

CHAPTER 8

DEVELOPMENT OF WASTEWATER NITROGEN PRIORITY AREAS

8.1 INTRODUCTION

Previous chapters discussed the environmental resources, existing and future development conditions, and identification of nitrogen removal needs. This chapter will discuss the factors used in determining the priority areas for nitrogen removal and developing the management plan. The goal of identification of these areas is to guide the nitrogen management planning process. Identifying these areas helps focus the approach to dealing with nitrogen issues within the PPA along with setting the framework for the development of alternatives and, ultimately, the development of a recommended plan.

Although this will establish areas in the PPA where nitrogen removal efforts might be focused, this will also consider the proximity of these areas to existing wastewater treatment facilities, the feasibility and continuity of possible collection system expansion, and the Town of Mashpee's goals of addressing year round developed areas first.

The term Priority Area is used as a planning tool to provide an initial ranking of areas of the PPA with the goal of identifying high need areas first. The advantage of the planning process is that as the Town of Mashpee approaches the final development of a recommended plan, these areas can be refined. This refinement process will be a result of the Town's reviews, State reviews, and public comments.

8.2 DELINEATION OF PRIORITY AREAS

A. **Determining Factors.** The following factors were the primary considerations used in identifying planning zones that are priorities for implementation of a nitrogen remediation plan.

- MEP calculations of necessary nitrogen removal for estuary health
- Wastewater nitrogen loading per acre
- Seasonality (seasonality is identified for towns outside of Mashpee for comparison only – these other towns may not consider this a priority factor when developing their town-wide management plans)
- Other Town considerations (phosphorous, previous studies, etc.)

As discussed in previous chapters, MEP performed detailed evaluations of the Popponesset and Waquoit Bay watersheds, both of which have substantial segments within Mashpee's boundaries. The results of the MEP work led to development of nitrogen TMDLs, which provide target nitrogen loading levels for each subwatershed. Planning zones that lie within the boundaries of MEP subwatersheds with high nitrogen removal requirements were identified as a higher priority. In addition, the further down in the watershed the planning zone is located, the higher the priority because less natural attenuation is available for those areas.

It should be re-stated that the MEP removal rates for septic nitrogen load were a presentation of one potential scenario to achieve the target nitrogen concentrations necessary to restore watershed health. Although these recommendations were used as part of the prioritization process, they are not the only way to achieve the target nitrogen concentrations and are therefore not binding. Alternative ways to reach the target nitrogen concentrations are possible.

Nitrogen load calculations (in kg/acre/year) were performed as described in Chapter 7. The results of those calculations led to the sorting of planning zones from low to high nitrogen loading rates. Planning zones with high nitrogen loading rates that also fell predominantly within subwatersheds to the Popponesset Bay and Waquoit Bay watersheds identified by MEP as areas requiring high nitrogen removals were classified as higher priorities. The nitrogen loading rates are ranked as follows:

TABLE 8-1

RELATIVE RANKING OF NITROGEN LOADING RATES

Nitrogen Loading Rate (kg/acre/year)	Relative Ranking
0-10	Low
10.1-15	Moderate
15.1-30	Moderately High
>30	High

Further identification and ranking of priority planning zones was done by evaluating the seasonality of the planning zones. Estimates of the seasonality were developed by the Mashpee Planning Department, based on the 2000 US Census. Census data indicated whether or not a home was occupied at the time of the census. The Mashpee Planning Department used this information to calculate percentage occupancy rates for each planning zone. Planning zones with 100% occupancy are assumed to consist completely of year-round residences. On the other end of the spectrum, planning zones with 0% occupancy are assumed to be entirely seasonal properties (with the exception of entirely commercial planning zones, which would have no residences). Highly seasonal planning zones tend to have higher nitrogen loading rates due to the typically smaller lot size. However, the predominantly year round areas will provide consistent flows to any resultant treatment plant.

The factors discussed above resulted in identification of a relatively small number of priority planning zones, most of which were scattered throughout the PPA. In order to identify larger priority areas, nitrogen loads from all sources were considered. The non-wastewater sources included road, roof, sidewalk, driveway, and parking lot runoff, lawn fertilizer, and precipitation on natural areas. The values and assumptions used for this calculation are discussed in Chapter 7. The wastewater and non-wastewater nitrogen loads were combined, and nitrogen load per acre of planning zone was calculated. Again, the planning zones with relatively high nitrogen loading rates were identified.

B. Prioritization. The planning zones that met the previously mentioned criteria were identified and grouped into Priority Areas consisting of multiple planning zones. Some of the

Priority Areas include planning zones of a relatively low priority; however, the Priority Areas were set up to include these areas based on the fact that there are nitrogen concerns to some degree in every part of the PPA. In addition, proximity to existing WWTF facilities was considered in deciding which planning zones were included in a Priority Area. Future phases of this project will include development of alternative scenarios for addressing the nitrogen loading issue and refining these areas as part of a comprehensive plan to address the Town's nitrogen loading issues. These scenarios will likely incorporate maximization of existing treatment capacity. Therefore, areas near existing WWTFs may be included in Priority Areas regardless of the nitrogen loading rate.

