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“You Can’t Improve What You Don’t Measure”

Moving from Reactive to Proactive Operations—
Barstow, CA WRRF’s Journey to Optimization

NEWEA Session 23 – 8:30 AM

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Acknowledgement



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Agenda

- Nutrient Removal - Overview
- Classic Operation
- Optimal Process - **Nutrients**
- The **Connected** System ☐
Predictive Operation



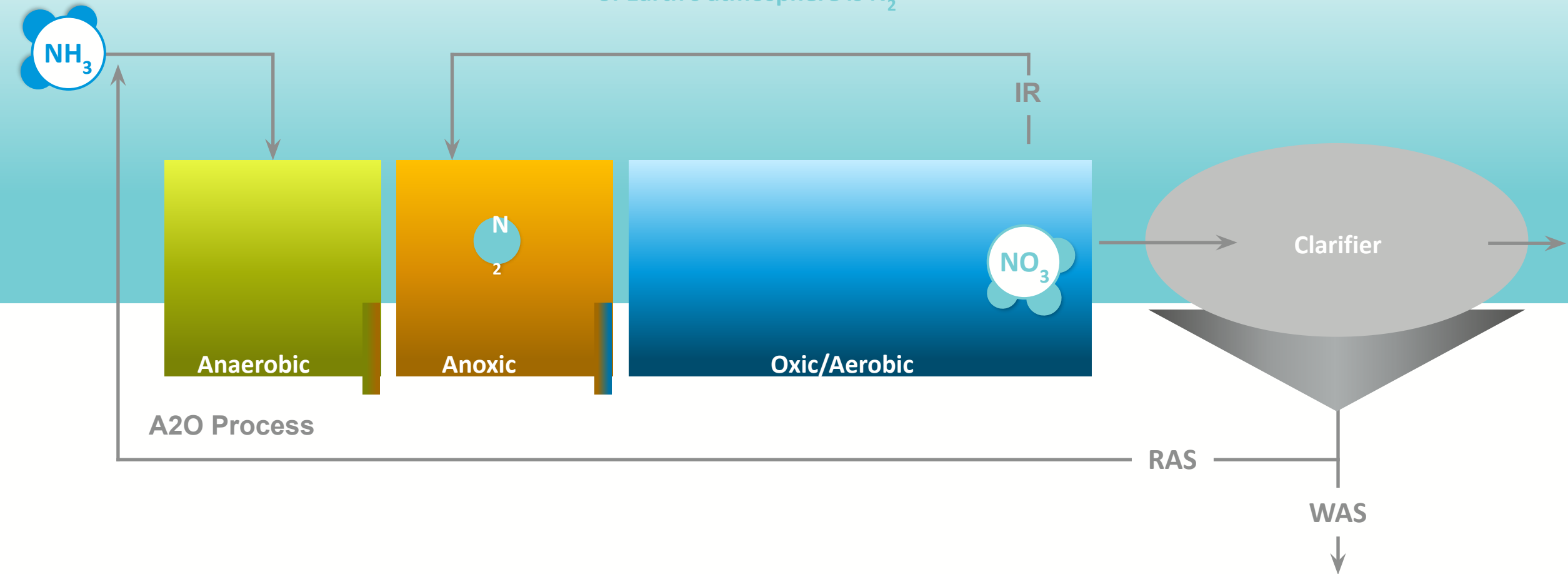
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Overview of Nitrogen Removal Basics

~78%
of Earth's atmosphere is N_2



Nitrogen Removal





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Classic Operations at Barstow

Barstow

~45,000
People
Connected

2.1
MGD ADF

4.5
MGD
Design

Extra 200k - 400k GPD

Stopping point for travelers between
Las Vegas and So Cal create swings in influent

High Desert Temperatures

Ambient temperature can vary by 40°F in 24hrs

No Pump Stations!

Collections system completely gravity fed



Grab
Samples

Composite
Sampling

3rd Party Lab
Data

Settleometer

What is Classical Operation?

SVI

Hand-written
Data
Recording

Constant
MLSS



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What More Can We Do?

Operating off permit from 1994, know changes are coming...

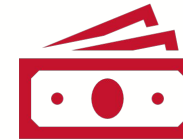
Forward
thinking team

constantly asking
“What more can we
do with this?”

- Insufficient resources to see influent changes and act with the right strategy
- Resulting in:



Inconsistent
treatment



Over-budget
for electricity



Challenges with
sludge storage
& pressing

What More Can We Do?

