

Advancing each generation.



Natural Engineered Wastewater Treatment:



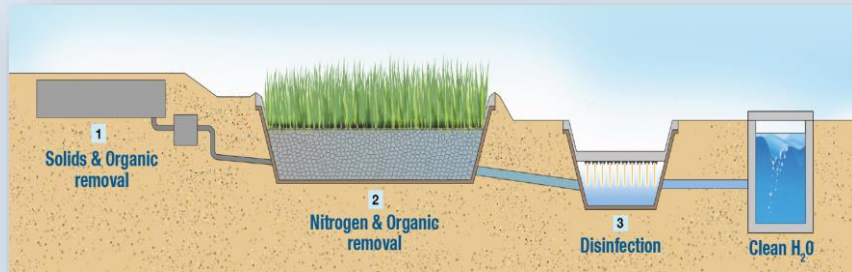
Prepared by Alcoa for Technology Introduction

September 2016

While Alcoa is traditionally considered an Aluminum company, our technical expertise has developed broad innovative solutions

Alcoa has set the goal of **reducing freshwater consumption 25% by 2025**

When Alcoa couldn't find a commercial technology that achieved a **step change in our water sustainability goals**, we created our own...



...the NEWT™ technology was perfected as an **innovative hybrid wastewater treatment technology** that maintains high effluent quality

This innovative technology helps Alcoa **exceed** its water consumption goals and maintain our standing as one of the world's most sustainable companies

Today, Alcoa has three permitted installations operating, with over 10 NEWT-years of total domestic & international operating experience



With positive technical and financial performance and three additional installations *in the build stage*, **Alcoa is commercializing the NEWT™ technology**

Natural Engineered Wastewater Treatment: NEWT™

NEWT TECHNOLOGY OVERVIEW

***Natural, green design
produces high
quality effluent***



**Simplified
maintenance**



**Condensed
Footprint**

**Sustainable
operations**



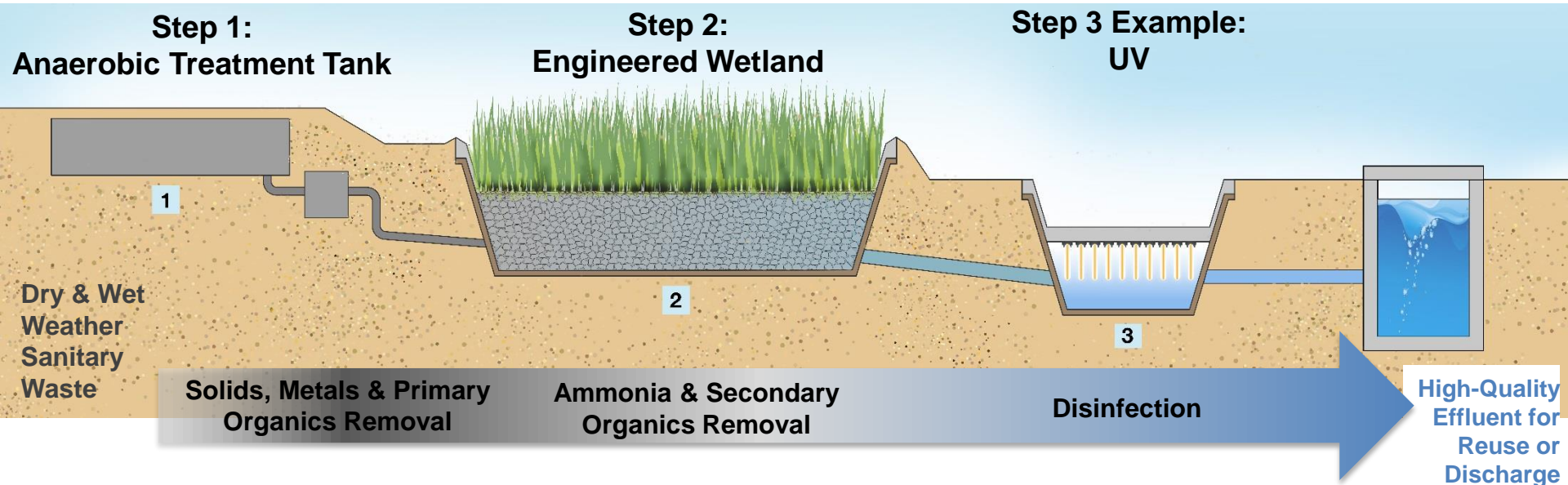
**Nearly
Odorless**



**Minimal sludge
disposal**



Resulting from continuous innovation in wastewater treatment for Alcoa production facilities, the **NEWT™ system** **effectively removes a wide range of contaminants** from industrial and sanitary wastewaters and **generates high quality treated effluent suitable for reuse** – *while significantly lowering energy and operating costs.*



