



**Buzzards Bay Project**  
*National Estuary Program*

Stuart Richardson  
Chairman, Marion Housing Committee  
PO Box 924  
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May 26, 2005

Mr. Richardson:

With respect to a proposed Chapter 40B project in the Town of Marion on an 8.67-acre lot, you also requested nitrogen loading analysis comparison among different development scenarios. Specifically, you asked for a comparison of nitrogen loads for the following four hypothetical scenarios:

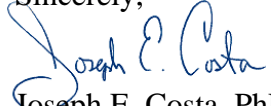
- A) the current zoning presumably enabling 4 homes (presumably with 4 bedrooms),
- B) a 40B plan with 28 three-bedroom homes with conventional septic systems,
- C) a 40B plan with 28 three-bedroom homes with nitrogen removing systems (at 19 ppm) and D) with a single package treatment plant discharging 10 ppm nitrogen.

For this analysis, I used a modification of the spreadsheet posted at <http://www.buzzardsbay.org/n-subdivision.xls>.<sup>1</sup> Because this subdivision is less than 400 feet from the river, I presumed there was no attenuation of nitrogen in groundwater travel to coastal waters.

The attached four tables are my preliminary analysis based on various assumptions of road area, roof and sidewalk area, and the likely portions of the lot disturbed. As I do not have a copy of the plans, the impervious areas are estimated. However, these estimated nitrogen loadings are fairly robust with respect to impervious surface area because 59 to 77% of the nitrogen in the different development scenarios is derived from wastewater disposal.

As shown, the proposed 28 unit Chapter 40B project with conventional wastewater disposal exceeds by nearly 6-fold the nitrogen loading from the site if it were developed under current zoning.

I hope you find this information helpful.

Sincerely,  
  
Joseph E. Costa, PhD  
Executive Director

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<sup>1</sup> I have used a 1.8 kg per capita per year loading rate used by the Massachusetts Estuaries Project, instead of the BBP's and Cape Cod Commissions previously adopted rate of 2.7 kg per capita per year.



**Buzzards Bay Project Subdivision worksheet -5/25/05**

**Scenario A: Marion 40B Site, 4 units conventional Title 5 onsite systems**

Sources		Total		N Loading	Notes
				Pounds/yr	
Subdivision area (land only)		8.67	acres		Enter actual area in column D
Buildable lots, 1 house per lot	4 lots				
avg lot size estimate	75,416 sq. ft.				Approximation after subtracting road layout and dividing by lot number
Bedrooms (average number)	4 per house				
Total Bedrooms	16				
assumed occupancy, T5	2 per bedroom				set by policy or regulation, should be higher than actual
assumed occupancy, expected	3.2 per/unit	TRUE	Use?		Typical area occupancy, enter True to use
Wastewater Treatment by Septic? (F=package treatment)	TRUE (true or false)				if false, package facility calculation used
<b>Wastewater N Loading</b>					
units with conventional systems	4.0 units	12.8	persons	50.7	
units with N removal systems	0.0 units	0.0	persons	0.0	
Alternative N discharge rating	0.0 ppm rating	0.00	loading factor		enter 25, 19, 12, or 10 (note: no onsites currently rated at 10 ppm)
Total onsite wastewater N				50.7	conventional assumed to be 27 ppm x 110 gpd per cap to gw for loading factor calculation
Package facility est. actual flow	0 gpd				load based on planning occupancy, not design flow
Package facility discharge limit	10 ppm nitrogen			0.0	annual loading from community facility, load based on planning occupancy
Road Length	1900 feet				
Paved road width	24	1.0	acres	14.3	
Road Layout width, non paved load	40		acrea		non-paved road layout, assume grass
<b>Lot statistics</b>					
driveway area	800 sq. ft.	0.1	acres	1.0	
sidewalk - paved area	200 sq. ft.	0.0	acres	0.1	
roof area (house+garage)	3500 sq. ft.	0.3	acres	2.1	
lawn size	5000	0.5	acres	10.7	
other disturbed	4000				
undisturbed lot area	61,916 sq. ft.	5.7	acres	0.8	
Total Lot Area	75,416				
wetlands in subdivision	0.0 acres	0.0		0.0	n loading from wetlands is zero (a sink)
unaltered upland on buidable parcels		2.1	acres	0.3	incl. additional 1000 sq. ft margin of error altered
proposed greenspace not included above			acres	0.0	
<b>Total Nitrogen Loading</b>				80.0	
<b>net lb/acre</b>				9.2	
Use Upper Watershed Attenuation	FALSE	0.7	coefficient		enter true if you want to use the loss cooefficient shown
<b>Total Nitrogen Loading to Bay</b>				80.0	use this value
<b>effective net lb/acre</b>				9.2	pounds per acre to receiving waters

