Wastewater Compliance Systems, Inc.

SIMPLE NUTRIENT REMOVAL IN WASTEWATER CONTAINMENT PONDS

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COLORADO
Department of Public Health & Environment

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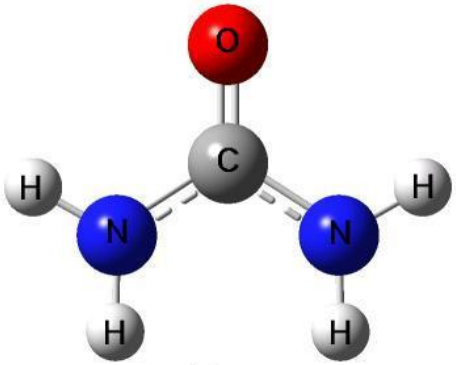
Rocky Mountain National Park Initiative

Back to air quality planning and outreach

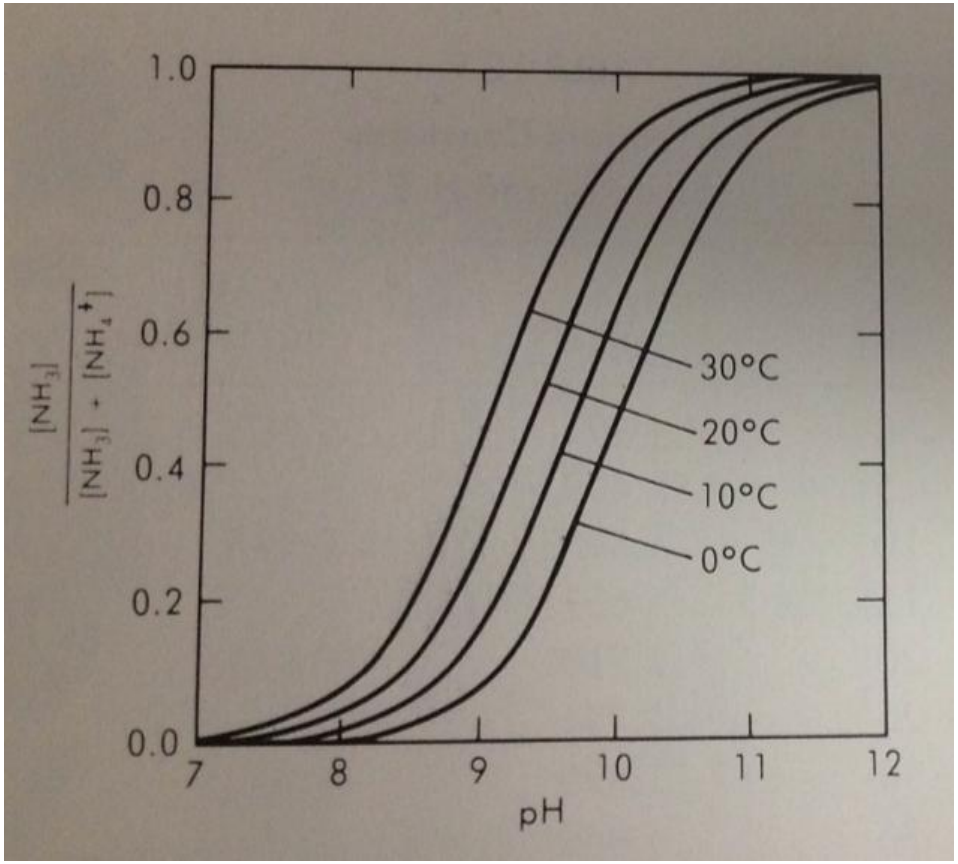
The Rocky Mountain National Park (RMNP) Air Quality Initiative was formed in 2004 to study and recommend strategies regarding air quality. The main focus has been atmospheric nitrogen deposition, which impacts park ecosystems. Other major air quality issues are ozone and regional haze. Participating agencies include the Colorado Department of Public Health and Environment (CDPHE), the U.S. Environmental Protection Agency (EPA) Region 8, and the National Park Service (NPS).

Rocky Mountain National Park Initiative

- How can we reduce Ammonia deposition?
  - It will happen as we get waste runoff into stabilization ponds and then manage the ponds from there.

