LNBA 2026 — Technical Session

trinnex®
a CDM Smith company

Wastewater Operators Training Workshop

The Operator's New Co-Pilot: Demystifying AI in Wastewater Operations

LNBA 2026 Wastewater Operators Training Workshop

Raleigh, NC — July 28

Kinston, NC — July 30

Mark Zito, VP of Product & AI | Travis Wagner, SVP of Digital Consulting

July 2026

From Hype to Help

AI has real potential in the water industry. The hard part is telling it apart from the noise.

Math, Not Magic

Most of these models run on statistics that are decades old. What changed is that we now have enough data, and cheap enough computing, to make them pay. You can open one up and see its reasoning.

Save Time and/or Save Money

On critical infrastructure this should never be a science experiment. If a tool does not save you time or money, it has no business at your plant.

Human in the Loop

This adds to what an operator already knows. We do not recommend handing process control to software. Think of it as a second screen you can ignore.

From Reactive to Predictive

The point is to move your day from fighting fires to seeing them coming, hours or days before an alarm sounds.

Stage 1

Reactive

SCADA alarms after a threshold is already breached — high level, high temp, low DO. You are already in firefighting mode.

Stage 2

Proactive

Preventive maintenance on a calendar. Better, but a schedule cannot read a sensor, so it still misses the failure that was building.

Stage 3

Predictive

The software picks up small shifts in sensor patterns days or weeks ahead of a failure or an exceedance, while SCADA is still quiet.

Stripping Away the Tech Jargon

In a wastewater plant this is not a thinking machine. It is pattern recognition software wired to the sensors you already own.

What AI Actually Is

Pattern Recognition, Running on Statistics

Identifies patterns in your existing data by looking at everything all at once.

Machine Learning in Plain Language

The Software Studies Your Plant's History

It learns from your history what normal looks like and can spot abnormalities days or even weeks ahead of time.

How It Works — End to End

Existing Plant Sensors

DO · ORP · TSS · Flow · pH · Temp

→

AI Pattern Recognition

Reads every variable together, around the clock

→

Operator Dashboard

Recommendations in plain language you can act on

You do not need new sensors to start, and you do not need a data scientist to read the output.

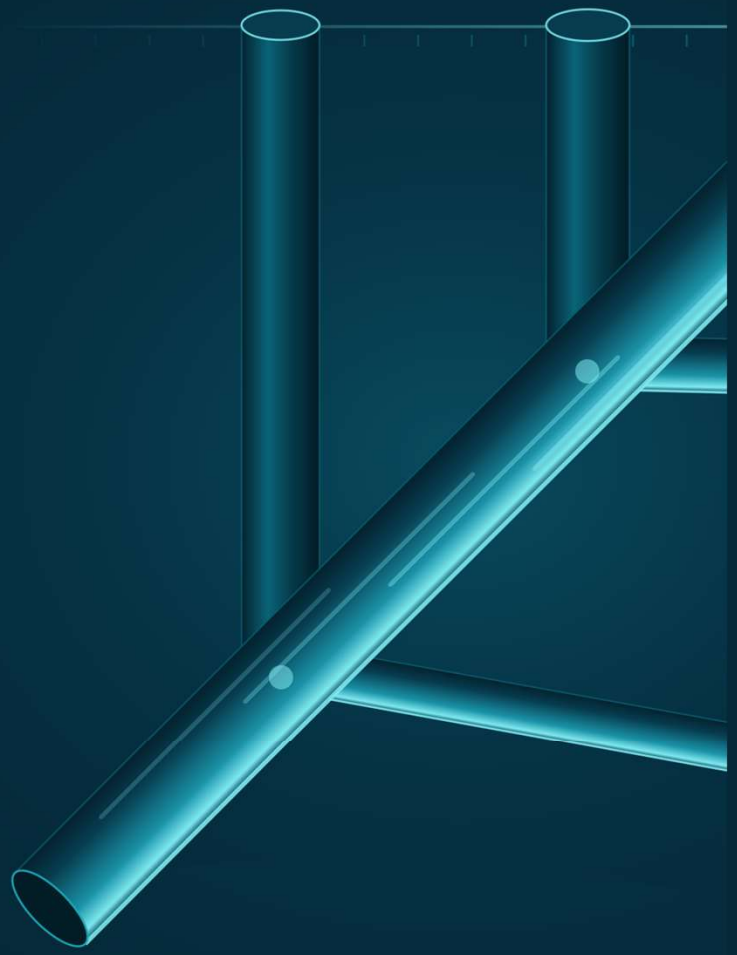
AI Across the Water Cycle

Water Source	Water Treatment	Pumping & Storage	Distribution	Use	Wastewater Collection	Wastewater Treatment	Treated Wastewater to the Environment
Prediction of Source Water Quality	Optimized Treatment Processes & Chemical Use	Optimized Water Quality & Energy	NRW, Risk & CIP Optimization	Consumption Prediction & Meter Condition	Blockage Reduction, O&M Optimization	Optimized Treatment Processes & Energy Use	Water Quality Optimization

SECTION 2

Collection System

For a group whose whole reason for existing is what reaches the Neuse, this is where the biggest wins are.



COLLECTION SYSTEMS

Blockages Announce Themselves Quietly

A grease or root blockage rarely fails all at once. It chokes down over weeks, and that slow change shows up in level and flow data before anyone gets a call.

1 What it watches

- Level monitors upstream of known trouble spots
- Pump station run times and wet well cycling
- Work order history, segment by segment
- Rainfall, and how long since the last of it
- The FOG bad actors