2012-2013 Projects – Beginning the Journey

\$8.3
Million

SRT/MCRT

Trying to forecast weather, travelers, using
“Split Second Grab Samples” to set wasting

- Inconsistent
- Under and Over wasting

Typical Winter SVI: 200

Blower Upgrade to High Speed Turbo

BNR Upgrade to MLE

Instrumentation

- 2 Ammonia Analyzers
- 6 DO probes
- 4 Nitrate probes

Meet all permit requirements consistently

Stabilize the process

Gain Real-Time visibility of the process through
Advanced Controls

Reduce Energy Consumption

Optimize process

Stabilize the process by tightly controlling
Nitrification, Denitrification and SRT

Optimize wasting and avoid over or
under wasting events

Operate the process looking forward - **Predictive**

2017 Goals



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Partner with SCE for a WISE project



Ammonia Based Aeration Control

- Reduce effluent ammonia spikes
- Energy savings
- Correct response to influent load changes
- Uses existing instrumentation

Internal Recirculation Control Based on Nitrate

- Minimize energy consumed by IRC pump
- Maximize denitrification
- Uses existing instrumentation

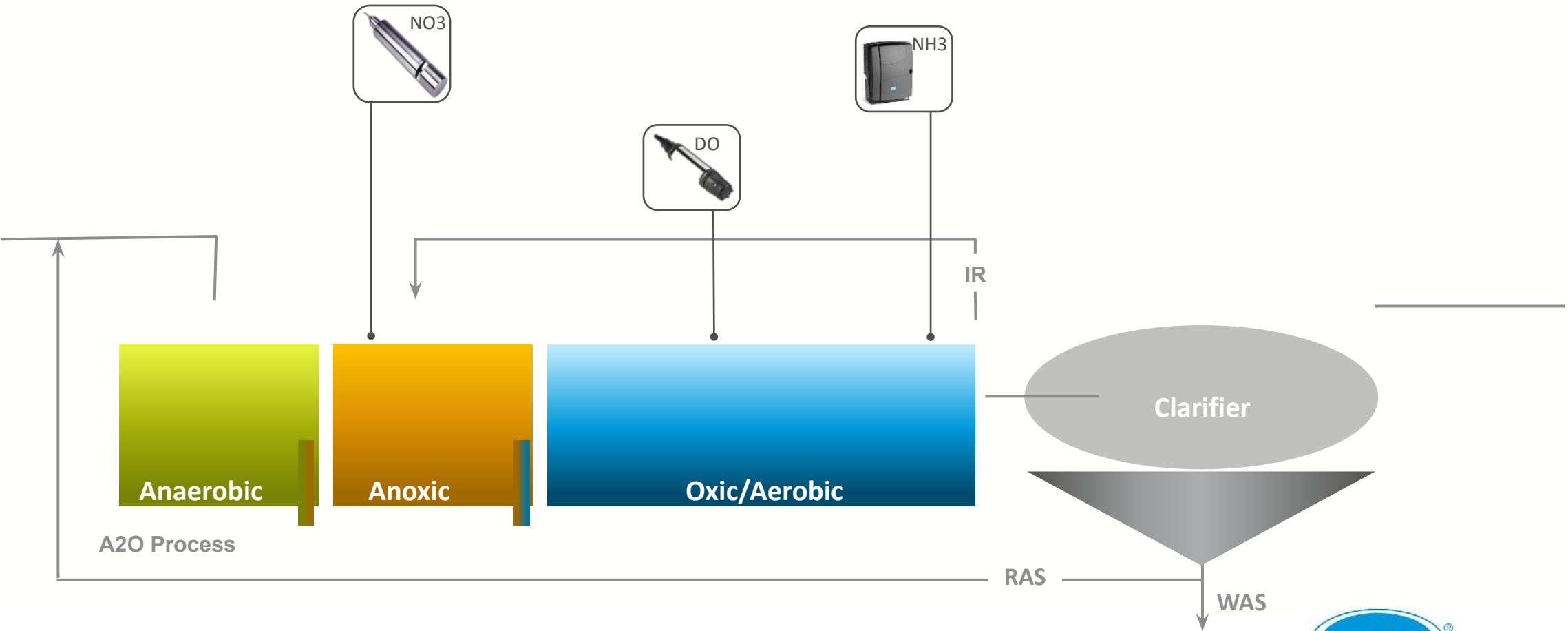
Automate Wasting with SRT Control

- Waste POUNDS, not GALLONS
- Consistent, accurate SRT
- Consistent sludge to press

