
TO:	Korrin Petersen, Buzzards Bay Coalition	DATE:	9/14/2020
FROM:	Mike Giggey, Ed Leonard	PROJECT NO.:	20364A
SUBJECT:	Upper Bay Project Peer Review of GHD Memorandum and BETA Report		

INTRODUCTION

The Buzzards Bay Coalition (BBC) is conducting the Upper Bay Project with funding support under a SNEP (Southeast New England Program) Watershed Grant. The project involves converting the Wareham WPCF into a regional facility to serve Wareham, Marion and parts of Plymouth and Bourne, and the relocation of the Wareham outfall to a location on the Cape Cod Canal near Massachusetts Maritime Academy. The Buzzards Bay Coalition has requested that Wright-Pierce perform a peer review of the following key documents for the project:

- Draft “Wareham WPCF Expansion Memorandum”, GHD, April 29, 2020; and
- Draft “Preliminary Report, WPCF Outfall Alternatives Analysis”, BETA, July 2020.

To provide context for our analysis, we have also reviewed:

- SNEP Watershed Grant Full Proposal, Multi-Community Collaboration to Reduce Nitrogen in Upper Buzzards Bay – Phase II Baseline Assessment & Alternatives Selection, Buzzards Bay Coalition.
- Massachusetts Estuaries Project (MEP) Technical Report for the Wareham River System (Final Updated Report, May 2014).

We participated in coordination conference calls with BBC and each consultant to discuss questions prior to preparing this memorandum. This memorandum summarizes our observations on the GHD memorandum and the BETA report. This memorandum also provides some suggestions on the “bridge document” that BBC is preparing to pull together the various technical elements being analyzed under the SNEP project.

GHD MEMORANDUM

Our observations on the GHD memorandum are summarized below.

1. General
 - a. See general comments to BBC regarding coordination among the BBC, GHD and BETA documents.
2. Flows and Loads

- a. Given the fact that the prospective service areas are in part seasonal, the memo should address the annual average flow as well as the shorter-term flows upon which the WPCF design would be based. The term “average design flow”, as used in the memo, is the standard term for the WPCF capacity whereas the annual average flows translate to the annual nitrogen removal capability that is being offered to the towns who must address nitrogen-based TMDL compliance in comparison to the MEP Technical Report(s).
 - b. The per-capita flows used in estimating the design flows contain an allowance for garbage grinders. Most newer homes that rely on Title 5 systems do not have garbage grinders because of the added cost for the leaching field. The nitrogen in the ground garbage is an unnecessary load that could be removed from the watersheds if garbage is handled as a solid waste. The GHD calculations include a large flow increment for garbage grinders, which seems excessive, even if garbage grinders are allowed.
 - c. The per-capita flow estimates used in the MEP technical report indirectly account for the seasonality of the population. The average water consumption in the 35 or so MEP-studied watersheds in the region is approximately 170 gpd per single-family residence. If the occupancy (averaged over the year) is 2.0 to 2.5 persons per home, that translates to an average per-capita water use of 68 to 85 gpd. Once reduced for consumptive use, the wastewater flows would be 61 to 77 gpd, quite a bit less than the 85 gpd figure used in the memo. If not already accomplished, we suggest that these flow projections be reviewed against the water use data compiled for the applicable MEP watershed reports.
 - d. By combining the flow and nitrogen load data, GHD arrives at an influent nitrogen concentration of 48 mg/l. Although this concentration is based on what we believe to be high estimates of both per-capita flow and per-capita nitrogen load, the result falls in a range that seems appropriate. In that no separate estimate is made of the nitrogen that will be received in septage, it is wise to be conservative in the composite concentration, so we take no exception to the 48 mg/l concentration estimate.
3. Expected Future Effluent Limits
 - a. We would not expect that a NPDES permit for a Cape Cod Canal discharge would include phosphorus, metals or ammonia limits. The remainder of the parameters seem appropriate.
4. Treatment Process Selection (Sections 5 to 9)
 - a. Much of the GHD memorandum deals with upgrade options and a cost-effectiveness analysis for the Wareham WPCF. Per our contract with BBC, the scope of our review is limited and a thorough review of the analysis would require a significant amount of time. In general, our experience supports the GHD conclusion that the WPCF include a MLE activated sludge process with

denitrification filters and UV disinfection. Some additional comments are provided below.

