COMPLEX SITE DISCHARGE PERMITTING

HYPERSCALE DATA CENTERS

Sophia Smith

Senior Environmental Officer

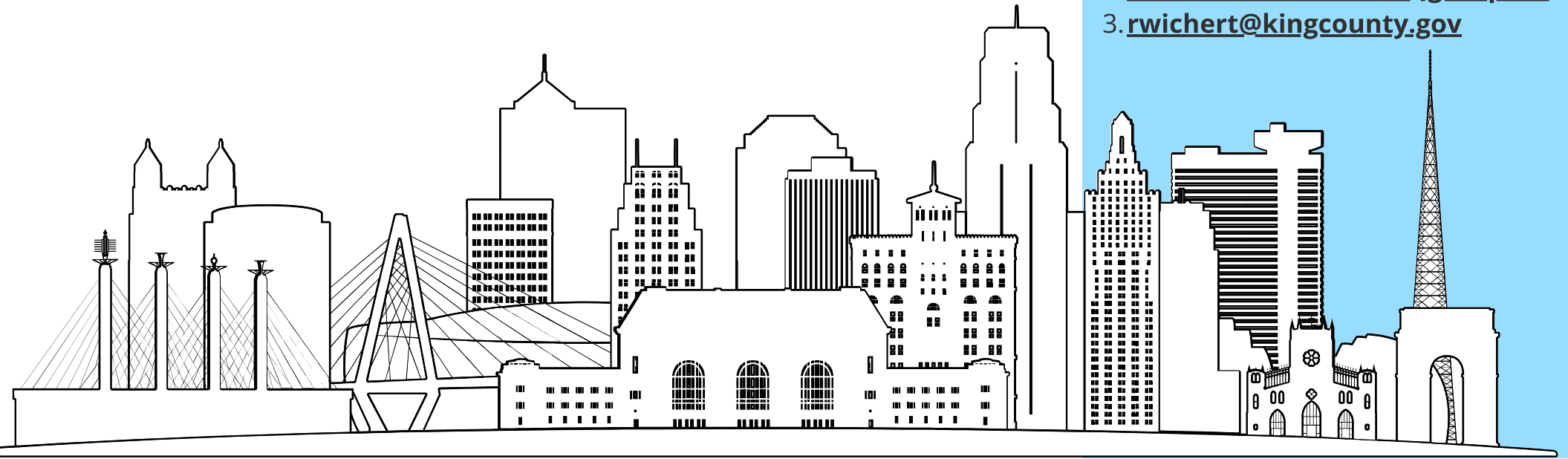
Pretreatment Coordinator

Cell: (816) 885-0949

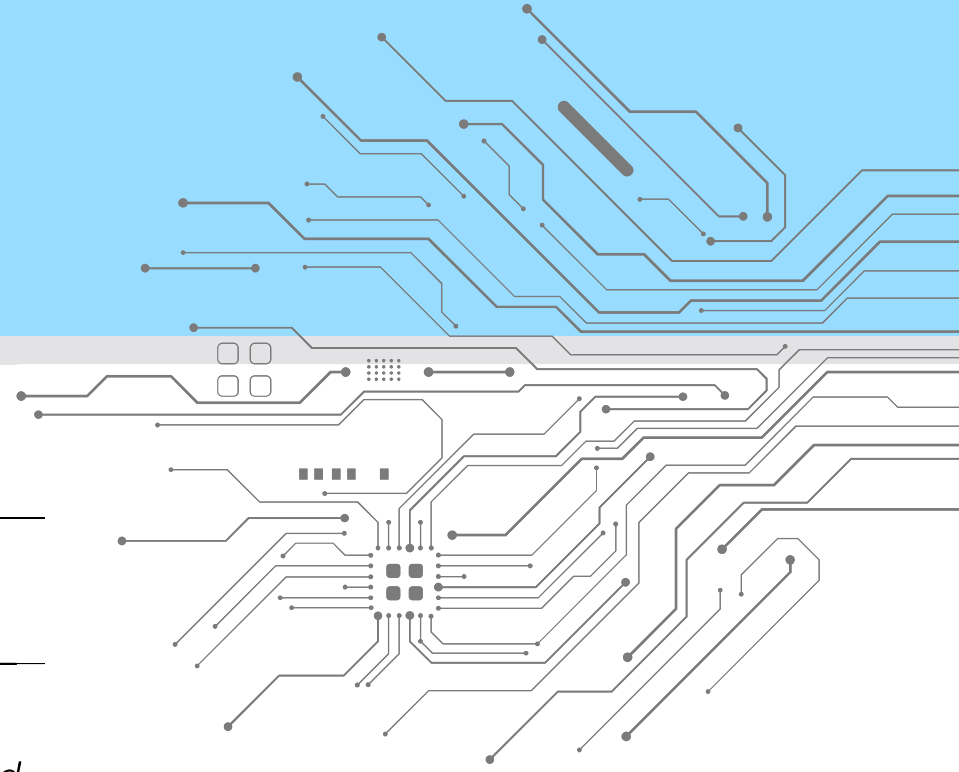
Desk: (816) 513-7269

Email: Sophia.Smith@kcmo.org

1. **groups.io/g/Pretreatment**
   a. **Apply for membership**
2. **Pretreatment+owner@groups.io**
3. **rwichert@kingcounty.gov**



HOUSEKEEPING & BOUNDARIES



/01 **Publicly verifiable information only**

No confidential project information.

/02 **My experience, not official City policy**

Views are my own

/03 **Examples have been simplified for teaching**

Calculations are illustrative unless otherwise identified

/04 **This is a pretreatment and wastewater discussion**

The focus is regulation, not endorsement/opposition

/05 **Questions and constructive disagreement are welcome**

Every condition requires local authority and technical review

1

New Achievement!!!
You Have a Data Center

Kansas City's data-center activity and how we got here.

2

Roll for Investigation

Research, public records, agreements, and the questions to ask.

3

Winter Is Coming...
and So Is Phase Two

Why temporary conditions, phased construction, and future growth matter.

4

The Infinity Stones of Pretreatment

Authority, industry process, plant loading, risk, coordination, and adaptability.

5

Fantastic Conditions and Where to Find Them

Practical permit conditions for complex sites.

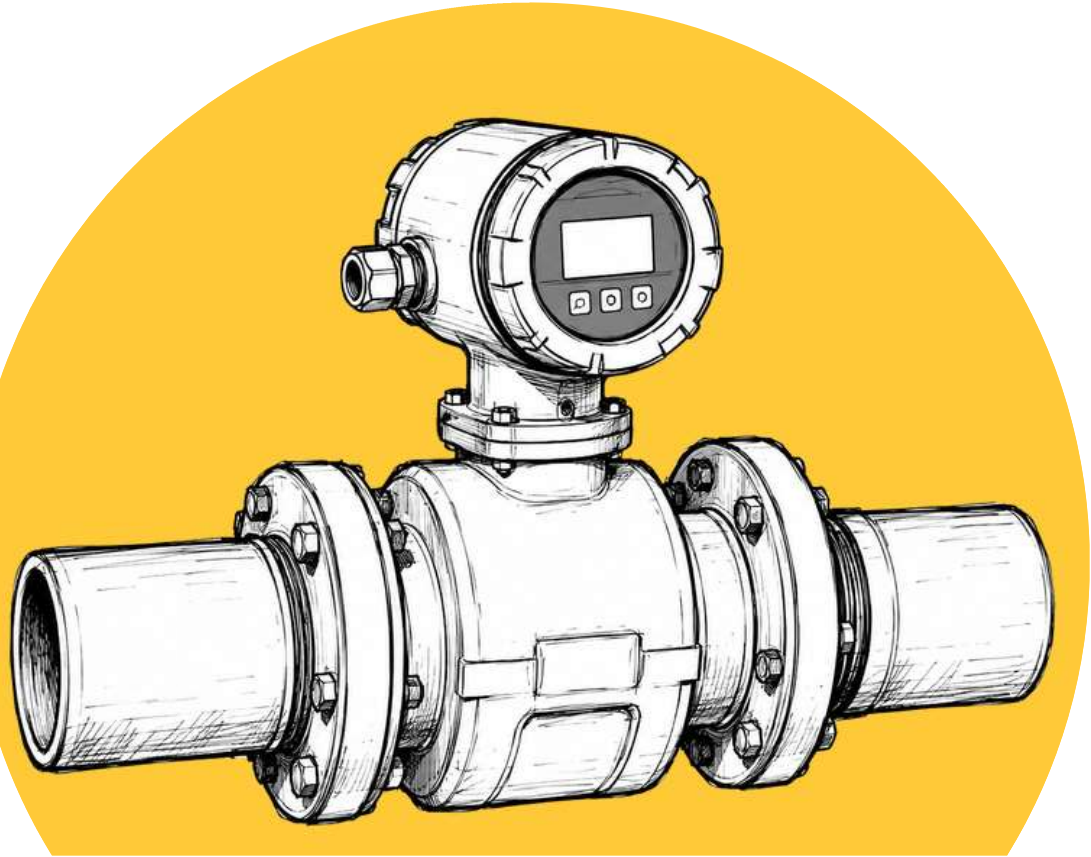
6

Do Or Do Not.
But Document It.

Workload, authority, relationships, and defensible decisions.