2 What it looks for

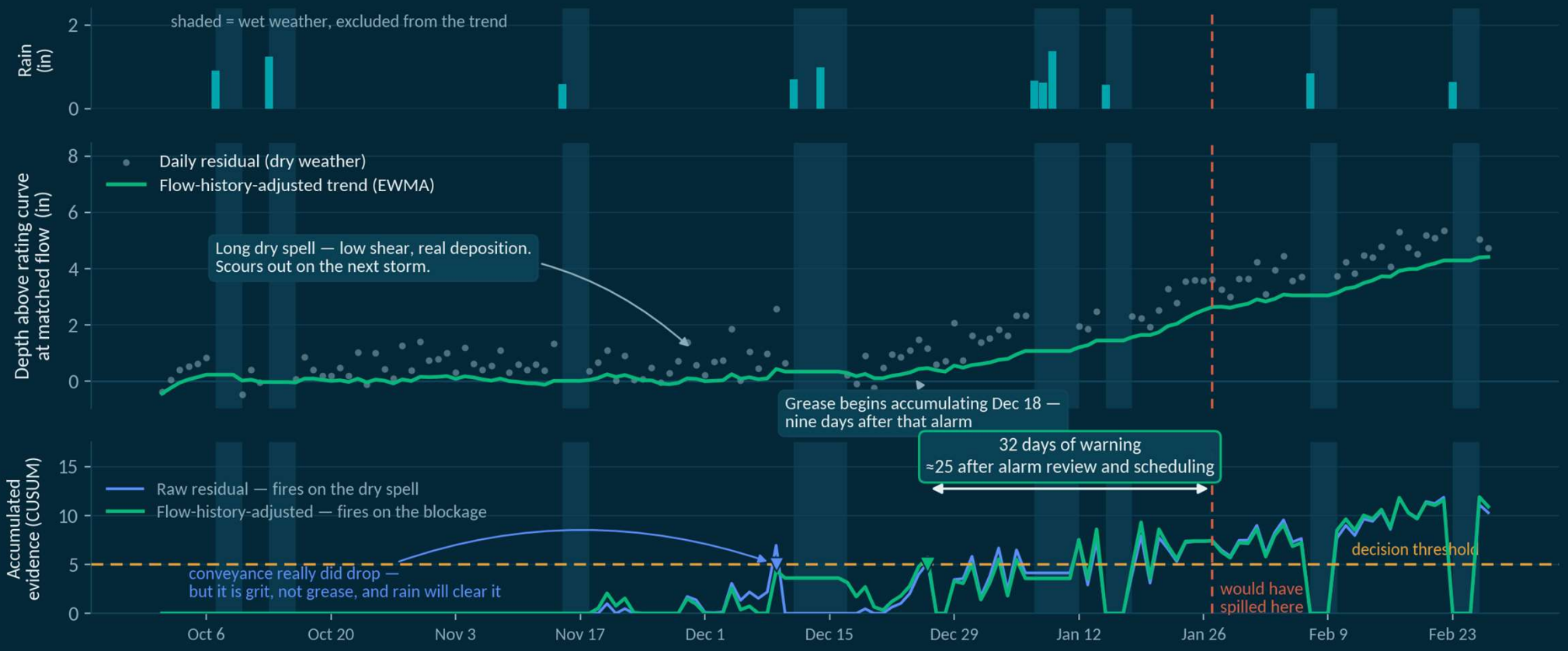
- Dry weather level creeping up week over week
- The same flow taking longer to drain down
- Segments that have blocked before, because they block again
- A trend across many readings rather than one bad one
- A rise that clears after rain, not grease

3 What you get

- A ranked cleaning list instead of a fixed route
- Potentially weeks of warning on grease
- Crew time spent on the small share of pipe that needs it
- A record of why you cleaned where you cleaned

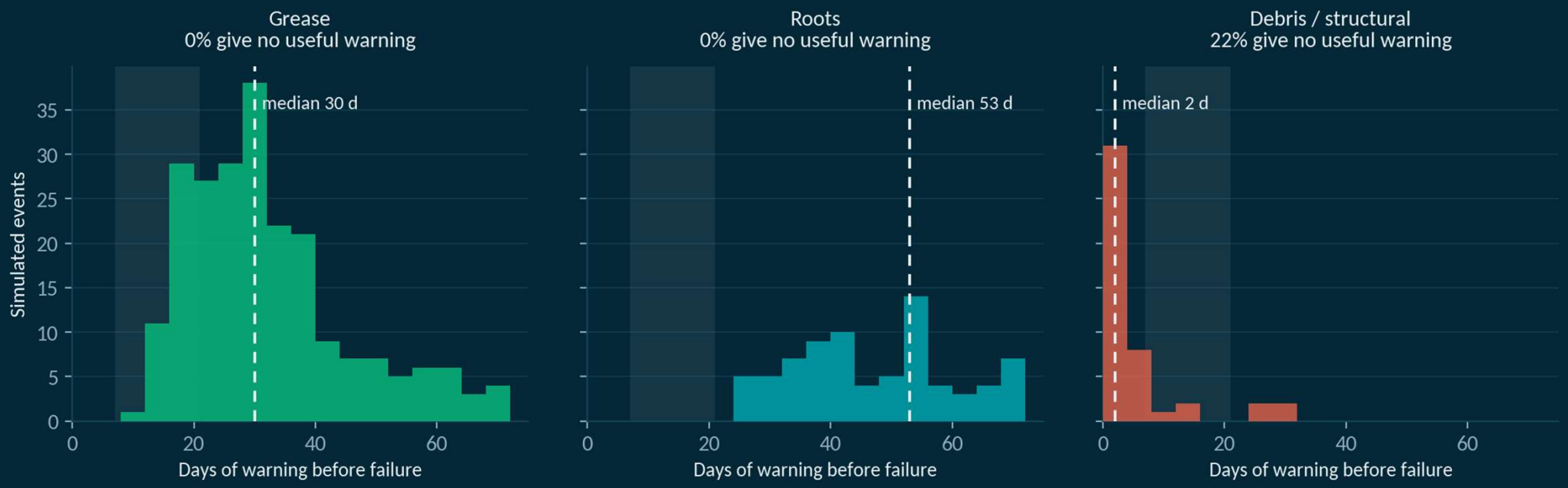
COLLECTION SYSTEMS · WORKED EXAMPLE (MODELED)

The Pipe Was Telling Us for Three Weeks



COLLECTION SYSTEMS · WORKED EXAMPLE (MODELED)

Warning Time Depends on What Is Blocking the Pipe



COLLECTION SYSTEMS

Wet Weather: Which Basins are Problematic?

Where is the I&I and how much flow is coming before the rain comes?

