

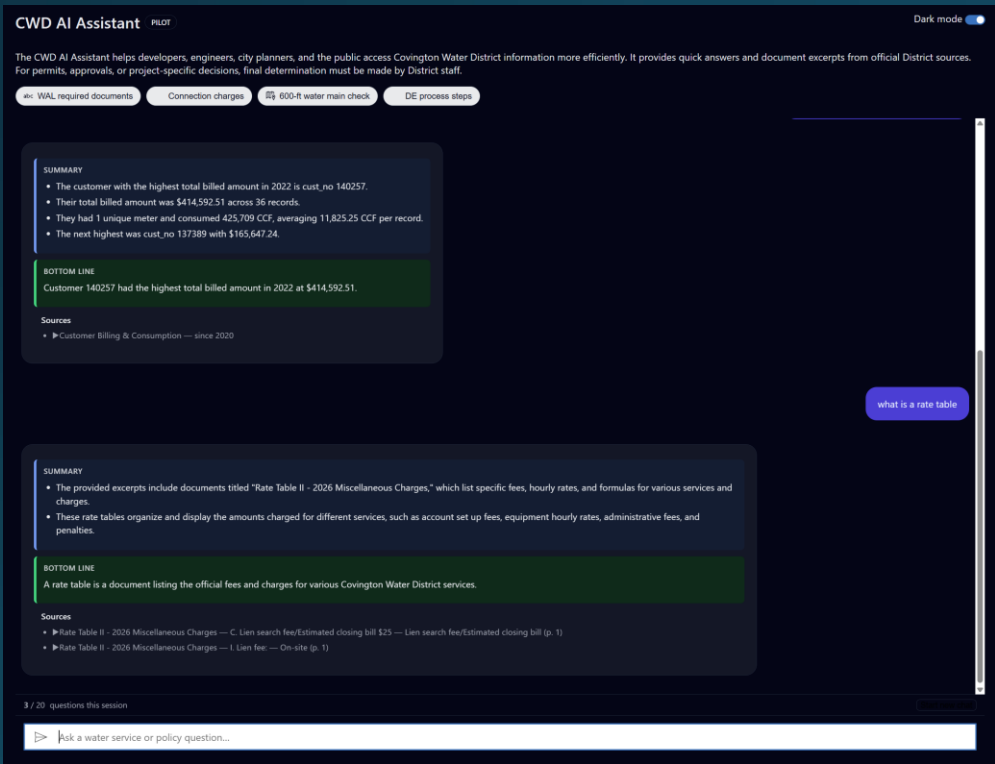


# Covington Water District Chat Bot



# What are we going to cover in this presentation...

- Who is Covington Water District...
  - Who are we...
  - Leadership Support!
- Path to AI –Tech and Skills
  - Our Solution
  - Architecture
  - Data Routes
    - DEMO!
  - Lessons Learned
  - Future Steps
  - Takeaways



# Who is Covington Water?

Founded in 1960

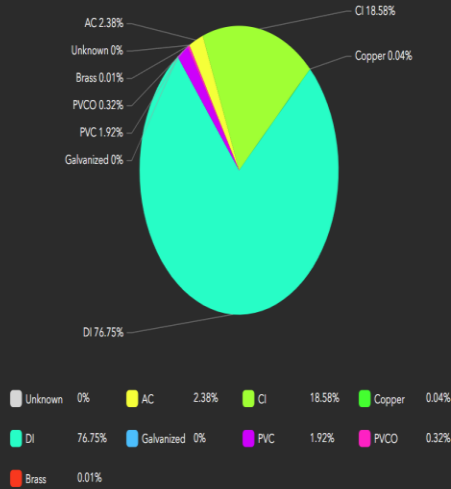
Provide clean, safe and reliable water to a 55-mile area in South King County, serving a population of over 50,000 through 19,000+ connections

Responsible for about 90,000 water assets, including 326 miles of transmission and distribution pipe.