01

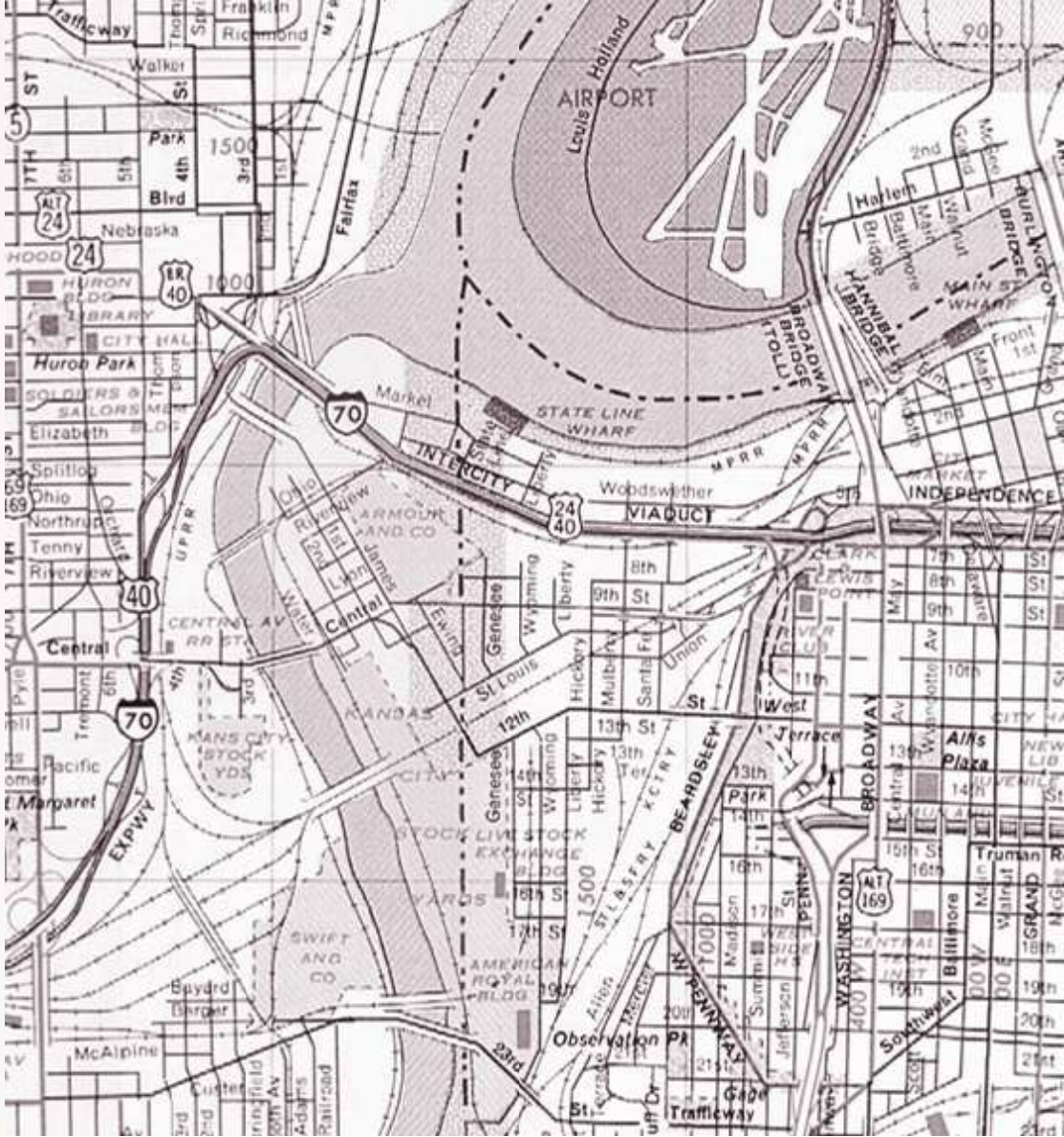
NEW ACHIEVEMENT! YOU HAVE A DATA CENTER

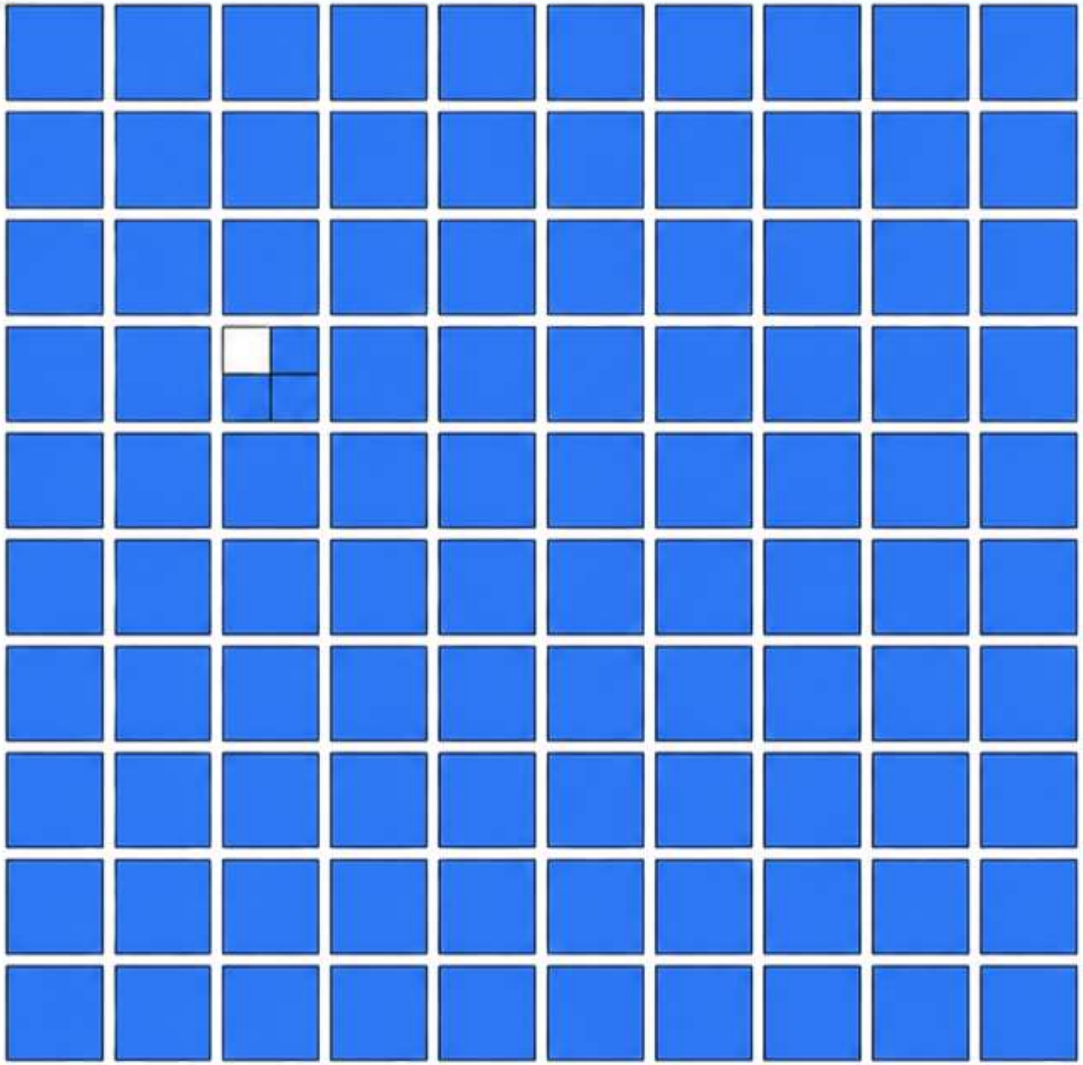


How did we get here?
And, more importantly,
what do we do now?

WHY KANSAS CITY?

- Central location and strong transportation access
- Large, development-ready industrial sites
- Existing utility infrastructure with room for phased growth
- Competitive Midwest and development incentives