A Finding the I&I, basin by basin

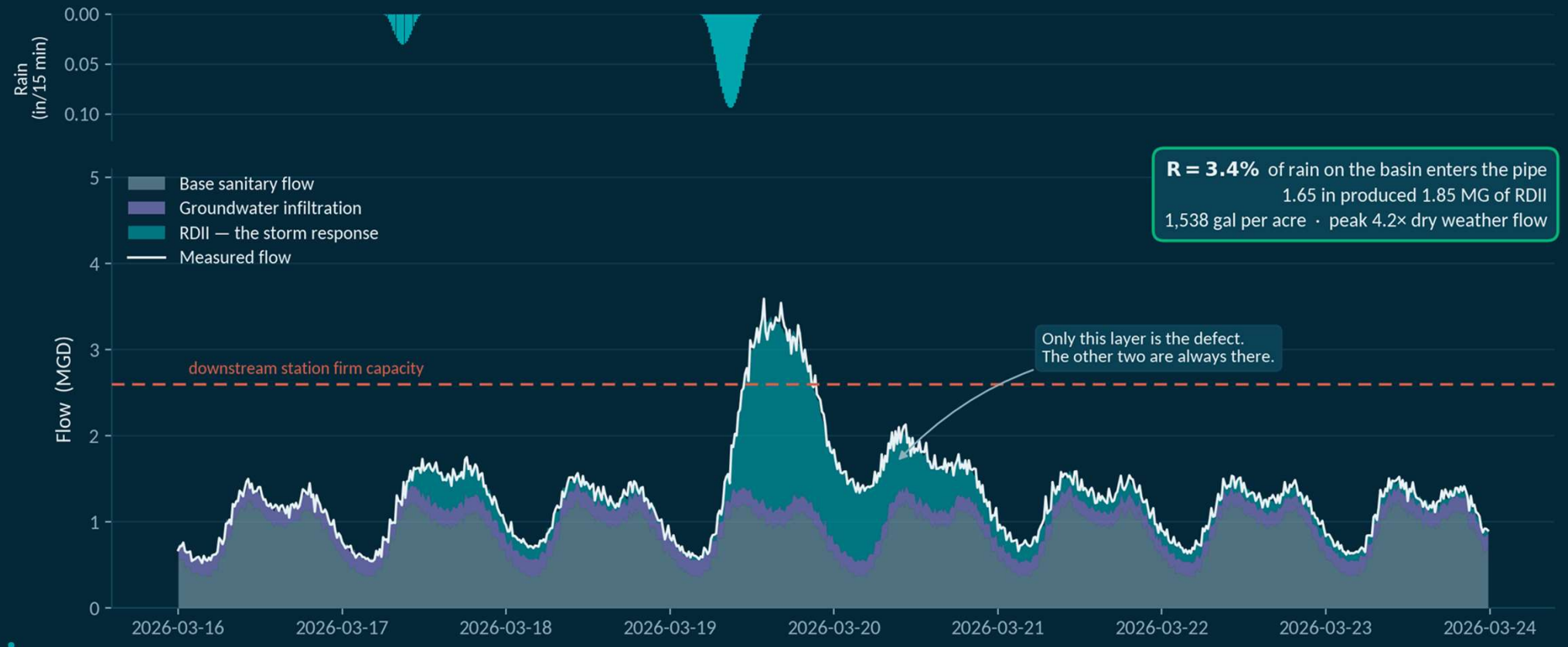
- Compares rainfall against measured flow in each sub-basin, storm after storm
- Builds a rainfall response fingerprint: how much extra flow per inch of rain
- Ranks basins by how badly they leak, so rehab money follows the water
- Re-scores after the next storm, so you can show a rehab project worked

B Forecasting the surge

- Pulls a 72-hour weather forecast
- Predicts flow at your key lift stations hours ahead of the peak
- Buys you time to draw down storage and stage crews

COLLECTION SYSTEMS

Measured Flow is Three Things



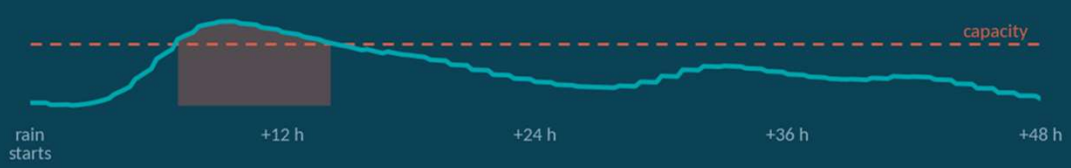
COLLECTION SYSTEMS

Storm Response Card

The rainfall-to-flow analysis, written for the person on shift at 3 AM.

A The clock

for about 1.5 in over 8 hours, normal antecedent



0–2 h — Rain starts, flow barely moves

Check what fell in the last 72 hours. That picks your column on the card to the right — not the forecast alone.

2–7 h — Your head start

Draw storage down now, stage the crew and portable pumps, and tell the plant what is heading its way.

7–14 h — Over capacity

Peak lands about 10 hours after the rain starts. Bypass at the surcharge points you already know about.

14–77 h — Still elevated for two to three days

Do not stand down early. A second storm landing now moves you a whole column to the right.

B The lookup

peak flow at the station (MGD), and hours over capacity

Forecast rain	Dry nothing in 72 h	Normal under ½ in	Wet over ½ in
0.5 in	2.0 under capacity	2.0 under capacity	2.4 under capacity
1.0 in	2.5 under capacity	2.7 2 h over	3.4 8 h over
1.5 in	3.1 6 h over	3.3 8 h over	4.4 13 h over
2.0 in	3.6 9 h over	4.0 11 h over	5.3 15 h over
2.5 in	4.2 12 h over	4.6 13 h over	6.3 19 h over

Peak assumes the storm lands on the morning sanitary peak — the worst timing, and not one you get to pick.

COLLECTION SYSTEMS

Lift Stations Energy: An Easy Place to Start

A pump tells you it is dying well before it dies. Most of that story is already in your SCADA historian, unread.

