

TN REMOVAL USING EX SITU WASTEWATER TREATMENT PROCESSES



9/19/2014

CONCEPTS LISTED IN GMP 156

EX SITU BMP's ARE WW TREATMENT SYSTEMS NOT USING SOILS

GOAL

**TN LEVELS PRODUCED BY AOSS < 50% FROM THOSE
PRODUCED BY COSS**

TN REDUCTION BASED ON LOADING

**EX SITU BEST MANAGEMENT PRACTICES (BMP) ARE ASSIGNED
SPECIFIC TN % REMOVAL VALUES.**

**TL-2/TL-3 EFFLUENT
NSF STANDARDS**

**VALUES ARE QUANTITATIVE NOT QUALITATIVE
*MASS PER DAY NOT CONCENTRATION***

WASTEWATER TREATMENT FUNDAMENTALS

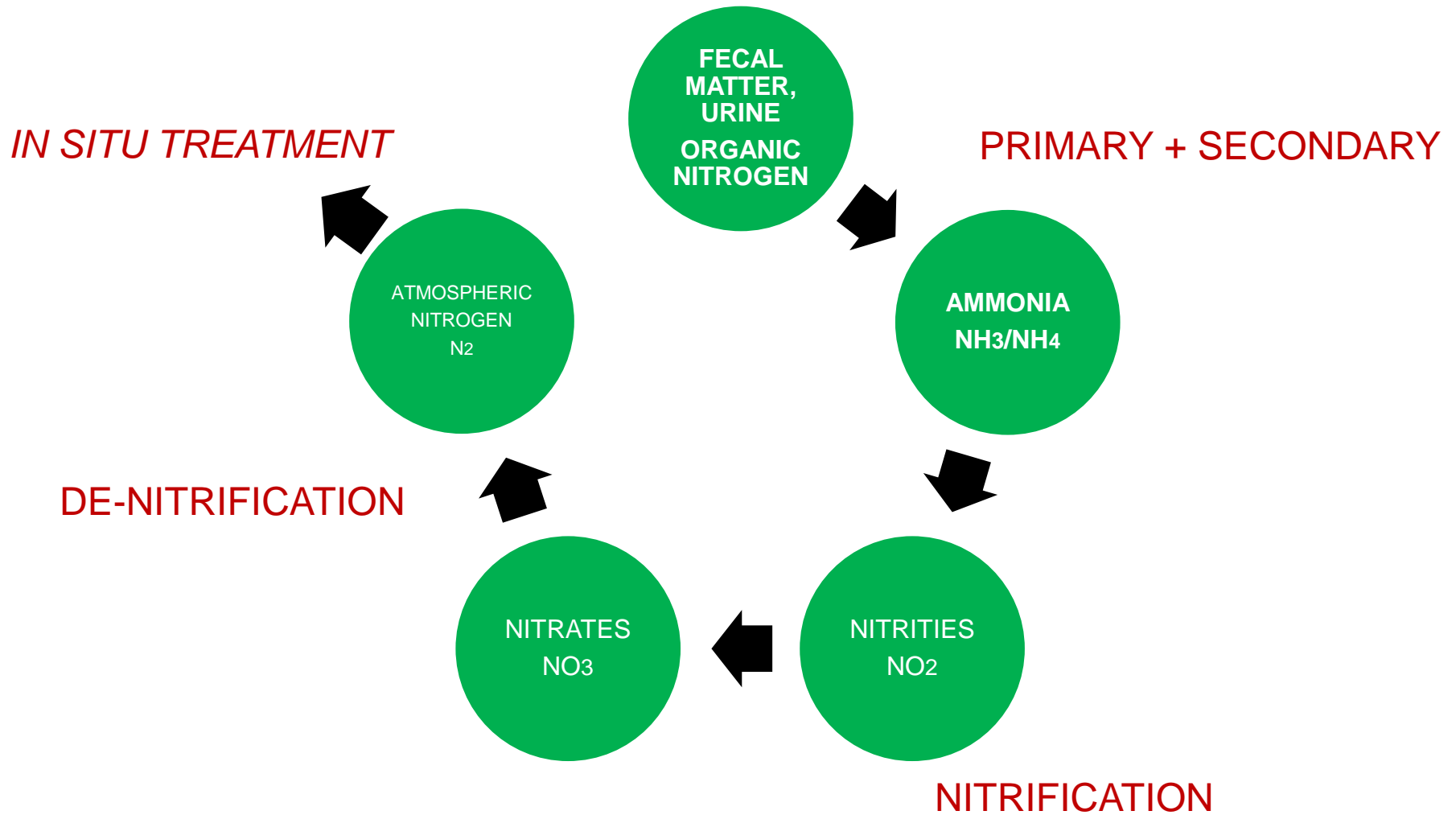
- REMOVE SOLIDS/FLOATABLES/DEBRIS/FOG
 - PRIMARY TREATMENT
 - » SEPTIC TANK
- REMOVE OXYGEN DEMAND
 - SECONDARY TREATMENT
 - » cBOD
- REMOVE NUTRIENTS
 - ADVANCED TREATMENT
 - » TN /TP
 - » nBOD
- REMOVE DISEASE
 - DISINFECTION
 - » UV/CHLORINE