The NEWT system can be design to remove contaminants like Nitrate and Phosphate

NEWT™ is active in all stages of deployment: bid & proposal, construction, and operation

Alcoa has accumulated over 10
NEWT-years of operational
know-how & experience

Alcoa Technical Center

Pittsburgh, Pennsylvania
U.S.A.

Since replacing an ageing conventional system in **2009 the first commercial-scale system has experienced first sludge removal after 6 years.**

System Facts:

Installed:	2009
Wastewater Type:	Sanitary
Design Flow:	50,000 gpd
Footprint:	1.5 acres



Ma'aden Aluminium

Ras Al Khair
Kingdom of Saudi Arabia

*In one of the most arid regions on the planet, **reducing water demand through reuse of 1.3 million gallons per day will save the industrial facility over \$8 million annually.***

System Facts:

Installed:	2013
Wastewater Type:	Sanitary & Industrial
Design Flow:	1.3 MGD
Footprint:	17 acres



1.0 MGD reference plant has further reduced footprint to 2.5 acres

Alcoa Power and Propulsion

Wichita Falls, Texas
U.S.A.

*In 2014, North Central Texas's Stage 5 drought conditions required industrial users to cut water consumption - **installing a NEWT system allows the facility to reduce its water consumption by 68% - far above the 10-35% required***

System Facts:

Installed:	2015
Wastewater Type:	Sanitary
Design Flow:	35,000 gpd
Footprint:	2 acres



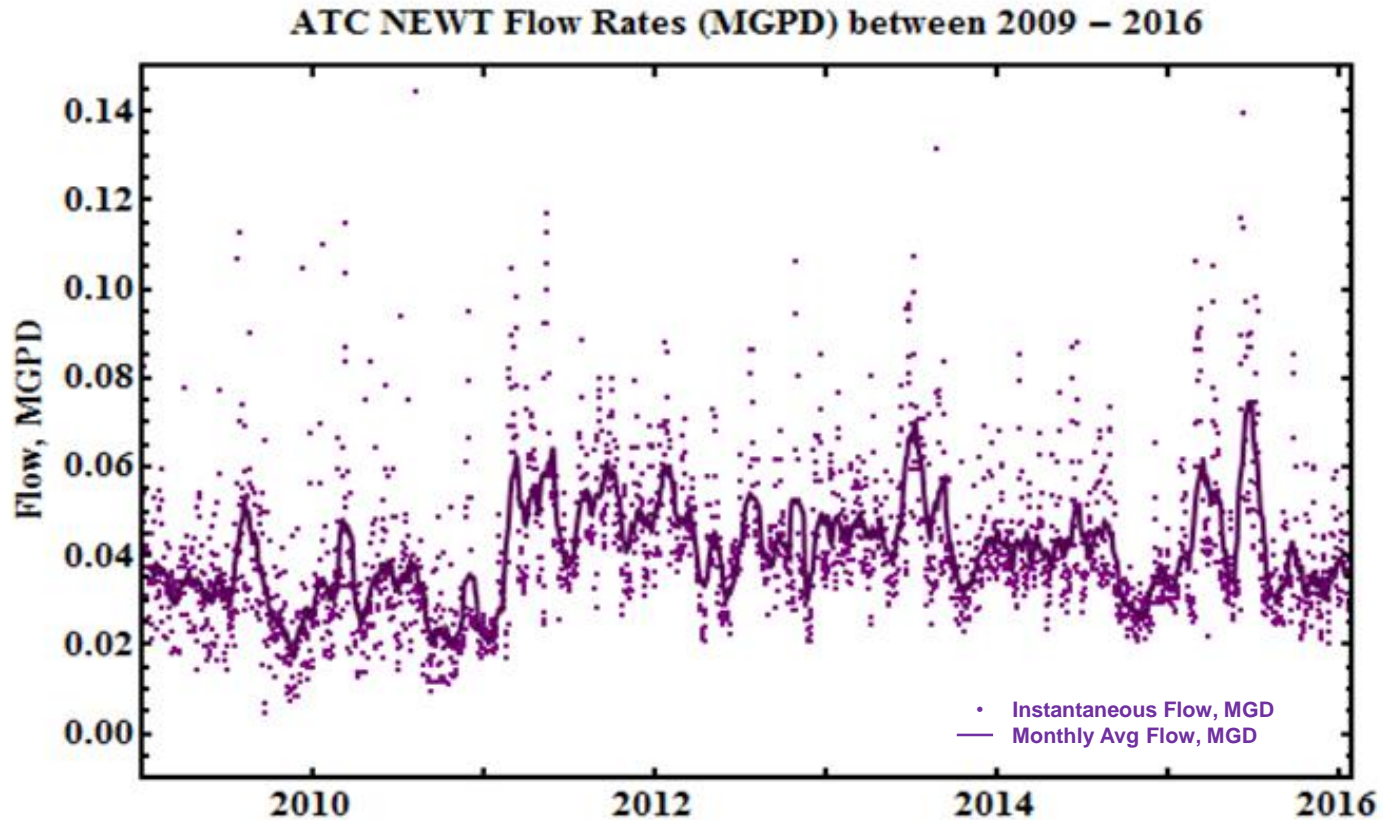
NEWT™ System Performance Data for Alcoa Technical Center's (ATC) Sanitary Natural Engineered Wastewater Treatment