- b. The membrane bioreactor (MBR) treatment process considered in the report would produce somewhat better effluent which could provide benefits associated with outfall permitting and/or potential effluent reuse, if desired; however, it would come at a higher capital and O&M cost, as outlined in the report.
- c. Primary treatment would typically be considered for treatment plants above 3 to 5-mgd. We suggest adding text on this topic in Section 9.
- d. The influent equalization basins and potential effluent equalization basins do not appear to have been explicitly considered in the analysis. We suggest adding text on this topic.
- e. We strongly agree with the need for flexibility in biosolids disposal options given the current market conditions.
- f. There are a few additional chemical systems which would typically be required at a facility of this nature, including: supplemental carbon, sodium hypochlorite for odor control and/or filamentous control. We suggest adding some text on this topic.
- g. Additional nitrogen could be removed from the Buzzards Bay watershed if the septage receiving systems were configured to direct septage through the solids treatment process vs the liquid treatment process.
- h. Looking ahead to the ocean discharge permitting process and the associated public consultation, the permitting and consultation process may be enhanced by the Coalition having considered effluent disposal/reuse alternatives. The provision of a long effluent force main provides the opportunity to access potential land-based disposal sites and potential effluent reuse locations.
- i. There is a detailed site layout for the 3.5-mgd WPCF but no layout for the 7.0-mgd WPCF. Appendix A presents working materials but not a “final plan”. The report should include a figure for both the 3.5-mgd and 7.0-mgd WPCF site layouts. The site plans should indicate the existing 100-year or 500-year flood zones.

5. Costs

- a. It is beyond the scope of this peer review to complete an independent estimate costs or to complete a detailed review of the key parameters that influence costs; however, we have compared the GHD costs to the “unit costs” (e.g., capital cost per gpd of capacity, etc.) to other regional planning efforts on Cape Cod. From estimates we have prepared for regional facilities of about this size (JBCC Regional), and from cost data we have reviewed by others (Dennis/Harwich/Yarmouth Regional WWTF, CDM-Smith), it would be our expectation that an all-new plant of this size would have a capital cost \$25 to \$30 per gpd of capacity. The GHD estimate are approximately \$27.50 per gpd. The GHD estimates are based on a conceptual design and are appropriately using a higher contingency than costs based on more detailed analysis. The current volatility in the construction market will not likely play a role, since this facility

would not be built for some time; however, inflation to midpoint of construction is appropriately noted.

- b. The annual operating and maintenance cost appear to be quite low when compared to the JBCC Regional and D/H/Y Regional estimates. This warrants a more detailed review.
 - c. There is not much text to describe the purpose of, or basis for, the incremental costs presented in Table 7.1 and 7.2. We suggest removing these columns as they do not provide clarity and do not appear to be used elsewhere in the memorandum. These numbers do not reflect any economies (of diseconomies) of scale.
 - d. Contingency, Engineering and Technical Services (CET) should be treated consistently in both the GHD and BETA reports. We suggest including CET in the summary tables.
 - e. Inflation to midpoint should be treated consistently between GHD and BETA reports.
 - f. The 3.5-mgd WPCF site layout will involve considerable construction sequencing. We suggest that GHD confirm this is adequately covered in the costs and schedule.
 - g. A facility upgrade of this extent typically warrants additional staff. We suggest adding some text on this topic and adding O&M, as appropriate.
6. Schedule
- a. While completion of design, bidding and construction in 5 years seems reasonable, completion of construction by 2026 seems aggressive given the funding, permitting and public process required for this project. Accordingly, we suggest an expanded schedule be prepared. The schedule should consider the timeline for the regional communities to permit, design and construct the sewers needed to convey sewage to the regional WPCF. The schedule should also consider BETA's anticipated schedule to permit, design and construct the effluent force main and outfall.

