LUMO

# Closing the Execution Gap:

## How Block-Level Irrigation Data Drives Profitability


This report presents first-of-its-kind block-level irrigation data from over 4,500 irrigation events across hundreds of premium vineyard blocks during the 2024 growing season. The findings show that irrigation system performance is highly variable—1 in 10 irrigations miss by 50% or more, while 3 in 4 miss by 10% or more—making it difficult for growers to reliably deliver planned water volumes.

This variability results in an **Irrigation Execution Gap**—the difference between intended and actual water applied. This is estimated to be costing growers **$1,000-$5,000/acre** every year in lost yield, worse fruit quality, and wasted labor, while also dramatically increasing operational risk to land, crop and critical infrastructure.

The good news: the data also highlights actionable strategies growers can adopt to close the gap, improving outcomes and their bottom line.

## The Block-Level Data Revolution

Until recently, growers lacked access to flow and pressure data at the individual block level. Without this visibility, irrigation planning and performance assessments relied on assumptions or aggregate estimates.

Block-level monitoring, enabled by systems like Lumo, changes this.
With granular, verified data, growers gain an accurate, real-time view of system performance and can take informed actions to optimize it.

This dataset—the first of its kind—exposes the variability of irrigation performance across thousands of events. The result is clear: growers are not consistently irrigating to plan, and the economic consequences are significant.

# At a Glance

This report covers four key insights:

1. **Common causes of large variations in system performance**
2. **How common it is for irrigations to miss their intended volume**
3. **The relative prevalence of under vs over irrigating**
4. **How precision improves with block-level visibility**

The report concludes with four recommendations to achieve optimal irrigation performance and deliver better crop outcomes.

# Key Insights from the 2024 Season

## 1. Big misses are common

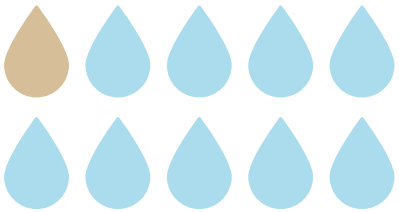
Many factors contribute to the high variability in block-level performance of irrigation systems, including but not limited to: clogged filters, worn out emitters, main line breaks, blown out risers, leaking air vents, sludge in the lines, pressure issues, elevation changes, power outages, lack of water supply, and wildlife chewing on the lines.

As a result, the data shows that **1 in 10 irrigations miss their target volume by 50% or more.**

In the past these issues were hard to notice, even harder to quantify, and often went undetected or under appreciated for long periods of time.

With block-level flow data these problems get detected and quantified right away, so that growers can take action to restore precision.

Here are five examples of big misses where growers used block-level data to identify the issue and correct course.



**1 IN 10 IRRIGATIONS MISS THEIR TARGET BY 50% OR MORE**

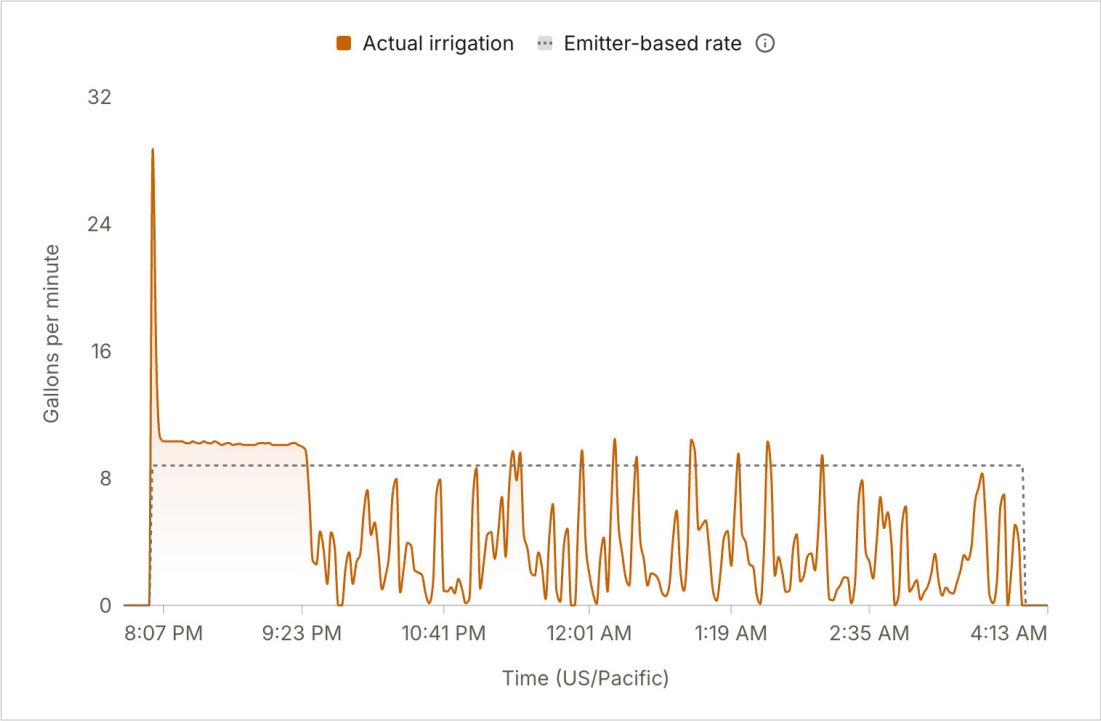
## How to read the following graphs:

These graphs visualize irrigation performance over time. The **x-axis** represents time. The **y-axis** shows flow rate, measured in **gallons per minute (GPM).**

- The solid line represents the actual irrigation flow rate recorded during the event.
- The dotted gray line indicates the expected flow rate, calculated based on the number of emitters and their individual flow rates (i.e., the baseline or target rate).

Irrigators use these graphs to assess how closely their actual irrigation aligned with the expected baseline, and to identify any deviations or inconsistencies in water delivery.

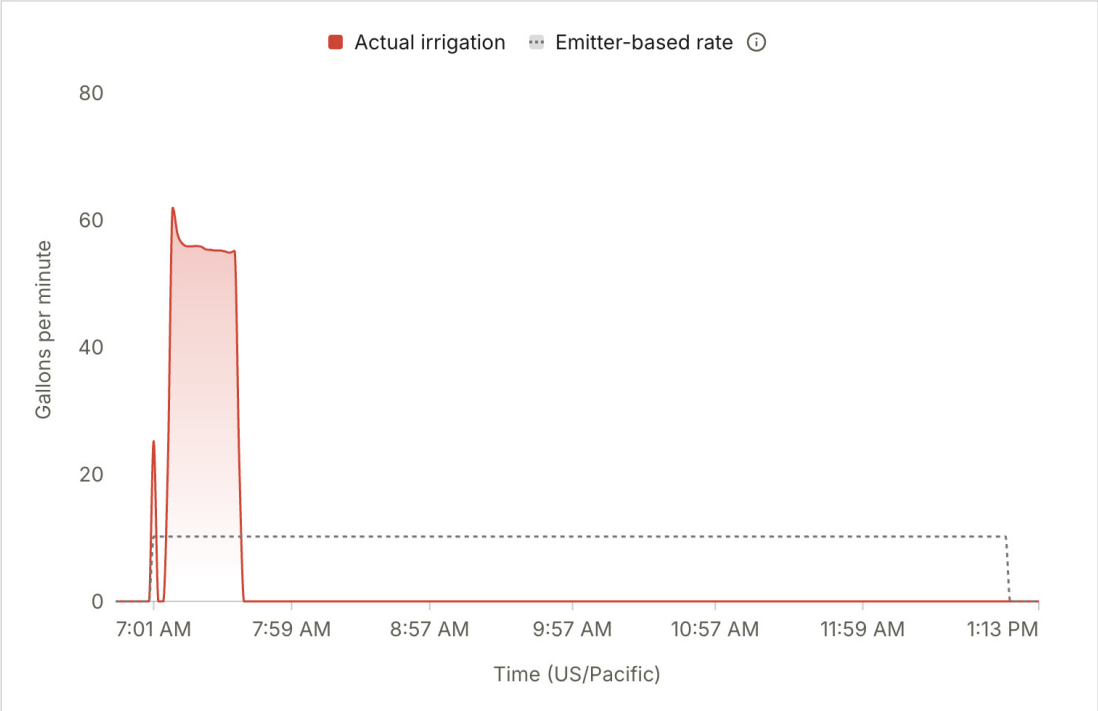
## Example 1 - Insufficient Water Supply