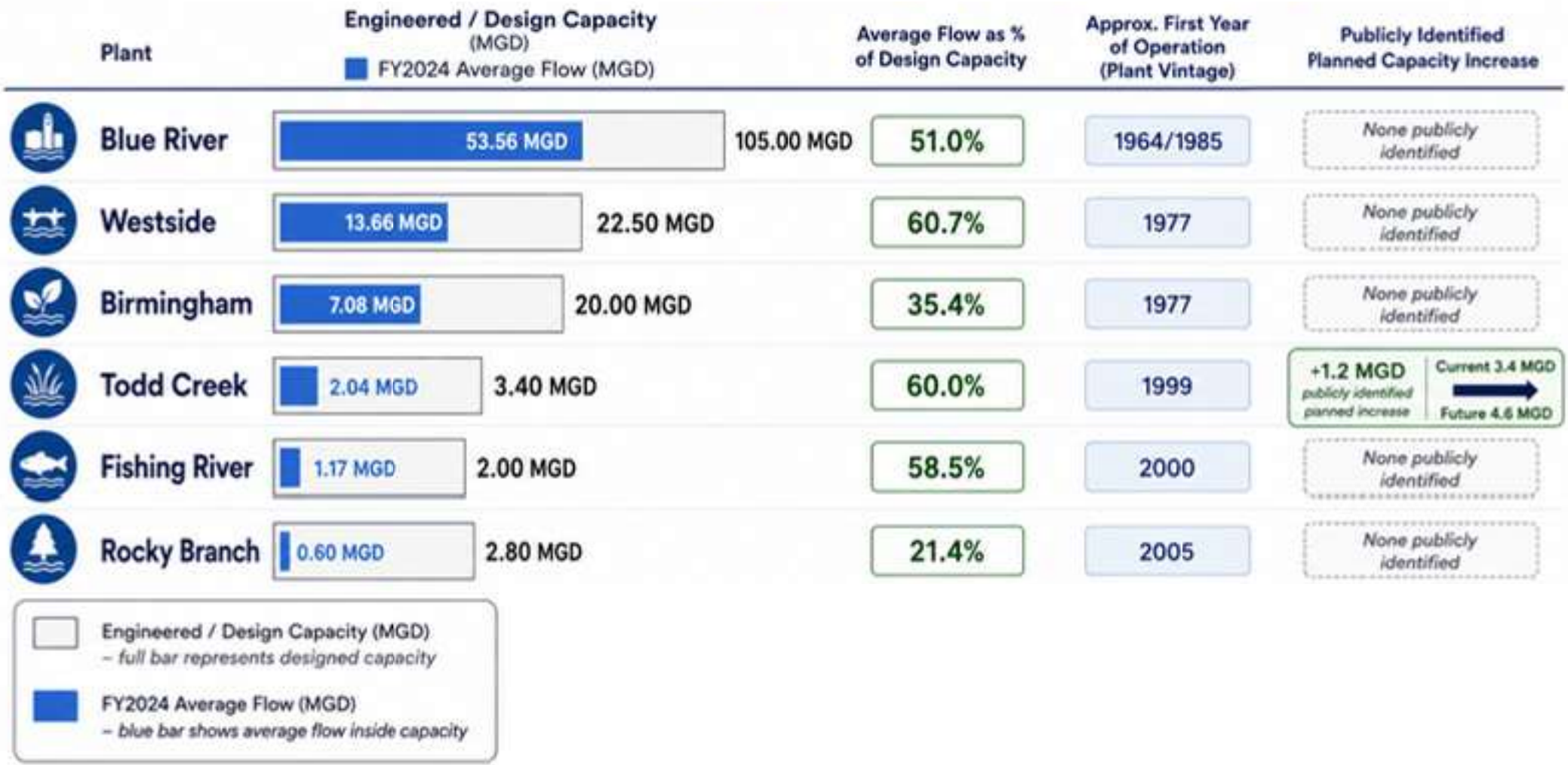


≈37 billion gallons pass us

≈100 million gallons enter our system

About 0.25% of the river's daily flow

Engineered Capacity vs. FY2024 Average Flow



Kansas City Makes, Moves, Grows and Treats It

4,701 miles
four Class I railroads

20 sectors
all the major & 100s of subsectors

85 million
gallons per year of biodiesel & biofuel

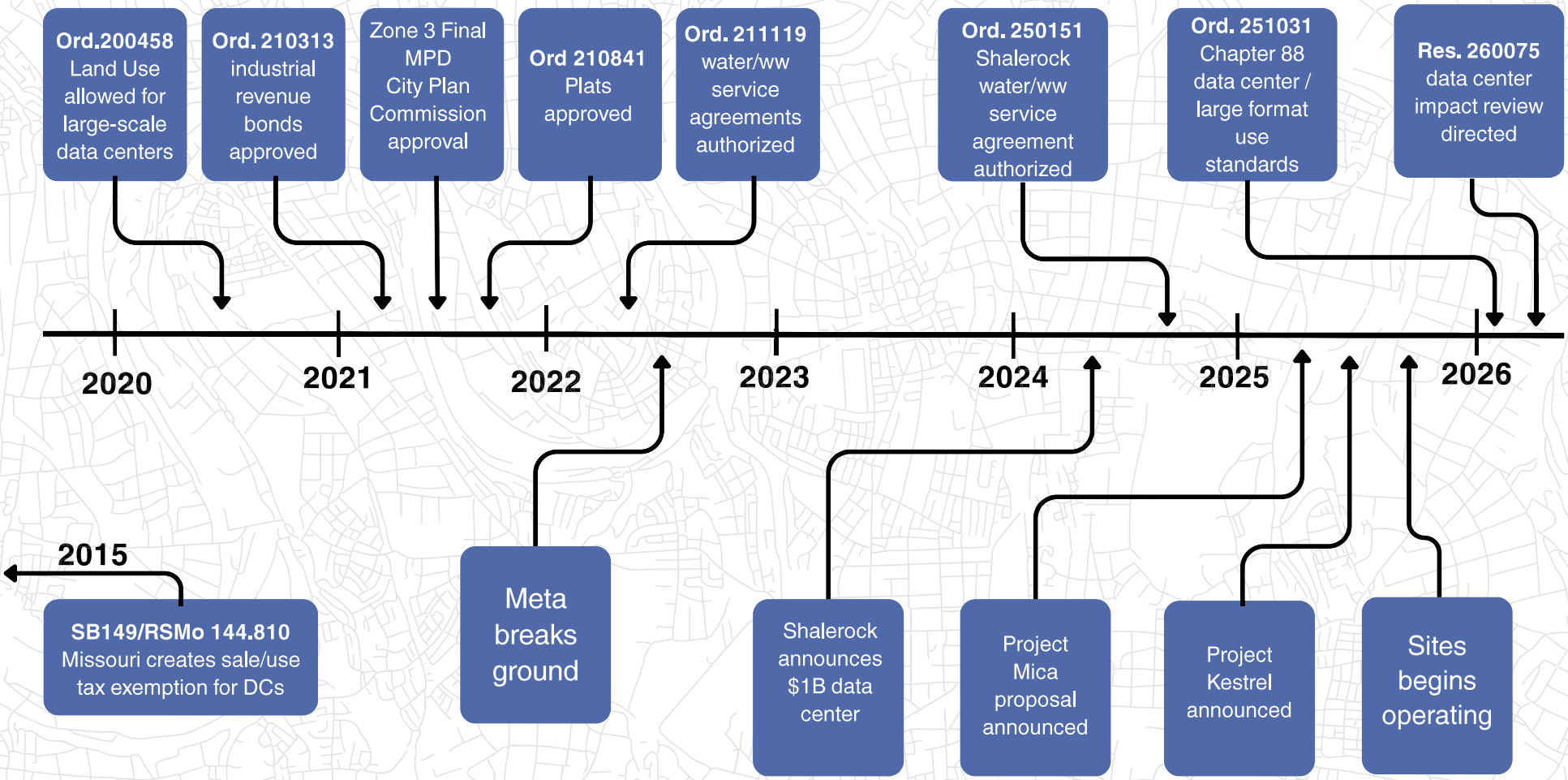
500,000+
vehicles made a year

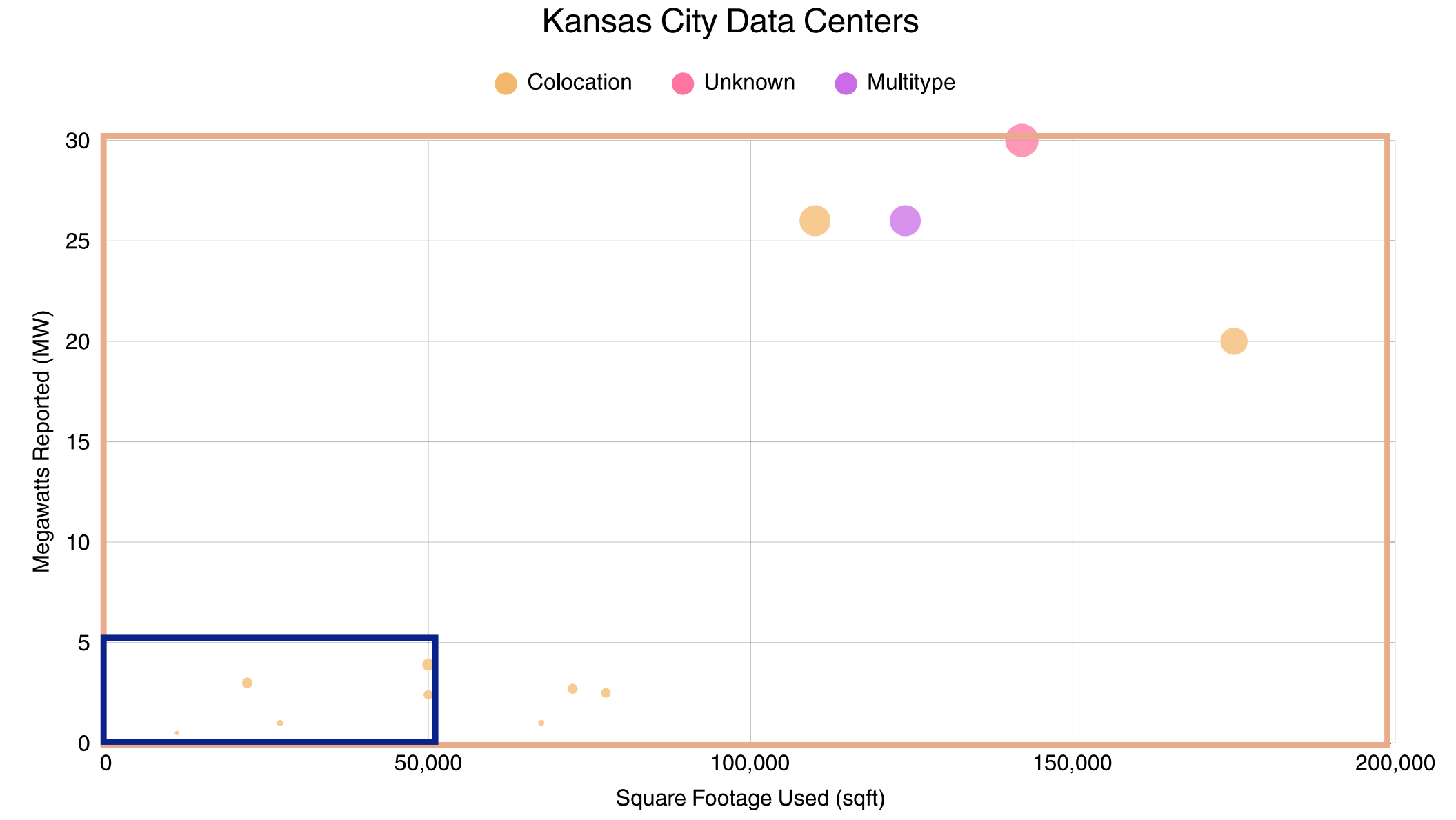
14 mil sqft
limestone-mines

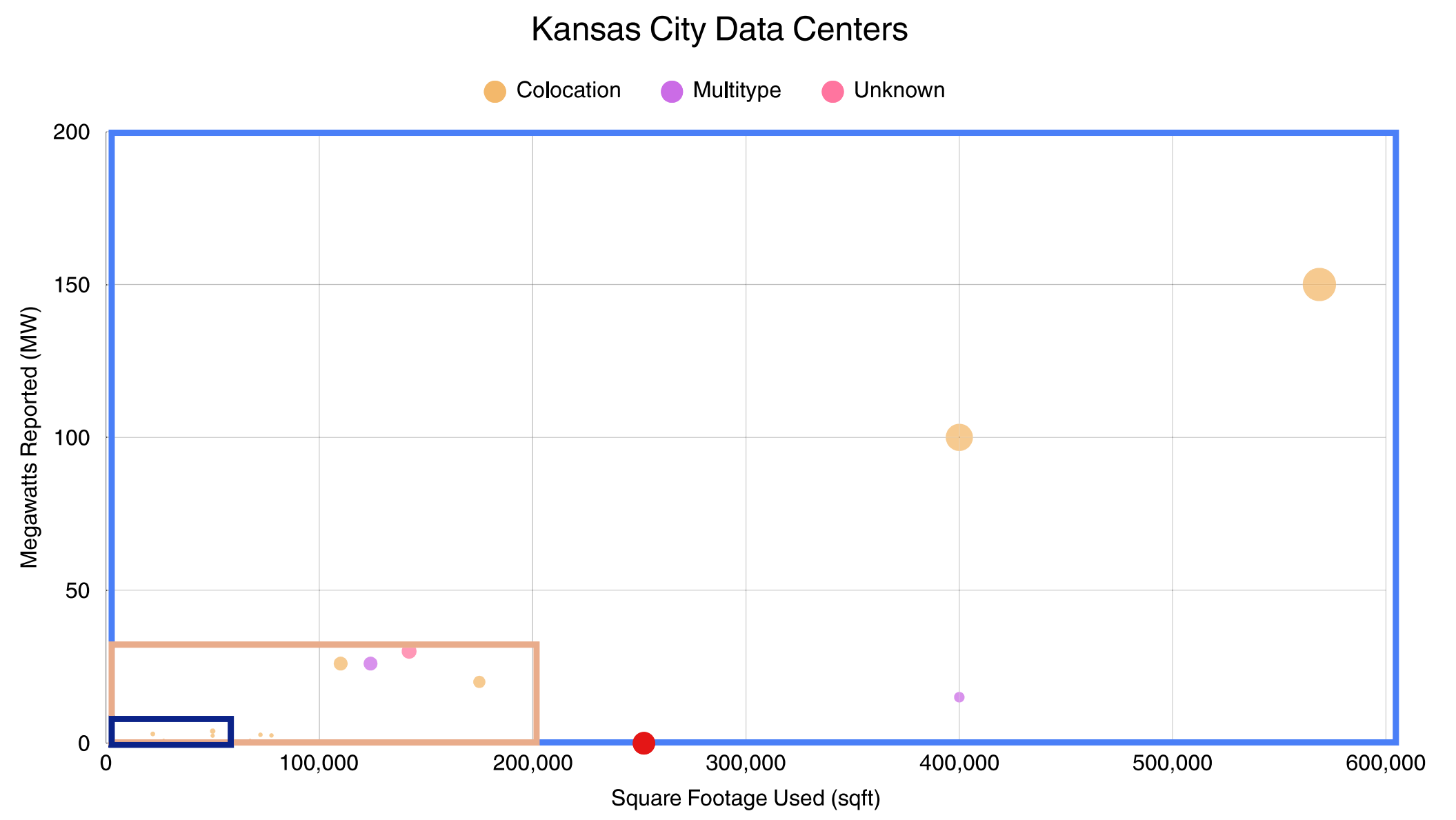
56%
animal-health industry

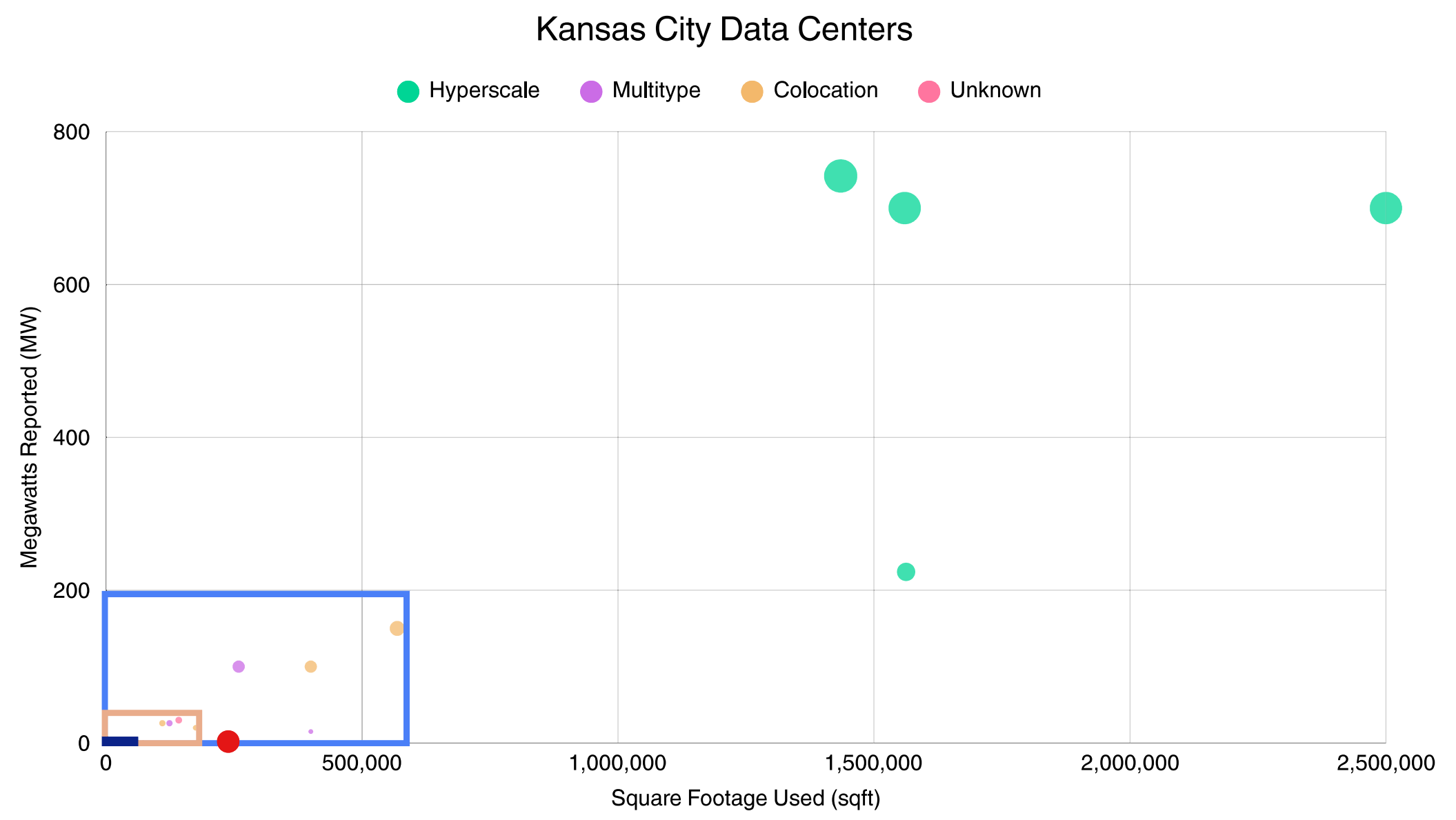
Different industries. Different processes. Different wastewater profiles.

By the time pretreatment entered the conversation, land use, financing, infrastructure and construction decisions were already underway.




Kansas City Data Centers
Colocation
Unknown
Multitype
Megawatts Reported (MW)
30
25
20
15
10
5
0
0
50,000
100,000
150,000
200,000
Square Footage Used (sqft)


Kansas City Data Centers
Colocation
Multitype
Unknown
200
150
100
50
0
Megawatts Reported (MW)
0
100,000
200,000
300,000
400,000
500,000
600,000
Square Footage Used (sqft)


Kansas City Data Centers
Hyperscale
Multitype
Colocation
Unknown
800
600
400
200
0
Megawatts Reported (MW)
0
500,000
1,000,000
1,500,000
2,000,000
2,500,000
Square Footage Used (sqft)

Kansas City Hyperscale Size Comparison

Publicly stated square footage benchmarked against GEHA Field at Arrowhead Stadium event space

1 GEHA Field at Arrowhead Stadium

250,000 sq ft

event space

2 Meta Kansas City

1.0 million sq ft

publicly reported campus size

~4.0x Arrowhead event space

3 Shalerock

1.435 million sq ft

4 potential phases + ancillary buildings

~5.7x Arrowhead event space

4 Project Mica

1.56 million sq ft

5 hyperscale buildings

~6.2x Arrowhead event space

5 Project Kestrel

Up to 1.8 million sq ft

6 hyperscale data centers

~7.2x Arrowhead event space

RELATIVE SCALE (BY SQUARE FOOTAGE)

250,000 sq ft | 1.0 million sq ft | 1.435 million sq ft | 1.56 million sq ft | Up to 1.8 million sq ft

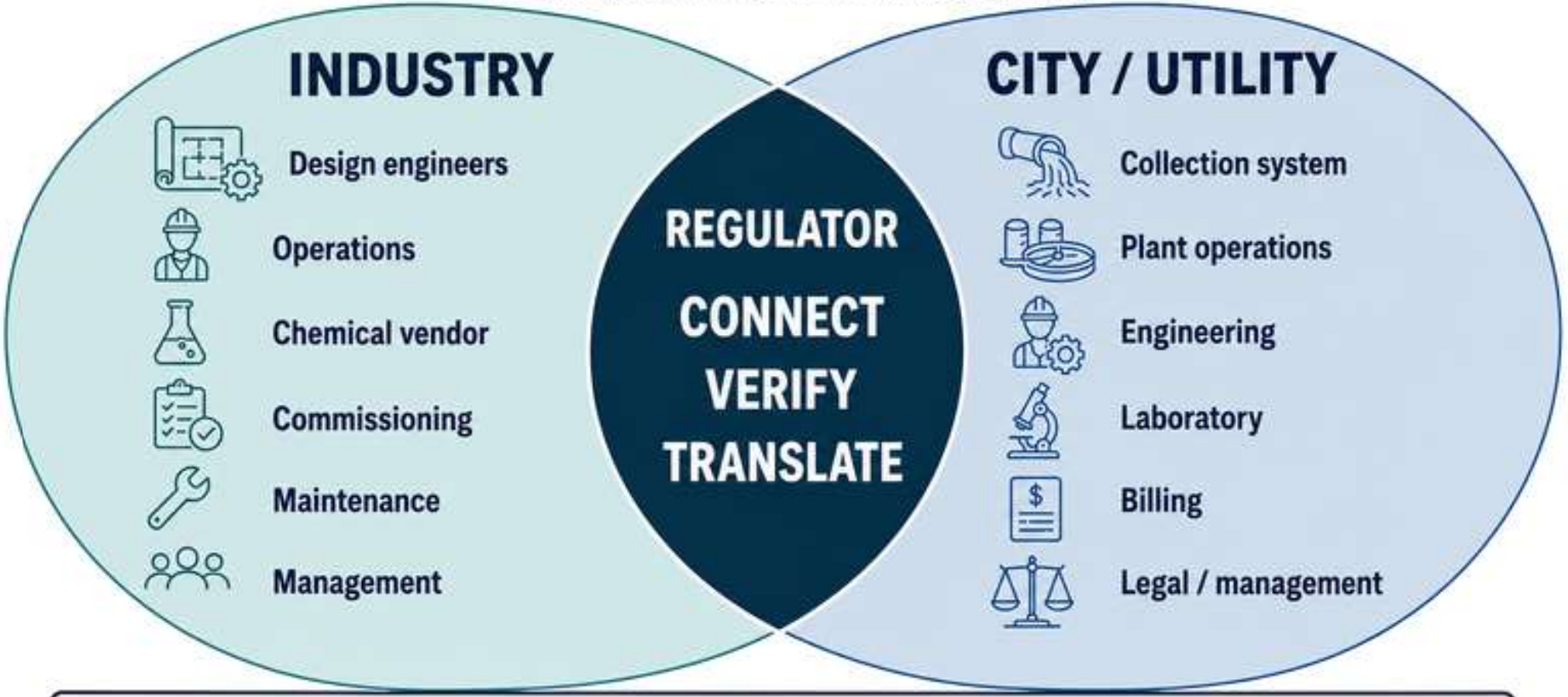
02

ROLL FOR INVESTIGATION

Good questions to the right people will save you from stress down the road

Who Has the Answers?