## Asset Summary Dashboard

Total Material Types at CWD



Material Distribution | Install Year

Pressure Zone	Pipe Volume (GAL)
1061 Zone	14,497.6
500 Zone	106,241.9
540 Zone	6,421
600 Zone	862,235.7
600 Zone::660 Zone	116.7
625 Zone	13,335.7
650 Zone	169,614.4
660 Zone	2,926,114.6
720 Zone	45,214.2
770 Zone	1,750,336.1
913 Zone	4,292.8
941 Zone	46,162.5
942 Zone	35,239.6
<b>Total (GAL)</b>	<b>5,979,822.8</b>

Total Miles of In Service Pipe

326.3

Ductile Iron Pipe Sizes and Total Lengths (FT)

Diameter	Length (FT)
2	92,225.1
3	247,344.1
4	4,770,982.77
6	45,492,327.2
8	84,808,783,077.5
10	6,224,155.3
12	2,774,732,468
14	1,842.2
16	55,973,783.4
18	6,942.9
20	13,799.3

Total Length (FT) 1,322,560.9

DI Total | CI Total | AC Total | PVC Total | PVCO Total

Total Service Meter Connections

19,286 | 2,622

Total Fire Hydrants

Total Service Connections | Total Meters

# Leadership Vision / Culture



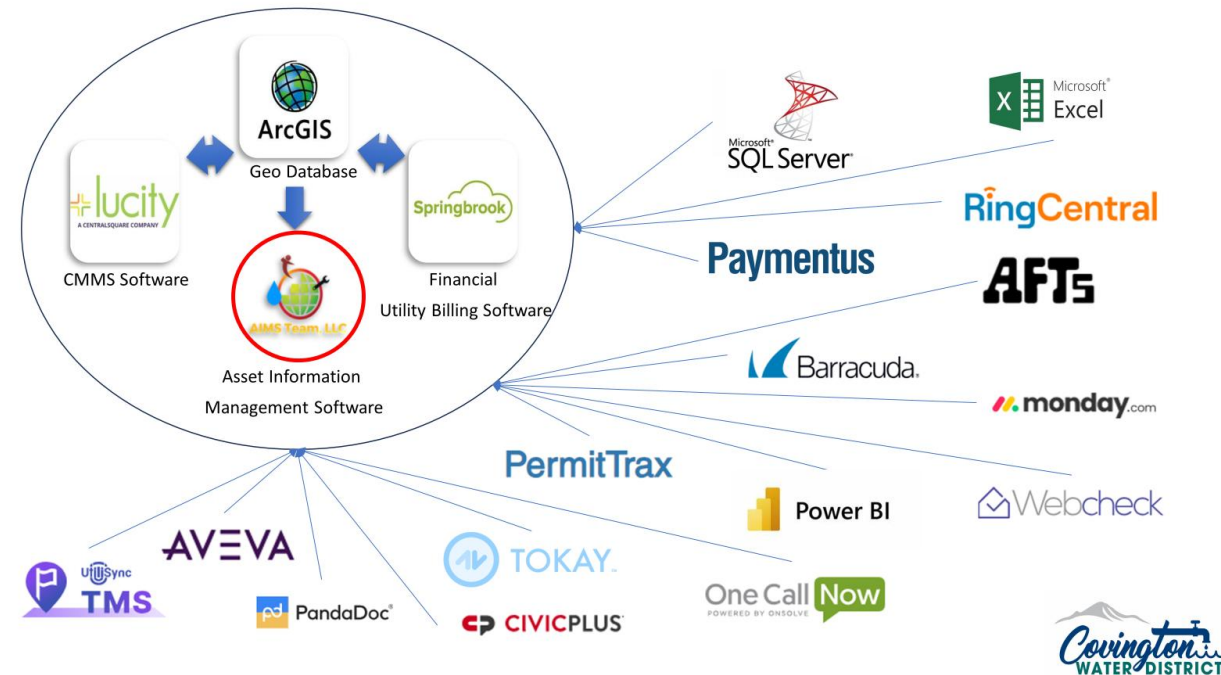
## Covington Water District Common Commitments

1. **We will work to “break down silos” and build unity:** We will be intentional about collaboration, information sharing, and support and engagement between and within departments.
2. **We will ask for and be open to feedback:** We will avoid defensiveness and any reaction to feedback that could be interpreted as “punishing”. We will seek feedback, ask for suggestions, and practice being approachable.
3. **We will explain the “why”:** Communications will be thorough and explain the intent of decisions and provide “by when’s” as appropriate.
4. **We will model a healthy, supportive, and unified Team:** We will avoid expressing negativity about our team members and customers and we will proactively collaborate and problem-solve together.
5. **We will be committed to continuous improvement:** We will commit ourselves to team building exercises, discussing and improving our workflows, continued work on our culture, sustainability of practices, employee professional development and more.

“To serve quality water with excellent customer service, commitment to strategic and emergency planning, fiscal responsibility, regulatory compliance, stewardship and partnerships.”

