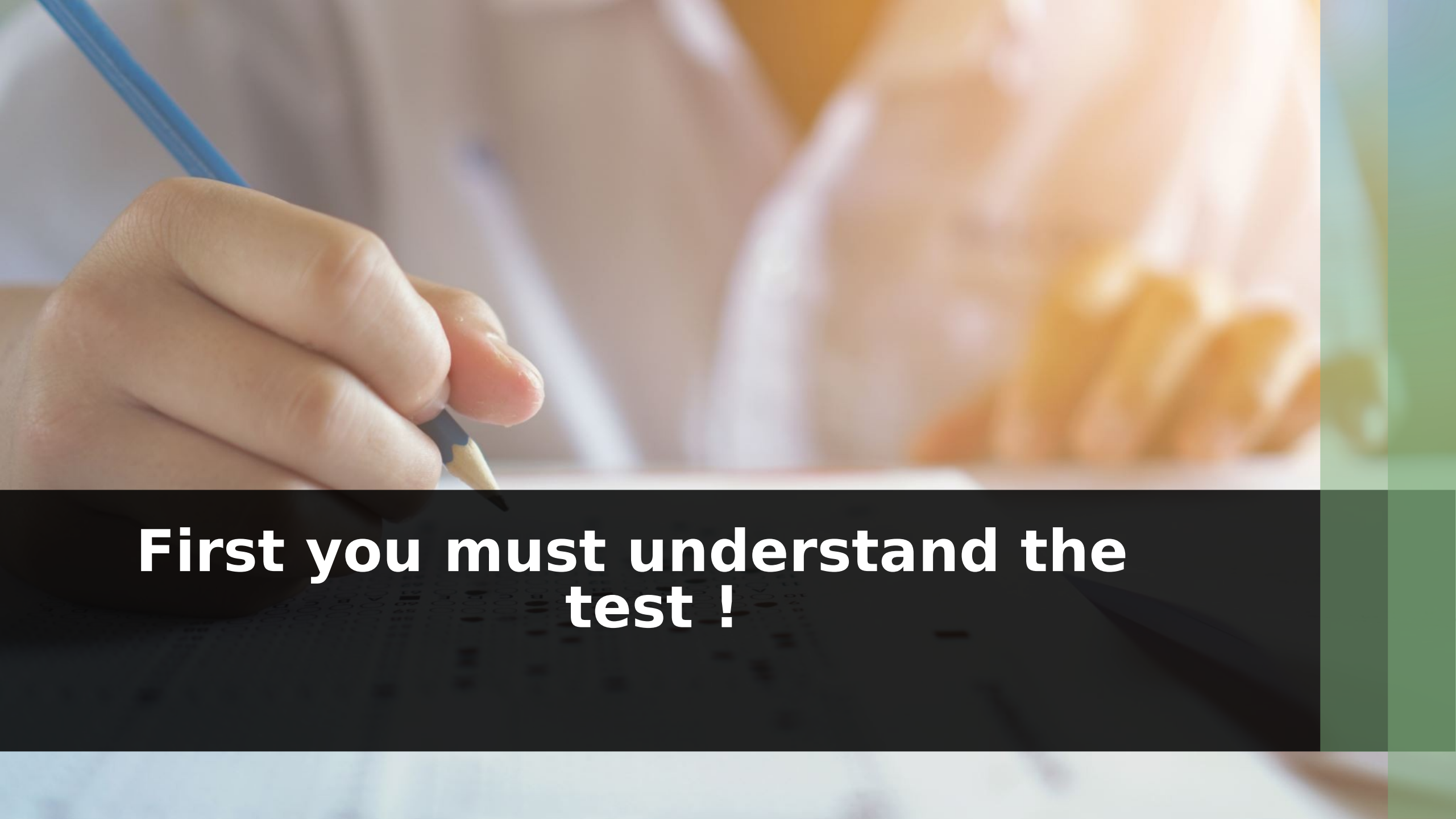
Reviewing Proprietary Aerobic Units Testing Data during Standard 40 Tests

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These views are my own and not those of NOWRA



First you must understand the test !

