



# ZEOLITE ANAMMOX DE-AMMONIFICATION PROCESS

ORO LOMA SANITARY DISTRICT

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# What is it and its Purpose?

- The zeolite anammox process combines the cationic attraction of ammonium to zeolite with the energy efficiency of anammox bacteria.
- The process provides a simple and low cost method of treating side stream wastewater for nutrient removal.



# Process Description

- Zeolite-anammox is a fixed film bio-reactor. Zeolite immobilizes ammonium by Cationic Exchange, bacteria consume  $\text{NH}_4$  and regenerate the CEC sites.
- Aerobic nitrification stage is provided by a partial re-circulating trickling filter.
- Zeolite media graded from 0.25" to 1" sized aggregate.
- Anammox grows in anaerobic, submerged portion of vessel.

# Project Description

- Current study based upon prior pilot.
- Current design is a 20,000 gallon reactor treating 10% of the belt press filtrate.
- Side-stream  $\text{NH}_4\text{-N}$  averages 500mg/L  $\text{NH}_4\text{-N}$ .
- Target is 60% Total N removal. An additional unit can be placed in series for higher removal.

# Pilot Plant

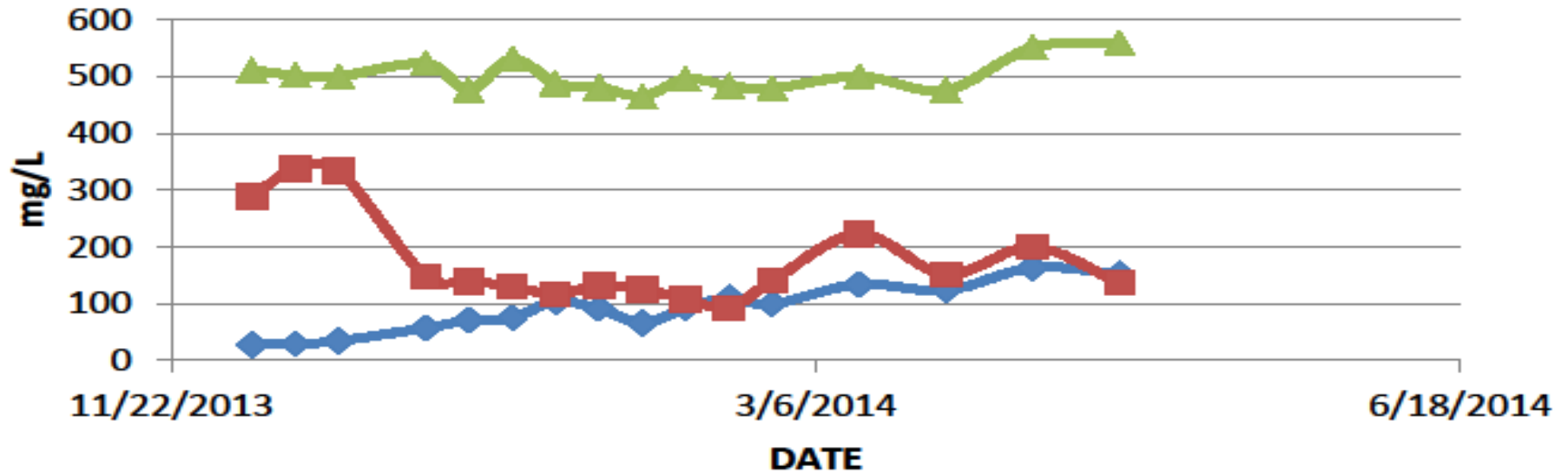
- Pilot plant commissioned November 2013, and de-commissioned June 2014.
- Notable for very fast anammox establishment (7 weeks).
- Influent  $\text{NH}_4 = 500\text{mg/L}$ ; effluent  $\text{NH}_4 = 100\text{mg/L}$ ; effluent  $\text{NO}_3 = 100\text{mg/L}$ .
- 80% removal of ammonium; 60% removal of TN.
- $0.35\text{kg/m}^3/\text{day}$   $\text{NH}_4\text{-N}$  removal



# PILOT RESULTS

## OLSD PILOT PLANT 1TFL

◆ NH4    ■ NO3    ▲ INF.



## Current Study

- Reactor volume 20,000 gallons.
- Influent flow 10gpm; 500mg/L NH<sub>4</sub>-N.
- Re-circulation flow is 50gpm.
- Temperature is 22°C.
- Total cost including design, construction, and materials = \$81K.

# Second Phase System











Worker in a dark shirt and blue jeans, holding a blue bucket, is positioned in the background near a concrete structure.



Handwritten arrow pointing upwards and the number '5'.