Given proper final design, and installation, the system is capable of providing the minimum effluent quality listed for the influent quality cited

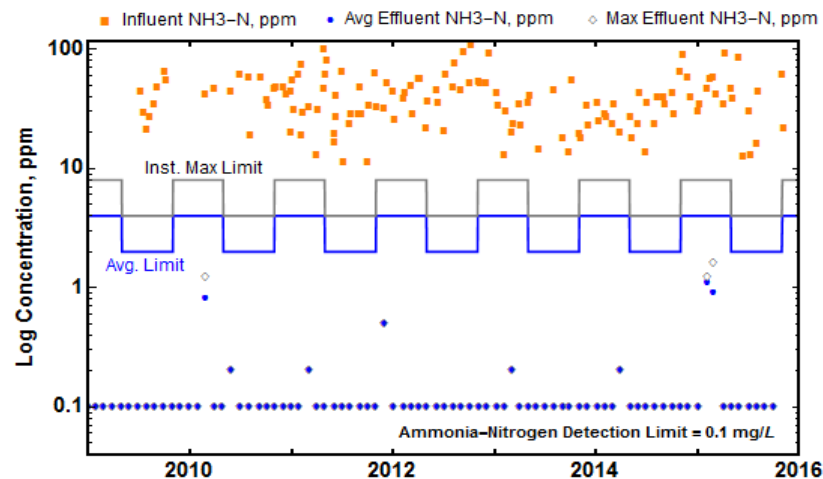
	Influent Upper Limit	Effluent Upper Limit Monthly average	Effluent Upper Limit Instantaneous Max.
Water Temperature	> 45 F	Matches inlet	Matches inlet
Oil & Grease	50 mg/L	Matches inlet	Matches inlet
pH	6 to 9	6 to 9	6 to 9
Flow Rate	Design flow	Matches inlet	Matches inlet
Fecal Coliform	~ 10 ⁶ CFU/100 ml	200 cfu/100 ml summer 2000 CFU/100 ml winter (monthly geometric mean)	1000 cfu/100 ml summer
Ammonia	50 mg/L	5 mg/L	
Total Suspended Solids	389 mg/L	30 mg/L	60 mg/L
BOD-5	400 mg/L	25 mg/L	50 mg/L

The system can be designed to remove Phosphorus and Nitrate. Data can be supplied upon request.