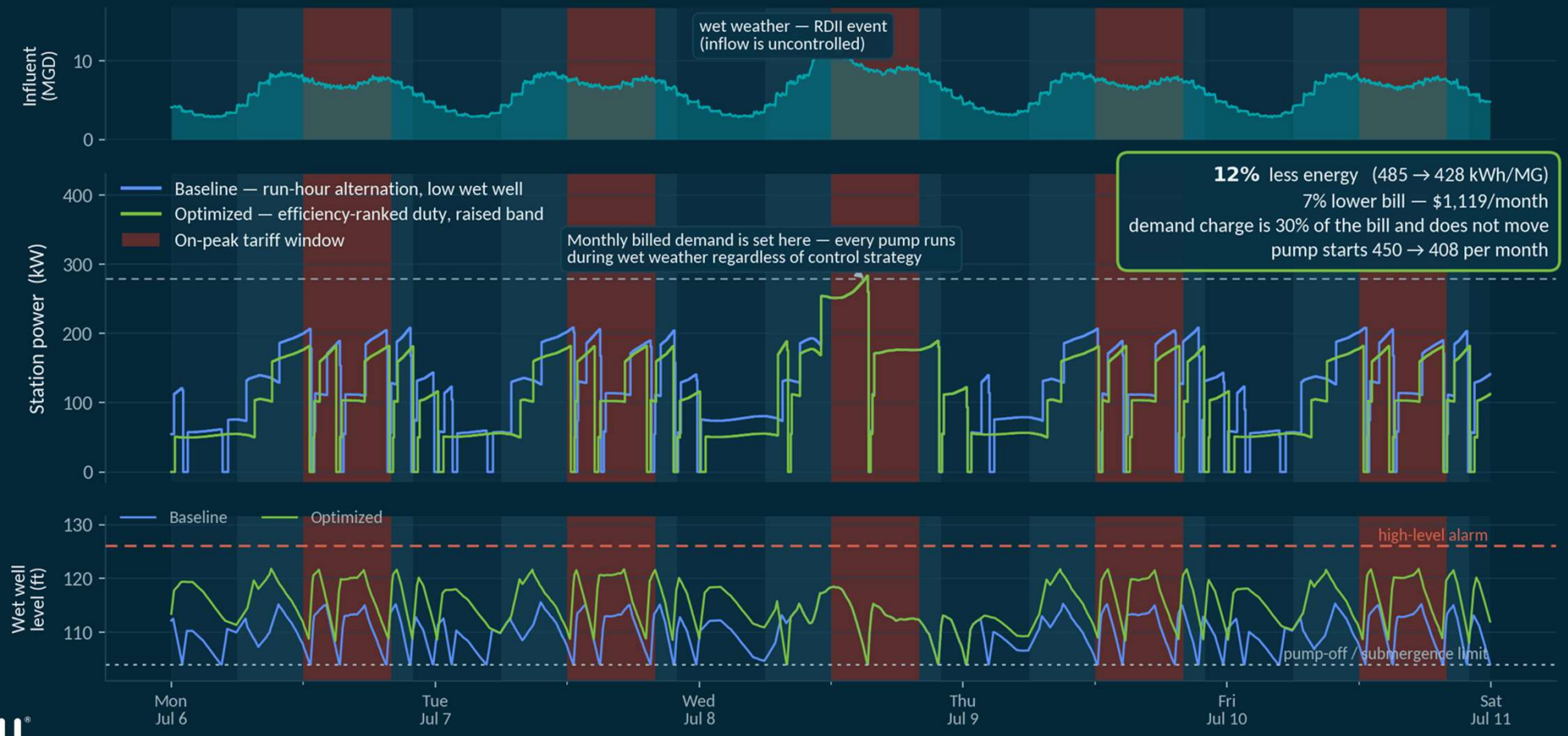
1. **Run time creeping up**
   Same inflow, longer runs. Impeller wear, a partly clogged discharge, or a check valve going bad.
2. **Amp draw drifting**
   The motor working harder for the same duty. One of the earliest reliable signs of trouble.
3. **Cycle counts climbing**
   More starts per hour than the station's own history. Often a float, sometimes I&I.
4. **Lead and lag imbalance**
   One pump carrying the station because the other is not pulling its weight. Easy to miss on a daily round.

Why start here

- The data already exists, so there is nothing to buy
- The failure modes are straight forward and they repeat
- One avoided emergency callout is easy to put a dollar on
- If the model is wrong, you inspect a pump that turned out fine
- A win here buys credibility

COLLECTION SYSTEMS

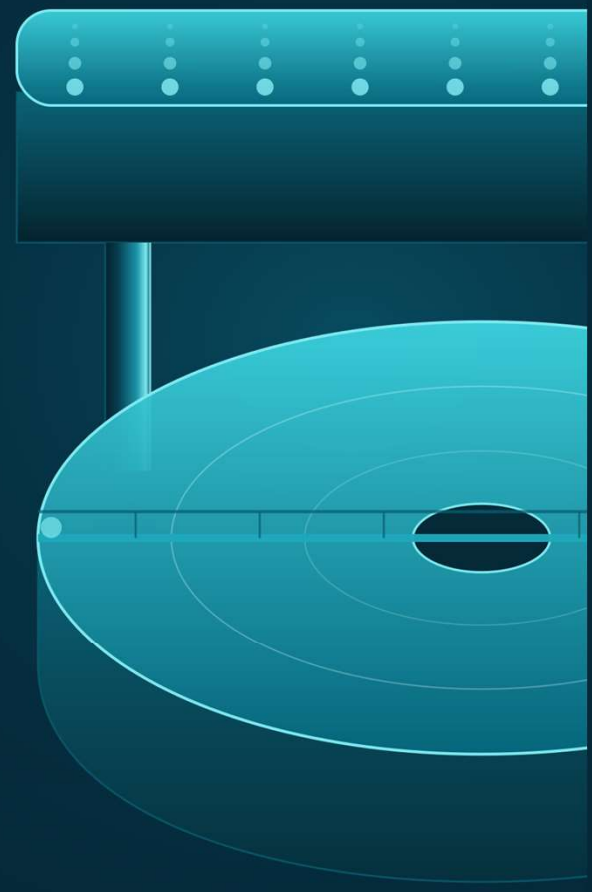
What Optimizing One Lift Station Actually Delivers



SECTION 3

Inside the Fence

Aeration, chemical feed, and knowing what the storm is going to do to you before it gets here.



TREATMENT PLANT

Dynamic Aeration Control

Match blower output to actual needs instead a flat setpoint. Compliance holds and your largest power draw comes down.

1 How it works

The model reads incoming flow, the weather forecast, and current DO and ORP trends, then trims blower speed minute by minute.

2 The night shift

At 2 a.m. when loading drops off, a static setpoint keeps the blowers wide open. Dynamic control backs them down on its own.

3 Compliance holds

Nitrification is maintained while aeration energy falls. The savings are excess air, not less treatment.