No one person knows the whole system.



INDUSTRY KNOWS THE FACILITY. THE CITY KNOWS THE SYSTEM. THE REGULATOR MUST UNDERSTAND BOTH.

Confidentiality Has a Boundary

Respect legitimate confidential information—but know what must remain public.

MAY QUALIFY FOR CONFIDENTIAL TREATMENT

- Proprietary processes
- Chemical formulations
- Detailed engineering information
- Security-sensitive information

MUST REMAIN PUBLIC

EFFLUENT DATA

- Discharge flows
- Sampling results
- Pollutant concentrations

> “Information and data provided to the Control Authority pursuant to this part which is effluent data shall be available to the public without restriction.”

40 CFR §403.14(b)

WATER & SEWER USE AGREEMENTS

- *Capacity allocations*
- *Phasing and buildout schedule*
- *Infrastructure improvements*
- *Ownership after construction*
- *Rates, charges, and billing*
- *Confidentiality or public records language*

ENTERPRISE

- One organization
- Private facility for its own IT
- Typical setting: company campus

COLOCATION

- Many customers
- Shared building; rented space and power
- Typical setting: regional data hub

HYPERSCALE

- Massive cloud platform
- Purpose-built for enormous computing demand
- Typical setting: multi-building campus

EDGE

- Close to the user
- Small site for fast, local processing
- Typical setting: city, tower, or factory

CONTAINERIZED

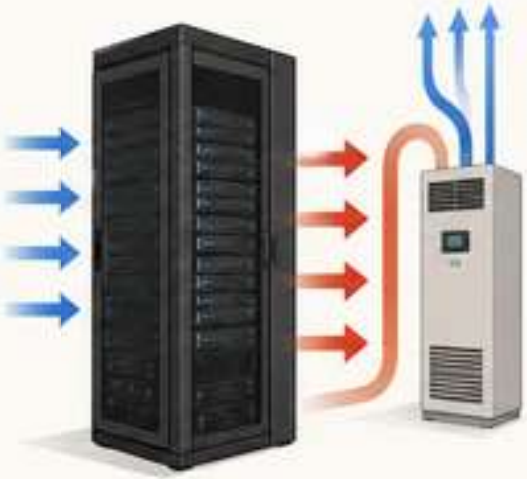
- Modular and movable
- Equipment installed in prefabricated modules
- Typical setting: temporary or expandable site

How Heat Is Collected from the Equipment

The closer cooling gets to the component, the more heat it can capture directly.

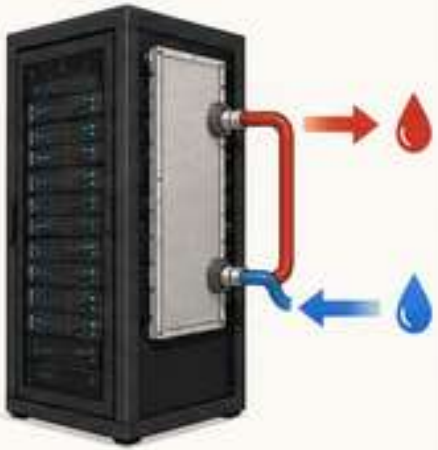
1 AIR COOLING

Fans move heat into the room air



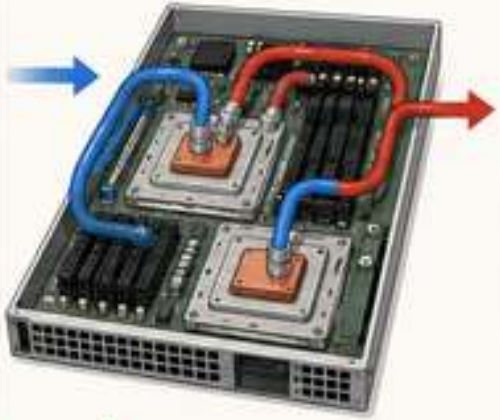
2 RACK-LEVEL

Heat exchanger captures heat at the rack



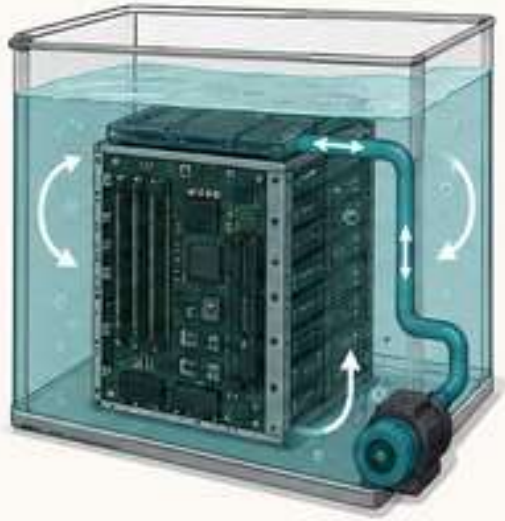
3 DIRECT-TO-CHIP

Liquid collects heat from CPUs and GPUs



4 IMMERSION

Equipment sits in nonconductive cooling fluid



HYBRID: Liquid captures the hottest components while air cools the rest.

Heat collected farther away ← → Heat collected closer to the source

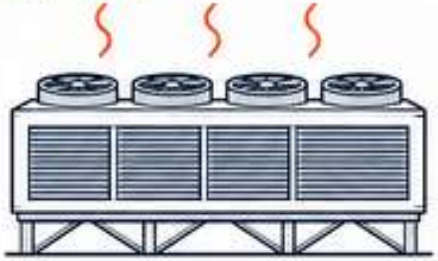
How Heat Is Released from the Facility

Cooling equipment transfers heat. The facility must ultimately reject or reuse it.

DRY COOLING

Fans release heat to outdoor air.

Water use: Low



EVAPORATIVE COOLING

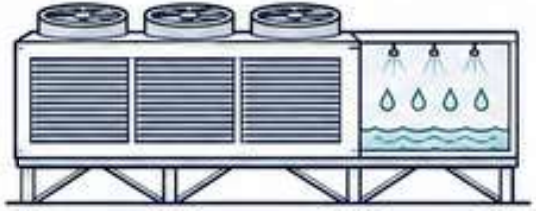
Water evaporation carries heat away.

Water use: High

HYBRID WET–DRY

Runs dry when possible and uses water when needed.

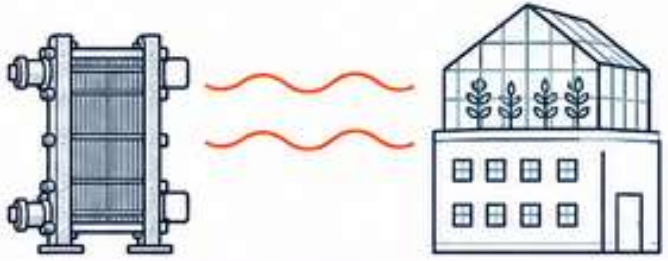
Water use: Variable



HEAT REUSE

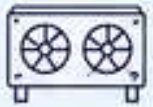
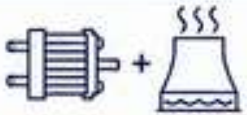
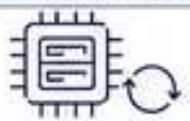
Recovered heat serves another useful demand.

Water use: System dependent

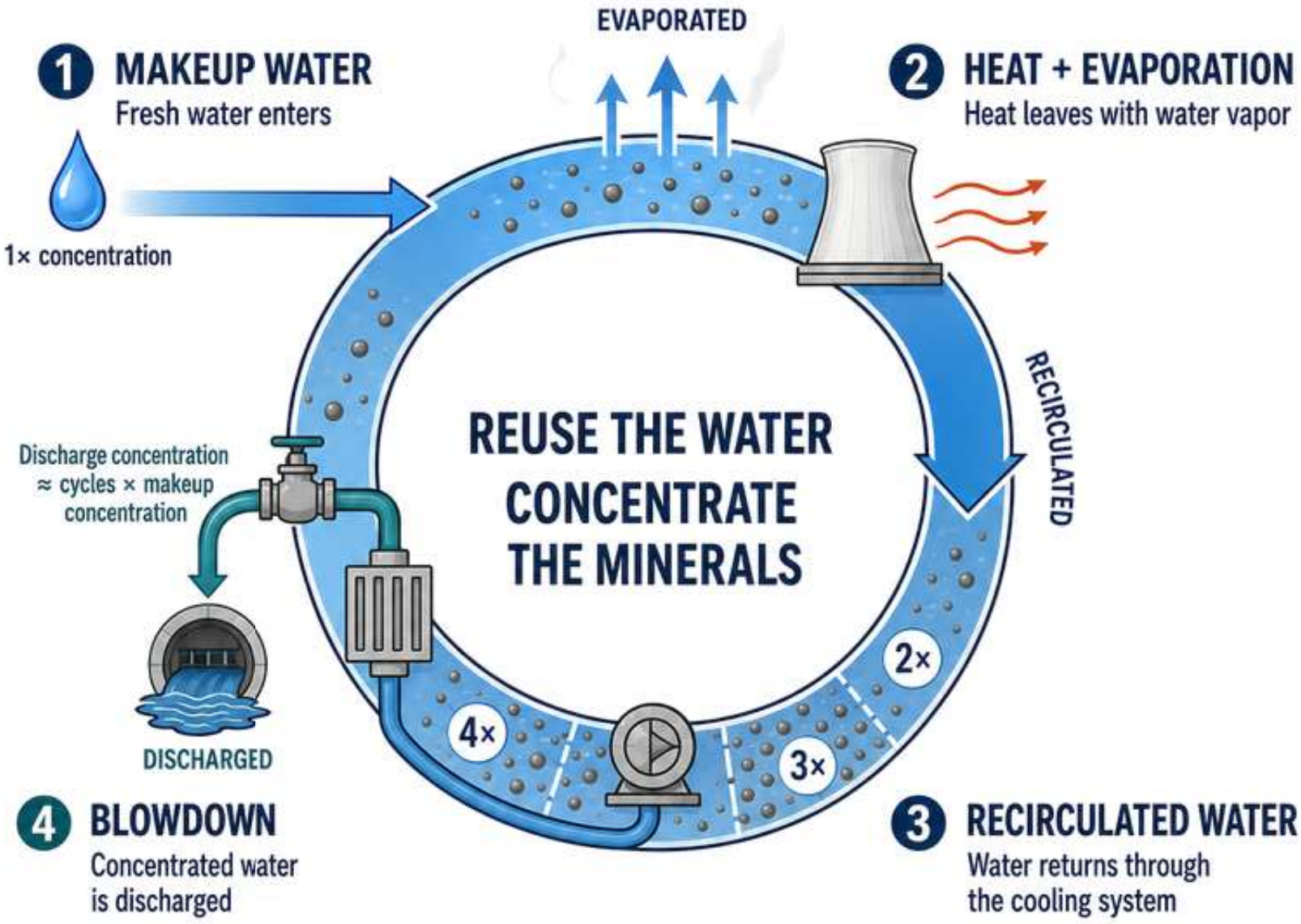


From Investigation to Permit Conditions

The cooling-system label tells us where to start. The investigation tells us what to regulate.

INVESTIGATION FINDING	POTENTIAL PERMIT RESPONSE
 Closed loop + dry coolers →	Address leaks, draining, flushing and maintenance discharges
 Closed equipment loop + evaporative tower →	Regulate tower blowdown separately from closed-loop drainage
 Glycol or specialty-coolant loop →	Require chemical disclosure and approval before discharge
 Closed-circuit cooling tower →	Investigate and regulate the separate evaporative spray-water loop
 Hybrid wet–dry system →	Account for seasonal and load-dependent discharge variability
 Future transition to liquid cooling →	Require advance notice before equipment or chemical-program changes

"CLOSED LOOP" DESCRIBES CONTAINMENT — NOT THE ENTIRE COOLING PROCESS.


EVAPORATED
1 MAKEUP WATER
Fresh water enters
1× concentration
2 HEAT + EVAPORATION
Heat leaves with water vapor
RECIRCULATED
REUSE THE WATER
CONCENTRATE
THE MINERALS
Discharge concentration
≈ cycles × makeup
concentration
DISCHARGED
4×
3×
2×
4 BLOWDOWN
Concentrated water
is discharged
3 RECIRCULATED WATER
Water returns through
the cooling system

Get All Four Flow Numbers

One number cannot describe the entire discharge.

1 AVERAGE DAILY

What happens normally?

Typical gallons per day

2 MAXIMUM DAILY

What happens on the biggest day?

Highest total in 24 hours

3 MAXIMUM INSTANTANEOUS

How fast can it arrive?

Peak gallons per minute

4 MAXIMUM SIMULTANEOUS

What if multiple sources discharge together?

Combined sitewide peak

Go Look for Yourself

If a permit condition depends on a physical fact, verify that fact onsite.