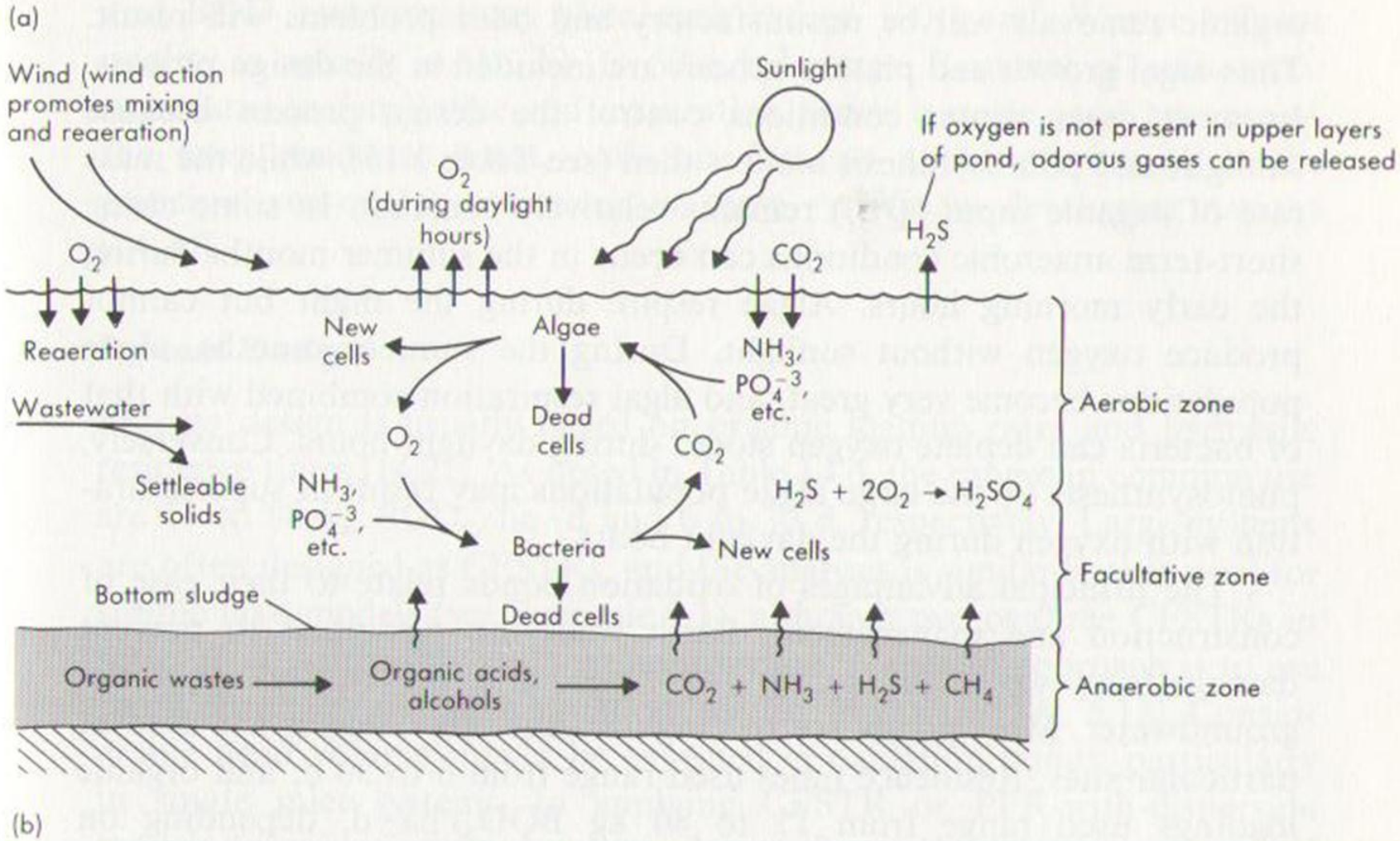


Urea



Fraction ammonia in NH_3 form as a function of temperature and pH (Water Quality, Tchobanoglous, p. 536)

