Agingan Treatment Plant (ATP)

1

Agingan - Service Area

Southwest Portion of the Island of Saipan

Built: 1993

Purpose: Secondary Treatment

Replaced: Primary Treatment 'Clari-gester'

Purpose:

Screenings and Grit Removal

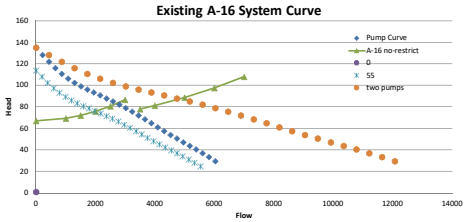
Secondary Treatment
- BOD Removal (biological oxygen demand)
- TSS Removal (total suspended solids)
- Bacterial Reduction

2

A-16 Lift Station

3

A-16 Lift Station



Flygt N3301 MT – 3 phase – 634 impeller
Output: 1,950 gpm @ 55 hertz

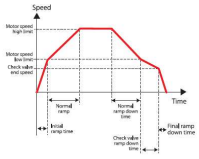
Dry Season:	11 hours	1.3 MGD
Wet Season:	13 hours	1.5 MGD

4

VFD – Throttling

		Hertz 1:	60		Hertz 2:	45
Flow 1	Head 1	Pump Eff	BHP	Flow 2	Head 2	BHP
gpm	feet	%	HP	gpm	feet	HP
1509	99	63	59.9	1131	56	25.3
1724	96	68	61.6	1293	54	26.0
1940	93	72	63.5	1455	53	26.8
2155	91	75	65.4	1616	51	27.6

Open and close your check valves quietly and quickly –
Check Valve Ramp
The Check Valve Ramp prevents water hammering as the pump stops and the check valve closes. The Check Valve Ramp slowly ramps down the pump speed around the value where the check valve ball is about to shut.



5

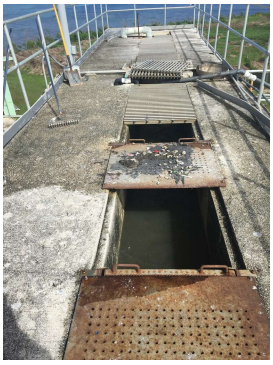
ATP Influent Characteristics

Low Strength Domestic Wastewater

BOD:	**160 mg/L**	**(biological oxygen demand)**
TSS:	110 mg/L	(total suspended solids)
TKN:	**~30 mg/L**	**(organic nitrogen)**
TP:	~5 mg/L	(phosphorus)
pH:	7.3 to 7.5	(neutral acidity)
Temp:	28°C ± 2°C	(no seasonal variation)

6

Headworks – Primary Treatment - Screenings



7

Headworks – Primary Treatment - Screenings

Screenings: 2 cubic feet per 1 MG at 6 mm sizing (1/4" sizing)

@ 1.5 MGD = ~1 cubic feet per day @ 12 mm sizing (1/2" sizing)

Solid Waste for Landfill Disposal

8

Headworks – Primary Treatment - Grit

Offline – 2009

1.5 #/MG

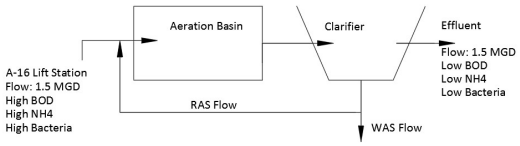
Capture-able: ~1 #/day

Gravity Separation

The grit finally ends up in the digester since it is not captured here.

9

Activated Sludge - Process Diagram



Aeration Basin: Biological Treatment

Clarifier: Gravity Separation

RAS Flow: Return Activated Sludge
WAS Flow: Waste Activated Sludge

10

Biological Treatment Goals

	Inflow	Outflow	Achievable
BOD (mg/L)	~160	< 30	< 15
TSS (mg/L)	~110	< 30	< 20
Nitrogen (N-mg/L)	~30 NH_4	20 NO_3 and	3 NH_4
Enterococci (Colony Forming Units / 100 mL)	+500,000	10,080	~4,000

11

Enterococcus in Wastewater

Enterococcus

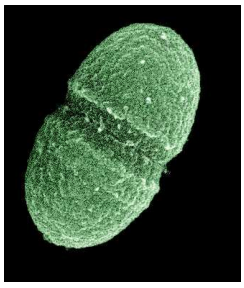
Indicator of Raw Sewage.

Varies less in treatment than E. Coli.

Less biological decay (die-off) during treatment (long lived)

Is present until it is consumed or destroyed.
- Consumed by other bacteria or micro-organisms
- Destroyed by disinfection

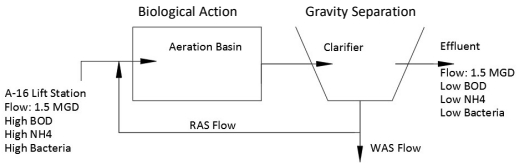
Marine Swimming Water: 35 CFUs/100 mL



Enterococcus Faecalis - Picture from:
https://www.ars.usda.gov/oc/images/photos/mar05/d035-1/
Population Distribution from:
The Enterococci: Pathogenesis, Molecular Biology, and Antibiotic Resistance

12

Process Diagram



What is the RAS Flow?