### Irrigation event analysis:

- Irrigation began at 7:59 PM, initially delivering water at a steady rate of approximately 10 GPM.
- At 9:29 PM, the flow rate dropped sharply to 2.8 GPM and remained erratic for the rest of the event.
- Performance summary:
  - → **Expected water volume:** 4.15 gallons per vine
  - → **Actual water volume delivered:** 2.23 gallons per vine
  - → **Total delivery:** 54% of the intended target

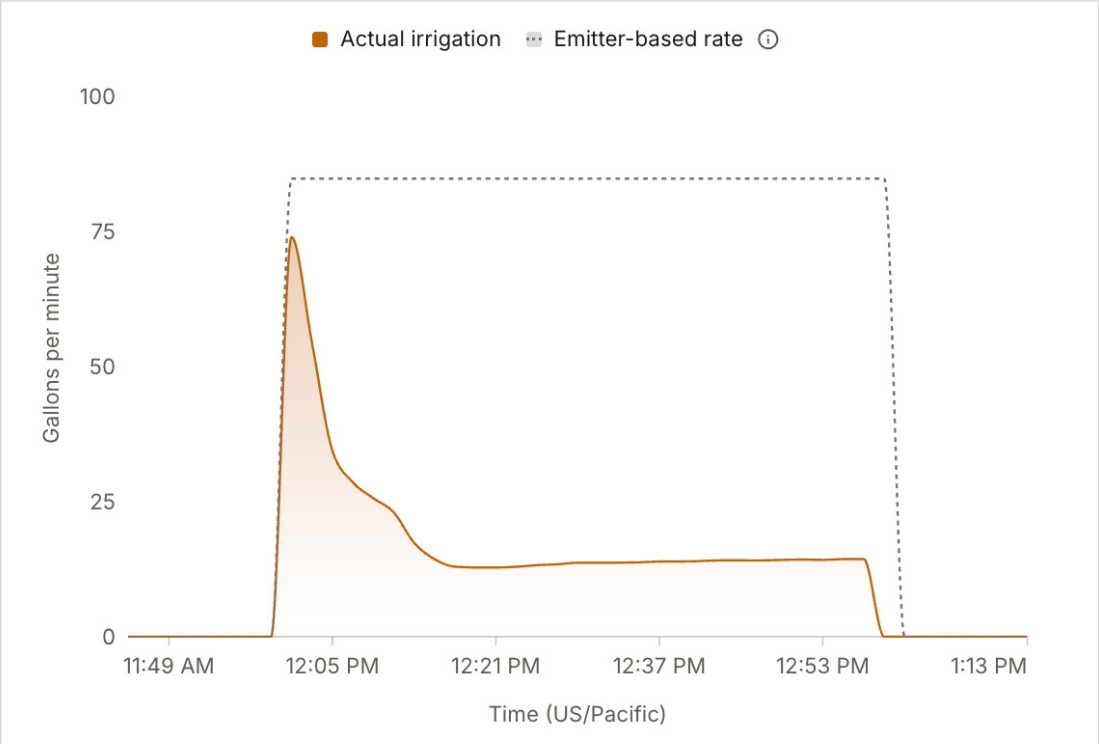
## Example 2 - Leaking Air Vent




### Irrigation event analysis:

- Irrigation began at 6:57 AM, initially delivering water at a rate of approximately 55 GPM, 5.4 times higher than the expected rate of 10.21 GPM.
- The grower received an alert and cancelled the irrigation at 7:39 AM protecting crops and saving an estimated 16k gallons of water.
- An open air vent was later identified as the cause.
- Performance summary:
  - → **Expected water volume:** 3 gallons per vine
  - → **Actual water volume delivered:** 1.41 gallons per vine
  - → **Total delivery:** 47% of the intended target