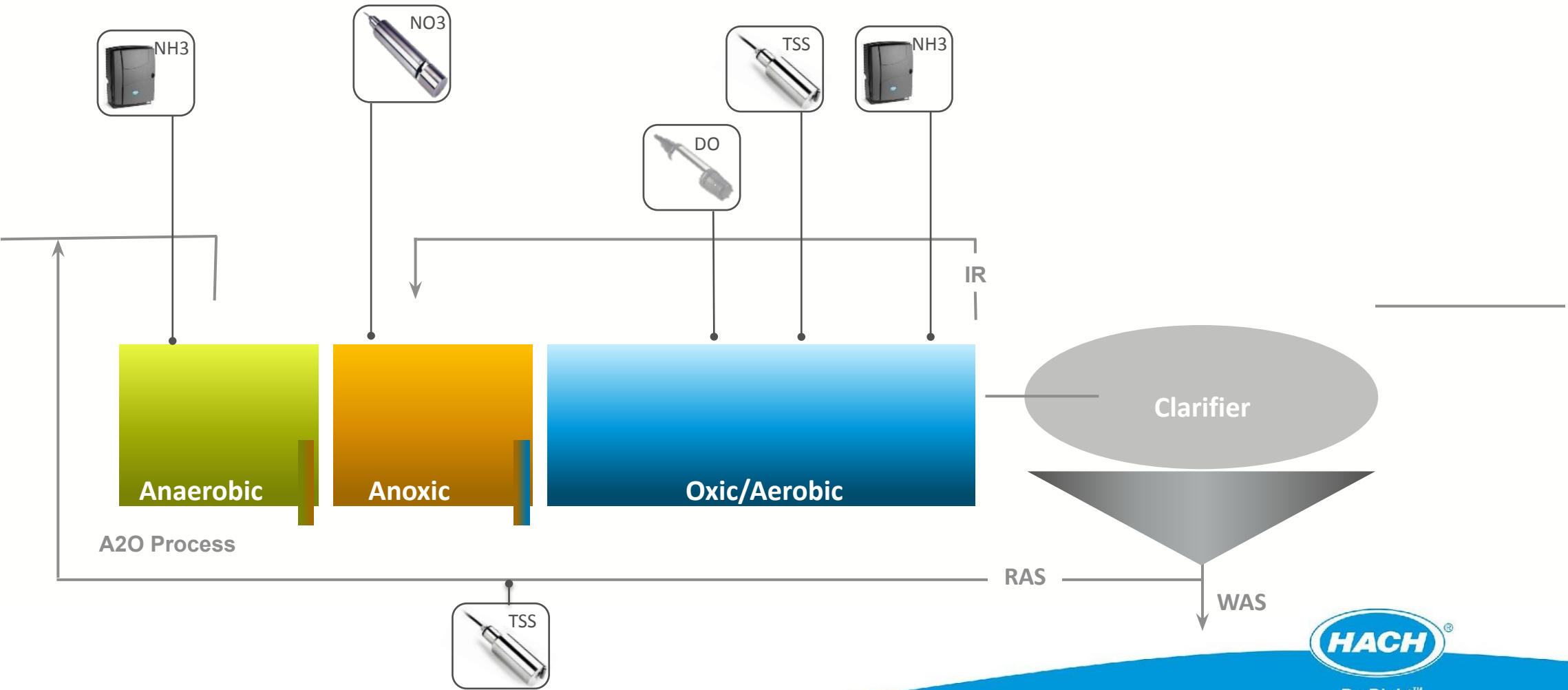
2018 Solution



Nitrogen Monitoring – Reactive (Classic) | Predictive



Nitrogen Monitoring – Reactive (Classic) | Predictive



Solutions for Optimization

Automation towards the following predictive approaches

Nitrification

Ammonia Based Aeration Control (ABAC) – “RTC-N”