1 PREPARE

Permission
Site contact
Required PPE

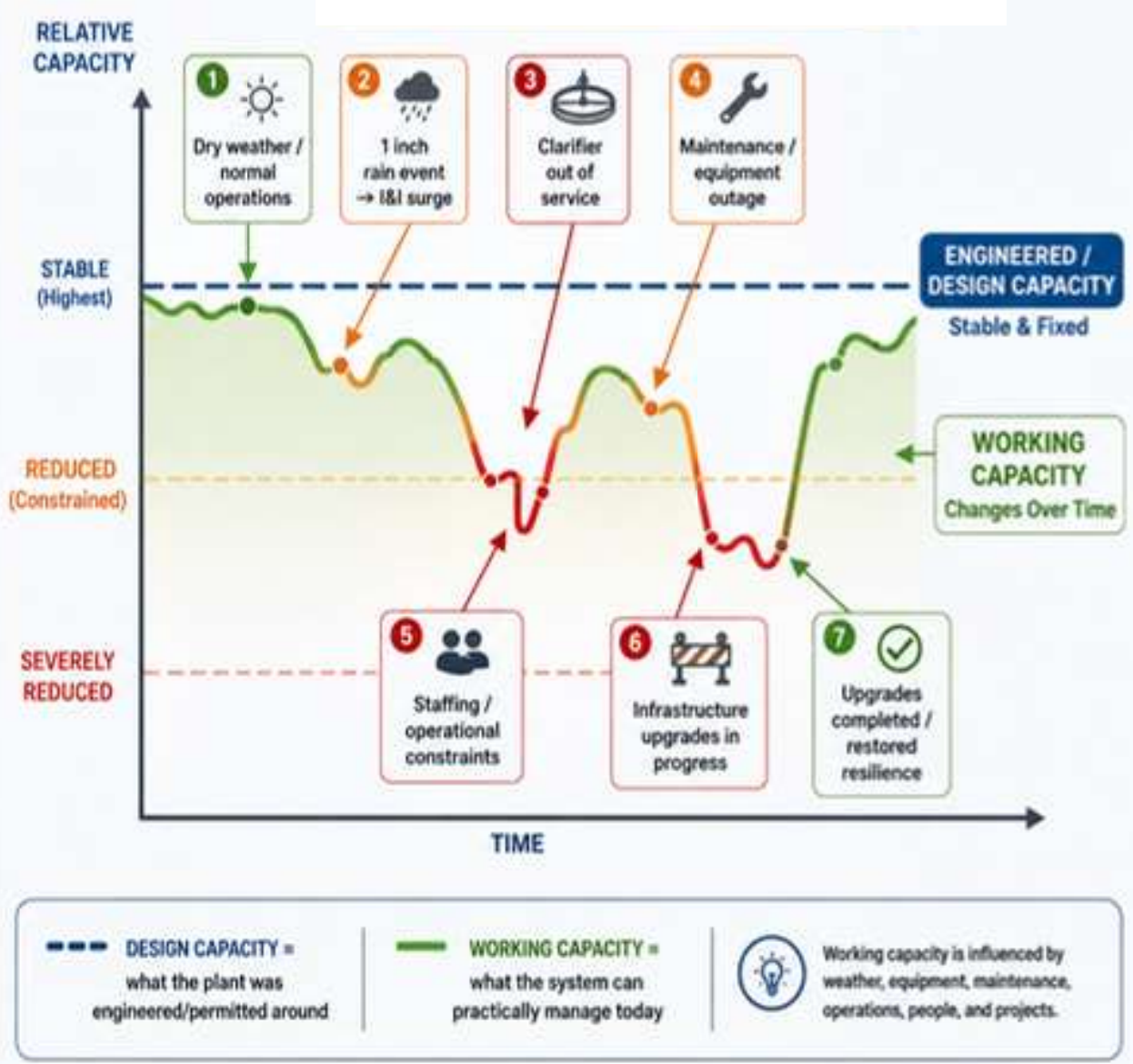
2 VERIFY

Trace the water
Compare the drawings
Confirm the connections

3 DOCUMENT

Field notes
Authorized photos
Unverified items


INFLUENT
(From Collection System)
1 HEADWORKS
Screens / Grit Removal
2 AERATION BASINS
Biological Treatment
3 SECONDARY CLARIFIERS
Solids Separation
4 DISINFECTION
Disinfection Prior to Discharge
EFFLUENT
(To Receiving Water)
5 SOLIDS HANDLING
Thickening / Digestion / Dewatering


RELATIVE CAPACITY
1 Dry weather / normal operations
2 1 inch rain event → I&I surge
3 Clarifier out of service
4 Maintenance / equipment outage
STABLE (Highest)
ENGINEERED / DESIGN CAPACITY
Stable & Fixed
REDUCED (Constrained)
WORKING CAPACITY
Changes Over Time
SEVERELY REDUCED
5 Staffing / operational constraints
6 Infrastructure upgrades in progress
7 Upgrades completed / restored resilience
TIME
DESIGN CAPACITY = what the plant was engineered/permitted around
WORKING CAPACITY = what the system can practically manage today
Working capacity is influenced by weather, equipment, maintenance, operations, people, and projects.

WINTER IS COMING. . . AND SO IS PHASE TWO

Today's conditions are temporary—seasons change, construction continues, and the next phase is already coming online.

CONSTRUCTION

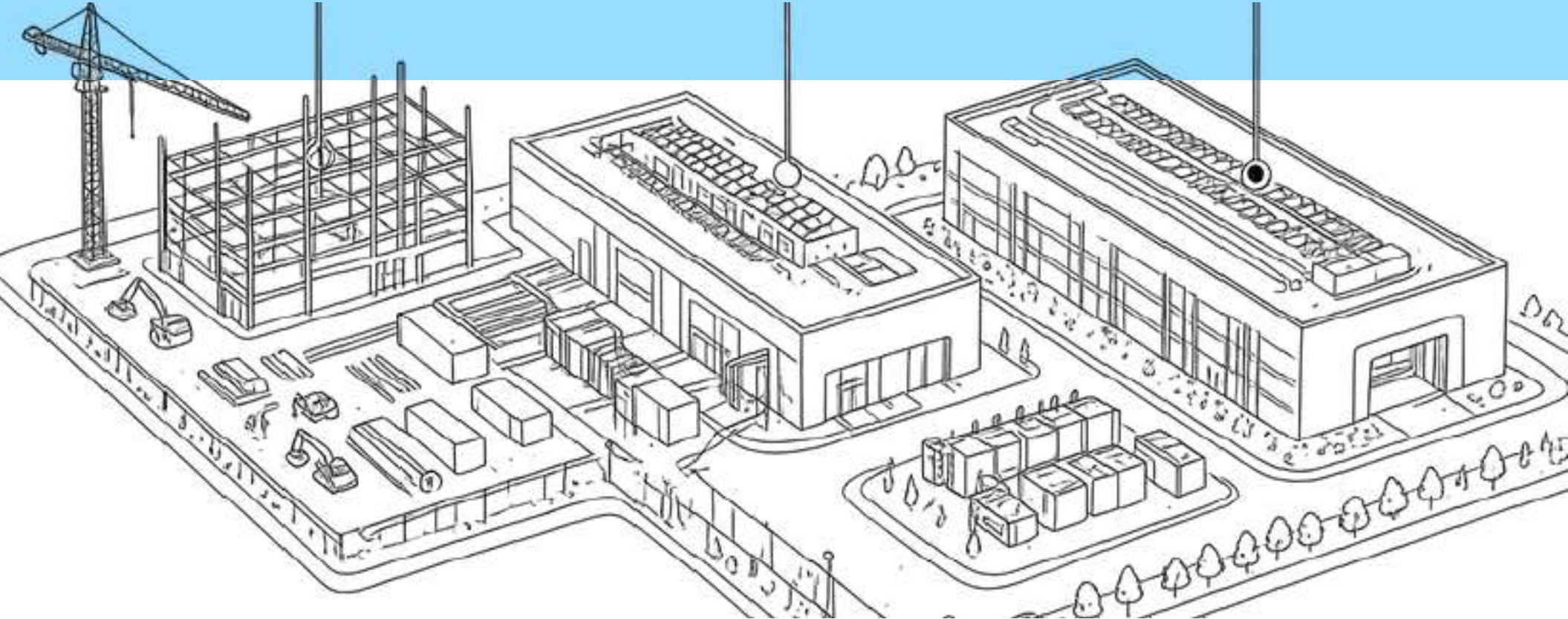
- TEMPORARY ACTIVITIES.
- CONTRACTORS MAY CONTROL.

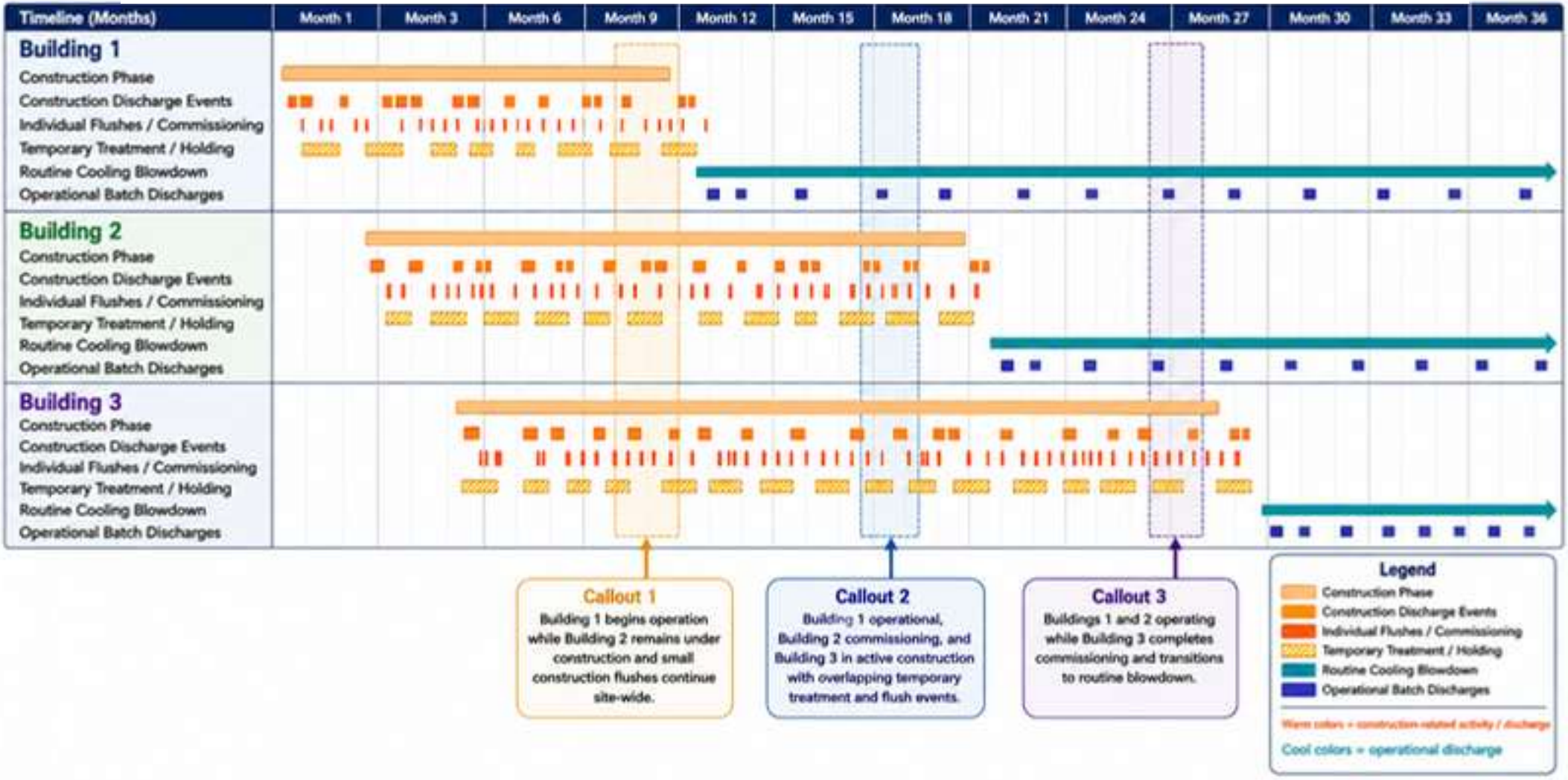
COMMISSIONING

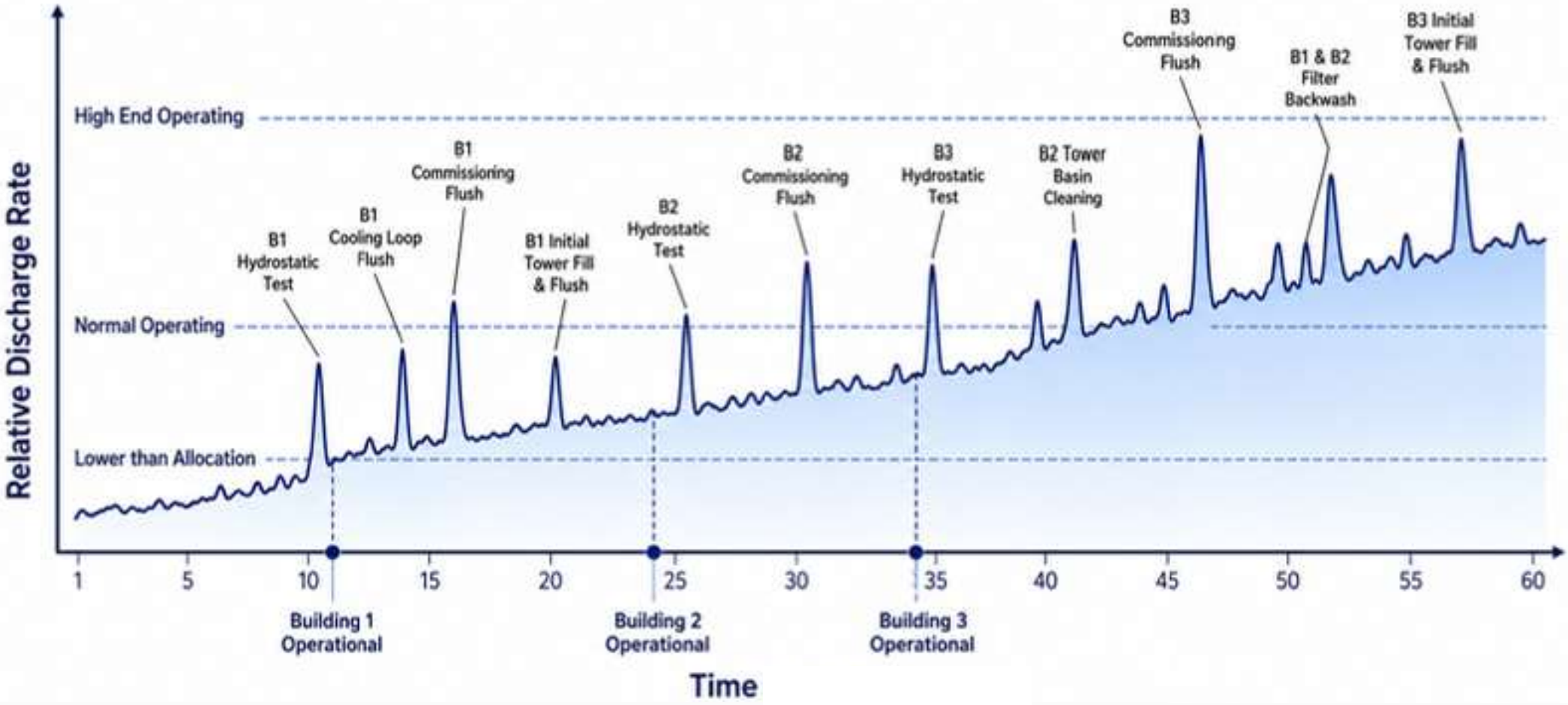
- DISCHARGES CAN BE INTERMITTENT, CONCENTRATED AND DIFFICULT TO PREDICT.