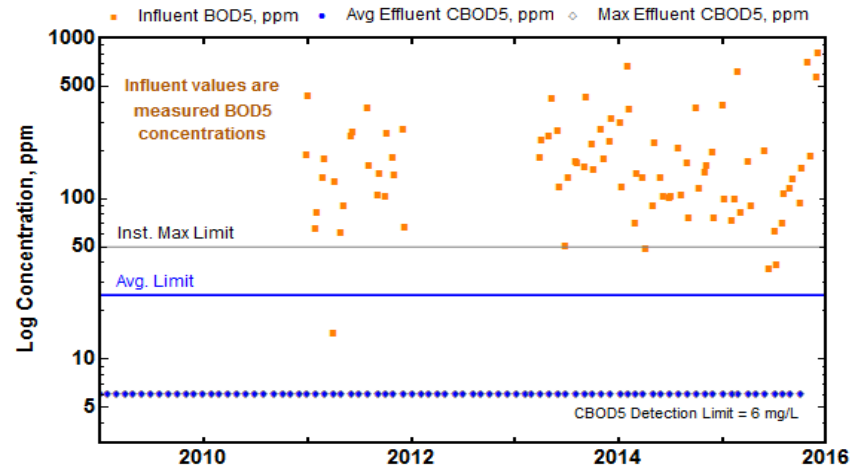
Range of Flow Rates @ ATC NEWT



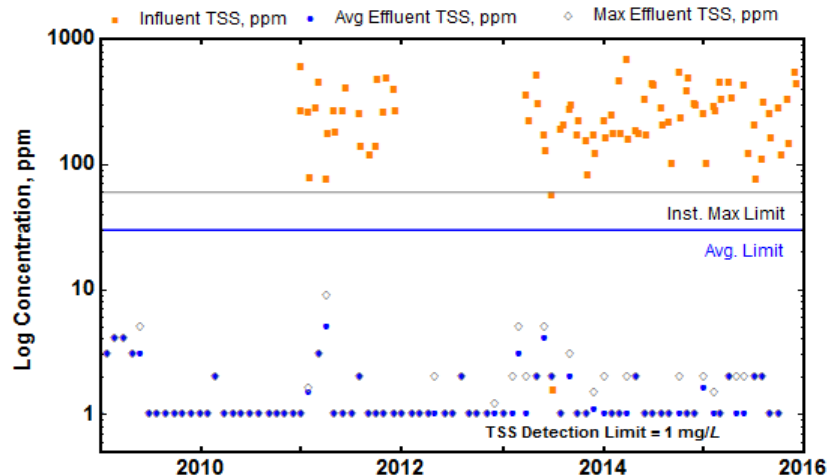
ATC NEWT monthly Ammonia-Nitrogen (NH₃-N) DMR values



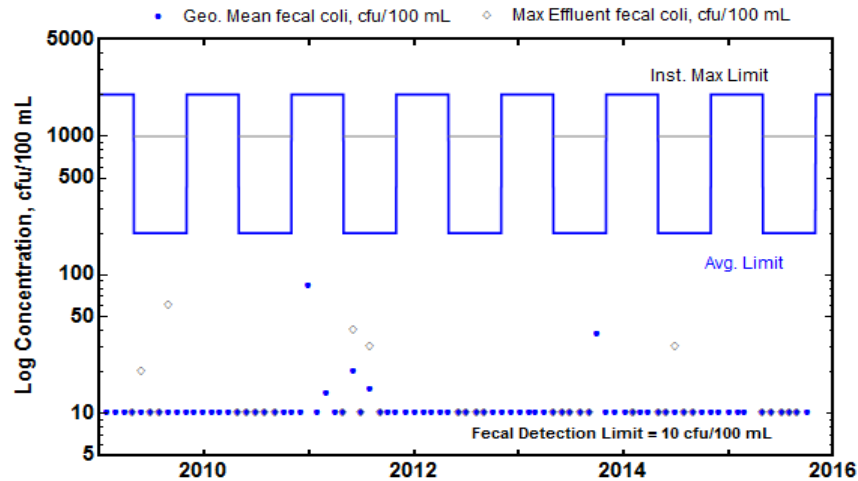
CBOD₅ DMR concentrations for the ATC NEWT between 2009–2016