TYPICAL TN CONCENTRATIONS IN RAW RESIDENTIAL WASTEWATER

- **PARAMETER**
 - TOTAL NITROGEN
 - AMMONIA, NH_4/NH_3
 - ORGANIC –N
 - TKN
 - NITRITES/NITRATES
- **CONCENTRATIONS**
 - 20 TO 85 mg/l (40 ave.)
 - 15 TO 50 mg/l (25 ave.)
 - 8 TO 35 mg/l (15 ave.)
 - 20 TO 85 mg/l (40 ave.)
 - <1 mg/l

TN TREATMENT CYCLE

REF: Fig. 7-11 Metcalf & Eddy *Wastewater Engineering*



NITRIFICATION PROCESS REQUIREMENTS

- MUST REMOVE ORGANIC CBOD BEFORE nBOD REMOVAL.
- TEMPERATURE SENSITIVE
- DETENTION TIME IS IMPORTANT
- OXYGEN MUST BE AVAILABLE
- ALKALINITY DEMAND
 - CARBON SOURCE
 - 4 TO 8 # ALKALINITY (CaCO₃)USED/ 1# NITRATE PRODUCED
 - *GROUND WATER MAY HAVE INSUFFICIENT ALKALINITY*
 - *SUPPLEMENTAL CHEMICAL FEED (SODA ASH) MAY BE REQUIRED TO MEET STANDARD*

***NITRIFICATION IS THE CONVERSION OF TN TO ITS MOST STABLE FORM
NITRATE IS SOLUBLE IN WATER & WILL TRAVEL WITH GROUNDWATER***

EFFLUENT CONCENTRATIONS NSF 40 & NSF 245 v. VDH REGS

NSF 40

- CBOD5 =< 25 mg/l
- TSS =< 30 mg/l
- TKN / AMMONIA not tested

NSF 245

- CBOD5 = < 25 mg/l
- TSS =< 30 mg/l
- TN =< 50% OF AVE. INFLUENT TKN

"Treatment level 2 effluent" or "TL-2 effluent" means secondary effluent as defined in 12VAC5-610-120 that has been treated to produce BOD5 and TSS concentrations equal to or less than 30 mg/l each.

"Treatment level 3 effluent" or "TL-3 effluent" means effluent that has been treated to produce BOD5 and TSS concentrations equal to or less than 10 mg/l each.