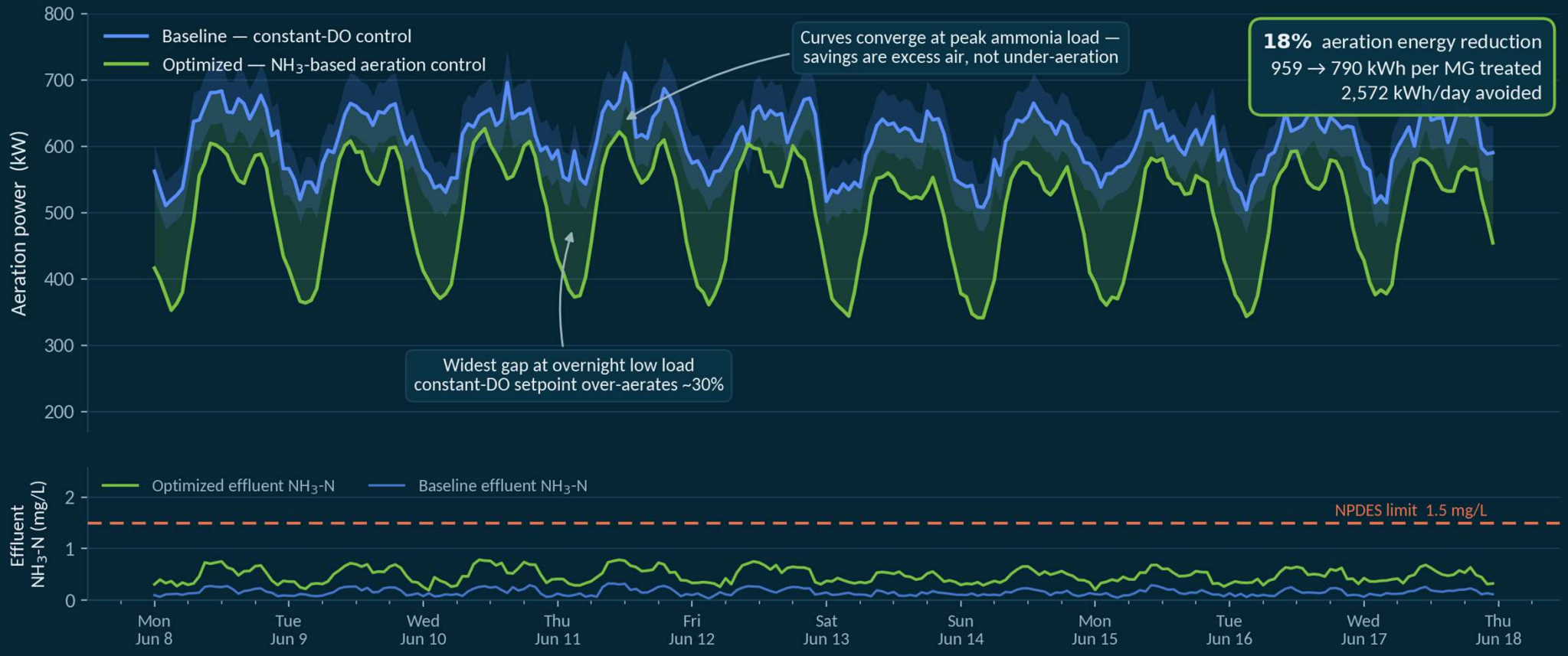
4 What you actually get

Fewer manual adjustments per shift, and a smaller power bill you can measure on the invoice.

Nothing changes a setpoint on its own. The recommendation is advisory.

TREATMENT PLANT

Ammonia-Based Aeration Control Over Ten Days



TREATMENT PLANT

Smart Chemical Dosing

Instead of a flat dosing table, a dose sized for influent — alum, polymer and carbon.

1 Alum — Phosphorus Removal

Dose follows actual influent TP loading rather than a calendar average.

2 Polymer — Solids Capture

Tracks clarifier blanket depth, SVI trends and RAS rates to cut carry-over.

3 Carbon Source — Total Nitrogen

Works out the dose that meets TN without overfeeding and spiking effluent BOD.

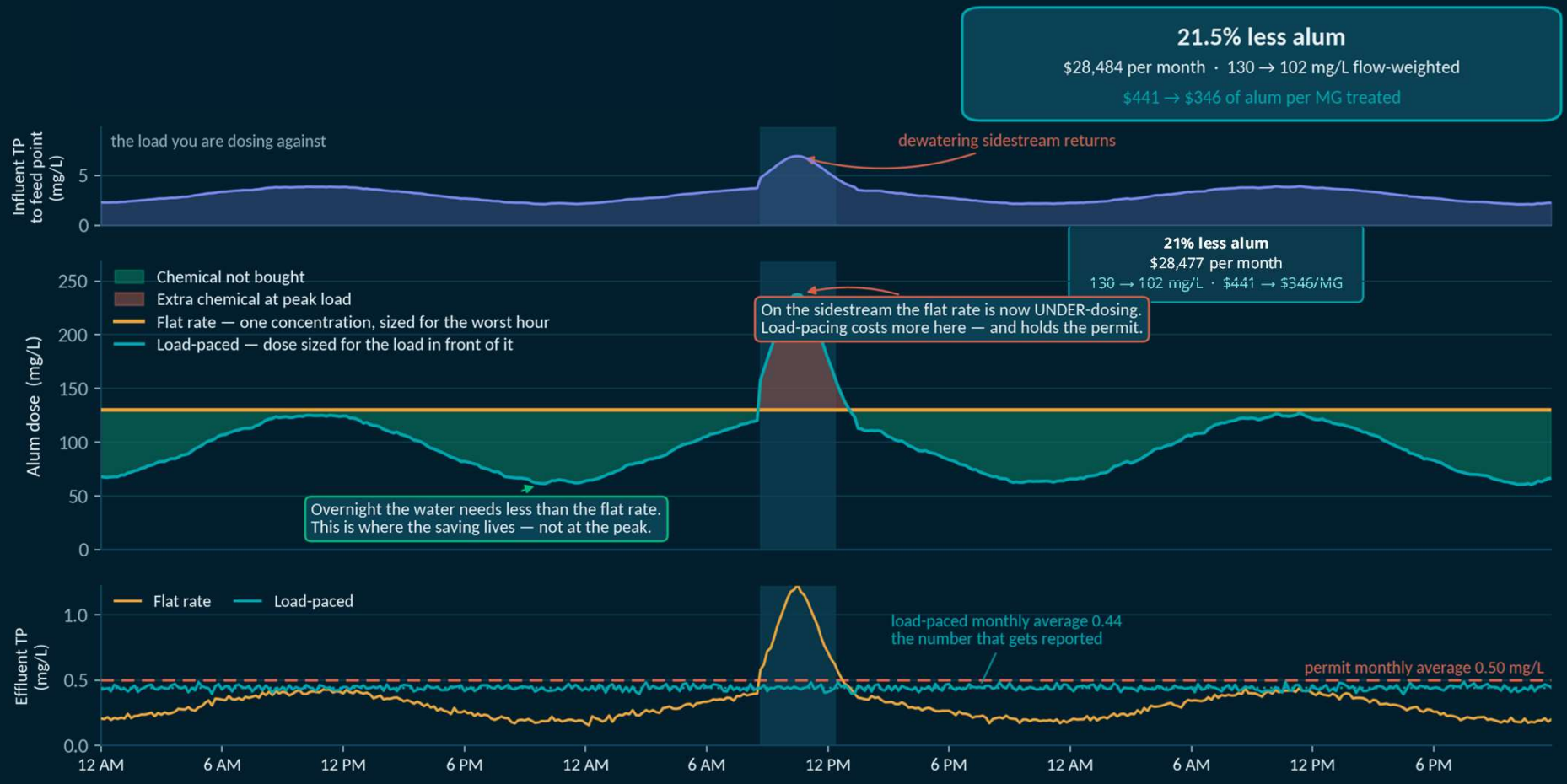
4 What It Needs From You

The phosphorus has to be measured, not inferred. TSS, pH and turbidity do not see soluble orthophosphate, so budget for an online ortho-P analyzer or carry a wider margin.

Dose is set by an operator. The analysis proposes a value and shows the load it was sized against.

TREATMENT PLANT

The Saving Is Overnight, Not at the Peak



TREATMENT PLANT

Wet Weather Preparation

Run the storm through a model of your plant before it gets there to act before its too late.