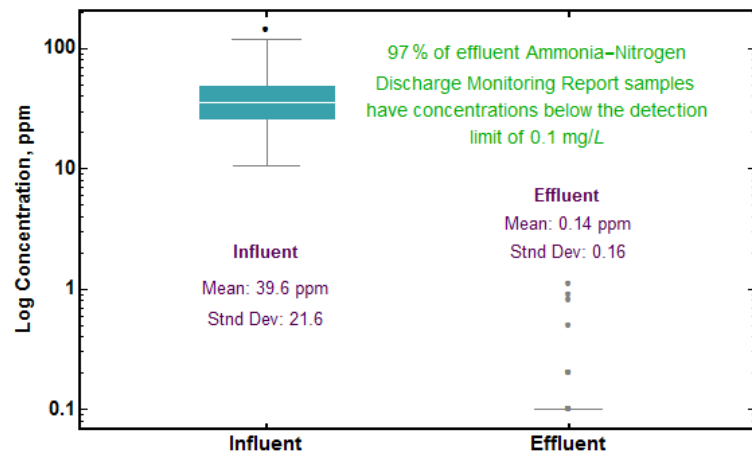
Total Suspended Solids (TSS) DMR concentration time series between 2009–2016



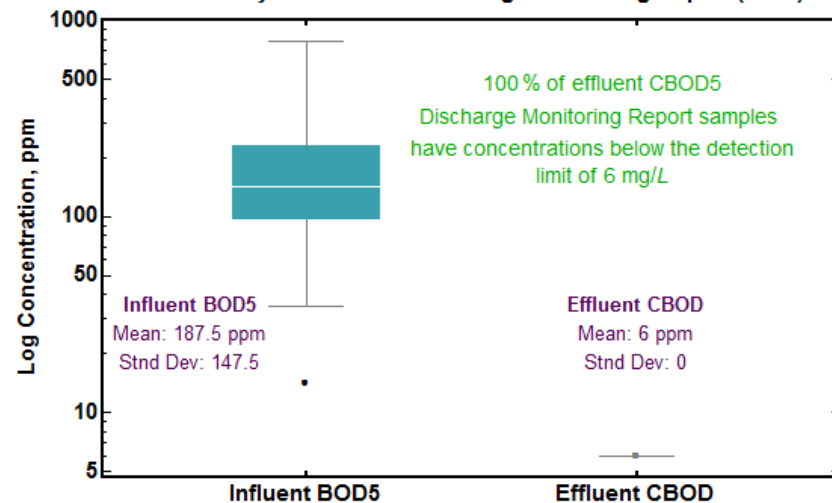
Fecal Coliform DMR concentrations for the ATC NEWT between 2009–2016



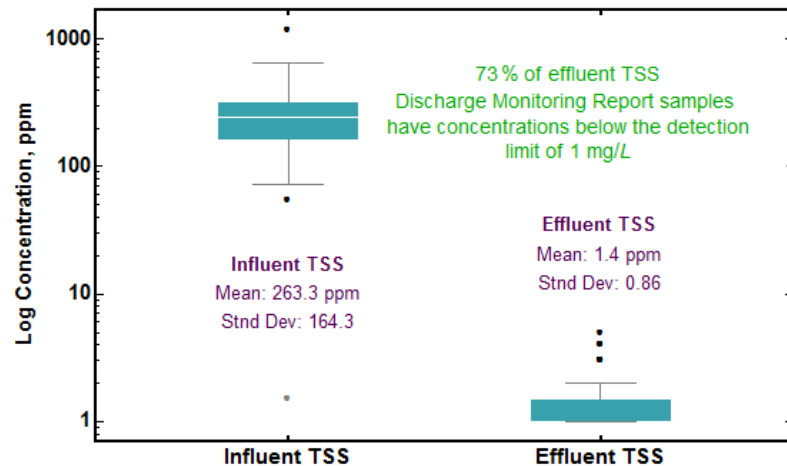
ATC NEWT monthly Ammonia-Nitrogen (NH₃-N) Discharge Monitoring Report (DMR) values



