

Design Calculations

- Design Flow: 8,000 gal/day
Design flow calculated from the Magnolia Utilities monthly water bill for the mobile home park. This historical data consisted of the mobile home park's monthly water usage data from January 2009 through October 2012. The average flow rate from these 46 months is 7,946 gallons per day, which includes excess flows from known water leaks.
- Influent Strength - lab data from grab samples from taken from the discharge of the existing septic tanks:
 - pH 7.32
 - Ammonia-N 8.70 mg/L
 - Total Phosphorus 2.62 mg/L
 - TSS 400 mg/L
 - CBOD 108 mg/L
 - Fecal Coliforms >600,000 CFU/100ml
 - Total Kjeldahl Nitrogen ... 13.9 mg/L
- Effluent Limits - taken from ADEQ letter dated April 12, 2012 for "Preliminary NPDES Discharge Limits for a proposed discharge from Mecca City Trailer Park in Columbia County." Shane Byrum with ADEQ re-ran the model using 8,000 GPD instead of the initial 6,000 GPD, and approved the original findings listed below in an email dated 03/13/2013.
 - May thru October 15.0/20.0/5.0/3.0 (CBOD₅/TSS/NH₃-N/DO)
 - November thru March 20.0/20.0/17.0/2.0 (CBOD₅/TSS/NH₃-N/DO)
 - April 20.0/20.0/6.1/2.0 (CBOD₅/TSS/NH₃-N/DO)
 - FCB: 1000 col/100ml (year round)
 - pH: 6.0-9.0 s.u. (year round)
- FLOW EQUALIZATION (Ten States Standard 65.52):
 - Tank size: 2,226 Gallons
 - Aeration: 2,226 gal (1.25 CFM/1000 gal) = 2.8 CFM minimum **OK**
 - Simplex ROOTS blower Model #24 URAI to furnish at least 7 CFM at an operating pressure of 3 PSI.
- CLARIFIER – Surface Overflow Rate at Design Peak Hourly Flow (Ten States Standard 72.232):
 - Per Ten States Standards, Extended Aeration Single Stage Nitrification = 1,000 GPD/ft².
 - Design Flow at Peak Hour: 8,000 GPD (3) = 24,000 GPD
 - Clarifier Size = 6' x 6' = 36 ft²
 - Surface Overflow Rate = 24,000 GPD / 36 ft² = 667 GPD/ft²

- $667 \text{ GPD/ft}^2 < 1,000 \text{ GPD/ft}^2$ **OK**

- CLARIFIER – Peak Solids Loading Rate (Ten States Standard 72.232):
 - Design $\text{BOD}_5 = 200 \text{ mg/l}$
 - Design Flow at Peak Hour = 8,000 GPD (3) = 24,000 GPD
 - Clarifier Size = $6' \times 6' = 36 \text{ ft}^2$
 - Ten States Standard Peak Loading Rate for Extended Aeration = 35 lbs/day/ft^2
 - $$\frac{0.024 \text{ MGD } (200 \text{ mg/l}) (8.34)}{36 \text{ ft}^2} = 1.1 \text{ lbs/day/ft}^2$$
 - $1.1 \text{ lbs/day/ft}^2 < 35 \text{ lbs/day/ft}^2$ **OK**

- CLARIFIER – Weir Loading Rate at Design Peak Hourly Flow (Ten States Standard 72.43):
 - Ten States Standards Maximum Weir Loading Rate = $20,000 \text{ GPD/lin ft}$
 - $$\frac{8,000 \text{ GPD } (3)}{6 \text{ ft weir}} = 4,000 \text{ GPD/lin ft}$$
 - $4,000 \text{ GPD/lin ft} < 20,000 \text{ GPD/lin ft}$ **OK**

- AEROBIC SLUDGE TANK REQUIRED VOLUME (Ten States Standard 85.31):
 - Sludge Tank Capacity = 1,900 gallons = 254 ft^3
 - Ten States Standard Minimum Volume/P.E. for Extended Aeration = $3.0 \text{ ft}^3/\text{P.E.}$
 - $$\text{Population Equivalent} = \frac{0.008 \text{ MGD } (200 \text{ mg/l}) (8.34)}{0.17 \text{ lbs/person-day}} = 78.5 \text{ P.E.}$$
 - $$\text{Required Tank Volume} = \frac{254 \text{ ft}^3}{78.5} = 3.2 \text{ ft}^3/\text{P.E.}$$
 - $3.2 \text{ ft}^3/\text{P.E.} > 3.0 \text{ ft}^3/\text{P.E.}$ **OK**

- AEROBIC SLUDGE TANK AIR REQUIREMENTS (Ten States Standard 85.5):
 - Ten States Standard aerobic sludge tank requirement = $30 \text{ CFM} / 1000 \text{ ft}^3$ of tank volume.
 - Aerobic sludge tank provided = 1,900 gallons = 254 ft^3
 - $$\text{Minimum Air Flow Rate} = 254 \text{ ft}^3 (30 \text{ CFM}/1000 \text{ ft}^3) = 7.6 \text{ CFM}$$
 - Sludge tank air flow rate to be added to aeration tank's air flow rate calculated below.

- AERATION TANK ORGANIC LOADING (Ten States Standard 92.31):
 - Ten States Standard Aeration Tank Loading for Extended Aeration = $15 \text{ lb BOD}_5/\text{d}/1000 \text{ ft}^3$
 - $$\text{Minimum Tank Volume} = \frac{0.008 \text{ MGD } (200 \text{ mg/l}) (8.34)}{15 \text{ lbs} / 1000 \text{ ft}^3} = 890 \text{ ft}^3 = 6,654 \text{ gallons}$$
 - 8,000 gallon tank $> 6,654$ gallon tank **OK**

- AERATION TANK – AIR REQUIREMENT (Ten States Standard 92.332):
 - Ten States Standards air requirement for extend aeration = $2050 \text{ ft}^3/\text{lb BOD}_5$
 - $$\text{Min. Flow Rate in Aeration Tank} = \frac{2050 \text{ ft}^3/\text{lb BOD}_5 (0.008 \text{ MGD}) (200 \text{ mg/l}) (8.34)}{1440 \text{ min/day}} = 19 \text{ CFM}$$
 - $19 \text{ CFM} + 7.6 \text{ CFM (sludge tank)} = 26.6 \text{ CFM} + \text{airlift pumps}$

- Air supply shall be duplex ROOTS blowers Model #33 URAI providing 48 CFM at an operating pressure of 3 PSI. **OK**

- **CHLORINE CONTACT MINIMUM TANK SIZE (Ten States Standard 102.44):**

- Ten States Standard minimum contact time 15 minutes
- Design Flow at Peak Hour = 8,000 GPD (3) = 24,000 GPD = 16.7 GPM
- Minimum Chlorine Contact Tank Size = 16.7 GPM (15 minutes) = 250 gallon tank
- 250 gallon tank provided **OK**