Nitrogen Limit Policy or Bylaw Subdivision Limit 7.5 lbs/acre 65.0 pounds

enter values in shaded boxes

Kg/y	%	Summary by source
50.7	64.3%	Wastewater
14.3	18.1%	Roads
3.2	4.1%	Other impervious
10.7	13.6%	Lawns
0.0	0.0%	Undisturbed area
78.8	100.0%	Total

**Buzzards Bay Project Subdivision worksheet -5/25/05**

**Scenario B: Marion 40B Project, 28 units, conventional onsite systems**

Sources		Total	N Loading	Notes
			Pounds/yr	
Subdivision area (land only)		8.67 acres		Enter actual area in column D
Buildable lots, 1 house per lot	28 lots			
avg lot size estimate	10,774 sq. ft.			Approximation after subtracting road layout and dividing by lot number
Bedrooms (average number)	3 per house			
Total Bedrooms	84			
assumed occupancy, T5	2 per bedroom			set by policy or regulation, should be higher than actual
assumed occupancy, expected	3.2 per/unit	TRUE Use?		Typical area occupancy, enter True to use
Wastewater Treatment by Septic? (F=package treatment)	TRUE (true or false)			if false, package facility calculation used
<b>Wastewater N Loading</b>				
units with conventional systems	28.0 units	89.6 persons	354.8	
units with N removal systems	0.0 units	0.0 persons	0.0	
Alternative N discharge rating	19.0 ppm rating	0.57 loading factor		enter 25, 19, 12, or 10 (note: no onsites currently rated at 10 ppm)
Total onsite wastewater N			354.8	conventional assumed to be 27 ppm x 110 gpd per cap to gw for loading factor calculation
Package facility est. actual flow	0 gpd			load based on planning occupancy, not design flow
Package facility discharge limit	10 ppm nitrogen		0.0	annual loading from community facility, load based on planning occupancy
Road Length	1900 feet			
Paved road width	24	1.0 acres	14.3	
Road Layout width, non paved load	40	acrea		non-paved road layout, assume grass
<b>Lot statistics</b>				
driveway area	500 sq. ft.	0.3 acres	4.4	
sidewalk - paved area	100 sq. ft.	0.1 acres	0.4	
roof area (house+garage)	2500 sq. ft.	1.6 acres	10.4	
lawn size	5000	3.2 acres	74.8	
other disturbed	1000			
undisturbed lot area	1,674 sq. ft.	1.1 acres	0.2	
Total Lot Area	10,774			
wetlands in subdivision	0.0 acres	0.0	0.0	n loading from wetlands is zero (a sink)
proposed greenspace not included above		acres	0.0	
<b>Total Nitrogen Loading</b>			459.3	
<b>net lb/acre</b>			53.0	
Use Upper Watershed Attenuation	FALSE	0.7 coefficient		enter true if you want to use the loss coefficient shown
<b>Total Nitrogen Loading to Bay</b>			459.3	use this value
<b>effective net lb/acre</b>			53.0	pounds per acre to receiving waters

Nitrogen Limit Policy or Bylaw Subdivision Limit  
7.5 lbs/acre  
65.0 pounds

enter values in shaded boxes

Kg/y	%	Summary by source
354.8	77.3%	Wastewater
14.3	3.1%	Roads
15.2	3.3%	Other impervious
74.8	16.3%	Lawns
0.0	0.0%	Undisturbed area
459.1	100.0%	Total