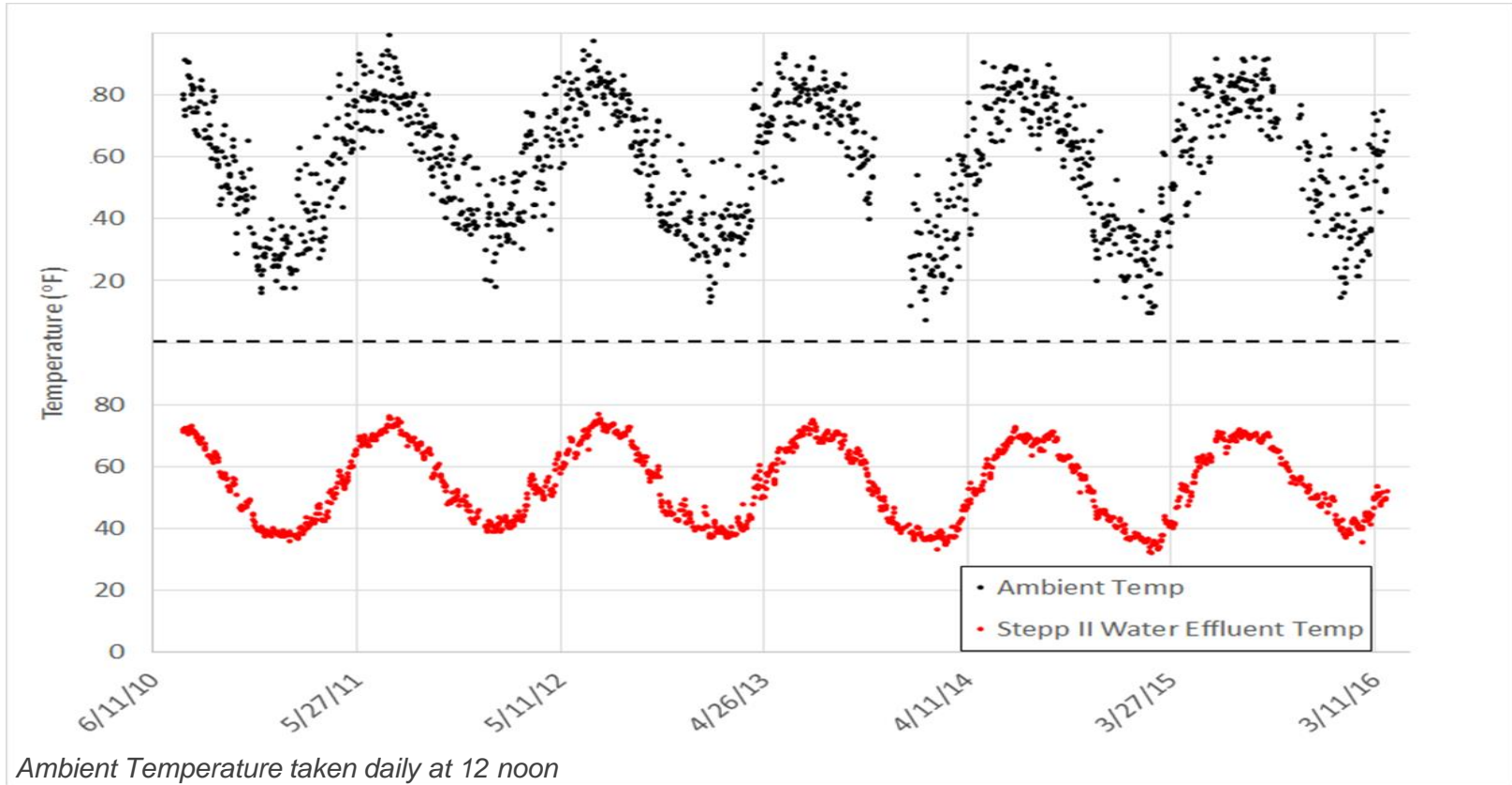
ATC NEWT monthly BOD₅/CBOD Discharge Monitoring Report (DMR) values



ATC NEWT monthly TSS Discharge Monitoring Report (DMR) values



Range of Temperatures @ ATC NEWT



NEWT™ Design for Alaska

Can NEWT work in sub-freezing temperatures?

- Keeping a trickle of flow through the system helps prevent freezing
- Step 2 flow is always 6" below media level, latest design is 6' deep
- ATC insulates STEP2 with bails of hay in winter
- Store in the lagoons in the winter and discharge through NEWT in summer