OPERATIONS

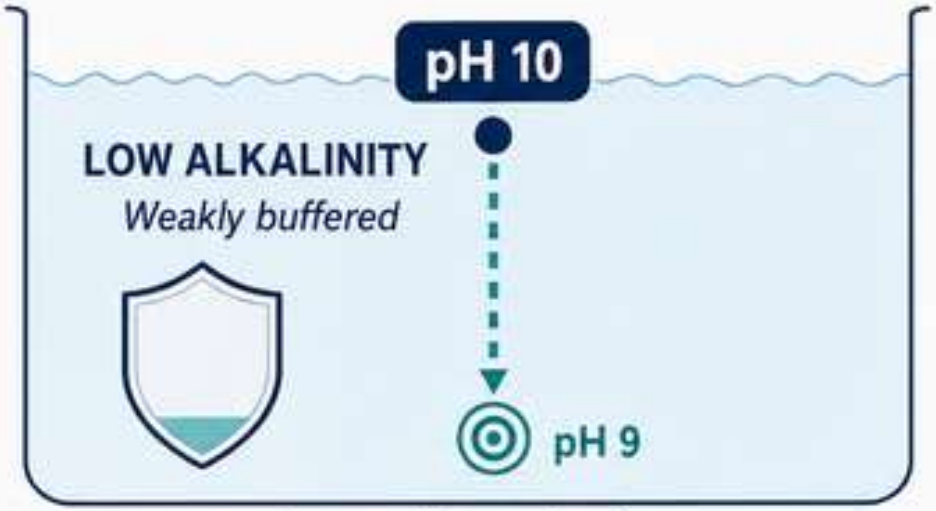
- MORE PREDICTABLE BUT STILL VARY



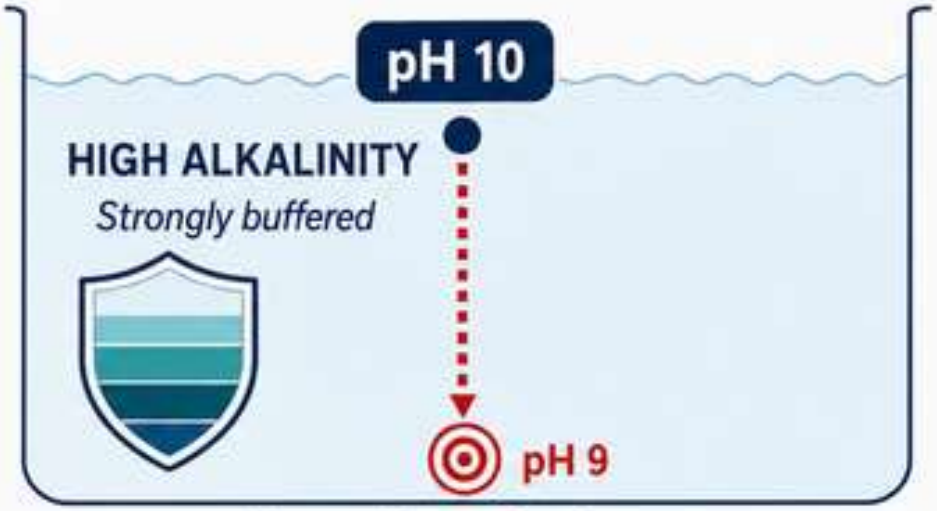

Timeline (Months)
Month 1
Month 3
Month 6
Month 9
Month 12
Month 15
Month 18
Month 21
Month 24
Month 27
Month 30
Month 33
Month 36
Building 1
Construction Phase
Construction Discharge Events
Individual Flushes / Commissioning
Temporary Treatment / Holding
Routine Cooling Blowdown
Operational Batch Discharges
Building 2
Construction Phase
Construction Discharge Events
Individual Flushes / Commissioning
Temporary Treatment / Holding
Routine Cooling Blowdown
Operational Batch Discharges
Building 3
Construction Phase
Construction Discharge Events
Individual Flushes / Commissioning
Temporary Treatment / Holding
Routine Cooling Blowdown
Operational Batch Discharges
Callout 1
Building 1 begins operation while Building 2 remains under construction and small construction flushes continue site-wide.
Callout 2
Building 1 operational, Building 2 commissioning, and Building 3 in active construction with overlapping temporary treatment and flush events.
Callout 3
Buildings 1 and 2 operating while Building 3 completes commissioning and transitions to routine blowdown.
Legend
Construction Phase
Construction Discharge Events
Individual Flushes / Commissioning
Temporary Treatment / Holding
Routine Cooling Blowdown
Operational Batch Discharges
Warm colors = construction-related activity / discharge
Cool colors = operational discharge


Relative Discharge Rate
High End Operating
Normal Operating
Lower than Allocation
B1 Hydrostatic Test
B1 Cooling Loop Flush
B1 Commissioning Flush
B1 Initial Tower Fill & Flush
B2 Hydrostatic Test
B2 Commissioning Flush
B3 Hydrostatic Test
B2 Tower Basin Cleaning
B3 Commissionng Flush
B1 & B2 Filter Backwash
B3 Initial Tower Fill & Flush
1
5
10
15
20
25
30
35
40
45
50
55
60
Building 1 Operational
Building 2 Operational
Building 3 Operational
Time

SAME pH. DIFFERENT CONDITION.



Less acid required



More acid required

Same pH ≠ Same Neutralization Demand

Relative hydroxide concentration*

pH 9 — 1×

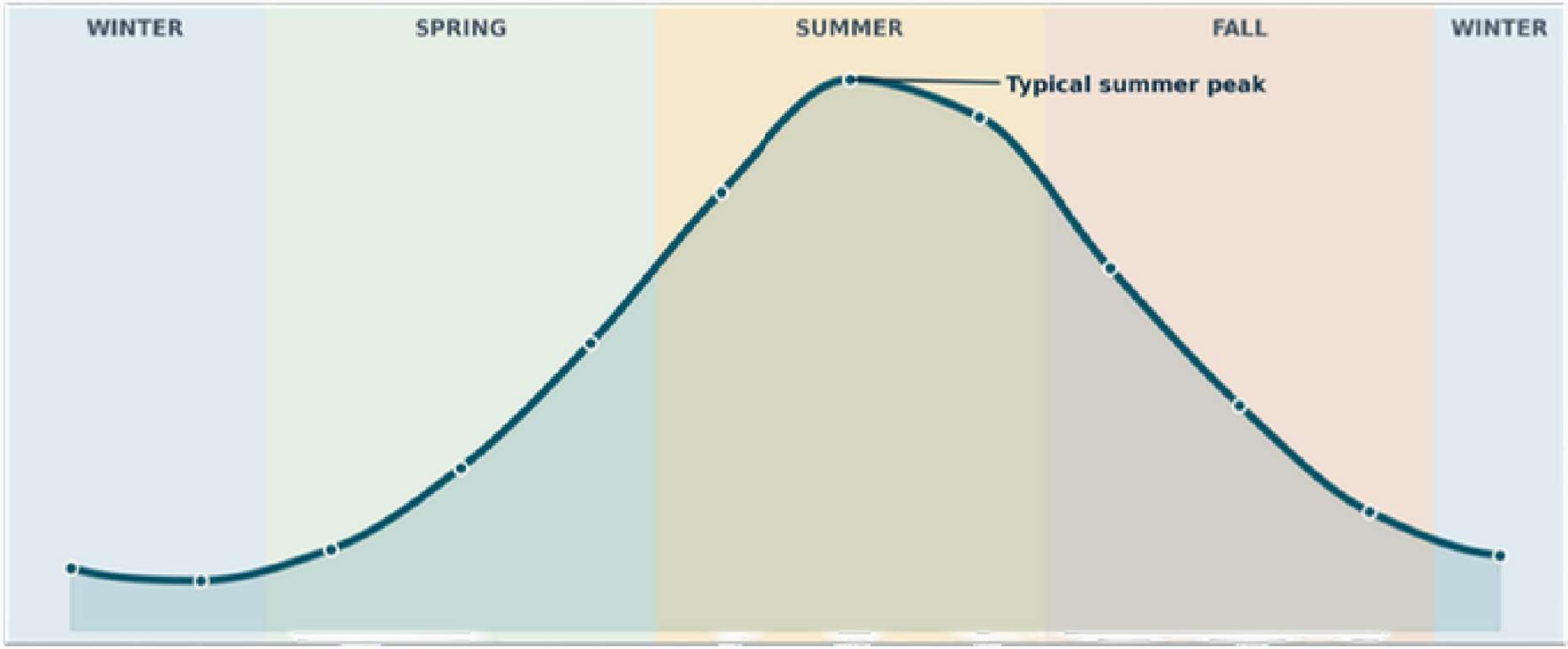
pH 10 — 10×

pH 11 — 100×

Factors that influence neutralization demand

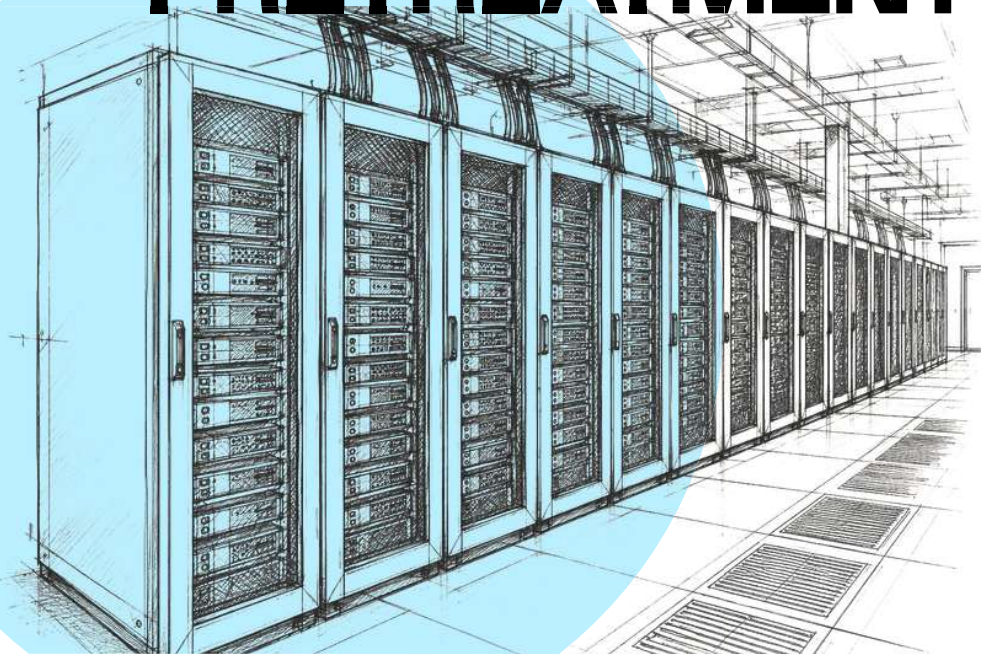
- Alkalinity
- Buffering
- Flow & duration
- Wastewater chemistry

pH is the reading. Alkalinity helps explain how hard it is to change.