1 Weather Forecast

- A 1-inch rain event forecast upstream
- Pulls the weather feed automatically
- Storm window and timing estimated for your service area

2 Hydraulic Simulation

- A virtual replica of your plant's hydraulics, biology and chemistry
- Built from your own sensor history and process data
- The projected surge runs through the model, which returns a recommended sequence

3 Pre-Storm Actions

- Adjust gate positions ahead of the surge
- Step up RAS rates and pre-empty wet wells
- Stage chemical inventory for peak demand
- An operator reviews, then approves or overrides every step

4 Storm Arrives Ready

- The sequence is already running when the rain starts
- Compliance holds through the peak
- The crew executes a plan instead of reacting

TREATMENT PLANT

Wet Weather Preparation

Managing influent storage.

Issue

- Storage-buffered facilities rely on manual setting of pump rates
- Fixed set points can’t adapt to changing flow

Solution

- Forecast near-term inflow and demand
- Optimization model identifies the ideal setpoint

Value

- 68% reduction in reactive-mode hours
- More consistent operation across shifts

trinnex

Hello,

Please find tonight's recommended RLS pump setpoint below. Operators should input this value before **9:00 PM** and hold it through **7:00 AM**.

RLS SETPOINT TONIGHT

9.91 MGD

9:00 PM → 7:00 AM | Night of 2026-07-01

Tunnel Conditions

Parameter	Value
Tunnel volume at 9:00 PM	1.0233 MGal
Forecast overnight inflow	3.921 MGal
Projected volume at 7:00 AM	0.8156 MGal (target: 0.8156 MGal / ~19 ft)
Optimizer status	success

Note: If optimizer status shows "fallback", the tunnel started near-empty at 9 PM. The setpoint is lower than usual to allow the tunnel to refill before draining to target by 7:00 AM.

TRAINING AND KNOWLEDGE

What Walks Out the Door?

The reason this topic belongs at a training school: the hardest thing to replace at your plant is not the equipment.

The Numbers, as of this Year

- 21% of utility employees are eligible to retire within five years, against an average vacancy rate of 9% (AWWA 2025 Benchmarking Survey)
- EPA puts 30 to 50 percent of the water sector at retirement eligibility within 5 to 10 years
- Small and rural systems feel both numbers harder
- Three to five years to bring an operator to competence the traditional way

What Actually Leaves with Them

- Institutional memory: the equipment quirks and seasonal patterns nobody ever wrote down
- Crisis judgment: recognising an upset or a toxic slug before the alarms catch up
- Mentorship capacity: the person who had time to teach on the floor
- None of this is in the O&M manual, and none of it transfers by PDF

TRAINING AND KNOWLEDGE

Borrowing the Answer Aviation Already Found

Pilots do not learn engine-out procedures on a full aircraft. Operators learn BNR startup on a live plant with a permit attached.

The Parallel Holds Up

Safety-critical public role	Air travel	Public health
Continuous 24/7 operation	Yes	Yes
Interdependent subsystems	Engines, hydraulics, avionics	Biological, mechanical, chemical
Learning on the live system	Unthinkable	**Standard practice**

