TOWNS OF EXETER AND STRATHAM, NH

Regional Wastewater Disposal Options

DRAFT

November 21, 2014

UNDERWOOD engineers

Portsmouth, New Hampshire

File NO. 1834

Table of Contents

Executive Summary

Background

The wastewater treatment facility (WWTF) in Exeter, NH is currently under an EPA Administrative Order on Consent (AOC) to meet new NPDES permit limits for total nitrogen. In 2013, the WWTF was issued a permit to discharge treated effluent into the Squamscott River with total nitrogen levels not to exceed 3.0 mg/l. Since the WWTF does not currently meet those standards, the AOC requires that the Town begin construction of a new WWTF or develop other means to meet the permit requirements.

The Town of Stratham, NH is interested in providing wastewater collection and treatment service to its Business District and other commercially zoned areas along Route 108 and Route 33. Stratham is currently without its own WWTF and has explored constructing a new WWTF as well as options to convey its wastewater to the Exeter WWTF. Due to the high costs of developing a new WWTF, the Towns of Stratham and Exeter have decided to cooperatively evaluate a regional wastewater treatment strategy. This study summarizes the evaluation.

Significant Findings

The City of Portsmouth currently has two WWTFs, Pease WWTF and Peirce Island WWTF. The City has indicated a willingness to consider accepting flows from Exeter and Stratham at the Pease facility. This study evaluates the scope and costs necessary for the conveyance wastewater to Pease and associated treatment improvements. A summary of the needed improvements includes the following:

- Exeter WWTF Modifications
    - Construct a new pumping station with design point of 2,600 gpm (3.7 MGD) at 190 feet of TDH (equalized) located at the Exeter WWTF site to convey effluent to Pease.
    - Construct a wet well that includes combined equalized flows from Exeter and Stratham.
    - Decommission lagoons (with 1 modified for stormwater equalization)
- Construct an interceptor for conveyance of equalized wastewater from Exeter to the Pease WWTF. The preferred route is:
    - 12.7 miles in length
    - Located primarily within the NHDOT ROW along Routes 101, 108 and 33.
    - Note, for the purposes of this study, it is assumed that Stratham will construct a pumping and conveyance system to the Exeter WWTF at their cost (not included in this evaluation).
- Pease WWTF Modifications
    - Construct a new headworks to accommodate additional regional flow.

- Construct additional Sequence Batch Reactors.
- Construct additional primary clarifiers.
- Construct sludge storage tank
- Improve conveyance system from the Pease WWTF to the outfall (50%).
- Expand/improve Pease outfall in the Piscataqua River.

Planning Costs

The following table provides a summary of the capital costs for the identified modifications and conveyance system as well as O&M costs. These preliminary costs are for planning purposes only, based on assumptions in this report. A further breakdown of the WWTF, conveyance and O&M costs can be found in Appendix E.

Opinion of Costs Based on Alternative 1(20 Year Flows)

	Summary of Low Range Opinion of Costs	Summary of High Range Opinion of Costs
Total Capital Costs	**$66.3M**	**$76.3M**
Total O&M	**$3.6M**	**$4.6M**
Present Worth (20 Years)	**$132.8M**	**$156.3M**

Recommendations

Based on this evaluation, the following is recommended:

- Compare regional costs from this study to those costs presented in the pending Exeter Facility Plan.
- Continue to discuss opportunity with Portsmouth.
- Monitor Portsmouth's discussion on conveying Peirce Island's sanitary waste to Pease. This may provide additional cost incentives to a regional Pease option. Note: the City of Portsmouth is currently evaluating the regional option as well.

1.0 Background

The Exeter Wastewater Treatment Facility (WWTF) is a secondary treatment facility located in Rockingham County, NH that is designed to handle an average daily flow of 3.0 MGD. The WWTF discharges its treated effluent to the Squamscott River, which feeds into the Great Bay before exiting to the Atlantic Ocean by way of the Piscataqua River. Currently the Town of Exeter is under an EPA Administrative Order on Consent (AOC) to meet new NPDES permit limits, primarily for Nitrogen removal.

The Town was issued a NPDES Permit in 2013 requiring an effluent limit of 3.0 mg/l of Total Nitrogen at the WWTF outfall in the Squamscott River. The Town's WWTF does not meet the limitations set by the NPDES Permit. The AOC was issued requiring the limits to be met by June 2018. Due to the high construction and operating costs of a new WWTF and possible other benefits, the Town of Exeter has partnered with the Town of Stratham to explore the feasibility of connecting to a regional WWTF at the City of Portsmouth Pease WWTF.

2.0 Goals and Objectives

The following are the main goals of this study:

- Identify the technical feasibility of a joint wastewater collection system to convey wastewater from Exeter and Stratham to the City of Portsmouth Pease WWTF.
- Develop costs for a regional option that can be compared to published costs for previously (or pending) identified solutions for Exeter, Stratham, and Pease.
- Identify challenges and opportunities of this option as compared to individual municipality options currently being considered.

