Memorandum

March 29, 2017

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CC:

Subject: Marion, MA Projection of Wastewater Flows

1. Executive Summary

The Buzzards Bay Coalition retained GHD to develop projections of wastewater flows for the parcels not currently connected to the existing sewer system in the Town of Marion. This memorandum is a supplement to the report by GHD, Inc. in March of 2017, "Buzzards Bay Coalition Projected Wastewater Flows" (Technical Memorandum).

Table 1.1 summarizes the daily flows and design flows of the parcels in Marion. The flows in the "Wastewater Flow" column in Table 1.1 can be added to the flows in the column "Total Projected Wastewater Flow (MGD)" of Table 6.5 in the Technical Memorandum to estimate the average daily flows and design flows of the project area including the parcels in Marion.

Table 1.1 Projected Wastewater Flows for Marion

Area	Wastewater Flow (MGD)
Average Annual Daily (Used for Permitting)	1.3
Maximum Month	3.1
Peak Hour	4.9

2. Additional Area Outside of Scoped Project Area

The existing sewered area in Marion is currently treated at the Marion Water Pollution Control Facility but, for the purposes of this evaluation, is assumed to be included as part of the wastewater sent to the proposed Wareham Treatment Facility. The methods used to estimate the design flow for Marion are similar to those used in the Technical Memorandum. As a reference, Table 2.1 summarizes the assumptions made in the original technical memorandum.

Table 2.1 Assumptions from the Technical Memorandum for the Original Scoped Study Area

Assumptions	Value
Average Annual Water Use per Day per Residential Property	137 gpd
Average Annual Water Use per Day per Industrial/Commercial Property	300 gpd
Water Use to Wastewater Conversion	90%
Maximum Month Peaking Factor	2.5
Maximum Month Design Wastewater Flow to Infiltration/Inflow (I/I) Conversion	20%

2.1 Maximum Month Design Wastewater Flow

The Buzzards Bay Coalition provided GHD with a spreadsheet which included all the undeveloped parcels within the existing Marion sewered area and all of the Marion parcels outside of the existing sewered area. Within the existing sewered area, there are 91 parcels that are currently undeveloped but are either developable or potentially developable. Of the 91 undeveloped parcels, 75 are for residential land use and 16 are for industrial/commercial land use. Outside of the existing sewered area, there are 1,432 parcels in the Town of Marion which include residential parcels, commercial parcels, and industrial parcels. The 1,432 parcels were developed, developable, or partially developable parcels. Of the 1,432 parcels, 1,034 parcels were residential and 398 were industrial/commercial. The project group decided to include the developable and partially developable parcels in the projection of wastewater flows as these parcels will contribute wastewater flow if developed at some point in the future. The parcels within the existing sewered area and outside of the existing sewered area were then combined. For the Town of Marion there are 1,523 parcels included in this projection of wastewater flows and 1,109 parcels are for residential use and 414 parcels are for industrial/commercial use.

2.1.1 Residential Parcels in Marion

The total water use for the 1,109 residential parcels, currently unsewered, in Marion was estimated using the average daily water use per day per residential property for the Buzzards Bay area (137 gpd) from Table 2.1. As a result of multiplying the number of parcels by the average residential water use, the total estimated water use in Marion was found to be approximately 152,000 gallons per day. The water use was then converted to wastewater flow by multiplying the water use by 0.9, from Table 2.1. The maximum month peaking factor from Table 2.1 was then applied to the wastewater flow in Marion. This calculation estimated a total maximum month wastewater design flow of 343,000 gallons per day for the residential unsewered parcels in Marion.

2.1.2 Industrial/Commercial Parcels in Marion

The water use for the 414 industrial/commercial parcels in Marion was estimated using the average daily water use per day per industrial/commercial property for the Buzzards Bay area (300 gpd) from Table 2.1. As a result of multiplying the number of parcels by the average industrial/commercial water use of 300 gpd, the total estimated water use in Marion was found to be approximately 124,000 gallons per day for all of the industrial/commercial properties. The water use was then converted to wastewater flow by multiplying the

water use by 0.9, from Table 2.1. The maximum month peaking factor (2.5) from Table 2.1 was then applied to the wastewater flow in Marion. This calculation estimated a total maximum month wastewater design flow of 280,000 gallons per day for all of the industrial/commercial unsewered parcels in Marion.

2.1.3 Existing Marion Water Pollution Control Facility Wastewater Flows

As a result of regionalizing the sewer system in Wareham, it was discussed that the flow from the current Marion Water Pollution Control Facility could be sent to the expanded Wareham Wastewater Pollution Control Facility. The Supplemental Comprehensive Wastewater Management Plan (CWMP) for the Town of Marion (April 2002) was used to estimate the design flows of the existing Marion Water Pollution Control Facility. The CWMP based its flow projections on its annual average of 588,000 gallons per day average design flow as defined in the May 2001 draft CWMP. As a result, the 588,000 gallons per day from the existing Marion Wastewater Treatment Plant would need to be accounted for in the projection of wastewater flow for the Town of Marion. The 588,000 gallons per day was considered an average annual wastewater flow for the Marion Wastewater Treatment Plant per the Coalition's request. The 588,000 gallons per day of wastewater flow was multiplied by the maximum month peaking factor (2.5) from Table 2.1 to estimate the maximum month wastewater design flow. The calculation resulted in a maximum month wastewater design flow of approximately 1.47 million gallons per day.