Test Overview

- Unit size test 400-1500 gpd typically 500 gpd
- Length of test 6 months
- Dosing Frequency

6am-9am	**35% of rated flow**	**(175g)**
11am-2pm	**25% of rated flow**	**(125g)**
5pm-8pm	**40% of rated flow**	**(200g)**
	Total	**(500g)**

- gallon doses.

- Test includes stress loading simulations four conditions.
  1. Wash day stress
  2. Working parent stress
  3. Power/equipment failure stress
  4. Vacation stress
- Test Report will provide flow and influent BOD_5 Average and effluent CBOD average.
- Test report identifies if unit is equipped with primary treatment and various component sizes.

What is learned from a test and understanding the test?

- The Maximum Hydraulic Daily Flow the unit is rated for, as well as instantaneous peek flows (≈5 gallons in 16 seconds or 18.75 gpm) and 100% of flow in 14 hours as well as 40% of flow in 3 hours. These are hydraulic peak flows to consider when designing.
- The report also typically list the **MAXIMUM** daily organic loading, the unit could be rated for. Normally it is 1.25 lbs BOD_5 for a 500 gpd unit or 3.75 lbs BOD_5 for 1500 gpd unit. Note newer tests reports have to report actual.
- This is developed using the maximum (not actual) theoretical BOD_5 loading during a Standard 40 Test.

$$\frac{1500}{1{,}000{,}000} \times 300 \text{ mg/L} \times 8.34 = 3.75$$

Test influent range is 100 mg/L to 300 mg/L

So, it could also be 1.25 lbs at 100 mg/L influent.

What is learned from a test and understanding the test? (cont.)

- A design using the maximum organic load without a safety factor will likely not perform properly!
- Different Units perform differently.
- Each unit’s actual treatment capacity can be analyzed.

Test Data Chart

		AVG	Std Dev	Min	Max	Med	1 Quart	2 Quart	3 Quart	4 Quart	Data Points
Dosed Volume (Gals)		468	118	0	500	500	500	500	500	500	182
Dissolved Oxygen, mg/L	Aeration chamber	2.90	0.53	1.79	4.82	2.92	2.53	2.92	3.21	4.82	116
	Effluent	2.10	0.66	1.03	5.56	2.08	1.62	2.08	2.58	5.56	116
Ambient Temperature, °C	Influent	14.8	9.0	4.0	26.4	20.7	4.0	20.7	22.5	26.4	131
	Aeration chamber	19.4	3.3	13.7	27.1	19.8	16.2	19.8	21.8	27.1	116
	Effluent	13.6	8.9	4.0	26.8	17.5	4.0	17.5	21.8	26.8	116
pH	Influent	7.43	0.17	6.67	7.95	7.43	7.36	7.43	7.51	7.95	131
	Aeration chamber	7.21	0.15	6.76	7.72	7.21	7.12	7.21	7.30	7.72	116
	Effluent	7.22	0.16	6.93	7.64	7.21	7.09	7.21	7.32	7.64	116
BOD, mg/L	Influent	200	36	130	330	200	180	200	220	330	132
CBOD, mg/L	Effluent	9	4	3	23	9	7	9	11	23	116
Total Suspended Solids, mg/L	Influent	180	56	71	490	180	140	180	210	490	132
	Aeration chamber	1,900	1,800	12	8,900	1,500	590	1,500	2,700	8,900	116
	Effluent	9	5	2	24	8	6	8	11	24	116
Volatile Suspended Solids, mg/L	Influent	37	31	0	140	24	12	24	58	140	134
	Aeration chamber	710	670	5	3,400	510	220	510	980	3,400	116
	Effluent	4	4	0	20	3	2	3	6	20	116
Settleable Solids (mL/L)	Aeration chamber	150	110	9	460	130	72	130	230	460	116

Table 1 Summary of Analytical Data

Calculating BOD Load

- BOD in lbs = Flow in MGD x strength of WW x 8.34

$$\frac{468}{} \text{ /1,000,000x 200mg/l x 8.34 = 0.78}$$

lbs BOD treated in this 500 GPD unit

- Therefore, a 1500 gpd unit could treat 3 x 0.78lbs or 2.34 lbs not the 3.75 lbs commonly assumed and have the same quality effluent.
- 3.75 is a 60% increase over 2.34.