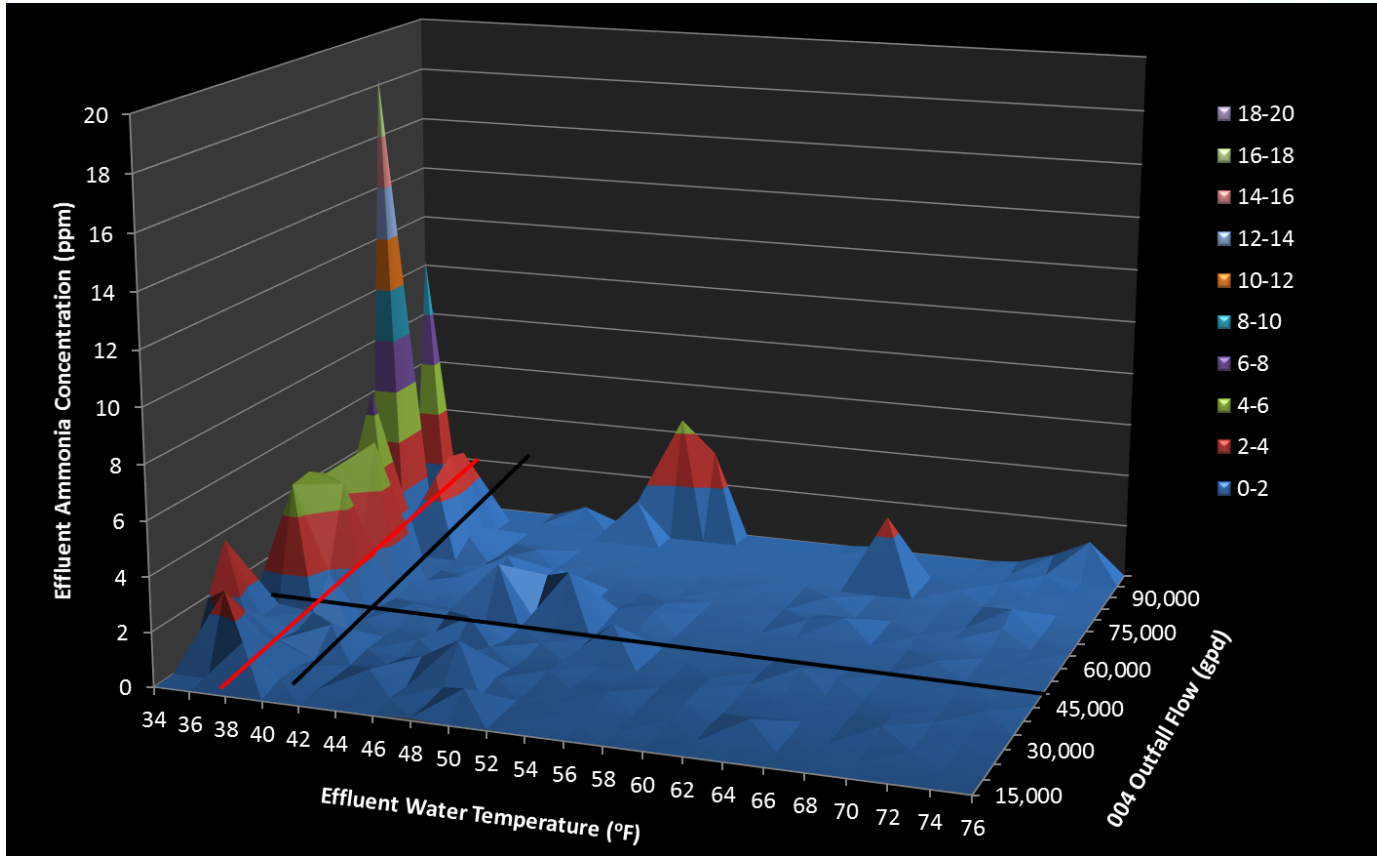
Can NEWT work if there is no power?

- NEWT™ requires limited power for pumps, aeration blower, and UV
- Evaluate low cost alternate power

Can NEWT pair with an existing lagoon?

- A lagoon with low TSS could feed the NEWT™ system
- Regular lagoon dredging/maintenance would be essential

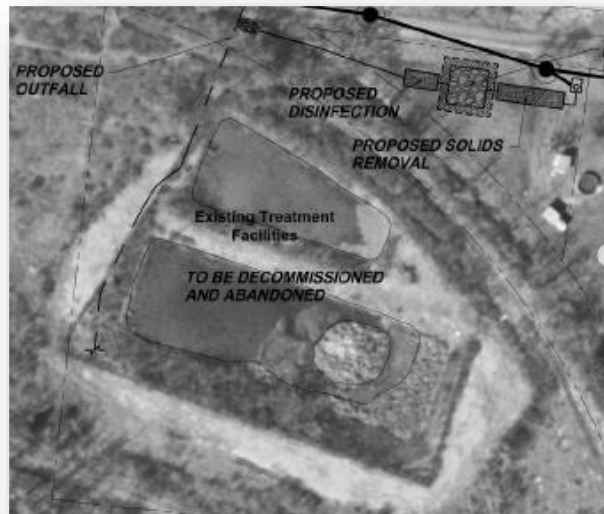
Ongoing Analysis on ATC NEWT™ system performance