Denitrification

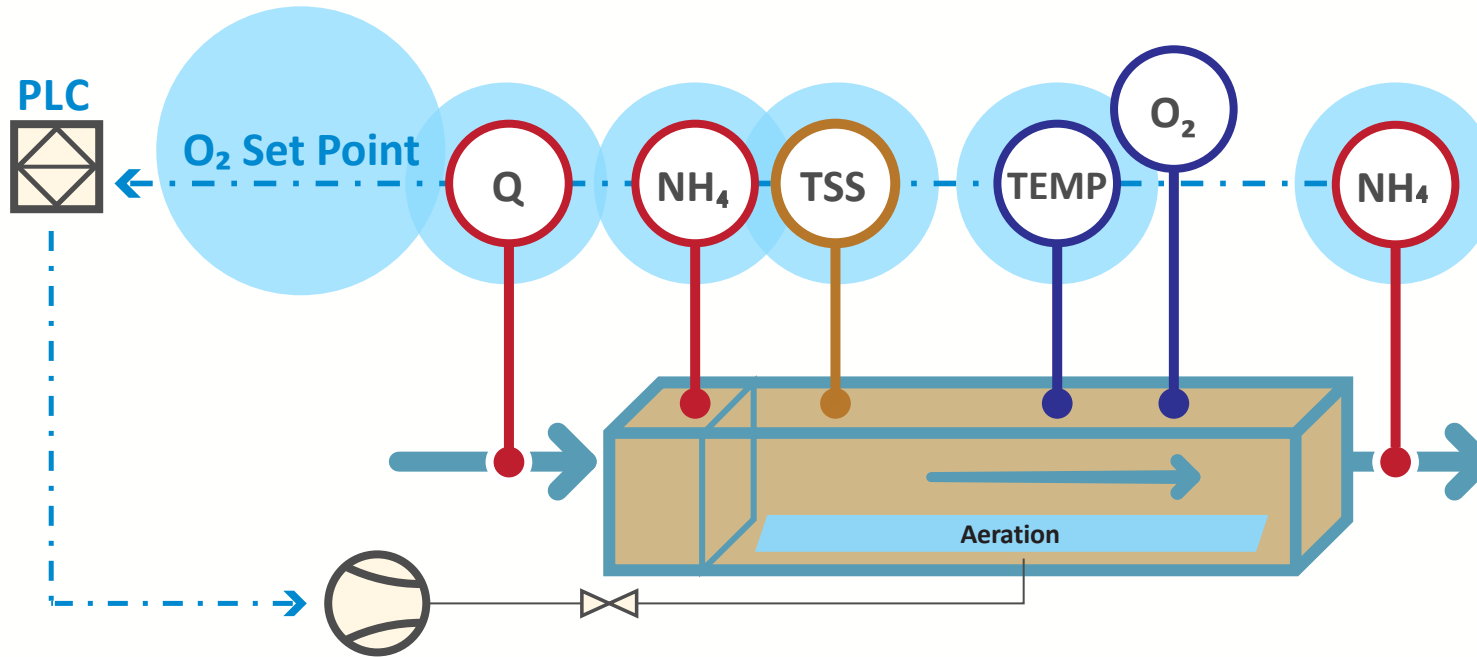
Internal Recirculation Control – “RTC-IR”

Sludge Retention Time

Wasting Control – “RTC-SRT”



Process Management for Nitrification



Process Management for Nitrification

Example of a single train in a plug flow plant. Options available for many other configurations.

