

®

Air Diffusion Systems

Fine Bubble Aeration For Water & Wastewater Treatment

Bridgeport, WV

Meadowfill Landfill Leachate Treatment Lagoon

Operated By: Waste Management

**System Start-Up Date: January 2012**

 

Given Data

Design Flow = 80,000 GPD

BOD estimate = 900 mg/l

TKN estimate = 1400 mg/l

NH3 estimate = 70% TKN = 980 mg/l

Present NPDES Limits to City WWTP

BOD = 400 mg/l

TSS = 400 mg/l

TKN = 200 mg/l

Existing lagoon volume estimation

(Note: Actual volumes may vary…irregular shape)

Bottom Average = 100’ x 150’

WD average = 4.75 with 2’ FB

Side Sloe = 4:1

Volume Estimate @ mid-depth 119’ x 169’ x 4.75 x 7.48 = 0.715 MG

Rt estimate = 0.715 / 0.08 MGD = 8.9 days

BOD treatment estimate @ 1C water

**Ket = N  N √ 1 - 1**

**p**

**WHERE: Ke Winter = 0.143 @ 1C**

**N = 1 lagoon**

**p = Per cent of remaining BOD in decimal**

**t = 8.9 Days of detention**

**Solving for p using winter Ke, and 4.75 feet of water depth in the lagoons**

**yields 396 mg/l effluent BOD.**

**This is just too close for BOD removal. In addition there is not enough time to treat Nitrogen and the oxygen transfer rate @ 4.75 feet WD is not very good.**

Immediate Aeration Installation Option

We could install 140 disks into the existing lagoon using two existing Roots 25 HP blowers that can be modified to deliver over 550 SCFM @ 6 PSI for each blower.

With two blower running that’s 550 x 2 = 1100 SCFM

140 Disks x 8.1 SCFM per LTC Disk = 1134 SCFM

We are within the margin of deviation of the calculated cubic feet of air to allow this preliminary installation. The BOD removal will be met in summer time and possibly in winter as well. The ammonia / TKN removal could be 60 to 75% in summer and maybe 50% in winter time as a guess. With the addition of Nitrogen reducing bacteria @ 5 to 10 PPM of the flow and adding baking soda we could see better results than suggested above.

While this treatment pilot is on the way …say within 3 to 4 weeks completed…you can design a 4 feet wall install it and increase the water depth to 8.75 feet with the disks running. We can also add beneficial teams of bacteria and a source of inorganic carbon (baking soda) into the lagoon either manually or automatic delivery system by installing a potable water line to the existing heated building.

New Wall around the lagoon volume estimation

(Note: We will fill the existing lagoon and add the 4 feet wall to estimate the new volume)

Existing full volume:

Bottom Average = 100’ x 150’

WD average = 6.75’ filled to top

Side Sloe = 4:1

Volume Estimate @ mid-depth 127’ x 177’ x 6.75 x 7.48 = 1.13 MG

4 feet Wall above existing lagoon volume estimation

154’ x 204’top of dike dimensions x 4’ x 7.48 = 0.94 MG

Note: with the wall constructed 3’ in back of anchor trench, the volume will be slightly larger

Total estimated new volume

1.13 MG + 0.94 MG = 2.07 MG

Rt estimate = 2.07 / 0.08 MGD = 25.9 days

BOD treatment estimate @ 1C water

**Ket = N  N √ 1 - 1**

**p**

**WHERE: Ke Winter = 0.143 @ 1C**

**N = 1 lagoon**

**p = Per cent of remaining BOD in decimal**

**t = 25.9 Days of detention**

**Solving for p using winter Ke, 8.75 feet of water depth in the lagoon,**

**yields 191 mg/l effluent BOD.**

This is a much safer calculation considering we have multiple variables in our design estimations. In addition we have almost 3 times the retention time to reduce the nitrogen and almost two times the oxygen transfer rate. This should really improve the year-round treatment to meet BOD and perhaps the TKN limits to the City.

**Total Oxygen Demand Estimations**

BOD = 900 mg/l x 0.08 MGD x 8.34 x 1.4 (O2 Factor) = 841 PPD O2

TKN = 1400 mg/l x 0.70 for NH3 x 0.08 MGD x 8.34 x 4.6 (O2 Factor) = 3008 PPD O2

Total O2 = 3849 PPD O2

SCFM @8.75 ‘ WD & 1081’ Elev. & 13.73 AOR transfer rate at site:

SCFM = 3849 / 1440 x 0.075 x 0.232 x 0.1373 = 1119 SCFM

As you can see the two existing Roots blowers will deliver the approximate SCFM.

This is a very good plan to put into operation and will drastically improve the existing system.

**Estimated Mixing Rate @ 8.75 feet WD**

Each LTC Disk will pump approximately 15 MGD at 8.75’ WD

Pumping = 140 LTC Disks x 15 MGD = 2100 MGD

Fluid Turnover Rate per Day = Pumping MGD / Volume MG = 2100 MGD / 2.07 MG = 1014 Times per day or 1.4 minutes

**Estimated Bacteria Dose Rate @ 0.08 MGD**

@ 5 PPM of the design flow = 0.08 MGD x 5 PPM = 0.40 gallons per day or 1.5 liters /D

@ 10 PPM of design flow rate = 0.80 gallons or 3 liters / D

The Bactivator Automatic Delivery System Model LSN 1500 will apply 1.5 liters per day of non-pathogenic bacteria of Nitrosomonas and Nitrobacter with1011 Plate count and requires 30 GPD of Potable water and 115 volt supply line. (Two required for winter time use)

Model LS 1500 is also recommended for BOD / TSS / FOG and Sludge reduction

(Two Units required for year-round use)

In addition to the bacteria system, it is necessary to monitor the inorganic carbon and trace elements and adjust pH as required to maintain optimum bacteria growth rates. Therefore adding baking soda and trace elements to the lagoon will supply proper growing conditions. As necessary the ph must be corrected to 6.5 to 9 for proper bacteria growth.

The final recommendation is to install an aerated living rock filter next to the lagoon to reduce the TKN / ammonia to very low levels even during winter time operation. I will engineer a aerated rock filter design at a later date. (See Henry County Landfill Leachate Ohio case study for basic components required)

All ADS Aeration Components have a 5-year warranty provided the aeration system is installed and maintained properly.

 

Two equal Sized Blowers = 1100 SCFM 140 ADS Billion Bubble Disk Modules