2.1.4 Infiltration and Inflow (I/I) from Marion

The potential (I/I) of the proposed area in Marion was also provided in the projection of sewer needs. Since the locations of the parcels and the proposed sewer layout were unavailable, the I/I from the scoped project area of Wareham, Bourne, and Plymouth was used to estimate the I/I that would be found in the Marion area. The I/I was calculated by dividing the I/I flow found in the scoped project area by the total maximum month design wastewater flow from the project area. The volume used to represent the estimated I/I volume was estimated to be approximately 20% of the maximum month design wastewater flow, as shown in Table 2.1. The 20% was applied to the approximately 2.1 million gallons per day of maximum month peaked wastewater flow in Marion and resulted in an I/I flow of about 419,000 gallons per day. The total projected maximum month design wastewater flows for the Town of Marion was about 3.1 million gallons per day including a contingency factor of 25%.

2.1.5 Calculations for the Maximum Month Wastewater Design Flow from Marion

The calculations for the Town of Marion's sewer needs can be found in Table 2.2.

Table 2.2 Maximum Month Wastewater Design Flow From Marion

Town	Parcels	Water Use (gpd)	Wastewater Flow (gpd)	Maximum Month Peaking Factor	Maximum Month Wastewater Design Flow (gpd)
Marion – Proposed Residential	1,109	152,000	137,000	2.5	343,000
Marion - Proposed Industrial/Commercial	414	124,000	112,000	2.5	280,000
Marion - Existing		-	588,000	2.5	1,470,000
Marion - I/I					419,000
Subtotal Estimated Flow					**2.5 MGD**
Contingency Factor (25%)					625,000
Total Estimated Flow					**3.1 MGD**

The maximum month design flow from Table 2.2 of 3.1 million gallons per day includes the Marion I/I flow and the contingency factor of 25% to account for any unknown parcels, faulty meters or extreme buildout that was not taken into account in this study.

2.2 Average Annual Daily Wastewater Flow

The average annual daily wastewater flow is used to represent the daily average amount of flow that the facility will treat and discharge. This flow is not a flow used for treatment or pump sizing. For the I/I estimation, the 250 gpd/in diameter/mile of sewer allowance would be used to represent the average daily I/I flow and the 500 gpd/in diameter/mile of sewer allowance would be used to represent the peaked I/I flow, per the Technical Memorandum. Table 2.3 summarizes the addition of the average annual daily flow from the Marion area.

Table 2.3 Average Annual Daily Wastewater Flow from Marion

Area	Water Use (gpd)	Wastewater Flow (gpd)
Marion (Proposed Residential)	152,000	137,000
Marion (Proposed Industrial/Commercial)	124,000	112,000
Marion (Existing)	-	588,000
Marion (I/I)		210,000
Subtotal Estimated Flow		**1.0 MGD**
Contingency Factor (25%)		250,000
Total Estimated Flow		**1.3 MGD**

Table 2.3 summarizes that the total estimated flow for the Marion study area is approximately 1.3 million gallons per day and includes the I/I flow in Marion and the contingency factor of 25%.

2.3 Peak Hour Design Wastewater Flow from Marion

For design purposes, the peak hour flow is used to develop a peaking factor to represent the flow during a peak hour. The peaking factor in this report will be different than the peaking factor used in the Technical Memorandum because it is estimated based on the average annual wastewater flow of the area. The peaking factor is estimated using the average annual wastewater flow from Table 2.3 and Figure 2-1 from "Guides for the Design of Wastewater Treatment Works" (TR-16). Using the average annual wastewater flow of 1.0 million gallons per day, Figure 2-1 from TR-16 estimates a peak hour peaking factor of 3.8. The peak hour design flow was calculated by applying the peaking factor of 3.8 to the total estimated flow calculated in Table 2.3, which resulted in a peak hour design wastewater flow of approximately 4.9 million gallons per day.

2.4 Summary of Projected Wastewater Flows for the Study Area Including Marion

Table 2.4 summarizes the projected wastewater flows for the Town of Marion. The flows in the "Proposed Marion Wastewater Flow" can be added to the flows in the column "Total Projected Wastewater Flow (MGD)" of Table 6.5 in the Technical Memorandum to estimate the average daily flows and design flows of the project area including the parcels in Marion.

Table 2.4 Projected Wastewater Flows for Marion

Area	Proposed Marion Wastewater Flow (MGD)
Average Annual Daily (Used for Permitting)	1.3
Maximum Month	3.1
Peak Hour	4.9