**Buzzards Bay Project Subdivision worksheet -5/25/05**

**Scenario C: Marion 40B Site, 28 units, 19 ppm N removing onsites**

Sources		Total	N Loading	Notes
			Pounds/yr	
Subdivision area (land only)		8.67 acres		Enter actual area in column D
Buildable lots, 1 house per lot	28 lots			
avg lot size estimate	10,774 sq. ft.			Approximation after subtracting road layout and dividing by lot number
Bedrooms (average number)	3 per house			
Total Bedrooms	84			
assumed occupancy, T5	2 per bedroom			set by policy or regulation, should be higher than actual
assumed occupancy, expected	3.2 per/unit	TRUE Use?		Typical area occupancy, enter True to use
Wastewater Treatment by Septic? (F=package treatment)	TRUE (true or false)			if false, package facility calculation used
<b>Wastewater N Loading</b>				
units with conventional systems	0.0 units	0.0 persons	0.0	
units with N removal systems	28.0 units	89.6 persons	203.1	
Alternative N discharge rating	19.0 ppm rating	0.57 loading factor		enter 25, 19, 12, or 10 (note: no onsites currently rated at 10 ppm)
Total onsite wastewater N			203.1	conventional assumed to be 27 ppm x 110 gpd per cap to gw for loading factor calculation
Package facility est. actual flow	0 gpd			load based on planning occupancy, not design flow
Package facility discharge limit	0 ppm nitrogen		0.0	annual loading from community facility, load based on planning occupancy
Road Length	1900 feet			
Paved road width	24	1.0 acres	14.3	
Road Layout width, non paved load	40	acrea		non-paved road layout, assume grass
<b>Lot statistics</b>				
driveway area	500 sq. ft.	0.3 acres	4.4	
sidewalk - paved area	100 sq. ft.	0.1 acres	0.4	
roof area (house+garage)	2500 sq. ft.	1.6 acres	10.4	
lawn size	5000	3.2 acres	74.8	
other disturbed	1000			
undisturbed lot area	1,674 sq. ft.	1.1 acres	0.2	
Total Lot Area	10,774			
wetlands in subdivision	0.0 acres	0.0	0.0	n loading from wetlands is zero (a sink)
proposed greenspace not included above		acres	0.0	
<b>Total Nitrogen Loading</b>			307.5	
<b>net lb/acre</b>			35.5	
Use Upper Watershed Attenuation	FALSE	0.7 coefficient		enter true if you want to use the loss cooefficient shown
<b>Total Nitrogen Loading to Bay</b>			307.5	use this value
<b>effective net lb/acre</b>			35.5	pounds per acre to receiving waters

Nitrogen Limit Policy or Bylaw Subdivision Limit  
7.5 lbs/acre  
65.0 pounds

enter values in shaded boxes

Kg/y	%	Summary by source
203.1	66.0%	Wastewater
14.3	4.6%	Roads
15.2	5.0%	Other impervious
74.8	24.3%	Lawns
0.2	0.1%	Undisturbed area
307.5	100.0%	Total

**Scenario D: Marion 40B Site, 27 units, 10 ppm Package Treatment Plant, 1 lot for plant**

Sources		Total	N Loading	Notes
			Pounds/yr	
Subdivision area (land only)		8.67 acres		Enter actual area in column D
Buildable lots, 1 house per lot	27 lots			
avg lot size estimate	11,173 sq. ft.			Approximation after subtracting road layout and dividing by lot number
Bedrooms (average number)	3 per house			
Total Bedrooms	81			
assumed occupancy, T5	2 per bedroom			set by policy or regulation, should be higher than actual
assumed occupancy, expected	3.2 per/unit	TRUE Use?		Typical area occupancy, enter True to use
Wastewater Treatment by Septic? (F=package treatment)	FALSE (true or false)			if false, package facility calculation used
<b>Wastewater N Loading</b>				
units with conventional systems	0.0 units	0.0 persons	0.0	
units with N removal systems	0.0 units	0.0 persons	0.0	
Alternative N discharge rating	0.0 ppm rating	0.00 loading factor		enter 25, 19, 12, or 10 (note: no onsite currently rated at 10 ppm)
Total onsite wastewater N			0.0	conventional assumed to be 27 ppm x 110 gpd per cap to gw for loading factor calculation
Package facility est. actual flow	4752 gpd			load based on planning occupancy, not design flow
Package facility discharge limit	10 ppm nitrogen		144.7	annual loading from community facility, load based on planning occupancy
Road Length	1900 feet			
Paved road width	24	1.0 acres	14.3	
Road Layout width, non paved load	40	acrea		non-paved road layout, assume grass
<b>Lot statistics</b>				
driveway area	500 sq. ft.	0.3 acres	4.2	
sidewalk - paved area	100 sq. ft.	0.1 acres	0.4	
roof area (house+garage)	2500 sq. ft.	1.5 acres	10.1	
lawn size	5000	3.1 acres	72.1	
other disturbed	1000			
undisturbed lot area	2,073 sq. ft.	1.3 acres	0.2	
Total Lot Area	11,173			
wetlands in subdivision	0.0 acres	0.0	0.0	n loading from wetlands is zero (a sink)
proposed greenspace not included above		0.3 acres	0.0	
<b>Total Nitrogen Loading</b>			246.0	
<b>net lb/acre</b>			28.4	
Use Upper Watershed Attenuation	FALSE	0.7 coefficient		enter true if you want to use the loss coefficient shown
<b>Total Nitrogen Loading to Bay</b>			246.0	use this value
<b>effective net lb/acre</b>			28.4	pounds per acre to receiving waters

Nitrogen Limit Policy or Bylaw Subdivision Limit: 7.5 lbs/acre / 65.0 pounds

enter values in shaded boxes

Kg/y	%	Summary by source
144.7	58.8%	Wastewater
14.3	5.8%	Roads
14.7	6.0%	Other impervious
72.1	29.3%	Lawns
0.2	0.1%	Undisturbed area
246.0	100.0%	Total