Operation of Facultative Lagoon



Biological Removal of Ammonia Nitrogen

- Nitrification Process – Two principal genera of *nitrosomonas* and *nitrobacter*
  - Oxidize ammonium to nitrate with intermediate formation of nitrite

$$2NH_4^+ + 3O_2 \xrightarrow{Nitrosomonas} 2NO_2^- + 4H^+ + 2H_2O + energy$$

$$2NO_2^- + O_2 \xrightarrow{Nitrobacter} 2NO_3^- + energy$$

  - Overall Reaction

$$NH_4^+ + 2O_2 \rightarrow NO_3^- + 2H^+ + H_2O + energy$$

Suspended Growth

Basics

Optimum Temperature

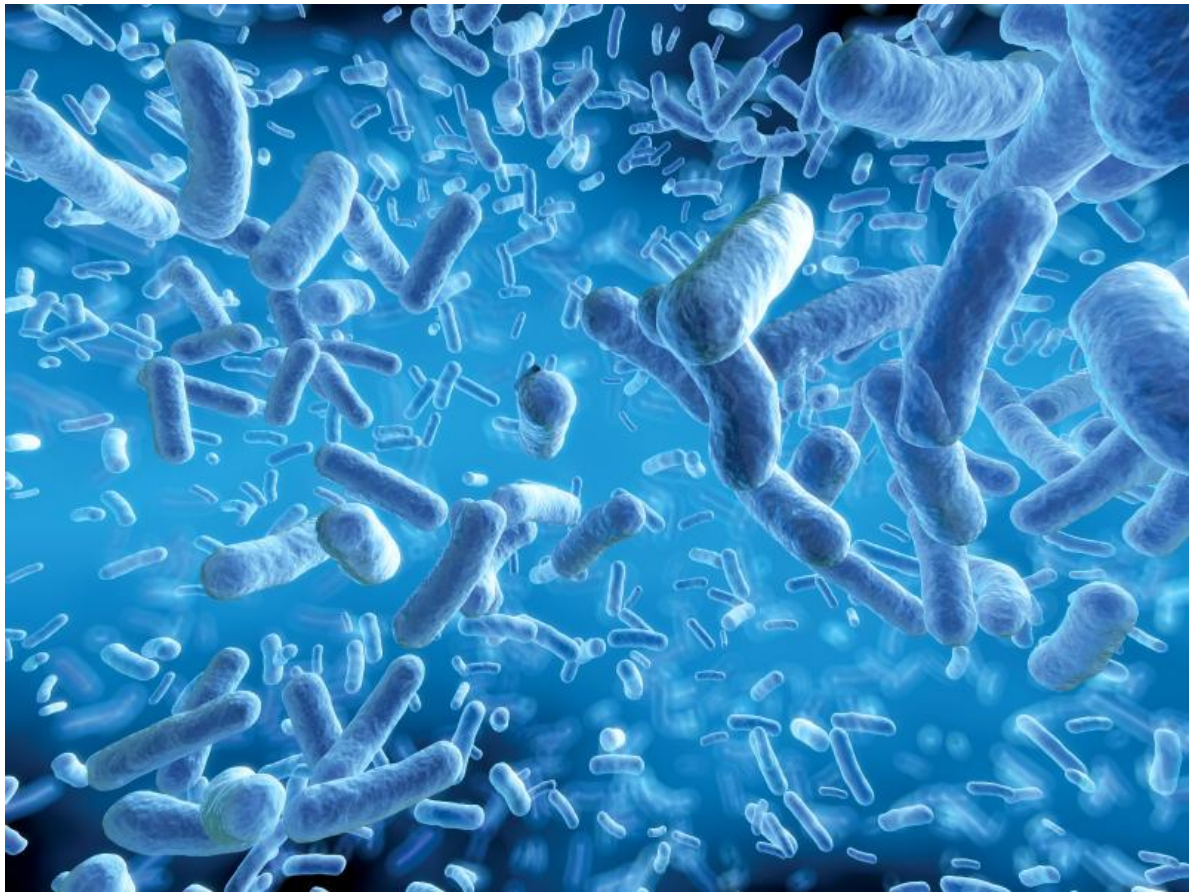
80 – 90°F

Temperature Inhibition

Below 50°F

No Growth = No Removal

Below 40°F



Fixed-Film Growth

Basics

Optimum Temperature

80 – 90°F

Temperature Inhibition

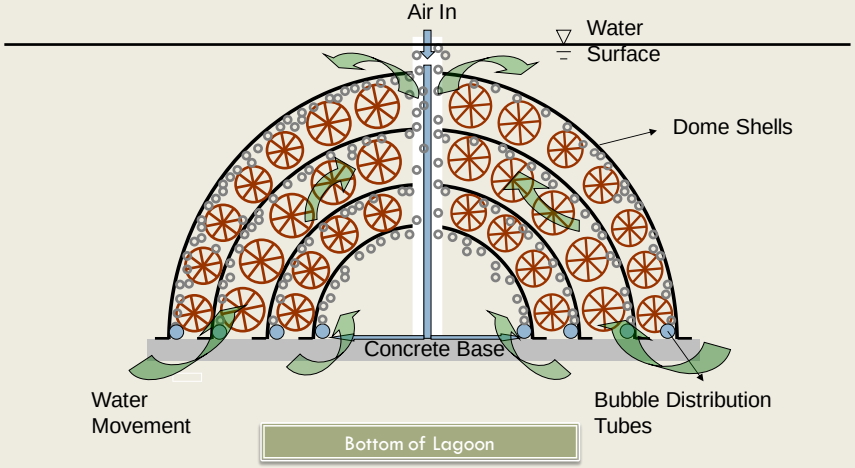
Below 40°F

No Growth = No Removal

Below 32°F

Fixed-Film, Bio-Reactor Basics