Handwritten text: '614 9/16 2100mm 2700'



DB5070

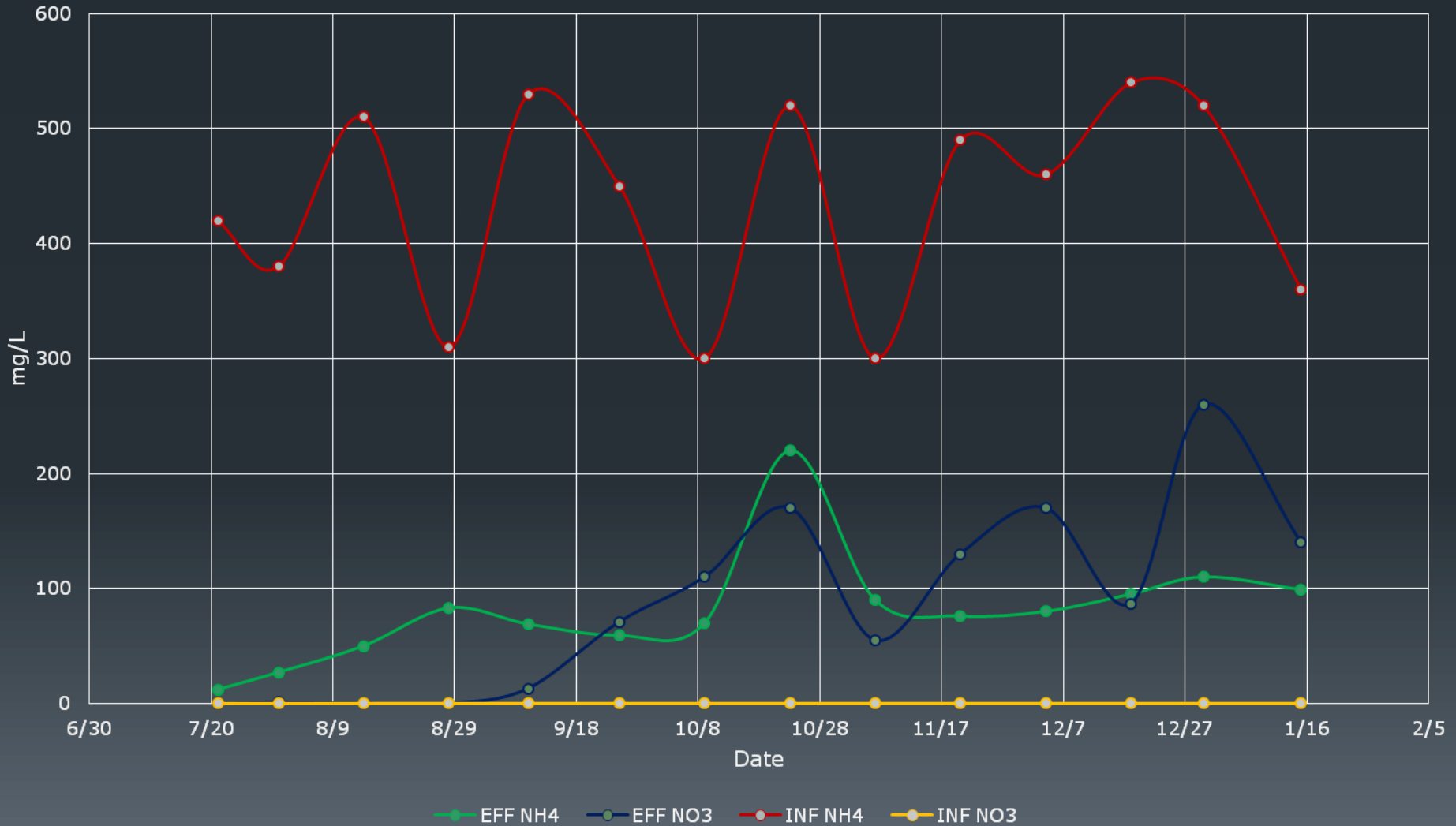
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# Preliminary Results

OLSD Zeolite-anammox



## Loading Rates

- Current loading rate: 0.22kg/m<sup>3</sup>/day.
- Current removal rate: 0.18kg/m<sup>3</sup>/day.
- Anticipated removal rate (when anammox mature): 0.35kg/m<sup>3</sup>/day.
- Performance depends on influent concentration and operating temperature.

# Results (12/18/14)

<u>PARAMETER</u>	<u>UNIT</u>	<u>INFLUENT</u>	<u>EFFLUENT</u>
<b>NH4-N</b>	(mg/L)	540	95
<b>NO3-N</b>	(mg/L)	0.1	87
<b>Alkalinity</b>	(mg/L)	1800	510
<b>Temperature</b>	(°C)	20	22
<b>pH</b>		7.6	7.1
<b>D.O.</b>	(mg/L)	2.8	3.3

## Next Steps

- Establish steady state conditions – expected in 3 months.
- Evaluate results for extension to full-scale system.
- Provide bio-zeolite seed to other WWTPs.
- We believe that total costs for sidestream treatment will be approximately \$1.1M – 85% removal.