ASSIGNED TN BMP VALUES

GMP 156

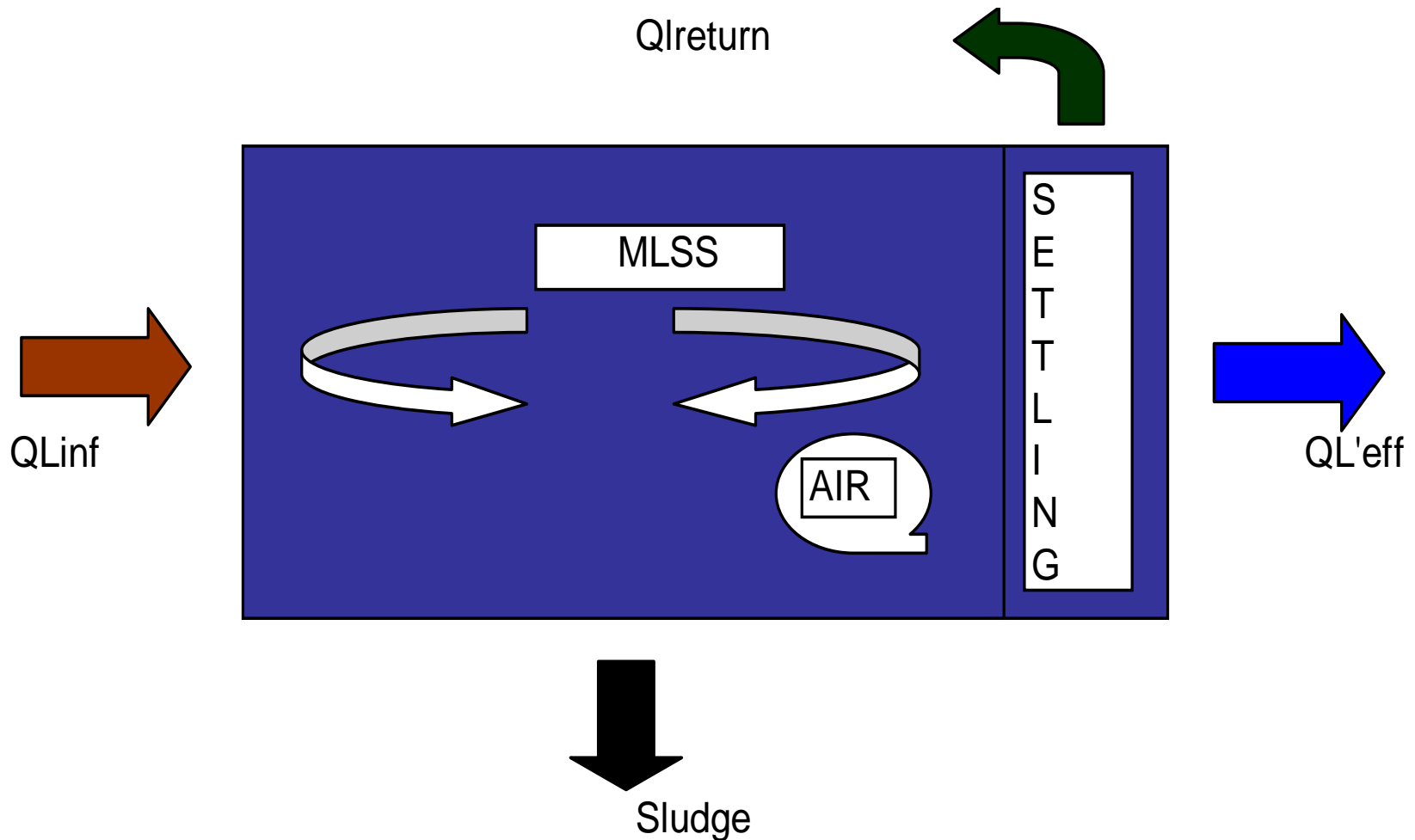
- TL-2/TL-3
- WETLANDS
- BURIED SAND FILTER
- 20% GROSS TN REDUCTION
- RECIRCULATING SAND FILTER
- PROPRIETARY N REMOVAL
- ENGINEERING DESIGN
- 50% GROSS TN REDUCTION