- GIS Strategic Plan 2026
- Technology Roadmap 2025
- AI Policy 2024
- Tech Tuesday
- Software Evaluation Committee

## Software Ecosystem at CWD >



# Tech Stack for this project

## Azure OpenAI

GPT-4o model for intent classification, answer synthesis, and multi-route orchestration

## Azure AI Search

Semantic + vector search over indexed policy documents with reranking and scoring profiles

## ArcGIS REST API

Live feature layer queries for meter records, parcel data, and 600-ft availability buffer

## ASP.NET / C#

Backend API with multi-route orchestration, SQL query builder, and CSV export engine

## SQL Server / Springbrook

Read-only billing database connection with parameterized queries and SELECT-only SQL login

## King County eReal Property

Live HTML scraping of public assessor records resolved by parcel PIN or street address

*All components integrate through a single ASP.NET API — no third-party AI orchestration framework required*

## New Skills Required “In House”

**RAG Pipeline Design** Document chunking strategy, semantic indexing, evidence validation, and multi-stage retrieval scoring

**Intent Classification** LLM-to-structured-DTO routing so AI classifies intent and deterministic C# builds the queries safely

**Prompt Engineering** Designing system prompts that reliably produce structured JSON, enforce output formats, and prevent hallucination

**Multi-Source API Integration** Parallel route execution, response merging, and composing unified answers from GIS, billing, and documents simultaneously

**Grounded Answer Validation** Scoring retrieved evidence for relevance and sufficiency before synthesis to ensure every claim is traceable

# AI-Powered Water Utility Intelligence

- How Covington Water District integrated GIS, billing, documents, and assessor data into a unified AI assistant

4

Data Sources  
Integrated

5+

Years of Billing  
Data Available

AI

Natural Language  
Powered

Real

Time Answers  
No Waiting

## The Problem We Were Solving



### Repeated Questions

Staff answered the same rate, availability, and billing questions dozens of times per day



### Multiple Systems

Answers required switching between GIS, Springbrook, county assessor, and policy documents



### Inconsistent Answers

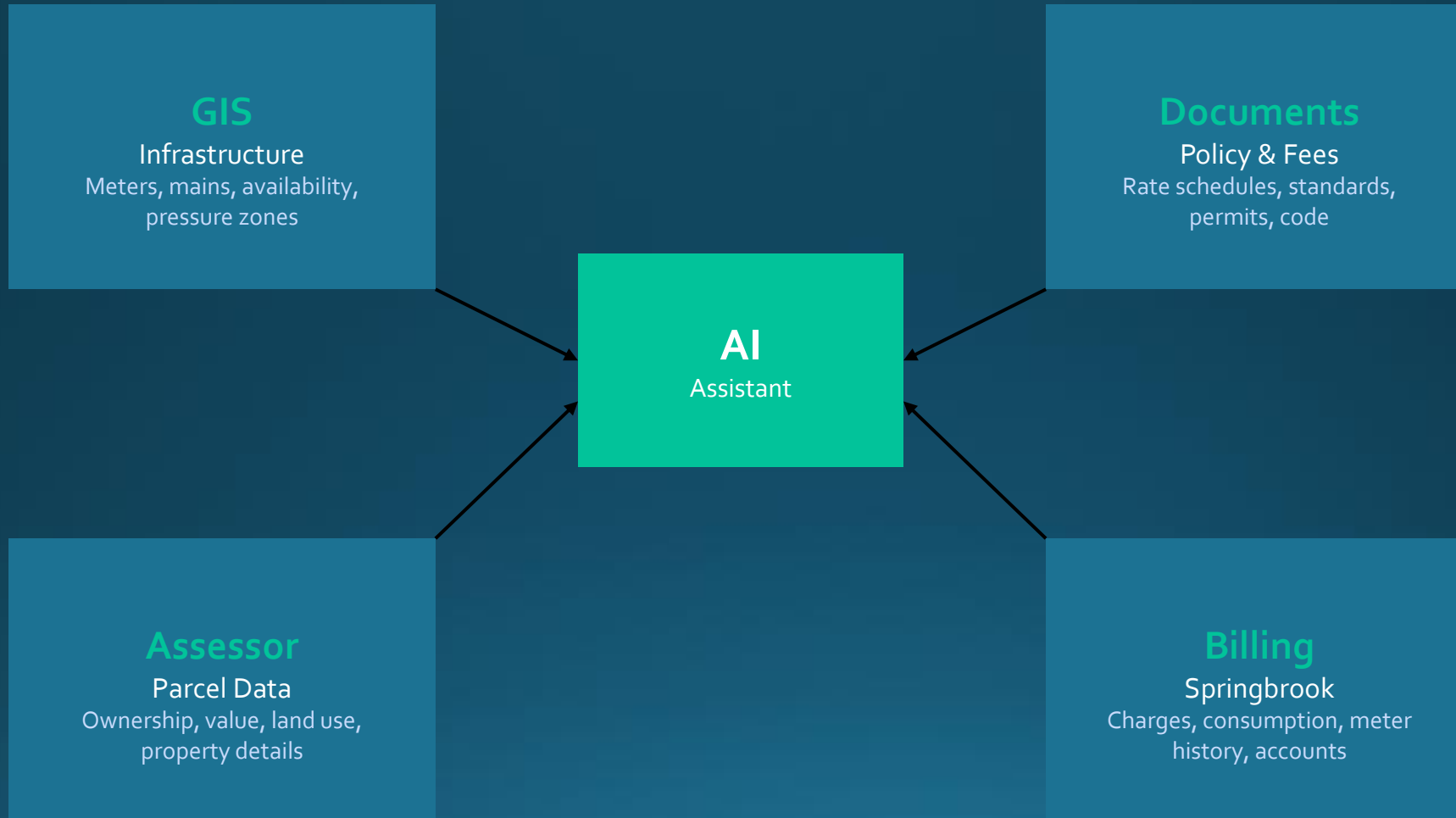
Different staff gave different answers to the same questions depending on their experience