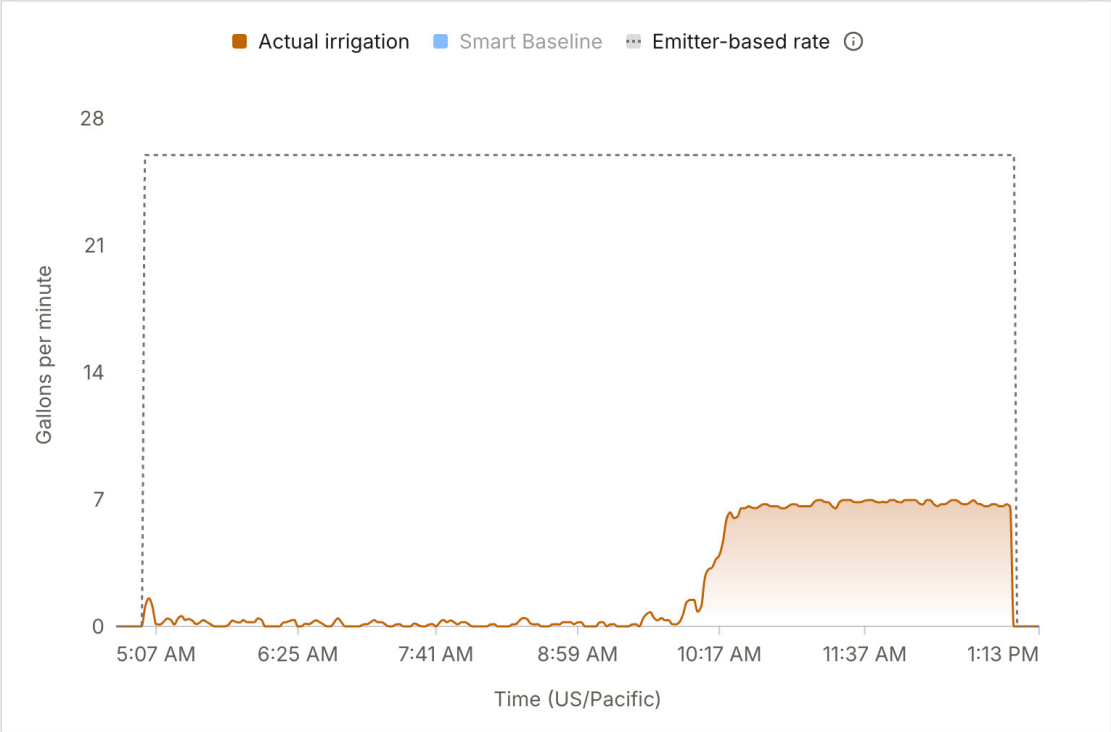
## Example 3 - Clogged Filter




### Irrigation event analysis:

- Irrigation began at 11:59 AM and the flow steadily declined until 12:17 PM at which point the flow rate settled at 13 GPM, 5.7 times lower than the expected 73.97 GPM.
- A clogged filter was later identified as the cause. Once flushed, the flow rate returned to normal.
- Performance summary:
  - → **Expected water volume:** 1 gallon per vine
  - → **Actual water volume delivered:** 0.23 gallons per vine
  - → **Total delivery:** 23% of the intended target

