

Nitrogen Loading Calculations
Southern Tier Site Development
Oak Bluffs, MA
Revised January 24, 2023

Allowable Site Nitrogen Load		
Project Site Area	7.78	ac
Adjusted Nitrogen Load Limit	2.02	kg/acre/yr
Sengekontacket Pond Watershed, Table A column 7		
Allowable Site Nitrogen Load	15.72	kg N/yr

Calculations Based on IHT Water Usage Data (50 gpd per Bedroom)		
Proposed Site Nitrogen Load (Water Usage Based on IHT Data)	49.38	kg N/yr
Mitigation Required for IHT Data (Proposed Site Load - Allowable Site Load)	33.67	kg N/yr
Calculated Reduction per NitROE System Upgrade (Title 5 to NitROE System)	1.13	kg N/bedroom/yr
Estimated Mitigation	29.67	bedrooms

REFERENCE CALCULATIONS

Mitigation Calculations Assumptions (MVC Balance)		
Title 5 Effluent Nitrogen Concentration (MVC Guidance)	26.25	mg/L
NitROE System Effluent Nitrogen Concentration (from KleanTu)	8.00	mg/L
Nitrogen Concentration Reduction with NitROE System Upgrade (26 mg/L - 8 mg/L)	18.25	mg/L
Calculated Reduction per NitROE System Upgrade (Title 5 to NitROE System)	4.21	kg N/Unit/yr

Calculations Based on MVC Wastewater Nitrogen Output Guidance (2 Bedrooms per Unit)		
Proposed Site Nitrogen Load (Flow based on MVC Guidance)	94.18	kg N/yr
Mitigation Required for MVC Balance (Proposed Site Load - Allowable Site Load)	78.47	kg N/yr
Estimated Mitigation	18.64	Units
Estimated Mitigation	37.29	bedrooms

Calculations Based on MVC Wastewater Nitrogen Output Guidance (5 Bedrooms per Unit)		
Proposed Site Nitrogen Load (Flow based on MVC Guidance)	38.10	kg N/yr
Mitigation Required for MVC Balance (Proposed Site Load - Allowable Site Load)	22.38	kg N/yr
Estimated Mitigation	5.32	Units
Estimated Mitigation	26.59	bedrooms

Notes:

1. MVC Water Use data is from the Water Quality Management Policy and represents residential structures with 5 or fewer bedrooms (MVC Unit). The proposed 48 apartments/residences are a mix of 1, 2 and 3 bedrooms totaling 88 bedrooms.

2. IHT Water Usage data obtained from similar housing projects documents an average water use of 41 gpd per bedroom. The nitrogen loading calculations are conservatively based on a water use of 50 gpd per bedroom.

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Calculations Based on IHT Water Usage Data (50 gpd per Bedroom)

ALLOWABLE SITE NITROGEN LOAD	
Project Site Area (ac)	7.78
Adjusted Nitrogen Load Limit (kg/acre/yr) Sengekontacket Pond Watershed, Table A column 7	2.02
Allowable Site Nitrogen Load (kg/yr)	15.72

PROPOSED SITE NITROGEN LOAD	
Input Data	
Number of Bedrooms	88
Water Usage Flow per Bedroom (gpd) ²	50
N-conc. in effluent (mg/L) ¹	8.00
Lawn/Landscape area (square feet)	Native Plantings Only, no Fertilizer Application Guaranteed
Pavement (square feet)	37,897
Gravel (square feet)	13,504
Road runoff N-conc. (mg/L) ¹	0.75
Roof area (square feet)	23,830
Roof runoff N-conc. (mg/L) ¹	0.75
Recharge rate for pervious area (in/yr) ¹	28.7
Recharge rate for impervious area (in/yr) ¹	46.9

¹ From MVC Water Quality Management Policy
²Based on IHT Water Use Data from Similar Uses

Calculations Based on IHT Water Usage Data (50 gpd per Bedroom)

INPUT		CALCULATIONS	RESULTS
			CALCULATED LOADING (KG/YR)
Wastewater Load	Number bedrooms x flow per bedroom x 0.9 (10% outdoor use) x 365 x 3.785 L/gal x N-conc (mg/L)/1,000,000		43.8
Native Plantings Only, no Fertilizer Application Guaranteed			0.0
Pavement Load	SF Pavement x (46.9 in/yr x 90% ÷ 12 in/ft) x 28.3 L/ft ³ x N-conc (mg/L) ÷ 1,000,000 mg/kg		2.8
Gravel Road Load	SF Gravel Road x (46.9 in/yr x 65% ÷ 12 in/ft) x 28.3 L/ft ³ x N-conc (mg/L) x1,000,000 mg/kg		1.0
Roof Area Load	SF Roof Area x (46.9 in/yr x 90% ÷ 12 in/ft) x 28.3 L/ft ³ x N-conc (mg/L) ÷ 1,000,000 mg/kg		1.8
		TOTAL PROPOSED SITE NITROGEN LOADING (KG/YR)	49.4
		ALLOWABLE SITE NITROGEN LOAD (KG/YR)	15.72
		NITROGEN LOAD OVERAGE (KG/YR)	33.67

PREPARED BY HORSLEY WITTEN GROUP, INC.

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Calculated NitROE System Upgrade Nitrogen Reduction per BEDROOM (Title 5 to NitROE System)

Input Data

Residential Housing Flow (gpd/bedroom) ²	50
Title 5 N-conc. in effluent (mg/L) ¹	26.25
NitROE System N-conc. in effluent (mg/L)	8.00

INPUT	CALCULATIONS	RESULTS
		CALCULATED LOADING (KG/BEDROOM/YR)
Title 5 Treated Effluent	flow per bedroom x 0.9 (10% outdoor use) x 3.785 L/gal x N-conc (mg/L)/1,000,000	1.6
NitROE System Effluent	flow per bedroom x 0.9 (10% outdoor use) x 3.785 L/gal x N-conc (mg/L)/1,000,000	0.5
NITROGEN REDUCTION WITH NITROE SYSTEM PER BEDROOM	Title 5 Treated Effluent - NitROE System Effluent	1.13

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Area Needed to Net Zero Nitrogen (IHT Water Use Data)

Project Site Area	7.78	ac
Adjusted Nitrogen Load Limit	2.02	kg/acre/yr
Sengekontacket Pond Watershed, Table A column 7		
Allowable Site Nitrogen Load	15.72	kg N/yr
Proposed Site Nitrogen Load	49.38	kg N/yr
Nitrogen Load Overage	33.67	kg N/yr
Additional Area Required for MVC Balance	16.67	ac

Note:

1. MVC Water Use data is from the Water Quality Management Policy and represents residential structures with 5 or fewer bedrooms (MVC Unit). The proposed 48 apartments/residences are a mix of 1, 2 and 3 bedrooms totaling 88 bedrooms.
2. IHT Water Usage data is from water meter data at similar housing projects.