### No Analytics Access

Field staff and managers had no easy way to query billing or consumption trends without IT help

# System Architecture: Four Integrated Data Sources



# GIS Route Infrastructure Intelligence

## Two sub-routes:

### GIS\_METER

Live meter & service records

### GIS\_AVAILABILITY

Parcel proximity to district mains

## Data source:

ArcGIS feature layers queried in real time via REST API

Parcel layer with 600-ft buffer field for availability  
Meter layer: diameter, pressure, install year, PIN

## • Questions You Can Now Ask

*"Is water available near parcel 0252000960?"*

*"Does this parcel have a meter installed?"*

*"What pressure zone serves 29366 SE 215TH PL?"*

*"Is there a main along SE 272nd St near this lot?"*

*"What is the estimated PSI at meter for parcel PIN 9485940170?"*

### SAMPLE RESPONSE

A 0.625-inch meter is recorded for parcel 9485940170. Pressure zone: 660. Estimated pressure: 61.5 PSI. Installed January 2010.

*Source: GIS Meter Layer (live)*

# Documents Route **Policy & Fee Intelligence**

## How it works

**1**

### Classify & Retrieve

Azure AI Search finds the most relevant passages from indexed policy docs

**2**

### Validate Evidence

Multi-stage scoring checks sufficiency and relevance before synthesis

**3**

### Synthesize & Cite

AI answers from document text only — no hallucination, every claim traceable

- **Documents indexed:**
- Rate Tables I & II (water rates, misc charges)
- Administrative Code (policies, requirements)
- Engineering standards & specifications
- Water Availability Letter (WAL) program docs
- Developer extension agreements

*"What is the WAL (water availability letter) administrative fee?"*

The WAL administrative fee is \$250 per application, as listed in Rate Table II Section III.

*"Is a backflow preventer required for a new commercial connection?"*

Yes. Per Section 4.3 of the Administrative Code, a backflow prevention assembly is required for all new commercial service connections.

*Source: Rate Table II - 2026 Miscellaneous Charges (p. 3)*

# Assessor Route King County Parcel Data

## Identity

Owner name  
 Site address  
 Legal description  
 Jurisdiction / levy code  
 Zoning / present use  
 Lot size (sq ft / acres)

## Building

Year built / renovated  
 Stories / living units  
 Bedrooms / bathrooms  
 Finished area / grade  
 Heat source / system  
 Water / sewer access type

## Valuation & Sales

Appraised land / improvements  
 Taxable total value  
 Latest sale price & date  
 Buyer / seller name  
 Latest tax year

## Data source

- King County Assessor eReal Property — scraped live via HTTP request using the parcel PIN resolved from the user's query

## Power combination

- Multi-route queries combine Assessor + GIS + Billing in one response

*"Who owns parcel 0252000960 and is water available there?"*

Routes: ASSESSOR + GIS\_AVAILABILITY. Owner: Smith Family Trust. Parcel is within 600 ft of district facilities.

