

 **Schofield, Barbini & Hoehn Inc.**
Land Surveying & Civil Engineering 

12 Surveyor's Lane, Box 339
Vineyard Haven, Mass.
508-693-2781
www.sbhinc.net
dhoehn@sbhinc.net

MV 11579

September 1, 2022

Martha's Vineyard Hospital – Navigator Homes Nitrogen Analysis

Acronyms:

MVH: Martha's Vineyard Hospital
NHMV: Navigator Homes of Martha's Vineyard, Inc.
WQMP: MVC Water Quality Management Policy v13 (1/12/18)

Site Conditions:

Locus lies entirely within the Sengekontacket Pond Watershed.
Adjusted Nitrogen Load Limit: 2.02 kg/acre/year per WQMP
Locus does NOT lie within Zone II of a municipal well
Total lot area: 27.53 acres

Project Notes:

Runoff Areas:

Roof area runoff to subsurface disposal:	86,475 sq ft
Roof area runoff to vegetated surface disposal:	0 sq ft
Impervious pavement to subsurface disposal:	0 sq ft
Impervious pavement to vegetated surface disposal:	90,637 sq ft
Pervious pavement to subsurface disposal:	0 sq ft
Pervious pavement to vegetated surface disposal:	0 sq ft

Wastewater Parameters:

Effluent strength: 5 mg/l (per MVC staff and Klean Tu denitrification system)

Flow Estimates per WQMP:

Green House Homes: (150 GPD/bedroom)(60%) = 90 GPD/bedroom
Workforce housing: (67,700 GPY/unit)(90%) / 365 days/yr = 167 GPD/unit

Analysis: Required: $[N(r) + N(l) + N(w)] < N(a)$

N(r) Runoff N-load:

Roof runoff to subsurface disposal:

$$(3.91 \text{ ft/yr})(90\%)(87,475 \text{ sf})(28.32 \text{ l/cf})(0.75 \text{ mg/l}) / (1\text{M mg/kg}) = 6.46 \text{ kg/yr}$$

Roof runoff to vegetated surface disposal:

$$(3.91 \text{ ft/yr})(90\%)(0 \text{ sf})(28.32 \text{ l/cf})(0.38 \text{ mg/l}) / (1\text{M mg/kg}) = 0.00 \text{ kg/yr}$$

Impervious pavement runoff to subsurface disposal:

$$(3.91 \text{ ft/yr})(90\%)(0 \text{ sf})(28.32 \text{ l/cf})(1.50 \text{ mg/l}) / (1\text{M mg/kg}) = 0.00 \text{ kg/yr}$$

Impervious pavement runoff to vegetated surface disposal:

$$(3.91 \text{ ft/yr})(90\%)(90,637 \text{ sf})(28.32 \text{ l/cf})(0.75 \text{ mg/l}) / (1\text{M mg/kg}) = 6.77 \text{ kg/yr}$$

Pervious pavement runoff to subsurface disposal:

$$(3.91 \text{ ft/yr})(65\%)(0 \text{ sf})(28.32 \text{ l/cf})(1.50 \text{ mg/l}) / (1\text{M mg/kg}) = 0.00 \text{ kg/yr}$$

Pervious pavement runoff to vegetated surface disposal:

$$(3.91 \text{ ft/yr})(65\%)(0 \text{ sf})(28.32 \text{ l/cf})(0.75\text{mg/l}) / (1\text{M mg/kg}) = \underline{0.00 \text{ kg/yr}}$$

$$N(r) \text{ total:} = 13.23 \text{ kg/yr}$$

N(l): Landscape N-load:

$$(43,439 \text{ sf})(3 \text{ lb}/1000 \text{ sf})(20\%) / 2.205 \text{ lb/kg} = 12.90 \text{ kg/yr.}$$

N(w): Wastewater N-load:

Estimated flow:

$$66 \text{ bedrooms @ } 90 \text{ GPD/bedroom} = 5,940 \text{ GPD}$$

$$48 \text{ units @ } 167 \text{ GPD/unit} = \underline{8,016 \text{ GPD}}$$

$$\text{Total:} \quad 13,956 \text{ GPD}$$

$$(13,956 \text{ GPD})(3.785 \text{ l/gal})(5 \text{ mg/l})(365 \text{ days/year}) / (1\text{M kg/mg}) = 96.40 \text{ kg/year}$$

N(a): Allowable N-load:

$$(2.02 \text{ kg/acre/yr})(27.53 \text{ acres}) = 55.61 \text{ kg/yr}$$

$$N \text{ total} = 13.23 \text{ kg/yr} + 12.90 \text{ kg/yr} + 96.40 \text{ kg/yr} = 122.53 \text{ kg/yr}$$

$$\text{Overage: } 122.53 \text{ kg/yr} - 55.61 \text{ kg/yr} = 66.92 \text{ kg/yr}$$

Potential Mitigation (as calculated):

WQMP:

Overage: 66.92 kg/yr

Project Life: 40 years

Cost: \$315/kg

Mitigation: $(66.92 \text{ kg/yr})(40 \text{ year})(\$315/\text{kg}) = \$843,192$

TRI process:

Overage: 66.92 kg/yr

Credit: $(67,700 \text{ GPY})(90\%)(3.785 \text{ l/gal})(26.25-5 \text{ mg/l}) / 1\text{M kg/mg} = 4.90 \text{ kg/yr/upgrade}$

Required upgrades: $(66.92 \text{ kg/yr}) / 4.90 \text{ kg/yr/upgrade} = 13.65$ (14 upgrades)

Cost: \$53,336/upgrade (see below)

Mitigation: $(14 \text{ upgrades}) (\$53,336/\text{upgrade}) = \$746,704$

Note: Estimated upgrade cost:

Design & Permitting:	\$ 4,000
Standard system upgrade:	\$12,000
NitROE upcharge:	\$25,000
<u>5 years O&M:</u>	<u>\$ 5,000</u>
	\$46,000
<u>15% TRI management fee:</u>	<u>\$ 6,900</u>
TOTAL:	\$52,900 (\$53,336 used by TRI)

Potential Mitigation (equivalent workforce units = bedroom count / 5):

WQMP:

Overage: 29.08 kg/yr

Project Life: 40 years

Cost: \$315/kg

Mitigation: $(29.08 \text{ kg/yr})(40 \text{ year})(\$315/\text{kg}) = \$366,408$

TRI process:

Overage: 29.08 kg/yr

Credit: $(67,700 \text{ GPY})(90\%)(3.785 \text{ l/gal})(26.25-5 \text{ mg/l}) / 1\text{M kg/mg} = 4.90 \text{ kg/yr/upgrade}$

Required upgrades: $(29.08 \text{ kg/yr}) / 4.90 \text{ kg/yr/upgrade} = 5.93$ (6 upgrades)

Cost: \$53,336/upgrade

Mitigation: $(6 \text{ upgrades}) (\$53,336/\text{upgrade}) = \$320,016$