Note before the next chart

I used 10 reports I had access to develop this data.

Most manufacturers have multiple test reports on multiple models, and these results do not necessarily represent what they are selling today.

The test results were both Standard 40 and 245, since a 245 test requires the unit to pass Standard 40, so they are done simultaneously.

If a Manufacturer is unhappy with what they see, send me more test reports.

The testing was done at both NSF and GCT, and that’s identified.

This is not an endorsement of one brand over another; it makes it clear that designers should understand what they are specifying and have the test results before specifying or approving alternates.

From the Standard 40 Reports

Make	Model	Tested by	Test year	Flow	Influent BOD	Effluent CBOD	Technology
Aeris	D-500-500	GCT	2014	472	243	13	EA
Aerogreen	500AG	GCT	2011	468	200	9	EA
Bio-Robix	B-500	GCT	2007	500	174	12	EA
Clearstream	500DA	GCT	2015	500	278	4	EA
Aquired Wastewater Technology	Cajun Aire 2	GCT	2009	500	172	13	EA
Delta Enviromental	UC 50	NSF	2001	500	181	6	EA
Fuji Clean	CEN5	NSF	2015	500	190	5	FF
Aquired Wastewater Technology	Mo-Dad 2 Poly	GCT	2009	500	208	12	EA
Enviro-Flo Inc	NuWater NR M-500	GCT	2016	500	183	5	EA
Septitech	N-M400	NSF	2010	500	200	12	TF

EA – Extended Air/Activated Sludge
FF – Fixed Film
TF – Trickle Filter

What I learned

Influent BOD averages ranged from 172mg/l to 278mg/l. with an overall average of 203 mg/l

CBOD effluent averages ranged from 4mg/l to 13mg/l with an overall average of 9 mg/l

Next I calculated BOD reduction for tested units

I took the BOD reduction influent minus effluent and calculated reduction

For example: 472/1000000 x (243-13) x8.34 =0.90 lbs

The 500 gpd unit reduced 0.90 lbs and a proportionally upsized 1500 gpd unit would be expected to reduce 2.7 lbs

BOD Load reduction by Make

Make	Model	Tested by	Test year	Flow	Influent BOD	Effluent CBOD	BOD Reduced lbs
Aeris	D-500-500	GCT	2014	472	243	13	0.9
Aerogreen	500AG	GCT	2011	468	200	9	0.7
Bio-Robix	B-500	GCT	2007	500	174	12	0.67
Clearstream	500DA	GCT	2015	500	278	4	1.14
Aquired Wastewater Technology	Cajun Aire 2	GCT	2009	500	172	13	0.66
Delta Enviromental	UC 50	NSF	2001	500	181	6	0.73
Fuji Clean	CEN5	NSF	2015	500	190	5	0.77
Aquired Wastewater Technology	Mo-Dad 2 Poly	GCT	2009	500	208	12	0.82
Enviro-Flo Inc	NuWater NR M-500	GCT	2016	500	183	5	0.74
Septitech	N-M400	NSF	2010	500	200	12	0.78

What I learned

- The BOD reduction in the 500gpd units ranged from 0.66 lbs to 1.14 lbs.
- The average BOD reduction was 0.79 lbs
- The lowest reducing unit as well as the highest reducing unit, both had Pretreatment Tanks (several did not)
- Based on proportional upsizing, the average 1500 gpd units theoretically should reduce 2.37 lbs; therefore, the average is 63% of the maximum rated reduction capacity of 3.75 lbs
- Regutory Agencies should publish BOD reduction on the unit’s approval list to facilitate proper design.

Pretreatment Tanks

- Many Regulators have minimum pretreatement tanks size requirements that exceed the tested version or allowable upsizing.
- This is less important on a NSF Standard 40 units but is critical on an NSF Standard 245 unit.
- There is ongoing discussion at the NSF Joint Committee on this issue.

Size of System vs Treatment Capacity

- Some of the smallest total tank size units performed the best while some of the largest performed the worst.
- Its not simple a matter of size . Its technology type and proper execution of the technology that results in smaller total tank size performing well.
- Proper required maintance is typically more critical on high performing units.
- An overview of all this , is a topic for another presentation.



Questions or Comments?