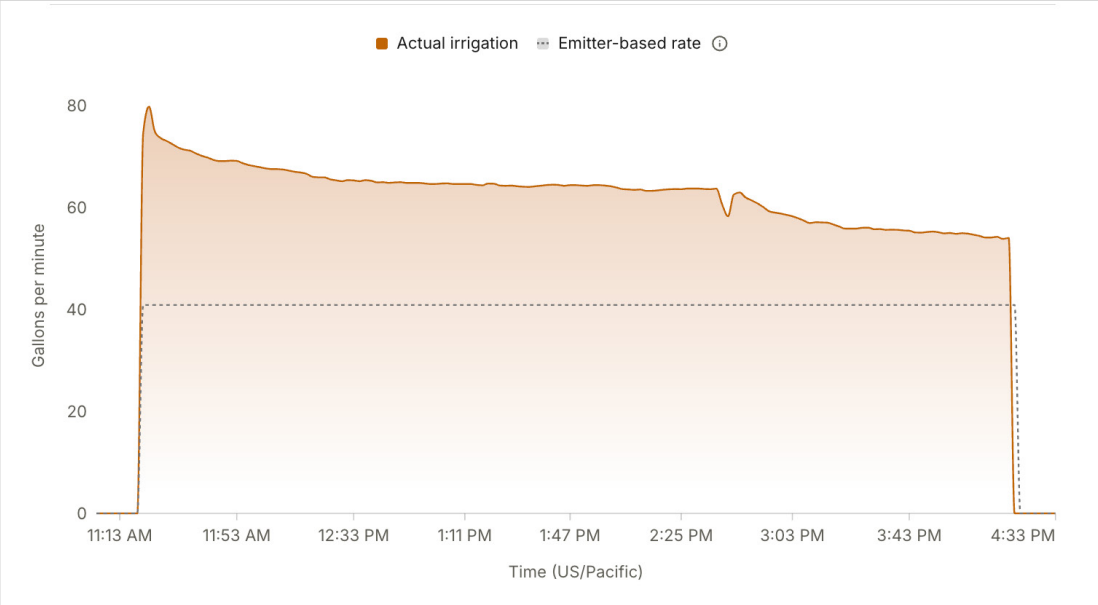
## Example 4 - Sludge Buildup




### Irrigation event analysis:

- Irrigation began at 4:59 AM and ran until 1:01 PM with an average flow rate of 2.46 GPM, 2.8 times lower than the expected 6.96 GPM.
- Sludge in the lines was identified as the cause. Once flushed, the flow rate returned to normal.
- Performance summary:
  - → **Expected water volume:** 8.57 gallons per vine
  - → **Actual water volume delivered:** 1.51 gallons per vine
  - → **Total delivery:** 17.6% of the intended target

## Example 5 - Worn Out Emitters




### Irrigation event analysis:

- Irrigation began at 11:19 AM and ran until 4:19 PM with an average flow rate of 62.87 GPM, 53.7% higher than the expected 40.88 GPM.
- A DU test later confirmed that the emitters were no longer pressure compensating and therefore over watering.
- Performance summary:
  - → **Expected water volume:** 5.4 gallons per vine
  - → **Actual water volume delivered:** 8.26 gallons per vine
  - → **Total delivery:** 153% of the intended target

## ECONOMIC IMPACT

### $2,000 - $4,000 in lost revenue per acre

This range reflects:

- **1 in 10 irrigations** being severely off-target **by over 50%** causing a 10-20% yield impact *(based on UC Davis studies and field reports)*
- The irrigation miss occurring mid to late season
- Potential revenue of **$20,000 per acre** *(4 tons/acre x $5,000/ton)*
- **$2,000 - $4,000 in lost revenue per acre** *(10% to 20% yield impact x $20,000)*

This figure underscores how **even one severe irrigation failure**, at the wrong time, can have **significant financial consequences.**

## 2. Small misses are the norm

With the long list of things that can hurt system performance in mind, it should come as no surprise that it's normal for an irrigation to miss its target volume by 10% or more. In fact, the data shows that it happened **75% of the time** for irrigations that weren't dialed in using block-level data insights.

**3 IN 4 IRRIGATIONS MISS THEIR TARGET BY 10% OR MORE**

Without real-time data and visibility into applied volumes, these misses can lead to crop damage and hurt quality markers, particularly on the hottest days of the year.

### ECONOMIC IMPACT

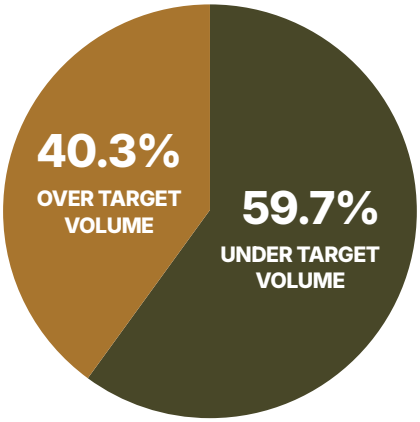
**$1,000 - $5,000 in lost revenue per acre**

This range reflects:

- **10 moderate misses** per season
- **A moderate yield loss per off-target irrigation** of **0.5% to 2.5%**
  → 10 misses x .5% = 5% yield loss per season (on the low end)
  → 10 misses x 2.5% = 25% yield loss per season (on the high end)
- Potential revenue of **$20,000 per acre** *(4 tons/acre × $5,000/ton)*
- **$1,000-$5,000 in lost revenue per acre** *(5% to 25% yield loss per season x $20,000)*

Even if severe irrigation failures are avoided, the **cumulative impact of frequent under-irrigations** can also create **substantial financial drag**—reinforcing the business case for precision irrigation.