WINTER
SPRING
SUMMER
FALL
WINTER
Typical summer peak

04

THE INFINITY STONES OF PRETREATMENT

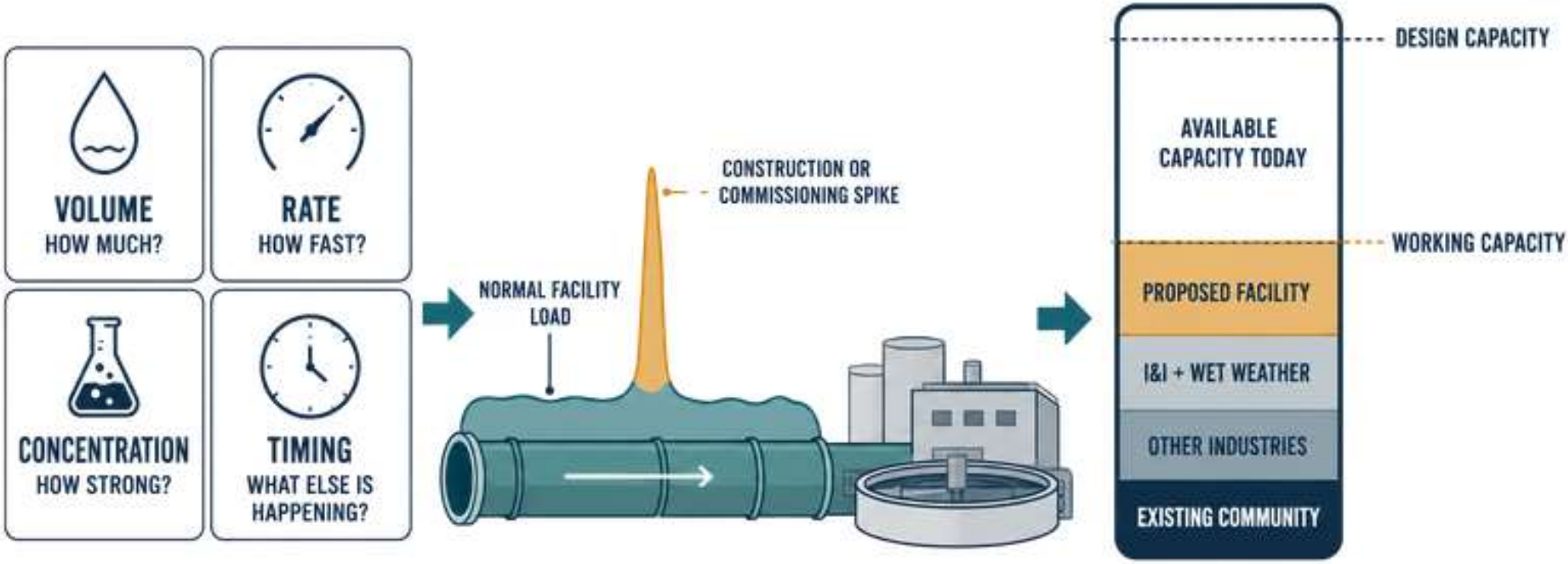


1. AUTHORITY
2. INDUSTRY PROCESS
3. PLANT LOADING
4. RISK & REWARD
5. COORDINATION
6. ADAPTIBILITY

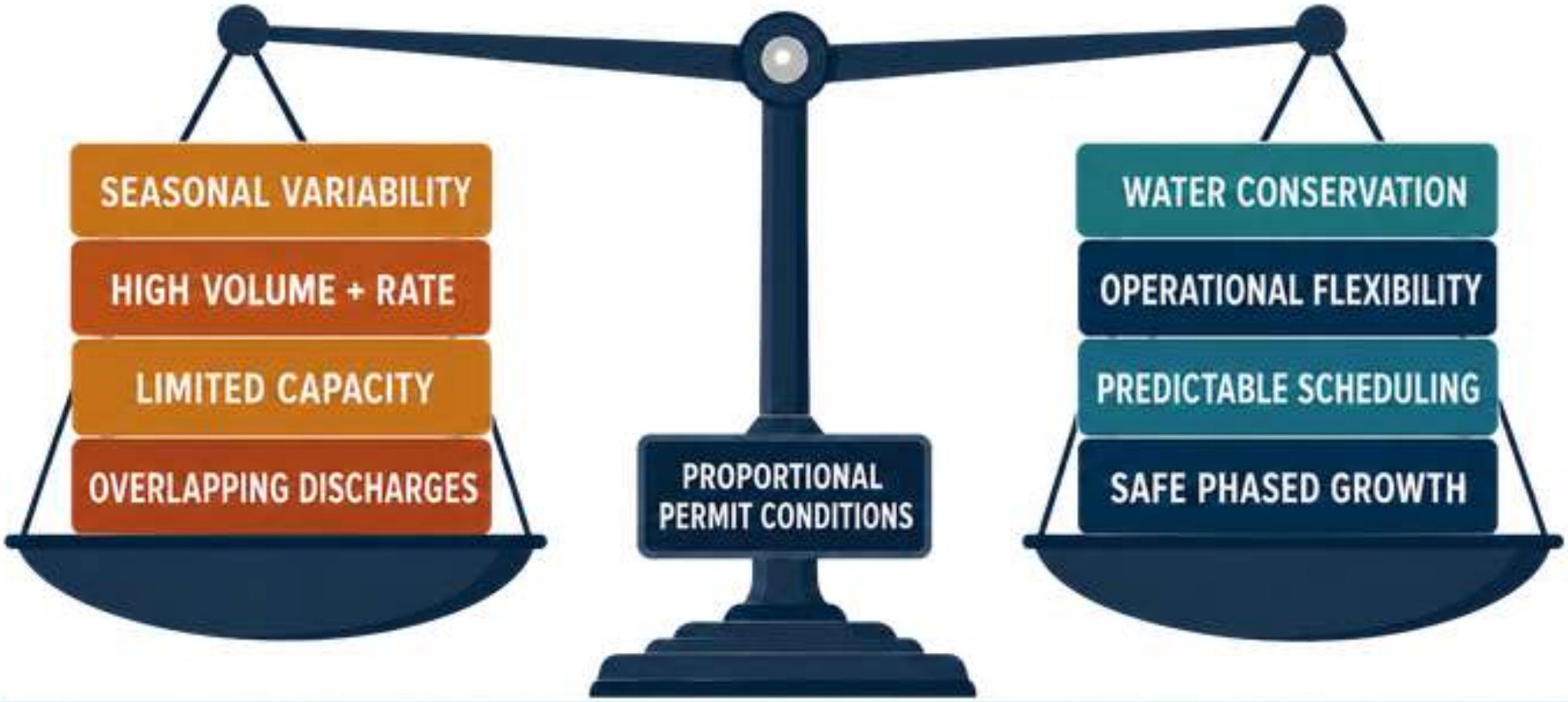

ENFORCEABLE PERMIT CONDITION
FEDERAL + STATE
LOCAL ORDINANCE
AGREEMENTS
PERMIT AUTHORITY

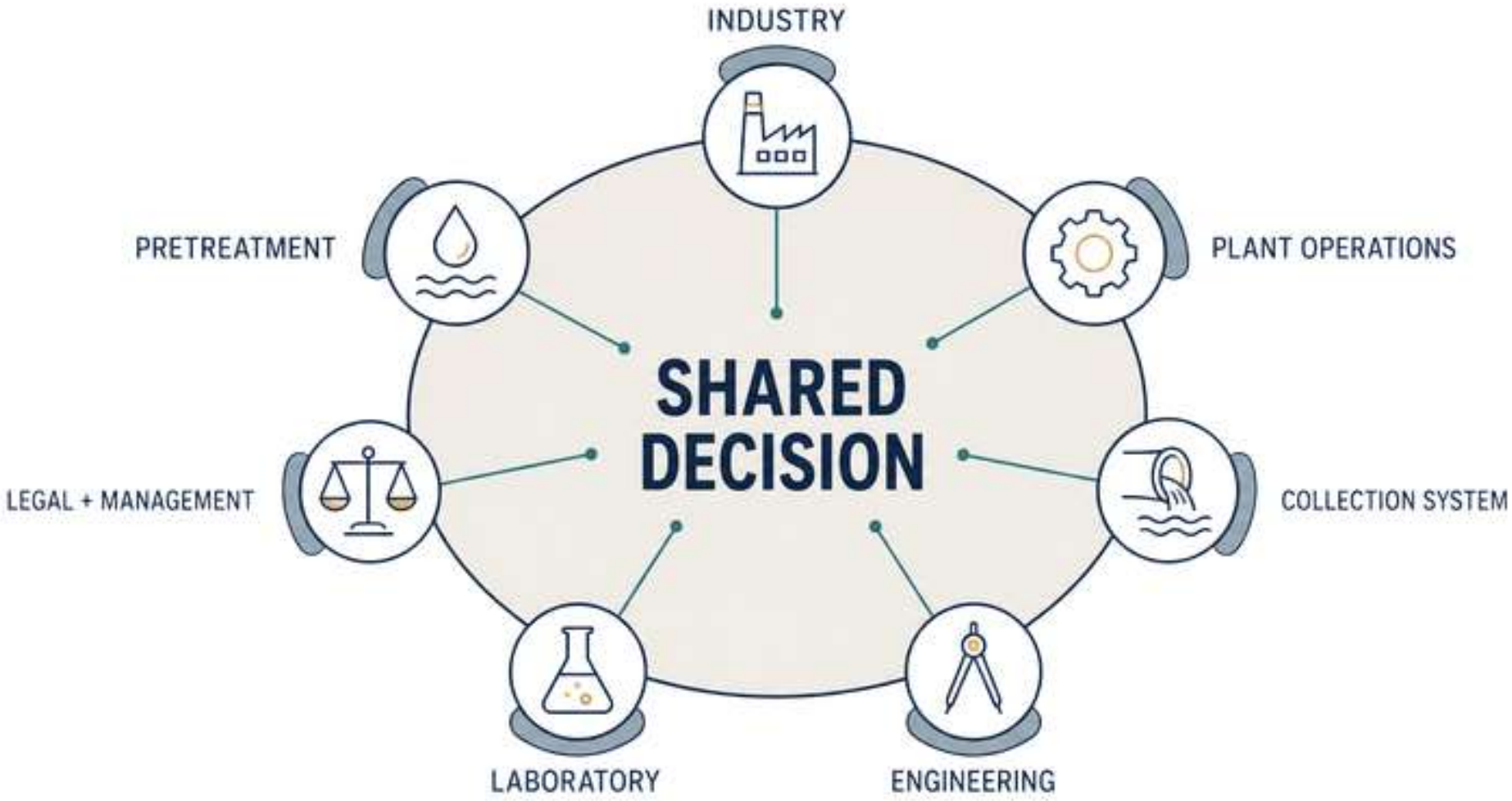
PHASE 1 → PHASE 2 → ULTIMATE BUILDOUT

CONSTRUCTION | COMMISSIONING | OPERATIONS



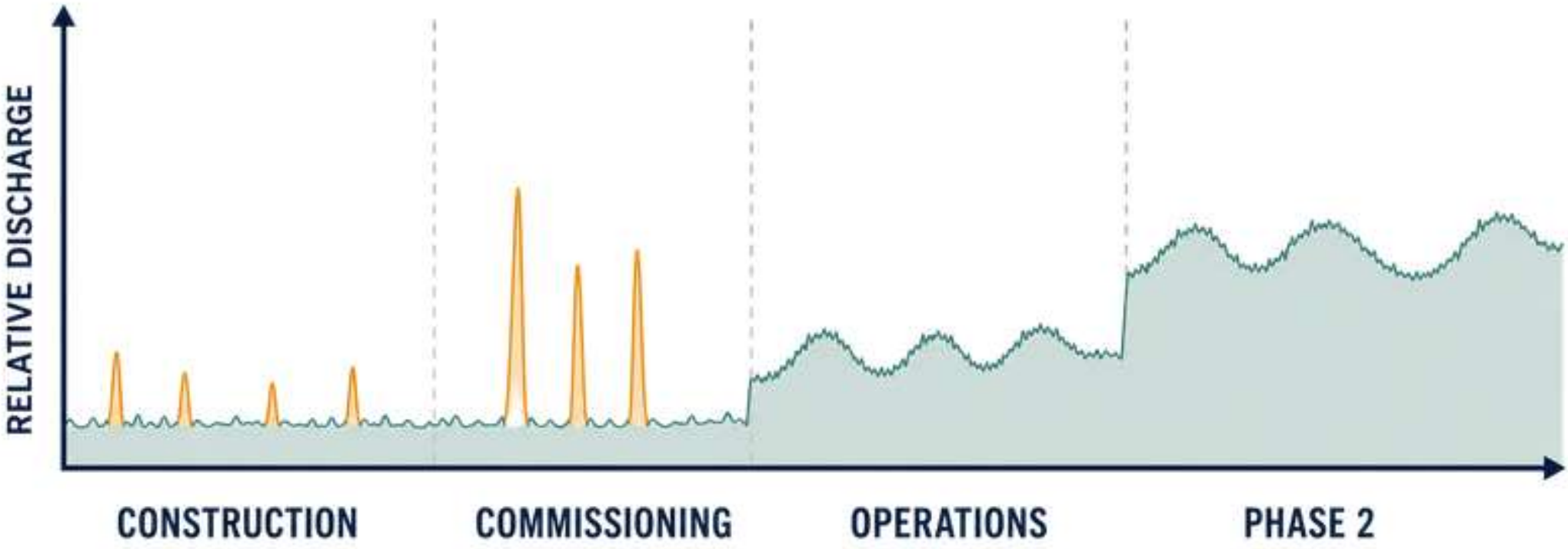
EVALUATE THE COMBINED LOAD AGAINST WORKING CAPACITY.


SEASONAL VARIABILITY
HIGH VOLUME + RATE
LIMITED CAPACITY
OVERLAPPING DISCHARGES
PROPORTIONAL PERMIT CONDITIONS
WATER CONSERVATION
OPERATIONAL FLEXIBILITY
PREDICTABLE SCHEDULING
SAFE PHASED GROWTH



NO SINGLE PERSON HAS THE ENTIRE ANSWER.

SAME SITE. CHANGING DISCHARGE.



FANTASTIC CONDITIONS AND WHERE TO FIND THEM

YOU DO NOT HAVE TO SOLVE EVERY PROBLEM FROM SCRATCH. GOOD PERMIT CONDITIONS ARE OFTEN ALREADY HIDING IN YOUR RESOURCES

CONCENTRATION LIMIT OR MASS LIMIT?

The limit you choose can influence water reuse.

SAME CONCENTRATION. DIFFERENT LOAD.

1 MGD

1 MGD × 100 mg/L → 834 lb/day

3 MGD

3 MGD × 100 mg/L → 2,502 lb/day

3× the flow = 3× the mass

lb/day = mg/L × MGD × 8.34

SAME MASS. LESS WATER.