*"What year was the house built and what was the last sale price?"*

Built 1998. Latest sale: \$625,000 on June 12, 2021. Buyer: John & Mary Williams.

# Springbrook Billing Data

- ▶ Billing history since 2020
- ▶ Consumption in CCF per billing period
- ▶ Meter size, install date, route, cycle
- ▶ Adjustments, late charges, lock fees
- ▶ PSI pressure readings per account
- ▶ Customer number, parcel PIN, meter ID

## Meter Intelligence: Age + Usage Analytics

20+

Year meter age threshold for replacement review

CCF

Consumption tracked per billing period per account

PSI

Pressure data linked to each meter account

### Example Workflow: Replacement Planning Query

1

#### Filter by Age

Install\_Date identifies meters over 20 years old across any route or cycle

2

#### Compare Usage

Average consumption vs district average flags under-reading meters

3

#### Rank Results

Returns ordered list of highest-priority candidates with street and meter detail

CSV

#### Download

Ready for field crew scheduling

### Questions You Can Now Ask

"What is the total consumption for route 11 in 2024?"

"Show billing trend for customer 692 by month"

"How many unique customers on 192ND PL SE?"

"Total billed for 2-inch and larger meters in 2023?"

"Which customers had both charges and adjustments in 2022?"

"How did route 11 billing change from 2022 to 2023?"

# Live Demo: High Consumption Use Case

**USER:** "Find meters over 20 years old on route 11 with above-average consumption in 2023"

- **AI RESPONSE**

- **Summary**

- - 14 meters on Route 11 installed before 2003 with above-average consumption in 2023
- - Meter 36464509 at 28129 192ND PL SE ranks highest (73 CCF avg vs 28 CCF district avg)
- - Installed January 2010, Device Size 5/8", currently Active
- - Full ranked list available as CSV download (14 records)

- **Bottom line**

- 14 high-priority meters identified for Route 11 replacement planning, led by 28129 192ND PL SE.

- *Source: Customer Billing & Consumption (since 2020) | Download CSV: [route11\\_meters\\_2023.csv](#)*

# Operational Benefits



## Faster Customer Service

Billing and GIS lookups that took 3-5 minutes now take under 10 seconds. Staff handle more calls per hour.



## Consistent Answers

Every policy question is answered from the same indexed source. No variation based on who picks up the phone.



## Data-Driven Planning

Field supervisors and planners can query consumption trends, meter age, and billing patterns without IT involvement.



## Read-Only Safety

The AI only reads data — never writes. SQL login is SELECT-only. All queries are logged. No data modification risk.

# Lessons Learned

## Your Data Is the Hard Part

Getting AI access to live, clean, queryable data took far more effort than the AI layer itself. Data quality is the real investment.

## Don't Use Raw Text-to-SQL

LLMs can hallucinate plausible-looking but wrong SQL. A structured intent DTO with deterministic SQL generation is far safer for billing data.

## Start Small and Modular

One route at a time. Each data source is independent. Adding GIS did not touch billing. That modularity was critical for managing complexity.

## Users Surprise You

Field supervisors used the system for queries we never anticipated. Build for flexibility, not just the use cases you planned at the start.

# Future Steps

1

**SCADA & Work Order Integration** Add real-time pressure and flow data from SCADA alongside work order history as new conversation routes

2

**Permit & Developer Extension Tracking** Enable engineering staff to query permit status, extension agreements, and inspection records conversationally

3

**Customer-Facing Portal** Explore a public-facing interface where customers can ask availability, billing, and general service questions directly

4

**Map based integration and chart graphics** Enable more ways to explore the data with selections on maps and chart visualizations of data

5

**Share the Pattern with Other Utilities** The architecture is replicable — any utility with GIS, billing, and policy documents can adopt it

## Resources to Get Started



# Key Takeaways

## AI + Real Data = Operational Intelligence

### 01 Leadership vision/ support

This is crucial to any project. This project was done “in-house” by design. Investing within the organization continues to build institutional knowledge and know how.

### 02 Not just answers — analytics

The system doesn't just look things up. It aggregates, compares, filters, and ranks — giving you insights that previously required a DBA or custom reports.

### 03 The architecture is extensible

Each data source is a separate route. Adding a new source — SCADA, work orders, permit tracking — means adding a new route without rebuilding anything else.

### 04 Your data is the differentiator

AI models are commodity. What makes this useful is your GIS, your billing history, your policy documents. The AI is just the interface to it.