RAS = 30% to 100% of Process Flow
~50% Typical

13

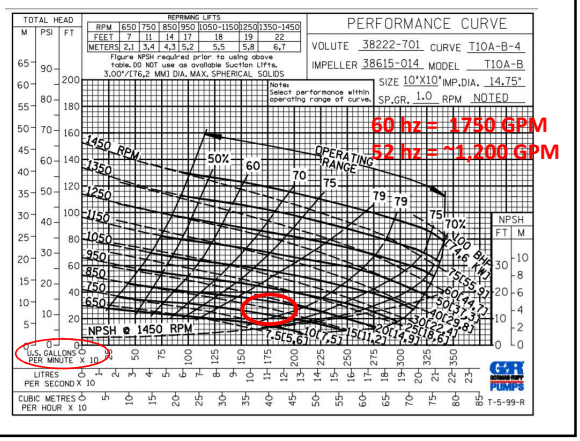
RAS Recycle

Solids from the Clarifier are pumped back to the Headworks

15 HP Gorman Rupp
20 hours per day
VFD: 53 hertz
1,200 gpm

20 hours * 60 minutes per hour * 1,200 gpm = 0.7 MGD
1.4 MGD = 100% of Process Flow

14



15

Process Flow and RAS Flow in the North Aeration Basin.

16

Aeration Basin – Biological Treatment

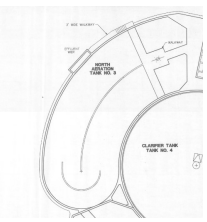
Physical Characteristics

- 2 Aeration Basins
- 100 HP Aerator per Basin
- 0.7 MGD per basin

17

Aeration Basin – Biological Treatment

2 Aeration Basins
100 HP Aerator each basin
0.7 MGD per basin



18

Aeration Basin – Biological Treatment

Oxygenation Requirement:

Key Parameters:

1.3 # Oxygen per 1.0 # of BOD (hot weather adjustment)
4.6 # Oxygen per 1.0 # of TKN (no denitrification)
Assumed Flow: 1.5 MGD

BOD Digestion:	2,600 # Oxygen Day
TKN Oxidation:	1,750 # Oxygen Day
	4,350 # Oxygen Day

19

Aeration Basin - Aeration

Vendor: 3.8 # Oxy / (hr*HP)

Assumed: 3.0 # Oxy / (hr*HP)

3.0 * 24 hours * 100 HP
= 7,200 # Oxygen Day

Supplied: 7,200 # Oxygen / Day
Required: 4,300 # Oxygen / Day

What about at 12 PM?
What about at 12 AM?

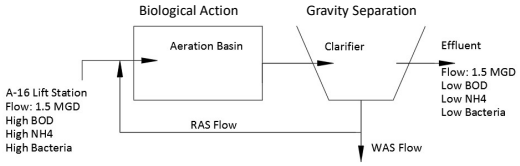
20

Aeration Basin – Key Parameters

Agingan – ATP		Conventional Treatment	
Residence Time = 9 hours		Residence Time = 6 hours	
Loading: 20 # BOD / 1000 cf.		Loading: 35 # BOD / 1000 cf.	
RAS Flow:	100%	RAS Flow:	40%
MLSS:	~4,500 mg/L	MLSS:	3,000 mg/L
Oxygen:	7,200 #/day	Oxygen:	4,350 #/day

21

Process Diagram



What is the Clarifier?

A Gravitational Separator

Biological Reactions are not welcome

22

Clarifier - Empty

Feedwell Ring

Weirs

RAS Pit

23

Clarifier - Filling

24

Clarifier - Full

25

Clarifier - Full

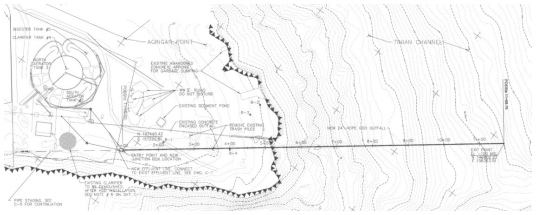
26

Clarifier Overflow

- 1.5 MGD Flow
- Dia: 80’ Area: 5,000 sq.ft.
- Clarifier Overflow: (1.5 MGD / 5,000 sq.ft.)
- Clarifier Overflow: ~300 gpd / sq.ft.
- Normal: 400 to 700 gpd / sq.ft.
- Plant Capacity: ~3.0 to 4.0 MGD

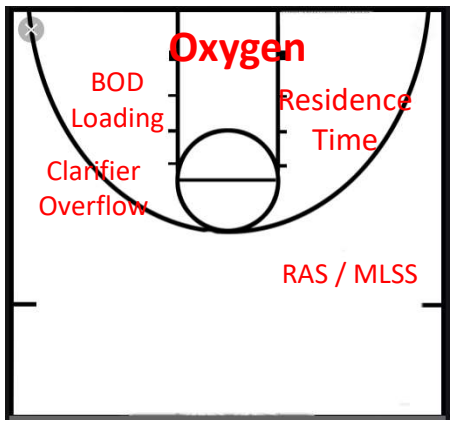
27

Agingan WWTP



550’ passed the rocky point, 100’ deep in the Ocean

28



29