Once Priority Areas were delineated, they were identified as primary, secondary, or tertiary priority. It should be noted that these rankings are purely relative. As mentioned, there are nitrogen concerns throughout the PPA. The rankings were designated for planning purposes.

1. **Primary Priority Areas.** The following primary Priority Areas were identified (shown in red on Figure 8-1):

Area M-1 "Johns Pond" – this Priority Area is located on the western side of Mashpee and includes planning zones 1511, 1611, 1621, 1622, 1632, 1641, 1651, 1652, 1661, 1671, 1672, 1673, 1681, 1682, 2111, 2121, and 2131. The following factors resulted in the classification of this as a primary Priority Area:

- Within the Waquoit Bay watershed
- Large number of planning zones with moderately high to high nitrogen loading rates
- Relatively high concentration of year round residents and businesses
- There is an existing WWTF within this priority area (Southport), which may be suitable for expansion

Area M-2 "Mashpee Central" – this Priority Area is located in the center of Mashpee, including the Mashpee rotary and Mashpee Commons, and includes planning zones 1522, 1531, 1541,

1542, 1551, 1552, 1571, 2211, 2221, 2231, 2241, 2242, 2243, 2251, 2252, 2271, 2272, and 2421. The following factors resulted in the classification of this as a primary Priority Area:

- Within the Popponesset Bay watershed; relatively far downstream in the watershed
- The majority of planning zones have moderately high or high nitrogen loading rates
- Relatively high concentration of year round residents and businesses
- There are three existing WWTFs in this priority area (Mashpee Commons, Southcape Village, and Windchime Point), some of which may be suitable for expansion

Area M-3 “Shoestring Bay” – this Priority Area is located on the eastern side of Mashpee and includes planning zones 1432, 1442, 1451, 2501, 2511, 2521, 2522, 2531, 2532, 2533, 2541, 2542, 2543, 2544, 2551, 2552, 2561, 2562, 2563, 2564, 2571, 2572, 2581, 2582, 2591, and 2592. The following factors resulted in the classification of this as a primary Priority Area:

- Within the Popponesset Bay watershed; relatively far downstream in the watershed
- Many of the planning zones have moderately high or high nitrogen loading rates
- Many of the planning zones consist of year round residences
- A portion of a public supply well watershed is within the priority area
- There is an existing WWTF in this priority area (Willowbend), which may be considered suitable for expansion after further evaluation

2. **Secondary Priority Areas.** The following secondary Priority Areas were identified (shown in blue on Figure 8-1):

Area M-4 “Santuit Pond” – this area is located on the northeastern corner of the Town, including Santuit Pond, and includes planning zones 1311, 1321, 1322, 1331, 1332, 1341, 1351, 1352, 1361, 1371, 1372, 1381, and 1382. The following factors were considered in prioritization:

- The majority of the planning zones have moderately high nitrogen loading rates
- The Town has identified phosphorous loading issues in Santuit Pond

- The planning zones are all predominantly year round residences
- The watershed for a public supply well falls within this area

Area M-5 “Mashpee River” – this Priority Area is in the north-central part of Town and includes much of the Mashpee River and its recharge area. This Priority Area includes planning zones 1213, 1221, 1222, 1223, 1241, 1251, 1252, 1253, 1261, 1271, 1411, 1431, 1441, 1521, 1561, and 1562. The following factors were considered in prioritization:

- Within the Popponesset Bay watershed
- The planning zones within this area are predominantly year round residences
- The Mashpee zoning bylaws have established a Mashpee River Protection District to protect the water resources

Area M-6 “Jehu Pond” – located on the southwestern side of Town, this Priority Area includes Jehu Pond and Hamblin Pond. It includes planning zones 2321, 3421, 3422, 3431, 3441, 3511, 3512, 3521, 3531, and 3541. The following factors were considered in classifying this as a secondary Priority Area:

- Moderately high nitrogen loading in most of the planning zones in the area
- Located in the lower portions of the Waquoit Bay watershed

Area M-7 “Popponesset Creek” – this Priority Area is located around the Popponesset Bay and Popponesset Creek and includes planning zones 3111, 3121, 3131, and 3141. The following were considered:

- Located in the furthest downstream section of the Popponesset Bay watershed
- All planning zones in this area have moderately high nitrogen loading per acre

Area F-1 “Red Brook” – this area consists of the Falmouth portion of the PPA that is within the Red Brook subwatershed. This Priority Area was identified based on the following criteria:

- Located far downstream in the Waquoit Bay East watershed
- Has moderate nitrogen loading rates (high existing rates)

Area S-4 “Sandwich Quashnet” – this portion of Sandwich is not in a freshwater subwatershed; groundwater flows directly into the Quashnet River subwatershed. This was identified as a secondary Priority Area based on:

- Moderately high nitrogen loading rates
- Most residences are year round
- Located in a Zone II area

3. **Tertiary Priority Areas.** The following Priority Areas were considered tertiary priorities (shown as yellow on Figure 8-1):

Area M-8 “Mashpee-Wakeby Pond” – this area is located at the very northern tip of Mashpee and includes planning zones 1111, 1112, 1113, 1121, 1122, 1131, 1141, 1151, 1211, 1212, and 1231. The factors resulting in tertiary prioritization include:

- Far upstream in the Popponesset Bay watershed (a large portion of the nitrogen load is naturally attenuated as groundwater flows through the Mashpee-Wakeby Pond)
- Low nitrogen loading per acre

Area M-9 “MMR” – this area consists of the portion of the Massachusetts Military Reservation within Mashpee (planning zone 4111) and planning zone 1631. The factors resulting in tertiary prioritization include:

- Far upstream in the Waquoit Bay watershed
- Low nitrogen loading per acre
- Majority of the area is open space
- Connected to treatment plant with discharge outside the PPA

Area M-10 “Mashpee East” – this Priority Area is located on the eastern edge of Mashpee, bordering the village of Cotuit (Town of Barnstable). It includes planning zones 1412, 1421, and 1422. The factors resulting in tertiary prioritization include:

- Low nitrogen loading per acre
- The existing WWTF in this priority area (Stratford Ponds) may have minimal potential for expansion

Area M-11 “Quashnet River” – this area lies in the Quashnet River and Red Brook watersheds in Mashpee and includes planning zones 2141, 2151, 2161, 2261, 2281, and 2291. The reasons for its tertiary prioritization include:

- Located somewhat upstream in the Waquoit Bay watershed
- Low to moderate nitrogen loading per acre
- Large portions are open space
- There is an existing WWTF in this priority area (Mashpee High School), which may be suitable for expansion

Area M-12 “Mashpee South” – this area lies in the Mashpee River, Ockway Bay, Hamblin Pond, and Jehu Pond watershed in Mashpee and includes planning zones 2311, 2411, 2422, 2431, 2432, 2441, 2442, 2443, 2451, and 3411. The reasons for its tertiary prioritization include:

- Located somewhat upstream in the Waquoit Bay watershed
- Mostly low nitrogen loading per acre
- Large portions are open space

Area M-13 “New Seabury” – this area consists mostly of properties considered part of the New Seabury development. This includes planning zones 3211, 3221, 3222, 3223, 3224, 3225, 3231, 3232, 3241, 3242, 3311, 3312, 3321, 3331, 3341, 3342, 3343, 3344, 3351, 3361, 3362, 3371,

and 3372. Although most of the area has relatively high nitrogen loading rates, the reasons for its tertiary prioritization include:

- Not located in either Waquoit Bay or Popponesset Bay watersheds
- Predominantly seasonal residences
- There is an existing WWTF (New Seabury) in this priority area, which may be suitable for expansion
- Located in the Zone II area of a public supply well

Area F-2 “Falmouth Quashnet” – this area consists of the Falmouth portion of the PPA that is within the Quashnet River subwatershed. The following considerations resulted in this tertiary prioritization:

- Predominantly seasonal residences
- Relatively low nitrogen loading rates

Area F-3 “Falmouth North” – this area of Falmouth is within the subwatershed that flows through Ashumet Pond. The following considerations resulted in this tertiary prioritization:

- Located high up in the Waquoit Bay East watershed
- Relatively low nitrogen loading rates

Area S-1 “Sandwich West” – this is the portion of Sandwich that flows through freshwater ponds in Mashpee prior to flowing into the Quashnet River subwatershed. The following considerations resulted in this tertiary prioritization:

- Located high up in the Waquoit Bay East watershed
- Relatively low nitrogen loading rates

Area S-2 “J Well” – this small portion of Sandwich is the subwatershed to a public water supply well. This was considered a tertiary Priority Area based on the following considerations:

- Located high up in the Waquoit Bay East watershed
- Moderately high nitrogen loading rates

Area S-3 “Snake Pond” – groundwater in this portion of Sandwich flows through Snake Pond in Sandwich prior to flowing into the Quashnet River subwatershed. The following criteria were considered for this Priority Area:

- Located high up in the Waquoit Bay East watershed
- Moderate nitrogen loading rates
- Located in a Zone II area

Area S-5 “Sandwich Popponeset” – this is the portion of Sandwich that contributes to the Popponeset Bay watershed. All of the groundwater in this priority area flows through a freshwater pond. This was classified as a tertiary Priority Area based on the following considerations:

- Located high up in the Popponeset Bay watershed
- Relatively low nitrogen loading rates
- Located in a Zone II area

Area B-1 “Barnstable Freshwater” – this is the portion of Barnstable that contributes to Popponeset Bay’s freshwater subwatershed. Following are some of the characteristics of this Priority Area:

- Located high up in the Popponeset Bay watershed
- Relatively low nitrogen loading rates

Area B-2 “Shoestring Bay Barnstable” – this area of Barnstable is part of the Shoestring Bay subwatershed.