7. Appendices

- a. Appendix A - Some of these PowerPoint slides are helpful because they provide some information that is not in the memo; however, many of the slides show the thought process and options but do not reflect the final thinking by the end of the project. Suggest removing the conflicting material.
- b. Appendix E – As noted above, this appendix should also include a site plan for the suggested 7.0-mgd WPCF.

BETA REPORT

Our observations on the BETA report are summarized below.

1. General

- a. Report Title. The BETA evaluation focuses on alternative routes for the effluent force main between the Wareham WWTF and the Cape Cod Canal. It does not

address options for outfall location or design. We suggest that the title of the BETA report be changed to something like “Alternatives for Routing a Proposed Effluent Force Main from a Regional Wareham WWTF to the Cape Cod Canal”.

- b. Terminology. We suggest considering whether these are “recommended routes” or whether they should be called “candidate route”, “suggested routes”, “composite plan” or similar. This will be a very challenging design and permitting effort and there are numerous technical and permitting issues which could render any of the sub-options infeasible or not cost-effective based upon more detailed review in pre-design phase (e.g., cobbles with respect to horizontal directional drilling options; utility conflicts and public opposition with respect to Route 6 options; railroad, power, public opposition with respect to railroad options, etc.). We suggest deleting the 4th paragraph under on Section 3.1.3 (pg 21) regarding other viable alternatives.
 - c. Much of the BETA report deals with the details of potential effluent pipe alignments and permitting considerations. Per our contract with BBC, the scope of our review is limited, and a thorough review of the analysis would require a significant amount of time. In general, our experience supports the BETA conclusion that dealing with railroad requirements is very complicated, time-consuming and costly. While dealing with state highways has many of the same issues, these issues are likely to be resolved more cost-effectively and expeditiously, so the choice of the Route 6/28 option appears sound.
2. Flows and Loads
 - a. Effluent Pumping Station. We suggest adding commentary regarding influent and effluent equalization basins, as appropriate. We suggest adding the related annual average flow under Section 1.1 (1.56-mgd current and 7-mgd future). Revise peak flow rates, as appropriate, to reflect the influent and effluent equalization basin.
 - b. See general comments to BBC regarding coordination between BBC, GHD and BETA documents. (Page 1, confirm the 80,000 lb/year nitrogen reduction).
 3. Permitting
 - a. The footprint for the conceptual effluent outfall (Figure 3) seems appropriate for a single-port diffuser (which might be preferred by ACOE); however, it is undersized for a multi-port diffuser (which would be preferred or required by EPA). We suggest adding text regarding the technical and cost-related assumptions utilized for the outfall concept.
 - b. Consider some additional permits that could be required, including: MassDEP plan review; MassDEP NPDES permit review; Cape Cod Commission 208 Consistency Review (based on inclusion of Bourne); Bourne Conservation Commission; and Wareham Conservation Commission.
 4. Pipe Size and Alignments
 - a. At a future peak flow of 26 mgd, the velocity in a 24-inch diameter would be quite high (12.8 fps) and corresponding headloss (and energy use) would be quite high.

We suggest adding some text to describe the potential for alternative pipe sizes or phasing options.