## 3. Growers are more likely to under irrigate than over irrigate




Of all the irrigations that missed their mark, 59.7% were under their target volume, while 40.3% were over.

Under irrigation is more common because irrigation system performance degrades over time. Systems are more likely to deliver less water than anticipated, rather than more.

Irrigation systems also tend to grow in complexity, as new blocks get added or altered, which can lead to situations where pumps and lines are underpowered and struggle to keep up with agronomic demand.

### ECONOMIC IMPACT

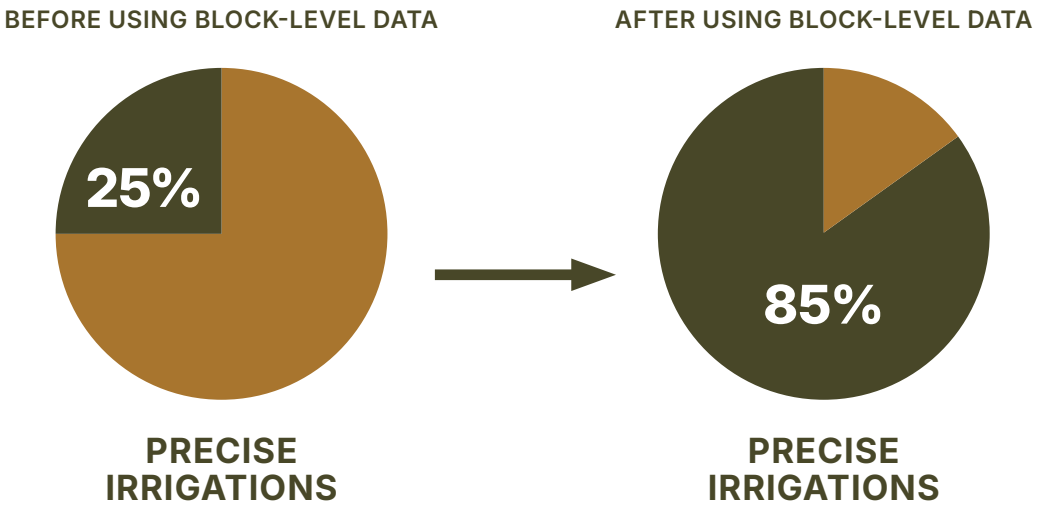
**$4,000 - $5,000 in lost revenue per acre**

**Strategic Risk:**
Under-irrigation is both more prevalent and more damaging (due to yield-limiting stress). Consistent under-irrigation increases the likelihood of hitting the higher end of the estimated yield loss ranges. Growers are often unknowingly leaving revenue on the table by under-delivering water in high-stakes periods.

This plausibly shifts the average expected yield loss toward the high end in each scenario (**$4,000 per acre** in the case of one severe miss or **$5,000 per acre** in the case of frequent small misses).

## 4. Precision improves with visibility

Despite early-season inconsistencies, growers who had access to block-level data showed rapid improvement. At the start of the season, only 25% of irrigations were within 10% of their target volume; by the end, 85% were within acceptable ranges. The data suggests that with the right tools, precision is both achievable and sustainable.