TYPICAL EX SITU TREATMENT PROCESSES

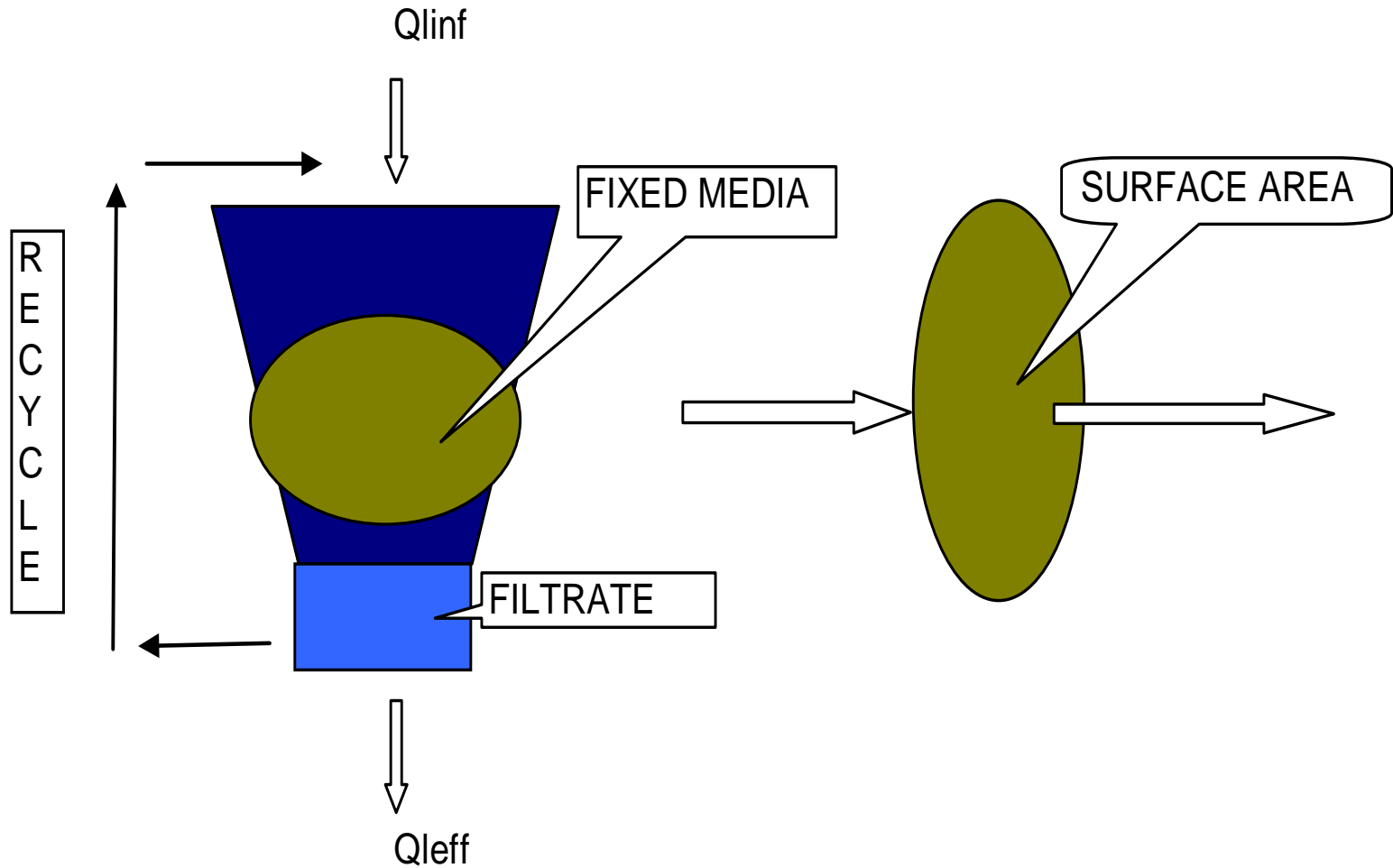


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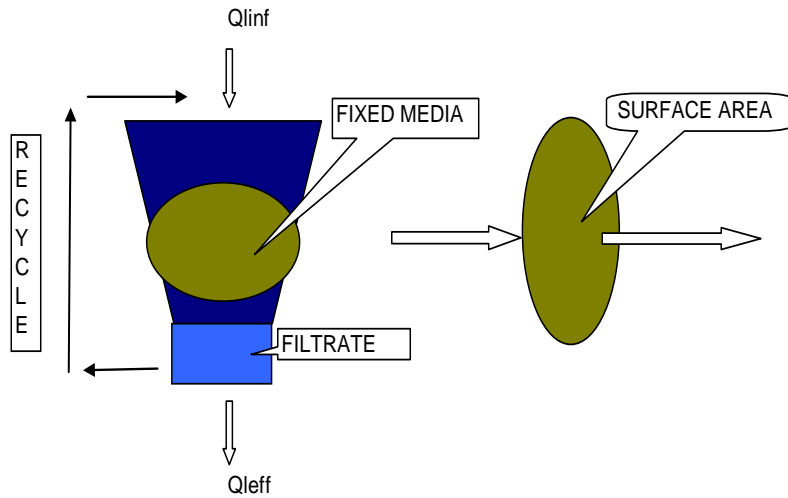
SUSPENDED GROWTH ACTIVATED SLUDGE



