



Memorandum

TO: Bill Richardson, Jacobs Engineering, Inc.
FROM: Amy M. Ball & Elizabeth Kittila
DATE: July 23, 2015
RE: Provincetown Municipal Airport Nitrogen Loading Calculations

Nitrogen loading has been calculated based on the Cape Cod Commission's Technical Bulletin 91-001 (Final, April 1992). Existing nitrogen-loading inputs at this site include the existing septic system, runoff from Airport Drive, runoff from the existing parking lot aisles, runoff from the terminal apron and the general aviation (GA) apron, runoff from the terminal roof, and runoff from the runway and taxiways.

The Technical Bulletin speaks only to the sources of nitrogen loading associated with three general sources (natural, wastewater, and impervious surfaces). However, it is important to note that there is little, if any, pollutant load from runways and taxiways at airports, unlike that found within paved roadways and parking lots. Since the majority of the impervious surfaces at the Airport are comprised of runways and taxiways, with typically lower pollutant loads, the Airport maintains that the nitrogen loading calculations are conservative.

As shown by the attached calculations, there is little difference between existing and proposed loading (0.387 and 0.380, respectively), far below the maximum 5ppm Nitrogen loading outlined in the Minimum Performance Standards of the Regional Policy Plan.

Nitrogen Loading Calculations
 Provincetown Municipal Airport
 Provincetown, MA

SUMMARY

EXISTING CONDITIONS

Summary

$$\frac{304,030}{8,687} + \frac{2,963}{3,950} + \frac{306,583}{204,388} + \frac{18,370}{12,247} + 1,403,375 = \frac{631,945}{1,632,647} \text{ mg L} = \boxed{0.387 \text{ ppm}}$$

PROPOSED CONDITIONS

Summary

$$\frac{304,030}{8,687} + \frac{3,006}{4,009} + \frac{288,179}{192,120} + \frac{23,453}{15,635} + 1,406,904 = \frac{618,669}{1,627,353} \text{ mg L} = \boxed{0.380 \text{ ppm}}$$



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Nitrogen Loading Calculations - Wastewater

Provincetown Municipal Airport

Provincetown, MA

EXISTING CONDITIONS

Wastewater

$$\left[2,295 \text{ gpd} \right] \left[\frac{3.785 \text{ L}}{\text{gal}} \right] = 8,687 \text{ L/d} \left[\frac{35 \text{ mg}}{\text{L}} \right] = 304,030 \text{ mg/d}$$

PROPOSED CONDITIONS

$$\left[2,295 \text{ gpd} \right] \left[\frac{3.785 \text{ L}}{\text{gal}} \right] = 8,687 \text{ L/d} \left[\frac{35 \text{ mg}}{\text{L}} \right] = 304,030 \text{ mg/d}$$



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Nitrogen Loading Calculations - Impervious Surfaces

Provincetown Municipal Airport

Provincetown, MA

EXISTING CONDITIONS

Impervious Surfaces

Roof

$$\left[15,274 \text{ sf} \right] \left[\frac{40 \text{ in}}{\text{yr}} \right] \left[\frac{\text{ft}}{12 \text{ in}} \right] \left[\frac{28.32 \text{ L}}{\text{cf}} \right] \left[\frac{1 \text{ yr}}{365 \text{ day}} \right] = 3,950 \frac{\text{L}}{\text{day}} \left[\frac{0.75 \text{ mg}}{\text{L}} \right] = 2,963 \frac{\text{mg}}{\text{day}}$$

Pavement (runway/taxiway/apron)

$$\left[790,273 \text{ sf} \right] \left[\frac{40 \text{ in}}{\text{yr}} \right] \left[\frac{\text{ft}}{12 \text{ in}} \right] \left[\frac{28.32 \text{ L}}{\text{cf}} \right] \left[\frac{1 \text{ yr}}{365 \text{ day}} \right] = 204,388 \frac{\text{L}}{\text{day}} \left[\frac{1.5 \text{ mg}}{\text{L}} \right] = 306,583 \frac{\text{mg}}{\text{day}}$$