### ECONOMIC IMPACT

Moving from less than 25% precise irrigations to 85% precise irrigations over a season could eliminate the vast majority of yield-impacting misses. This could help growers:

- Avoid a severe miss during critical periods, **recovering $2,000-$4,000 in lost yield per acre**
- Course correct to mitigate the cumulative impact of frequent small misses, recovering **$1,000-$5,000 in lost yield per acre**
- Improve quality markers with greater precision and optimized vine stress levels through key phenological stages
- Optimize labor and maintenance efficiency (not quantified in this report, but material)

# Summary: Business Value of Block-Level Data for a 50-Acre Ranch

| Insight | Estimated Value for a 50-Acre Ranch |
|---|---|
| One Severe Miss | Potential loss of $100,000-$200,000 in revenue |
| Frequent Small Misses | Potential loss of $50,000-$250,000 in revenue |
| Persistant Under-Irrigation | Increases risk of hitting top-end yield loss estimates |
| Precision Gains with Data Visibility | Up to $50,000-$250,000 in recovered revenue (plus any impact on quality and increase in operational efficiency) |

Without block-level data, growers run the risk of a severe irrigation failure, or persistent under-irrigation, greatly reducing yields. With block-level data and full visibility into volumes, they can catch those mistakes and course correct, greatly reducing both the risk and impact of errors.

# Recommendations for Closing the Execution Gap

## 1. Get access to block-level data

To achieve irrigation precision, growers need to know how much water is actually being applied to each block.

Flow rates and volumes are incredibly hard to estimate by eye. And other sensors and measures are just proxies. They don't directly measure applied volumes.

Direct block-level data is essential for performance validation and ongoing improvement.

## 2. Establish a baseline of system performance

The biggest and easiest improvement in precision comes from having an accurate sense of how much water the irrigation system is delivering to each block.

Rather than relying on assumptions, guesswork, or outdated system specs, block-level flow data tells growers exactly how much water their system is putting down and exactly how long it needs to run to deliver the intended volume.

If a system is only delivering 75% of the expected volume, irrigations can run for longer, or be scheduled more frequently, to get to plan.

Having a baseline grounded in real performance data allows growers to create a more realistic irrigation schedule and actually get their vines the right amount of water.

## 3. Get alerted to issues immediately

Growers' ability to irrigate to plan and protect their crops depends on their ability to catch problems as soon as they happen.

Block-level data puts the grower in control. Rather than hoping issues are surfaced, or worrying about what's really happening underground, growers can know for certain. When they see system performance suffering, they can be surgical with their irrigation team's time, sending them to fix problems as soon as they pop up.

### 4. Use performance trends to strategically target maintenance

Rather than applying blanket maintenance routines, growers can direct maintenance efforts to the blocks that have seen the biggest declines in performance, making maintenance dollars and irrigation labor hours go further.

## Block-Level Irrigation Data: A Strategic Imperative

Growers are highly invested in getting their irrigation recommendations right. They know that putting on the right amount of water at the right times is crucial to success.

Yet, without precision in execution, even the best irrigation plans fail. This report confirms what most growers already suspected deep down—they are limited not by their ability to make good decisions, but by their ability to execute those decisions precisely.

In a world where water is scarce, labor is expensive, and margins are thin, continuing to operate without block-level visibility caps crop potential and hurts the long-term viability of every operation.

Closing the execution gap, ensuring every block gets the right amount of water, is an economic and agronomic imperative.

# About Lumo

Lumo is the precision irrigation system growers use to irrigate to plan. With block-level data and accountable automation, growers are able to close the gap between the volume of water they would like to apply and the volume that actually gets delivered in the field. Assumptions get replaced by verified performance, issues get surfaced immediately through alerts, and irrigation teams get more done in less time.

To learn more, check out **Lumo.ag**

# Methodology

This report is based on flow and pressure data collected across more than 4,500 irrigation events during the 2024 growing season, spanning hundreds of premium vineyard blocks in California's top winegrowing regions. All data was captured via Lumo's proprietary, in-field IoT irrigation monitoring system, which uses high-precision flow sensors installed at the individual block level. These sensors provide real-time, high-frequency measurements of applied water volumes (gallons per vine), with timestamped records to validate delivery against plan.

The dataset was filtered to remove incomplete events and normalized to account for seasonal variation and irrigation duration. Quantitative analyses were conducted to determine deviation from target volumes, identify systemic under- or over-irrigation trends, and estimate economic impacts based on conservative yield loss and revenue assumptions. All findings are aggregated and anonymized.

The analysis assumes a standard vineyard configuration and is intended to illustrate generalizable patterns in irrigation system performance and management opportunity. Results may vary based on site-specific conditions.