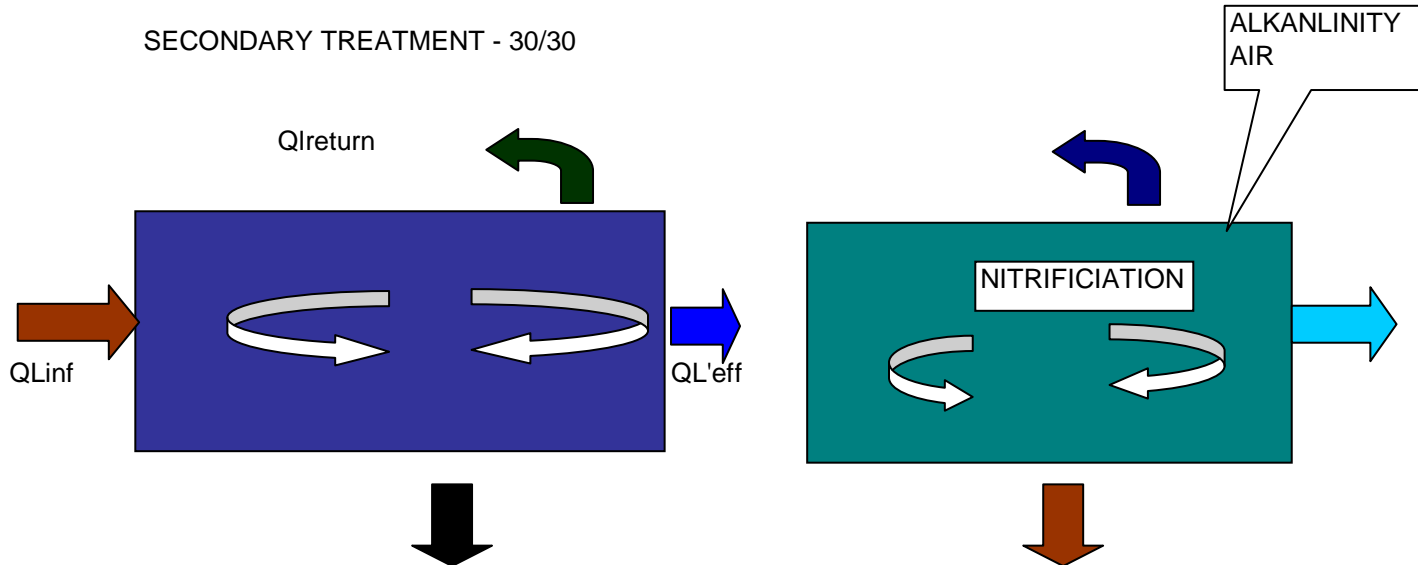
FIXED GROWTH BIOLOGICAL FILTRATION



ADVANCED SECONDARY



SECONDARY TREATMENT - 30/30





ENVIRONMENTAL SERVICES

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WASTEWATER TREATMENT & COLLECTION

ONSITE SEWAGE SYSTEM DESIGN
PERMITTING

WASTEWATERTREATMENT WORKS
SEWER & PUMP STATION
BIOSOLDS DISPOSAL
PLANNING STUDIES
NUTRIENT REMOVAL

WATER TREATMENT & DISTRIBUTION

DRINKING WATER WELLS
IRON + MANGANESE REMOVAL
pH ADJUSTMENT/COROSION CONTROL
BACTERIA & VIRUS REMOVAL
WATER SOFTENING
TASTE & ODOR CONTROL
RADIATION & RADON REMOVAL

ONLY THE BEST

Concentration vs. Loading

- Concentration (C): The amount of a particular substance in a solution or mixture.
 - Expressed as mg/l, ppm, grains/gallon
- Loading (L): The mass of a particular substance discharged with time
 - Expressed as kg/d, lbs./day
- Both parameters measure of treatment efficiency

CALCULATING TN EFFLUENT LOADING (IMPERIAL UNITS)

- ASSUMPTIONS

- Loading(L)= Concentration(C) * Flow (Q)

- $L = CQ$ (times weight of water)

- C, expressed as parts per million (ppm)

- Q, expressed as million gallons per day (mgd)

- Weight of water = 8.35lb per gallon

- $L = CQ(8.35)$, expressed as pounds per day

GMP 156 TN ASSUMPTIONS & LOADING GOALS

- INFLUENT TN LOADING
 - 9 #/person/yr.
 - 0.025 #pcpd
 - Baseline TN Loading @ edge of COSS
 - 9 #/person/yr.
 - 0.025 #/pcpd
- EFFLUENT TN LOADING
 - Required TN loading @ edge of AOSS
 - 4.5 #/person/yr.
 - 0.012 #/pcpd (50% reduction)
 - Ex situ TL2/TL-3 TN reduction
 - 20% or 0.02 #/pcpd (remain)
 - Ex situ RSF/Prop N/PE design TN reduction
 - 50% or 0.013 #/pcpd

EXAMPLE CALCULATIONS

- 3 Bedrm
 - TN inf = 0.025 lbpcpd
 - Q = 0.00045 mgd
 - L = 0.148 lbs/d
 - C = L/Q (8.35)

 - TN inf conc = 36.9 mg/l
- 20% Gross TN
 - TN eff = 0.022 lbspcpd
 - L = 0.118 lbspcpd
 - Q = 0.00045 mgd
 - C = 31.5 mg/l (TN)
- 50% Gross TN
 - TN eff = 0.013 lbspcpd
 - L = 0.075 lbspd
 - Q = 0.00045 mgd
 - C = 19.96 mg/l
 - TN conc = 19.96 mg/l



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