3 MGD

3 MGD × 100 mg/L → 2,502 lb/day

1 MGD

1 MGD × 300 mg/L → 2,502 lb/day

MORE REUSE → MORE CYCLES → LESS SEWER FLOW

A mass limit can allow a higher concentration at a lower discharge volume.

CHOOSE THE LIMIT THAT SUPPORTS THE PLANT'S PRIORITY

HYDRAULIC CAPACITY CONCERN

A mass limit can incentivize reuse and reduce wastewater volume.

OR

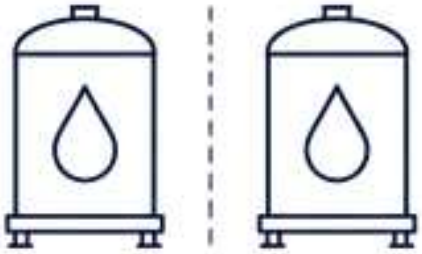
MASS LOADING CONCERN

A lb/day limit caps the total pollutant load.

Add a flow cap when a firm hydraulic ceiling is required. Timing and toxicity come next.

NOT EVERY PART OF THE BATCH IS THE SAME.

01 ONE WEIRD DISCHARGE AT A TIME



TRIGGER	Multiple unusual releases
PERMIT MOVE	No simultaneous batches without approval

02 THE TANK HEEL

TRIGGER	Tank-bottom or low-point residual
PERMIT MOVE	Segregate or characterize separately

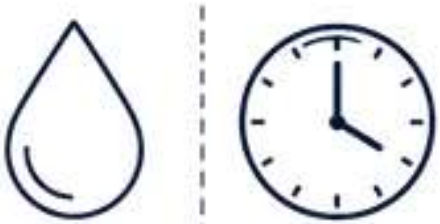
03 THE FIRST FLUSH IS DIFFERENT

TRIGGER	First water from new or cleaned piping
PERMIT MOVE	Hold or sample the initial volume separately

IDENTIFY • SEPARATE • CHARACTERIZE

CHEMISTRY NEEDS MORE THAN ONE NUMBER.

01 THE CHEMICAL KILL-WINDOW



TRIGGER	Biocide-treated batch awaiting release
PERMIT MOVE	Hold, verify residual, and restart after redosing

02 THE SDS IS NOT THE WASTEWATER

TRIGGER	Product sheet without discharge behavior
PERMIT MOVE	Require dose, active ingredients, and expected residual

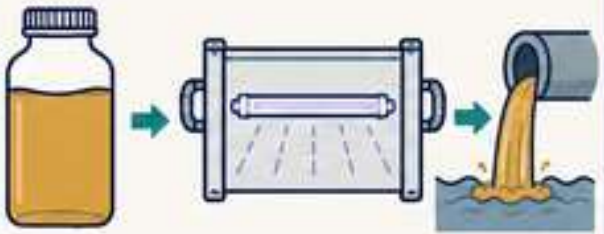
03 CONDUCTIVITY AS AN EARLY-WARNING TRIGGER

TRIGGER	Change in dissolved solids or cycles
PERMIT MOVE	Set a notification and investigation threshold

WHAT WAS ADDED • WHAT CHANGED • WHAT REMAINS

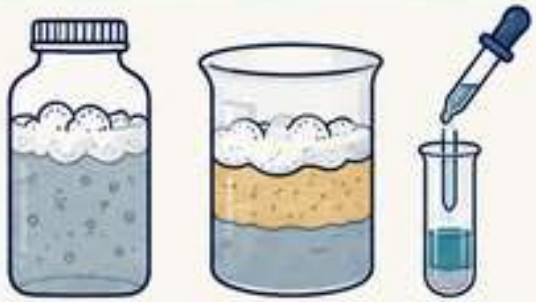
WHAT YOU CAN SEE—AND WHAT IT CAN HIDE

01 COLOR CAN PASS THROUGH



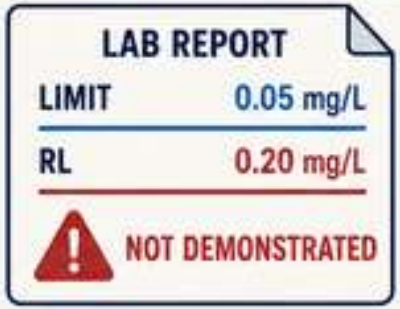
TRIGGER	Unexpected or persistent color
PERMIT MOVE	Identify the source; verify UVT and treatment removal

02 FOAM & SURFACTANTS CHANGE THE MATRIX



TRIGGER	Persistent foam, emulsion, or heavy surfactant load
PERMIT MOVE	Coordinate with the lab; evaluate dilution and recovery

03 CAN THE LAB PROVE COMPLIANCE?

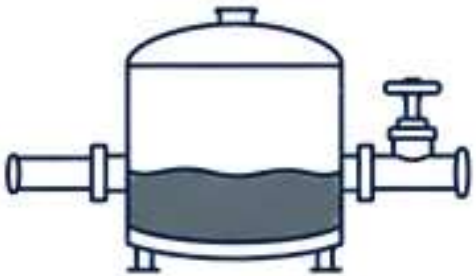


TRIGGER	Reporting limit exceeds the permit limit
PERMIT MOVE	Use a suitable method, alternate preparation, or resample

OBSERVE • EVALUATE TREATMENT • VERIFY THE METHOD

PRESERVE THE EVIDENCE.

01 CAPTURED MEANS CAPTURED

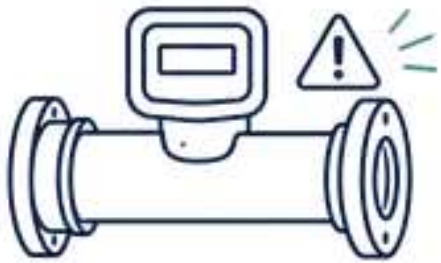


TRIGGER	Wastewater placed under hold or control
PERMIT MOVE	No rerouting or release without authorization

02 THE RETAINED-SAMPLE CONDITION

TRIGGER	Need for confirmation or dispute resolution
PERMIT MOVE	Preserve a documented split sample

03 IF THE METER DIES



TRIGGER	Loss of required flow measurement
PERMIT MOVE	Notify, hold or estimate as approved, and repair

CONTROL • PRESERVE • DOCUMENT

CONDITIONS MUST WORK IN THE FIELD.

01 RAINFALL IS NOT THE ONLY TRIGGER

TRIGGER	Receiving-system capacity changes
PERMIT MOVE	Allow delay based on actual system conditions

02 SHOW ME BEFORE YOU COVER IT

TRIGGER	Connection or sampling point ready for concealment
PERMIT MOVE	Require inspection before burial or enclosure

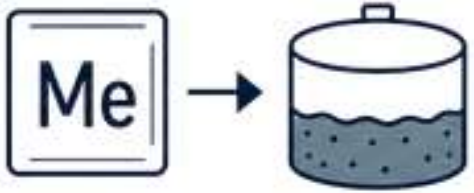
03 THE 2:00 A.M. TEST

TRIGGER	After-hours discharge decision
PERMIT MOVE	Define contacts, notice, release, and stop authority

ACTUAL CONDITIONS • VISIBLE INFRASTRUCTURE • USABLE PROCEDURES

THE PLANT GETS A VOTE.

01 METALS AND BIOSOLIDS

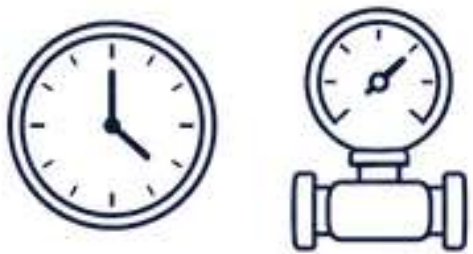


TRIGGER	Pollutant may accumulate in biosolids
PERMIT MOVE	Prohibit or allocate based on the solids pathway

02 MASS LIMITS AND TOXICITY

TRIGGER	Daily mass limit may not prevent a toxic slug
PERMIT MOVE	Pair mass with concentration, rate, or toxicity controls

03 TIME OF DAY VS GPM



TRIGGER	Capacity changes with timing and discharge rate
PERMIT MOVE	Set a discharge window and instantaneous-flow limit

SOLIDS PATHWAY • BIOLOGICAL PROCESS • HYDRAULIC CAPACITY

06

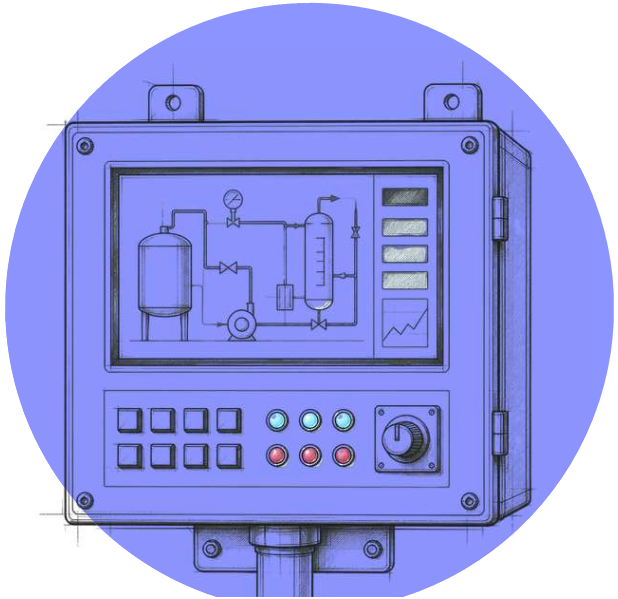
DO. OR DO NOT. BUT DOCUMENT IT

1. PERMITS HAVE A WORKLOAD

Staffing, training, administration, coordination, and institutional knowledge.

2. SCIENCE MEETS AUTHORITY

Ensuring ordinances, regulations, agreements, and permit language support the technical need.



3. RELATIONSHIPS ARE INFRASTRUCTURE

Building professional trust that supports early communication, accurate information, and problem-solving.

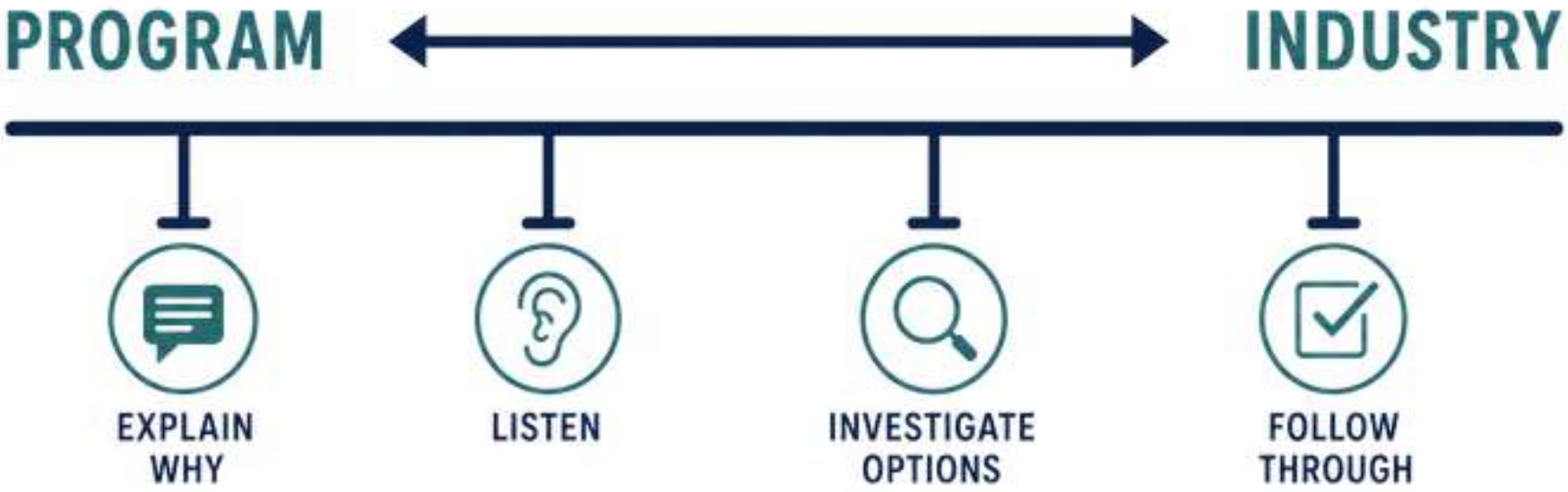
4. TRANSPERANCY FOR DEFENSIBILITY

Documenting what was known, what remained uncertain, who was consulted, what alternatives were considered, and why each decision was made.

PERMITS HAVE A WORKLOAD

A CONDITION IS ONLY USEFUL IF THE PROGRAM CAN ADMINISTER IT.

RELATIONSHIPS ARE INFRASTRUCTURE



THEY NEED TO UNDERSTAND THE DECISION, TOO.

SCIENCE MEETS AUTHORITY

TECHNICAL BASIS

PLANT NEED • DATA • RISK

+

PROGRAM AUTHORITY

ORDINANCE • REGULATIONS • AGREEMENTS

=

ENFORCEABLE CONDITION

WHY → SOURCE → PERMIT LANGUAGE → ACTION

KNOW THE SOURCE OF EVERY CONDITION.

TRANSPARENCY FOR DEFENSIBILITY

A DECISION TRAIL A FUTURE REVIEWER CAN FOLLOW.

DOCUMENT THE REASONING—NOT JUST THE RESULT.

THANK YOU!

- **Ask Earlier**

Get involved before designs, agreements, and discharge expectations become commitments.

- **Use Your Resources**

Bring operations, engineering, legal, industry, regulators, and peer programs into the process.

- **Share What You Learn**

Document your experience and help the next program begin further ahead.

Sophia Smith
Senior Environmental Officer
Pretreatment Coordinator

Cell: (816) 885-0949
Desk: (816) 513-7269
Email: Sophia.Smith@kcmo.org

UP NEXT: Q&A