- Surface Area
- Aeration
- Mixing



Bio-Dome

Bio-Reactor Basics

4000 sq-ft surface area

BOD Removal

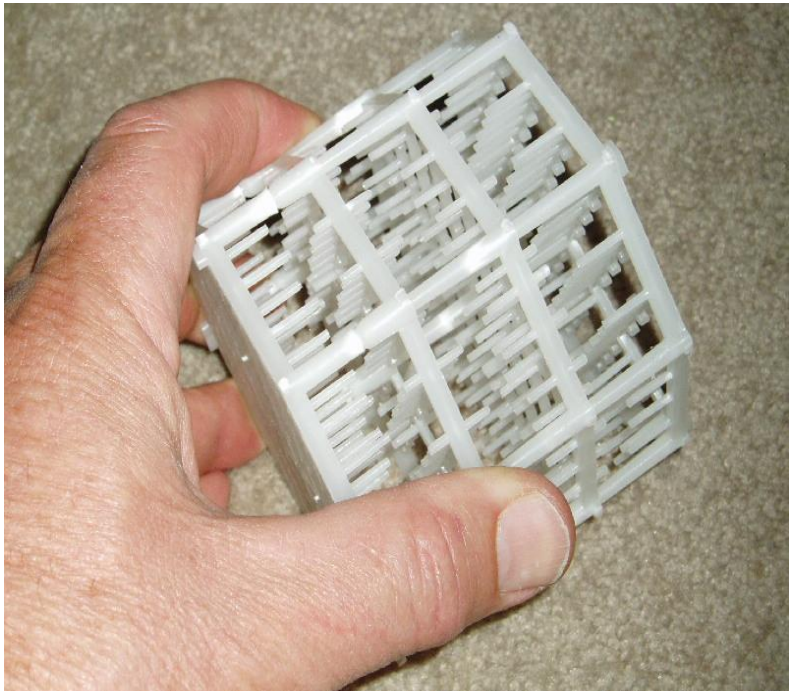
5.6 lbs/day/unit

TSS Removal

2.16 lbs/day/unit

Ammonia-N Removal

Water Temp Dependent



Jackpot, Nevada

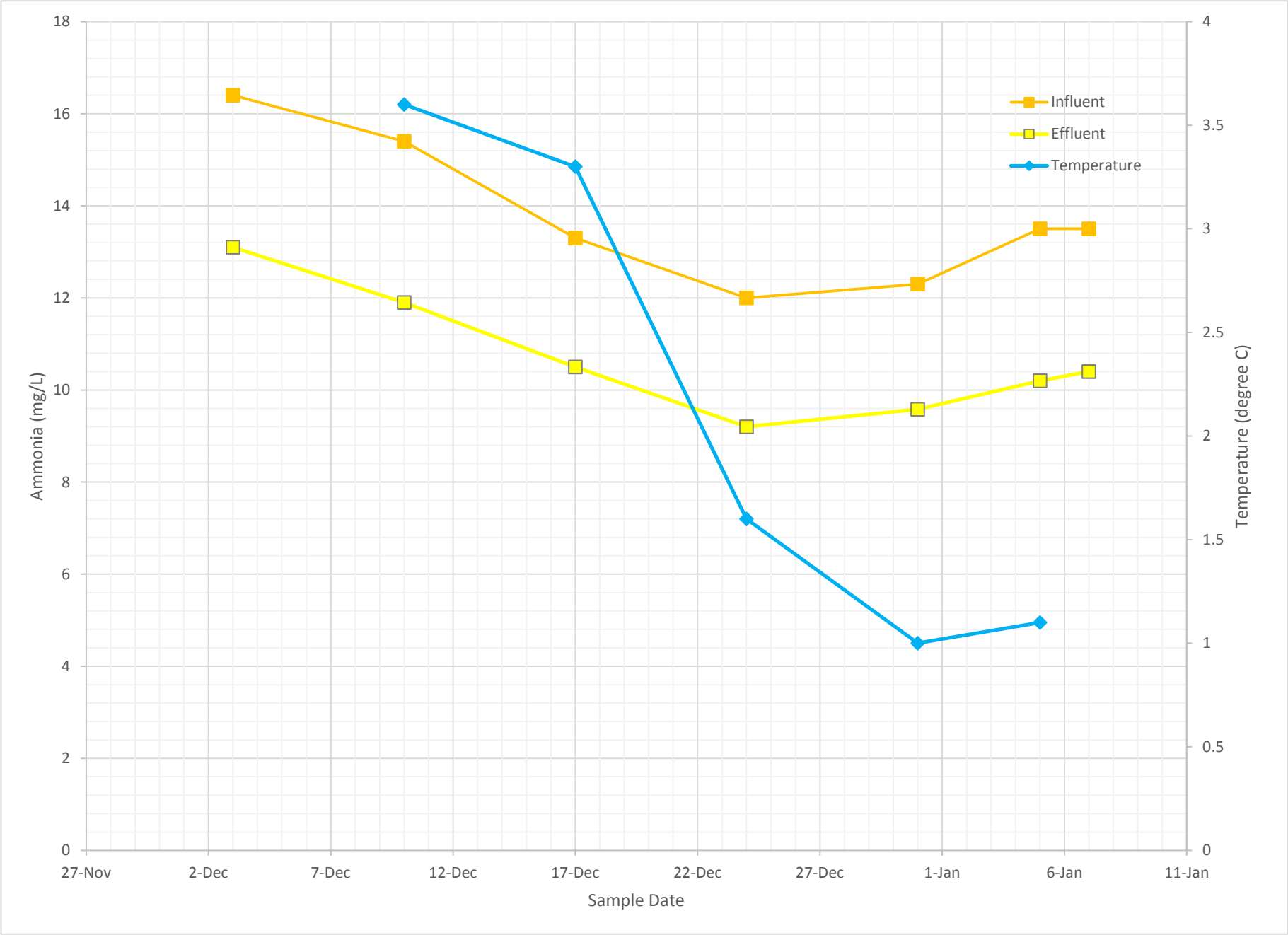
N
Google earth
1994
Imagery Date: 6/3/2013 41°58'47.70" N 114°39'22.80" W elev 5202 ft eye alt 6327 ft

