fredendall, Vice President at architecture, engineering and planning firm OHM Advisors, the council will benefit from his vast experience of bettering the state's infrastructure in his daily job, along with his knowledge gained working through problems and potential solutions as a stormwater subject matter expert for the Michigan Infrastructure Asset Management Pilot.

Fredendall has been extensively active at the local, state and national levels of several professional and educational organizations, including holding leadership positions with the American Council of Engineering Companies (ACEC) and the American Society of Civil Engineering (ASCE).

During his tenure with OHM Advisors, he has served in several leadership roles and as the Principal in Charge for many utility, transportation, construction management and infrastructure projects across the public and private sectors, employing innovative and long-term asset management solutions that deliver increased value.

Fredendall is eager to engage his fellow council members in thoughtful discussions. "This is an

opportunity to share an engineering perspective with the council," he said. "Engineers bring to the table creative visioning skills and the ability to develop solutions from broad, diverse and complex factors. I look forward to seeing how we, as a community-focused council, can develop a long term strategy to effectively address the state's infrastructure needs."

Dan is a civil engineering graduate of Michigan State University and has spent the past 35 years of his career with OHM Advisors at its Livonia, MI headquarters, and raising three children with wife Martha as an active Livonia community resident.

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## F&V CONTINUES TO GROW, ADDS 10 MORE STAFF

Fleis & VandenBrink (F&V) has added 10 more staff including four at its Grand Rapids headquarters.

New additions in Grand Rapids include Steve Czadzeck, landscape architect, Lori Hansen, administrative assistant, Susan Miller, human resources assistant, and Kyle Suttons, engineer-in-training.

Keith Moore, construction technician, Troy Molby, project engineer and Eric Wilde, engineer-in-training have been added to the Traverse City staff while Gerrad Godley joins the Grand Blanc office as a project manager. Molby and Godley are professional engineers with a combined 42 years of experience.

Two new environmental technicians – Stephen Pratt in the Kalamazoo office and Eric Londo in the Farmington Hills office – will assist the Environmental Group in environmental sampling, investigation and remediation projects.

“We’re excited about our continued growth and new staff that bring a good mix of experience and youth to our company,” said Paul R. Galdes, Principal and F&V’s president. “What’s even more exciting is that we continue to attract great talent in a very tight talent market. And that says a lot about our firm.”



Czadzeck

and infrastructure development.

Hansen, who has extensive construction background as an admin for an electrical contractor, is an admin in both the Design-Build and Development & Enhancement groups. F&V will also benefit from her recreation planning and grant procurement experience as a commissioner on a township parks and rec board.



Hansen

Miller has two decades of experience in human resources and administrative support in the insurance and employment industries. The Davenport University grad will assist the HR department in screening applicants, scheduling interviews and making travel plans and coordinating career fairs.



Miller



Sutton

Sutton, a recent Calvin College engineering grad, joins F&V after a co-op experience at a healthcare company, working in the facilities management department. He’ll assist on Stormwater Asset Management (SAW) projects with InfoMaster analysis and report writing and water modeling analysis to support water reliability studies.

Molby has over 20 years of experience managing environmental, civil and petroleum engineering projects. The Michigan Technological University grad will be providing leadership on various engineering projects in northern Michigan.



Molby



Wilde

Wilde has experience working on road and infrastructure projects as a design engineer and resident construction engineer. The Southern Illinois University grad will be assisting with design and construction oversight of infrastructure projects.

Moore has 20 years of experience in construction engineering, inspection and testing experience. He’ll assist the Traverse City office as a resident project representative.



Moore

## F&V CONTINUED

Godley, a Michigan Tech grad, is a former consultant with the Michigan Department of Transportation. He'll be responsible for managing and designing municipal public works projects and road/street improvements projects.



Godley



Pratt, a former health department sanitarian, has a geology degree from Grand Valley State University. He will provide support on a variety of remedial and hydrogeological projects.

Pratt

Londo, who recently received his bachelor's degree from Oakland University in Environmental Science, will provide support on a variety of environmental projects, with an emphasis on projects involving demolition.



Londo

## MDARD WELCOMES JESSICA TRIPP TO INTERCOUNTY DRAIN STAFF

The Michigan Department of Agriculture and Rural Development is pleased to announce the appointment of Jessica Tripp as the new secretary to the Intercounty Drain Program. Jessica has extensive administrative support experience in State government previously with the Jackson Department of Corrections, the Detroit office of Disability Determination Services and the Jackson Department of Health and Human Services. Jessica will be taking over the responsibilities of Peggy Snyder who is stepping up to manage the extensive project to digitize the files and maps for over 1,000 intercounty drains and to coordinate the GIS mapping by an outside vendor.



Tripp

Jessica can be reached at the same phone number that was previously Peggy's which is 517-284-5624. Her email address is [trippj8@michigan.gov](mailto:trippj8@michigan.gov). Peggy's email will remain the same at [snyderps@michigan.gov](mailto:snyderps@michigan.gov). Please welcome Jessica to our team and extend the same courtesies and assistance you've given all of us on the intercounty drain staff.

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# CALENDAR OF EVENTS

## FEBRUARY 13 – 15, 2019

MACDC Annual Winter Conference  
Radisson Plaza Hotel, Kalamazoo

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## MARCH 25 – 27, 2019

MAC Legislative Conference  
Lansing Center/Radisson, Lansing

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## APRIL 1 – 4, 2019

MTA Conference & Expo  
Amway Grand Plaza/DeVos Place, Grand Rapids

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## JULY 17 – 19, 2019

MACDC Annual Summer Conference  
Shanty Creek Resort, Bellaire

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Check our website [www.macdc.us](http://www.macdc.us) for a complete list of events. To place your event on this calendar, contact us at 517.484.9761 or [admin@macdc.us](mailto:admin@macdc.us).



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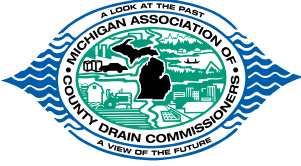


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