Limits

Winter	4.8 ppm
Summer	2.4 ppm

Two Projects are Active to Replace Lagoon Systems with NEWT™ System



Location	Western PA
Flow Rate	35,000 gpd
Justification	Lower Life Cycle Cost More customers served
Status	EPA Act 537 plan awaiting approval



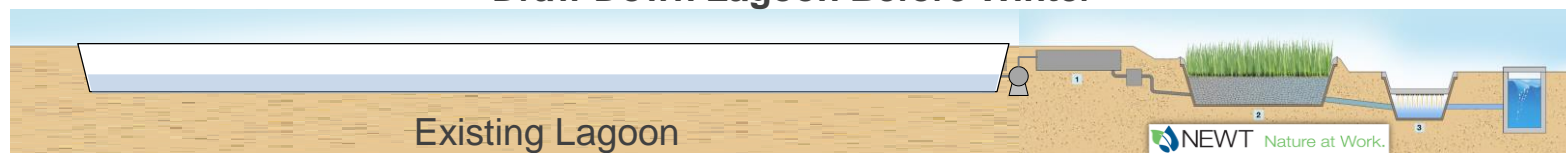
Location	Colorado
Flow Rate	350,000 gpd
Justification	Lower Life Cycle Cost More customers served
Status	Seeking CDPHE approval

Lagoon/NEWT™ Concept for Alaska

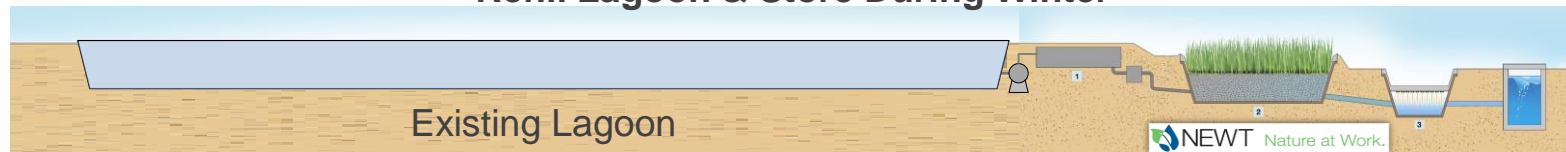
Summer Operation



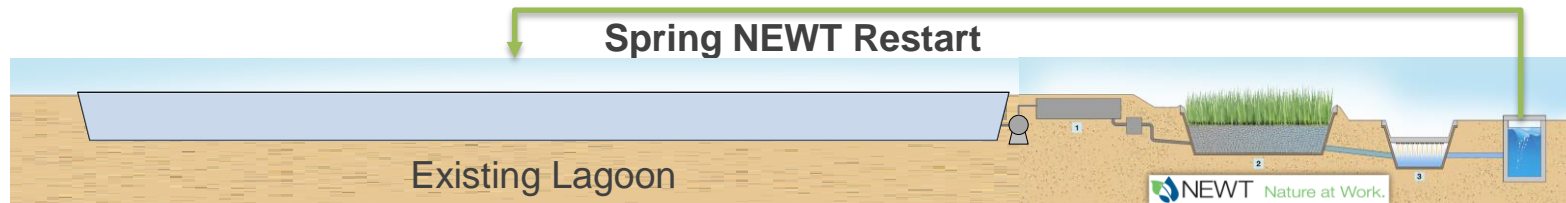
Draw Down Lagoon Before Winter



Refill Lagoon & Store During Winter



Spring NEWT Restart



***A green solution
that produces higher quality water***

Solids	Organics	Ammonia	Fecal Coliform
0.14* mg/L	<6* mg/L	1.4* mg/L	< 10** cfu/100 ml

At a lower total cost

**Minimal
sludge
disposal**

**Little to no
chemical
use**

**Condensed
Footprint**

**Simplified
maintenance
and
operation**

**Nearly
Odorless**



NEWT™

Natural Engineered Wastewater Treatment



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