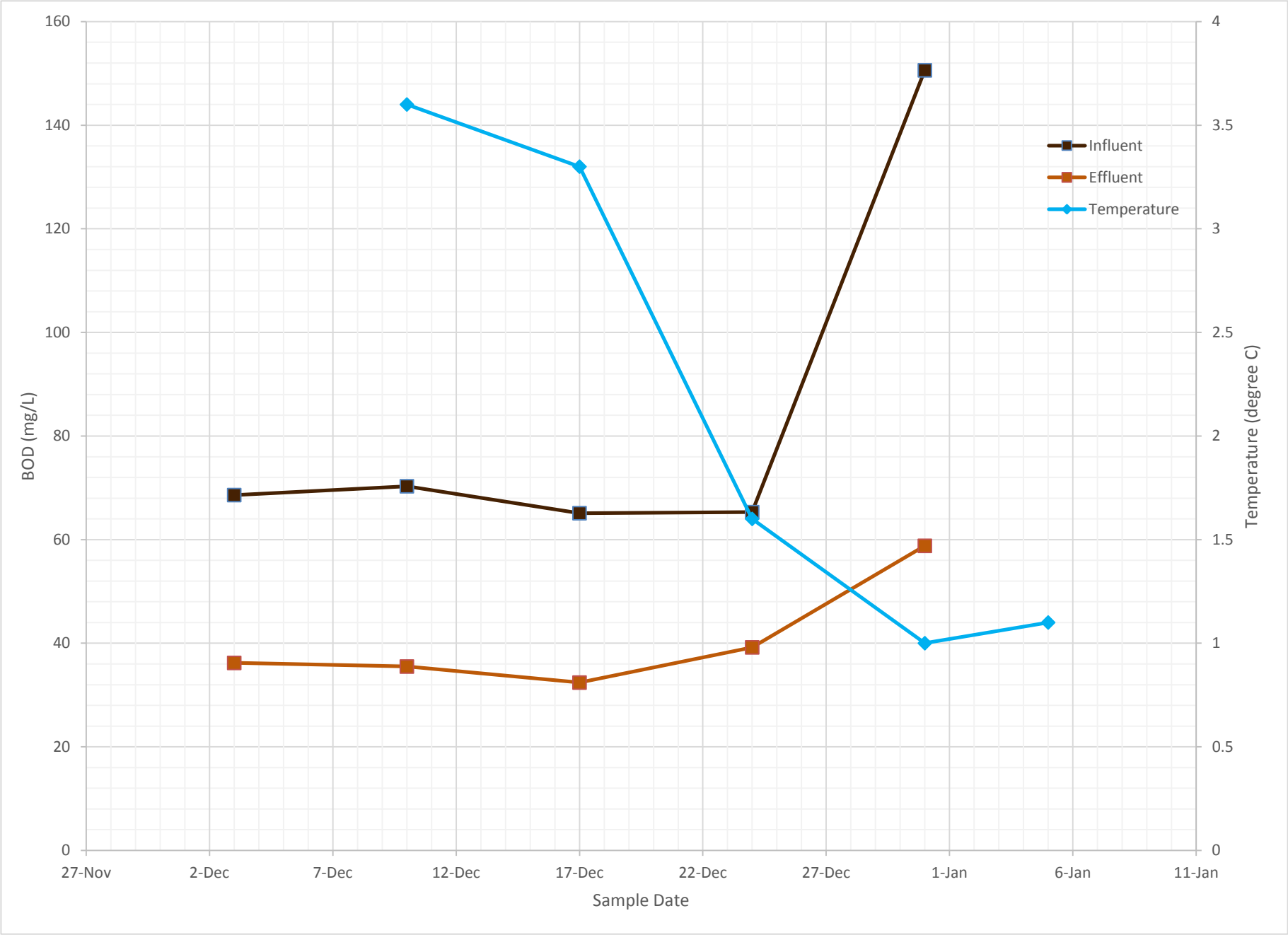
Kremmling, CO - 2013

- 0.17 to 0.2 MGD
- 4 cell lagoon system
- Elevation 7364 feet
- New ammonia limits
- Pilot with 50 Poo-Gloos
- Wintertime ammonia issue

Primary Pond BOD Removal Comparison

	Kremmling, CO	Jackpot, NV
Treatment	Bubble Aerators	90 Poo-Gloos
Flow (mgd)	0.2	0.25
lb BOD/day removed	236	334
HP Input	37.5	7.5
Monthly Power Bill	$ 2000	$400
Cost per lb removed	$0.28	$0.04


Influent
Effluent
Temperature
Ammonia (mg/L)
Temperature (degree C)
Sample Date
18
16
14
12
10
8
6
4
2
0
4
3.5
3
2.5
2
1.5
1
0.5
0
27-Nov
2-Dec
7-Dec
12-Dec
17-Dec
22-Dec
27-Dec
1-Jan
6-Jan
11-Jan


160
140
120
100
80
60
40
20
0
BOD (mg/L)
4
3.5
3
2.5
2
1.5
1
0.5
0
Temperature (degree C)
27-Nov
2-Dec
7-Dec
12-Dec
17-Dec
22-Dec
27-Dec
1-Jan
6-Jan
11-Jan
Sample Date
Influent
Effluent
Temperature

Thank you!

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