- Moderate nitrogen loading rates

Area B-3 “Pinquisset Cove” – this part of Barnstable makes up the entire Pinquisset Cove subwatershed.

- Relatively low nitrogen loading rates
- Primarily seasonal residences

Area B-4 “Popponesset Bay” – this is the portion of the Popponesset Bay subwatershed that is contributed by parcels in Barnstable.

- Relatively low nitrogen loading rates
- Primarily seasonal residences

Mashpee planning zones 3451 and 3381 were not included in the Priority Areas due to the lack of wastewater nitrogen loads. These areas are predominantly beach area.

8.3 SUMMARY

The following table summarizes the total nitrogen loads for all of the priority areas, both within and outside Mashpee. These numbers are nitrogen totals (kg/yr), not loading rates (kg/acre/yr). The loading rates were evaluated on the planning zone level and used for prioritization. The table presents the total wastewater flow for the priority area, the nitrogen load that results from that flow, and the non-wastewater nitrogen from that priority area. Priority areas labeled B-# are in the Town of Barnstable; areas labeled S-# are in the Town of Sandwich; areas labeled F-# are in the Town of Falmouth. The locations of all of these priority areas are shown on Figure 8-1.

TABLE 8-2

SUMMARY OF NITROGEN LOADS BY PLANNING AREA

Priority Area	Wastewater Flow (gpd)		WW Nitrogen Load (kg/yr)		Non-Wastewater Nitrogen Load (kg/yr)		Total Nitrogen Load (kg/yr)	
	Existing	Future	Existing	Future	Existing	Future	Existing	Future
Mashpee								
M-1 Johns Pond	140,000	380,000	6,600	15,000	4,000	4,100	11,000	19,000
M-2 Mashpee Central	94,000	210,000	4,700	10,000	3,800	3,800	8,500	14,000
M-3 Shoestring Bay	150,000	240,000	7,800	12,000	13,000	16,000	21,000	29,000
M-4 Santuit Pond	110,000	140,000	5,100	6,900	4,600	12,000	9,700	18,000
M-5 Mashpee River	76,000	160,000	3,600	7,000	1,100	2,400	4,700	9,400
M-6 Jehu Pond	95,000	150,000	4,600	7,200	980	1,100	5,600	8,300
M-7 Popponeset Creek	57,000	83,000	2,800	4,000	490	520	3,300	4,500
M-8 Mashpee-Wakeby Pond	44,000	99,000	2,100	4,800	690	750	2,800	5,500
M-9 MMR	0	140	0	7	350	350	350	360
M-10 Mashpee East	20,000	45,000	880	1,200	250	260	1,100	1,500
M-11 Quashnet River	45,000	78,000	2,200	3,600	640	700	2,900	4,300
M-12 Mashpee South	25,000	42,000	1,200	2,100	480	500	1,700	2,600
M-13 New Seabury	190,000	380,000	9,100	18,000	16,000	16,000	25,000	33,000
Barnstable								
B-1 Barnstable Fresh Water	0	560	30	30	30	30	30	60
B-2 Shoestring Bay	110,000	140,000	5,400	6,700	1,000	1,100	6,400	7,800
B-3 Pinquisset Cove	5,100	9,300	250	450	150	160	400	620
B-4 Popponeset Bay	3,900	5,900	190	290	80	85	270	370
Sandwich								
S-1 Sandwich West	48,000	61,000	2,300	3,000	750	800	3,100	3,700
S-2 J Well	19,000	22,000	920	1,100	170	180	1,100	1,300
S-3 Snake Pond	2,700	3,600	130	170	40	40	170	220
S-4 Sandwich Quashnet	22,000	25,000	1,100	1,200	190	190	1,300	1,400
S-5 Sandwich Popponeset	240,000	280,000	12,000	14,000	3,300	3,500	15,000	17,000
Falmouth								
F-1 Red Brook	23,000	58,000	1,100	2,800	310	380	1,400	3,200
F-2 Falmouth Quashnet	42,000	59,000	2,000	2,900	310	390	2,400	3,300
F-3 Falmouth North	1,700	1,700	80	80	30	30	120	120