- b. We suggest adding a comment regarding the OSHA setback requirements from the high voltage overhead electric lines along the railroad corridor lines.
 - c. Were other alignments identified and ruled out (e.g., Onset Ave; Railroad to Pine Tree Drive with trenchless across channel; etc.). If so, we suggest adding some text for completeness.
 - d. Some consideration should be given to the routing of the Massachusetts Maritime Academy sewage force main to the Bourne sewer system. We suggest adding information to Figure 23, Table 8 and Table 9.
5. Costs
- a. We suggest that the report identify key cost basis items related to the effluent force main costs, including: basis for the pavement restoration costs (trench width and thickness, overlay width and thickness); basis for other site restoration costs; state police traffic control; railroad inspection costs; laydown area costs; etc.
 - b. The report describes a “placeholder value” of \$3M construction cost for the outfall itself. While this approach is reasonable for this level of analysis, the placeholder would be substantially low if a multi-port diffuser were required. We suggest that some additional text be included.
 - c. Tables 6, 7, 8, 9: We suggest including a separate line item for land/easement acquisition costs, which may be proportionally higher than most projects given the length and location of the force main.
 - d. Tables 6, 7, 8, 9: Engineering percentages seem reasonable assuming that “Construction – Resident Inspection” means “Construction and Resident Inspection”.
 - e. We suggest that all costs estimates be tied to a current ENR Construction Cost Index and date.
 - f. See general comments to BBC regarding coordination between BBC, GHD and BETA documents.
6. Schedule
- a. We suggest adding a design, permitting and construction timeline to Section 6.
7. Appendices
- a. The BETA report would benefit from including “BETA Figure 1” that is in GHD’s Appendix C, or similar figure showing future sewer areas and the existing sewer infrastructure.

CONCLUSION

While the above comments and observations may alter some aspects of the GHD and BETA draft reports, we find that the alternatives analyses, cost assumptions, and overall recommendations presented in the reports are consistent with industry practice, reasonable and sound. It is our understanding the GHD and BETA have reviewed this memorandum and will be addressing many of these comments. Please let us know if there any comments that will not be addressed.

BBC “BRIDGE DOCUMENT”

As noted previously, it is our understanding that BBC is preparing a “bridge document” that pulls together the various elements being analyzed under the SNEP project. We have not seen this document, but suggest that it include a few topics, as summarized below.

1. **Flow Projections:** It would be advisable to have the flow projections segmented to reflect the following: i) flow required to meet nutrient removal needs for anticipated future TMDLs; ii) flow required for non-nutrient removal needs (e.g., failed septic systems, water supply protection, pond protection, etc.); and, iii) flow required for future growth. This will be helpful in the public consultation process as well as in determining cost sharing issues among the participants. This will also be important for demonstrating growth-neutral planning, which is a requirement of 0% Enhanced SRF loans.
2. **Narrative on Load Removal:** It would be advisable to have a narrative and accompanying figure that describes/depicts the boundaries of the nitrogen removal project, the relevant MEP watershed boundaries and the basis for the 80,000 lb/year nitrogen removal.
3. **Cost Estimates and Cost Allocation:** It would be advisable to assemble an “all-in” cost estimate that includes the costs in the following categories: collection system, transport to the Wareham WPCF, WPCF upgrades, effluent transport, effluent disposal, land/easement acquisition, technical services and contingency. Costs would then be allocated to the participants for each category.
4. **Funding.** There should be some discussion of funding opportunities and issues.
5. **Management Entity.** There should be some discussion of the types of management entities considered to own and operate the facilities.
6. **Schedule.** As noted herein, there should be a coordinated implementation schedule which considers the funding, permitting, design, construction and commissioning of the new facilities.
7. **Consistency Among Work Products.** It will be important to make sure that several key items are reported consistently between all work products and presentations. If there are discrepancies (e.g., between this report and the 2014 MEP report), they should be noted. These include: existing and build-out Wareham WPCF flow, existing and build-out Massachusetts Maritime Academy wastewater flow, ENR Construction Cost Index, inflation to mid-point of construction, and contingency basis.

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CLOSURE

We appreciate the opportunity to perform this review for the Buzzards Bay Coalition. We would be happy to provide additional input to the “bridge document”, particularly in the area of nitrogen credits and MEP reporting. If you have any questions or if you need any additional assistance, please contact us.