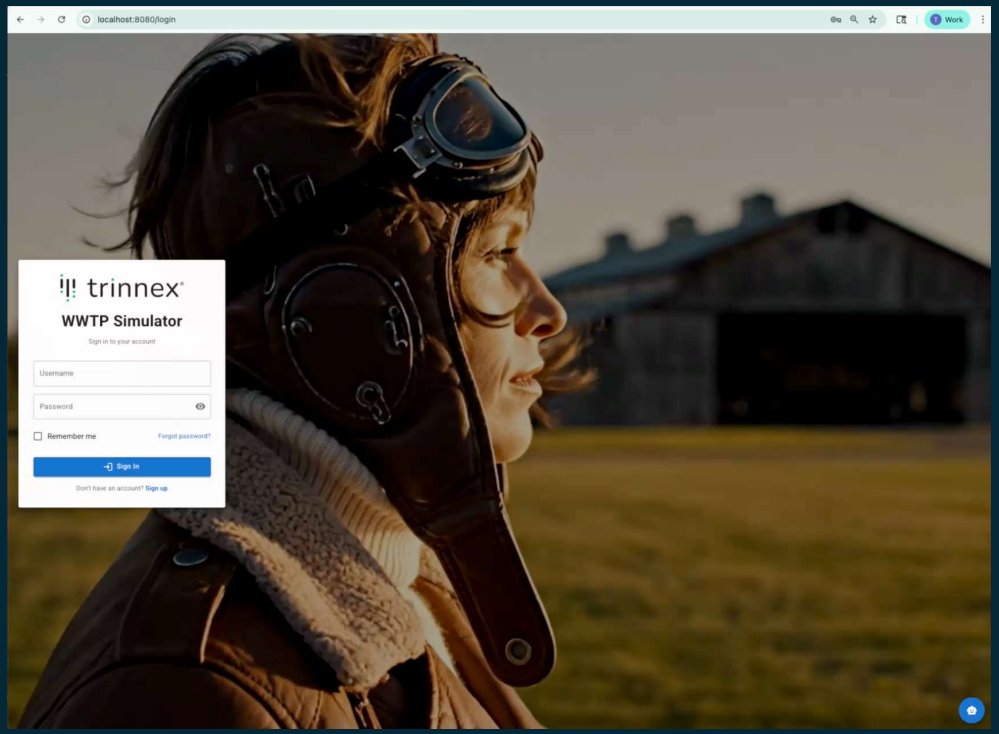
What A Plant Simulator Actually Is

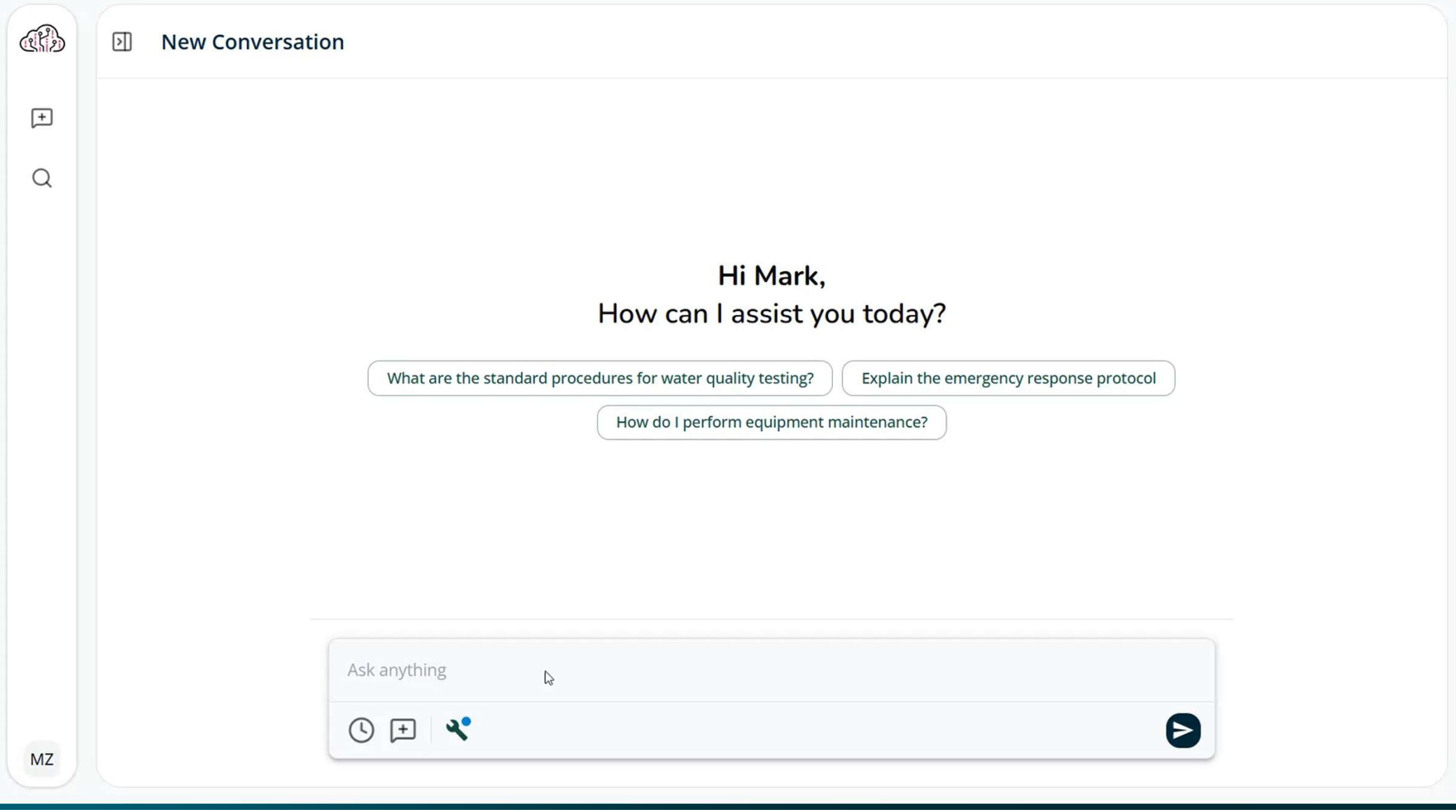
- Process models underneath: activated sludge, nitrification, EBPR, digestion
- Your own SOPs and O&M manuals indexed and searchable in plain language
- SCADA and LIMS history so the plant behaves like your plant
- Scenarios you cannot safely rehearse live: BNR startup, wet weather, a toxic slug
- Can interoperate with a calibrated model you already own in BioWin, SUMO or GPS-X

TRAINING AND KNOWLEDGE

Inside the Simulator

Train against your own plant models and data.




New Conversation
Hi Mark,
How can I assist you today?
What are the standard procedures for water quality testing?
Explain the emergency response protocol
How do I perform equipment maintenance?
Ask anything
MZ

SECTION 4

AI Safety

AI technologies are advancing rapidly, bringing both opportunities and risks.

As a regulated water/wastewater utility and critical infrastructure provider, your highest priorities are protecting public health, safeguarding the environment and maintaining operational safety

Garbage In → Garbage Out

Every tool we shared is only as good as what you feed it. That comes from your calibrations, your rounds, and your logs.

What kills these projects

- Probes that drift for months between calibrations
- Historian gaps from comms dropouts nobody logged
- GIS that does not match what is in the ground
- Overrides made in the field and never written down
- A sensor swapped for a different make with no note of it

What makes them work

- Calibration on schedule, and recorded when you do it
- A note in the log when something odd happens, because that is training data
- Flagging bad sensor periods instead of leaving them in the record
- Telling somebody every time the model gets it wrong
- Consistent tag names and units across the historian

AI does not make careful operations optional. It makes careful operations pay twice, once in the plant and again in every model built on your records.

There is no version of this where sloppy data gives a useful answer.

The "Human-in-the-Loop" Model

We do not hand the keys of the plant over to a computer. The AI makes suggestions, and the operator with the license makes the call.

AI Processes Data Streams
DO, ORP, TSS, flow, vibration, temp

→

Recommendation Generated
"Reduce RAS rate 5% — clarifier blanket rising"

→

Operator Reviews
Supporting data visible; reasoning explained

→

Approve or Override
✓ Approve × Override
No override is ever penalized or flagged

→

Action Executed
Manual control; operator remains in command

Addressing the Real Fear

AI will not take your job. AI is here to help in an advisory role. The operator decides at every step.

Building Trust the Right Way

Test AI deployments run in **recommendation mode for several months** .
Operators check the logic against what they already know, long before anyone brings up closed loop control.

Operator Expertise is Irreplaceable

The AI does not know your weekend mechanic always leaves a manual valve cracked, or that Basin 3 runs cold in January. **You do.**

Rules of the Road: Governance & Acceptable Use

Your certificate carries the risk, not the vendor's. Set the boundaries before any tool goes in.

Read-Only (Advisory Mode)

- AI recommends a setpoint change (e.g., "Reduce DO in Basin 2 to 1.8 mg/L")
- A certified operator reviews it, then runs it or overrides it
- Nobody gets dinged for an override
- Acceptable Use Policy defines exactly what AI can and cannot do at your plant
- Every integration goes past your IT and cybersecurity staff first

Human Approval Required

- Read-Write: AI directly adjusts PLCs or chemical feed pumps — requires engineering sign-off, formal change control, and utility board approval
- High-Risk Actions: e.g. chlorination dosing changes
- Bypass gate operations
- Waste Activated Sludge (WAS) rate adjustments

Strictly Prohibited

- Uploading live SCADA telemetry or network diagrams to any public or free AI service
- AI-generated final DMR submissions
- Unapproved plug-ins hanging off the OT network
- Shadow IT: AI tools deployed without IT/cybersecurity vetting

The certified operator in the control room holds final authority. No software overrides your judgment or your permit obligations.

Rules of the Road: The AI Already in Your Pocket, and Its Hard Limits

Separate from anything plant wide. These chat assistants are free or close to it, and useful today for paperwork. They are also where the real risk sits.

✓ Reasonable uses today

- Turn your rough notes into a clean SOP draft
- Put a permit condition into plain English the whole crew can follow
- Cut a 40-page O&M chapter down to the startup sequence
- Write the narrative around numbers you already have
- Make practice questions for somebody studying for the next grade

✗ Never

- Paste live SCADA or telemetry into a public tool
- Upload network diagrams, P&IDs, or facility drawings
- Share customer information or personnel records
- Let it write your DMR numbers, or submit anything it drafted unread
- Take a number it gives you on faith. These tools state wrong facts with complete confidence.