RTC benefit

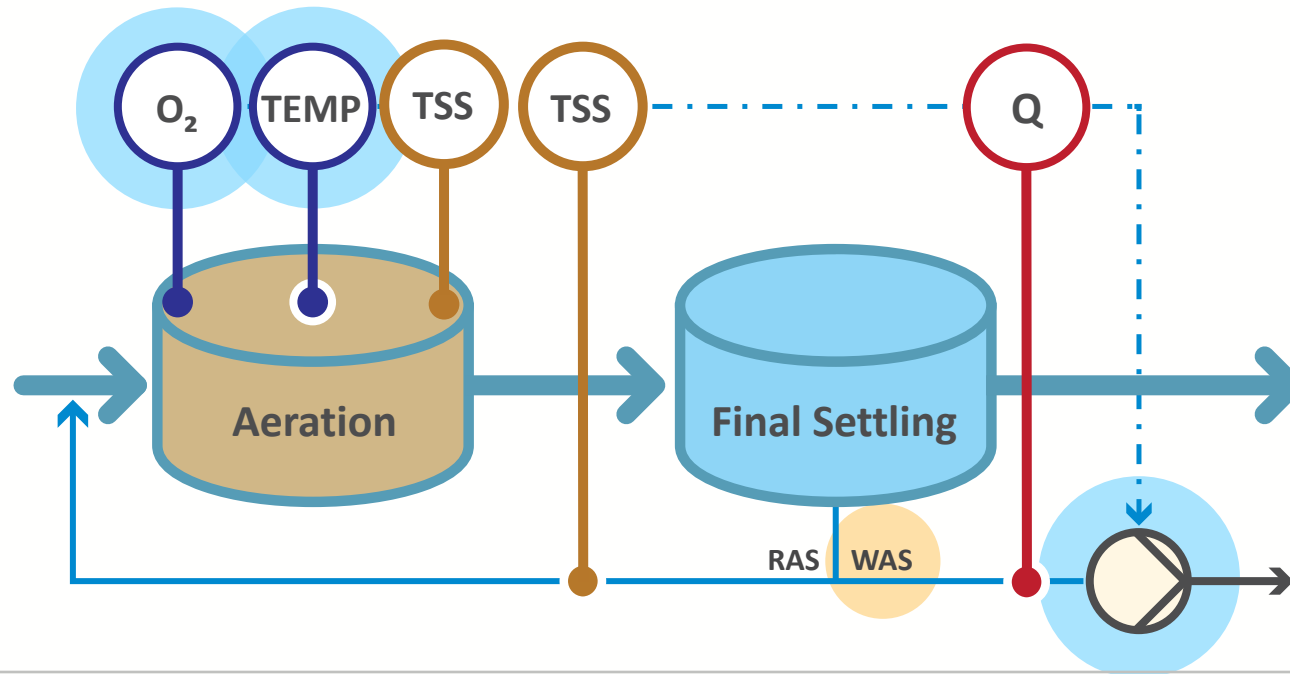


Systems evaluate:

- Flow
- NH₄-N
- NO₃-N
- DO
- MLSS

A consistent process simplifies nutrient management.

A consistent process begins with SRT.



Process Management for Sludge Retention Time

Example configuration only. Options available for many other configurations.

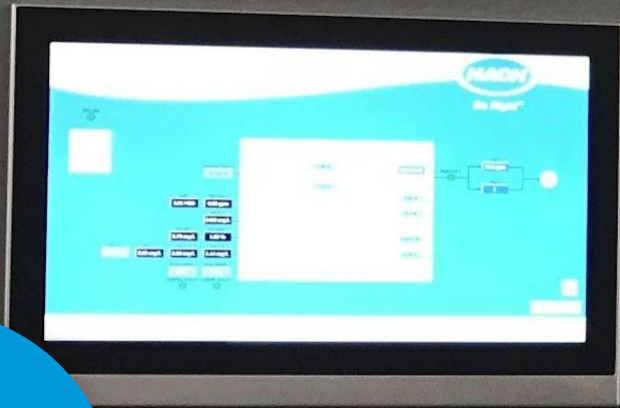
Solids Handling

Modules evaluate:

- TSS
- Feed Flow

PCM-SEC
PLC-S

Typical Installation



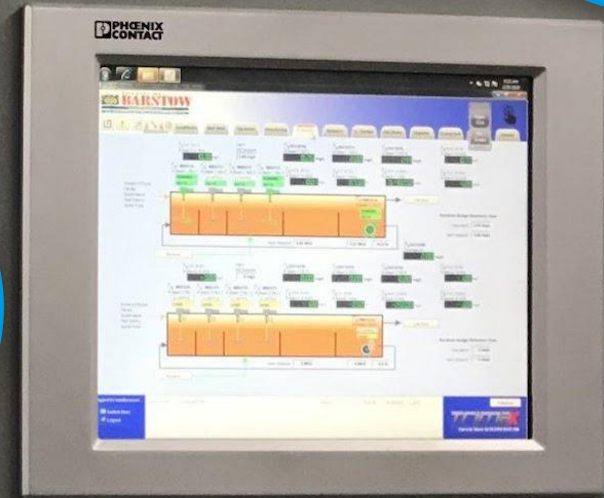
Analog or digital
communications

Commissioned
November 2018

Works with
existing SCADA

PLC cabinet for
easy integration

Easy touchscreen
interface



Preliminary Results

● Nitrification

Average DO reduced from 1.8 to 1.1mg/L

= **\$17,800 rebate from SCE**

24/7 Visibility of ammonia loads and process performance

Significantly reduced effluent ammonia spikes

● Denitrification

Reduction in energy for IRC pumps

= **\$13,000 annual savings**

24/7 Visibility of nitrate and denitrification performance

Average effluent 0.0 mg/L NO₃-N for March and April 2018

Sludge Retention Time

Found error in spreadsheet used for previous SRT control
= **Correct SRT**

24/7 Visibility of MLSS, RAS
Stable biological process with small adjustments

Winter 2018/2019 SVI: 80mL/g



Reactive

Permit Compliance
sampling/monitoring
lets you know what
already happened.

Longer lead time
on sample
results

Necessary
for NPDES
compliance

Predictive

Process sampling/monitoring
lets you know what's
happening now and what
could happen later

Immediate results
can indicate changing
conditions before
compliance issues
occur

Understand
connected plant
process and how they
react immediately

Not for
NPDES permit
compliance
reporting



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Bottom Line

Barstow is no longer burdened by the inefficiency and strain of operating a WWTP according to guess work and chance.

They have a **more consistent effluent and SRT**, and they've **lowered their energy costs**.

Operators have the
tools + resources
to operate efficiently

Reactive ☐ Predictive Operations



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