Pavement (roadway/parking lot)

$$\left[47,352 \text{ sf} \right] \left[\frac{40 \text{ in}}{\text{yr}} \right] \left[\frac{\text{ft}}{12 \text{ in}} \right] \left[\frac{28.32 \text{ L}}{\text{cf}} \right] \left[\frac{1 \text{ yr}}{365 \text{ day}} \right] = 12,247 \frac{\text{L}}{\text{day}} \left[\frac{1.5 \text{ mg}}{\text{L}} \right] = 18,370 \frac{\text{mg}}{\text{day}}$$

PROPOSED CONDITIONS

Impervious Surfaces

Roof (Including Electrical Vault)

$$\left[15,499 \text{ sf} \right] \left[\frac{40 \text{ in}}{\text{yr}} \right] \left[\frac{\text{ft}}{12 \text{ in}} \right] \left[\frac{28.32 \text{ L}}{\text{cf}} \right] \left[\frac{1 \text{ yr}}{365 \text{ day}} \right] = 4,009 \frac{\text{L}}{\text{day}} \left[\frac{0.75 \text{ mg}}{\text{L}} \right] = 3,006 \frac{\text{mg}}{\text{day}}$$

Pavement (runway/taxiway/apron)

$$\left[742,835 \text{ sf} \right] \left[\frac{40 \text{ in}}{\text{yr}} \right] \left[\frac{\text{ft}}{12 \text{ in}} \right] \left[\frac{28.32 \text{ L}}{\text{cf}} \right] \left[\frac{1 \text{ yr}}{365 \text{ day}} \right] = 192,120 \frac{\text{L}}{\text{day}} \left[\frac{1.5 \text{ mg}}{\text{L}} \right] = 288,179 \frac{\text{mg}}{\text{day}}$$

Pavement (roadway/parking lot)

$$\left[60,454 \text{ sf} \right] \left[\frac{40 \text{ in}}{\text{yr}} \right] \left[\frac{\text{ft}}{12 \text{ in}} \right] \left[\frac{28.32 \text{ L}}{\text{cf}} \right] \left[\frac{1 \text{ yr}}{365 \text{ day}} \right] = 15,635 \frac{\text{L}}{\text{day}} \left[\frac{1.5 \text{ mg}}{\text{L}} \right] = 23,453 \frac{\text{mg}}{\text{day}}$$



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Nitrogen Loading Calculations - Natural Areas

Provincetown Municipal Airport

Provincetown, MA

EXISTING CONDITIONS

Natural

$$\begin{aligned}
 & \left[331 \text{ ac} \right] \left[43,560 \frac{\text{sf}}{\text{ac}} \right] = 14,418,360 \text{ sf} - \begin{array}{l} \text{Roof} \\ 15,274 \text{ sf} \end{array} - \begin{array}{l} \text{Pavement} \\ \text{(Run/Taxiway)} \\ 790,273 \text{ sf} \end{array} - \begin{array}{l} \text{Pavement} \\ \text{(Road / Parking)} \\ 47,352 \text{ sf} \end{array} = 13,565,461 \text{ sf} \\
 & 13,565,461 \text{ sf} \left[\frac{16 \text{ in}}{\text{yr}} \right] \left[\frac{1 \text{ ft}}{12 \text{ in}} \right] \left[28.32 \frac{\text{L}}{\text{cf}} \right] \left[\frac{1 \text{ yr}}{365 \text{ day}} \right] = 1,403,375 \frac{\text{L}}{\text{day}}
 \end{aligned}$$

PROPOSED CONDITIONS

Natural

$$\begin{aligned}
 & \left[331 \text{ ac} \right] \left[43,560 \frac{\text{sf}}{\text{ac}} \right] = 14,418,360 \text{ sf} - \begin{array}{l} \text{Roof} \\ 15,499 \text{ sf} \end{array} - \begin{array}{l} \text{Pavement} \\ \text{(Run/Taxiway)} \\ 742,835 \text{ sf} \end{array} - \begin{array}{l} \text{Pavement} \\ \text{(Road / Parking)} \\ 60,454 \text{ sf} \end{array} = 13,599,572 \text{ sf} \\
 & 13,599,572 \text{ sf} \left[\frac{16 \text{ in}}{\text{yr}} \right] \left[\frac{1 \text{ ft}}{12 \text{ in}} \right] \left[28.32 \frac{\text{L}}{\text{cf}} \right] \left[\frac{1 \text{ yr}}{365 \text{ day}} \right] = 1,406,904 \frac{\text{L}}{\text{day}}
 \end{aligned}$$



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