If you would not read it aloud at a council meeting, do not paste it into a free AI tool. And check the facts it hands you.

Conclusions

> ***AI gives an operator a co-pilot. The licensed person in the control room still has final authority over the plant.***

It is a practical tool: pattern recognition wired to sensors you already have. It is not a thinking machine, and **no substitute for your judgment**.

Write the rules down before you need them. Advisory versus closed loop, no live SCADA in public tools, a certified operator in the loop every time.

Advance warning is the whole point. Hours or days ahead of an issue is worth more than any report written after the fact.

You already have the data. The question is how to get more value from it.

What to Do Tomorrow Morning

Name your worst recurring problem, then ask whether anything has been evaluated for it. If you remember one thing from today: start at a lift station.

AI Acceptable Use Policy Download

Questions & Discussion

your experience is the most useful thing here

Mark Zito — VP of Product & AI
Mark.Zito@trinnex.io

Travis Wagner — SVP of Digital Consulting
Travis.Wagner@trinnex.io

APPENDIX

Held back for questions

CCTV defect coding, the data-volume picture, scaling for smaller plants, and a live setpoint optimization screen.

LNBA 2026 Wastewater Operators Training Workshop

GETTING STARTED

Six Questions That Separate Help From Hype

You are going to get sales calls. These tell you in about ten minutes whether there is anything behind the demo.

1. **"What data do you need from me, and what happens when a sensor goes bad?"**

   A real answer covers gap handling and bad data flagging. A vague one means they have never run on a live plant.

2. **"Show me why it made that recommendation."**

   You should be able to see what drove any output. If the answer is that the model is proprietary, walk.

3. **"Name three utilities my size I can call."**

   Not logos on a slide. Phone numbers. Then ask those utilities what stopped working after year one.

4. **"What does this cost in year three?"**

   Get the subscription, the integration, and the retraining cost in writing. Year one is usually the cheap one.

5. **"Who owns my data, and can I get it back?"**

   Your operating history is a real asset. Confirm you keep it and can export it if you leave.

6. **"How does it fail?"**

   Every honest vendor has an answer ready. It is the fastest way to find out if they have been in a plant.

You do not need the math to ask good questions. You already know how to spot somebody who has never run a plant.

APPENDIX / COLLECTION SYSTEMS

CCTV Review: AI Takes the First Pass, You Sign It

Automated defect recognition watches the footage, proposes NASSCO PACP codes, and hands them to a certified reviewer for correction and sign-off.

The problem it actually solves

- Most utilities inspect somewhere between 1 and 10 percent of their network a year
- There is never enough budget or desk time to review all of the footage
- Coding consistency drops late in a shift, which is fatigue and not skill

What actually changes

- Same trucks and same crews. The footage is already being shot.
- The software flags and codes every frame by the same rules every time
- Your PACP certified staff review, correct, and own the deliverable

Straight from NASSCO, not from a vendor

NASSCO runs an AI workgroup and has published a position paper on this. Their bottom line: no AI system is certified today to recognize every PACP, LACP, or MACP observation, though that may not matter if what it does catch matches what your inspection program is looking for. Use it, check it, and keep a certified person on the signature line.

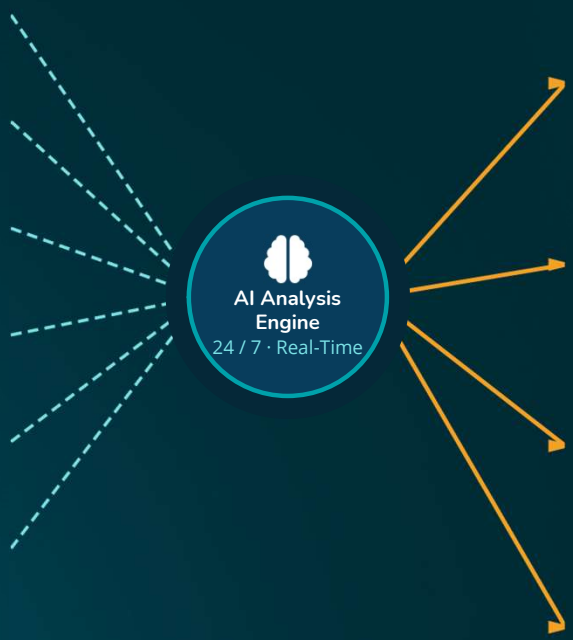
LNBA 2026 Wastewater Operators Training Workshop

You Already Have the Data

Your plant logs millions of data points every day that are never looked at again — AI acts as the 24/7 analyst reading every single one simultaneously.

Live Data Streams

- **DO & ORP** — Aeration basin sensors
- **TSS & MLSS** — Solids & settleability
- **Influent Flow & pH** — Headworks measurement
- **Temperature** — Process & ambient
- **Energy Draw** — Blowers & pumps
- **Chemical Feed Rates** — Alum, polymer, carbon



Operator Insights

Real-Time Correlation
All variables read, plotted, and correlated simultaneously — no spreadsheet, no manual lag.

Pattern Detection
Subtle multi-stream shifts spotted across weeks — invisible to day-to-day review.

Example: 3-Week MLSS Drift
Slow MLSS settleability decline correlated with a change in industrial loading — invisible day-to-day, obvious to a trained model.

Actionable Recommendation
Operator dashboard surfaces findings with context — not raw data, not alarms.

Data-rich, information-poor — AI bridges the gap between collected data and operational decisions.

MZ1

Scaling AI for Smaller Facilities

You do not need a big IT budget to start. Pick one thing that hurts, fix that, then go from there.

Enterprise Suite

Large Regional Utilities

Full-scale AI platforms integrated across all unit processes, historian databases, and asset management systems.

- All unit processes
- Historian integration
- Asset management
- IT / OT alignment

Modular Plug-Ins

Small and Medium Plants

Several instrument makers (Hach, YSI, Endress+Hauser) build diagnostics into the controller itself: probes that flag their own drift and fouling, feed modules that trim dose. Most is not sold as AI.

- Hardware-embedded
- No dedicated IT staff
- Targeted by process

Recommended Starting Points for Smaller Facilities

Clarifier Polymer Overrun

High polymer consumption at a clarifier with blanket carry-over issues

Lift Station Pump Failures

Chronic pump failures at a problematic lift station driving overtime and emergency costs

Cold-Weather Nitrification

Inconsistent nitrification performance during cold-weather months threatening TN compliance

Key Principle: Fix a real problem first. Show that it worked. Then expand. **Hardware-embedded tools do not need dedicated IT staff.**

Slide 37

MZ1 Replace with Crawl Walk Run Fly
Zito, Mark, 2026-07-21T20:29:51.126