3.0 Basis of Design

The following information was used to evaluate feasibility and costs of this project:

1. Pease Wastewater Treatment Facility Evaluation (UE, October 2013)
2. Wastewater Management Concept Plan (WP, March 2011)
3. Exeter-Stratham Intermunicipal Water and Wastewater System Evaluation Study (Kleinfelder, December 2012)
4. Sewer Extension Study Town of Greenland (Tighe and Bond, July 2012)
5. Information from the pending 201 Facility Plan Update Exeter (Wright Pierce, ongoing)
6. 201 Facilities Plan Update Portsmouth (Underwood Engineers, June 30, 1999)
7. NPDES Permit Modification – Outfall Improvements Pease (Underwood Engineers, May 1997)
8. Wastewater Master Plan and LTCP Update Portsmouth (Brown and Caldwell with Weston and Sampson, November 2010)

3.1 Design Flows

The design flows of the regional interceptor were based on the following information:

Table 1 : Summary of Flows[1]

Town	Buildout Flow (MGD) from Reports	20 year Flows (MGD)	Current Flows (MGD)
Exeter (Equalized)	3.0	2.6	~1.6
Stratham (Equalized)[2]	0.675	0.4	0[2]
Pease[3]	1.35	1.35	~0.6
Total	**5.025**	**4.35**	**~1.8**

1. **Although not in the table, it should be noted that Newington discharges 0.4 MGD into the Pease WWTF outfall prior to discharge into the Piscataqua River.** Greenland has prepared a sewer build-out study and identified potential sewer flows of 0.174 to -.34MGD
2. Stratham is currently served by on-site individual private septic systems.
3. The Pease WWTF is currently designed for 1.2 MGD capacity.

The evaluation of the conveyance system from Exeter to Pease was based a 20-year flow of 3 MGD from Exeter and Stratham (equalized). The Pease WWTF evaluation was based on a 20-year design flow of 4.35 MGD.

Currently the Town of Stratham does not have a collection system or a wastewater treatment facility. This report assumes that Stratham will construct their own collection system and convey the wastewater to the Exeter WWTF headworks. Alternatively, a pump system could be designed to discharge to the interceptor force main, which may require modifications to the interceptor design.

3.2 Interceptor Routing

The interceptor connecting the Exeter WWTF to the Pease WWTF was evaluated with the following assumptions:

- One pumping station located at the Exeter WWTF site
- One force main from Exeter to Pease without intermediate pumping (i.e. no gravity sections)
- Stratham would connect to Exeter's headworks in Exeter.
- Interceptor construction includes:
  - HDPE SDR 9 butt fused pipe
  - Open cut 5-6 feet deep trench
  - Directional Drilling at significant crossings
  - Air relief structures at high points
  - Cleanout/blow-off structures at every mile (+/-)

The Node Map found in Appendix A (Figure 1) depicts the general interceptor configuration.

4.0 Engineering Evaluation

4.1 Exeter WWTF Headworks and New Pumping Station

The following modifications will be made to the Exeter WWTF in order to meet the design requirements of this project:

- Existing headworks to remain
- New pump station located at the Exeter WWTF with a design point of 2,600 gpm (3.7 MGD) at 190 feet of TDH (equalized).
- Installation of a wet well with an equalization tank sized for diurnal flows (~740,000 gpd).
- Decommission lagoons (1 lagoon to remain for stormwater flow equalization).
- Maintain outfall for possible future use as stormwater discharge.

4.2 Conveyance Piping Hydraulics

Based on the 20 year flows from Exeter and Stratham and Conveyance Alternative 1 below, the regional interceptor was evaluated as follows:

- 3 HDPE Pipe sizes were evaluated: 18", 20", and 24"
  - 18" would require higher O&M costs due to higher head and may not meet future flow requirements.
  - 24" required the lowest O&M costs due to lower head, but may be too large for current flows.
  - 20' SDR9 HDPE pipe met present and future design requirements and was a cost effective solution for wastewater conveyance.

A flows velocity range for design was based on 2 to 4 feet per second. A 20" interceptor force main provides a practical flow range of 1,332 gpm to 2,570 gpm (1.9 MGD to 3.7 MGD). See pump and conveyance calculations in Appendix F.

4.3 Conveyance Route

Based on discussions with the Towns of Exeter and Stratham as well as the New Hampshire Department of Transportation and local utility companies (Unitil, Spectra Energy and PSNH), the following routing alternatives for the interceptor were selected for further evaluation (see attached meeting minutes, Appendix B):

- Alternative 1 – Highway Route (NHDOT)

- Alternative 2 – Utility ROW Route 1 (NHDOT, PSNH, and Unitil corridor)
- Alternative 3 – Utility ROW Route 2 (Spectra Energy, PSNH, and Unitil corridor)

Each alternative is shown in Appendix A, Figures 2-5.

4.3.1 Conveyance - Alternative 1 (Recommended)

Alternative 1 (Appendix A, Figure 3) connects the Exeter WWTF to the Pease WWTF by installing the interceptor within the NHDOT ROW along highways 101, 108, and 33 from the WWTF. The 12.7 mile interceptor will be located in a gas utility right of way and follow Route 101 to the Route 108 intersection. It follows Route 108 North through the Stratham Business District and continues on Route 33 through the Town of Greenland for approximately 7.3 miles. From the NHDOT ROW it will be located in Grafton Road and connect to the Pease WWTF on Corporate Drive.

In order to limit the amount of repaving required for this alternative, the interceptor will be installed along the unpaved shoulder of the road. Primary pavement repairs will be limited to the driveway and roadway crossings.

Advantages:

- Better access during construction and maintenance
- Fewer private ROW issues (will work primarily within NHDOT ROW)
- Will require less Directional Drilling

Disadvantages:

- Longest route
- Construction will be in public areas (traffic issues will increase during construction)
- Will require more road repair and traffic maintenance during construction (Stratham Business District, and roadway/driveway crossings)

4.3.2 Conveyance - Alternative 2

Alternative 2 (Appendix A, Figure 4) includes installing the interceptor along routes 101, 108, 33 and a Utility Corridor for gas and electricity. The 12.3 mile interceptor initially follows the same route as Alternative 1. From the Exeter WWTF it follows Route 101 and then north on Route 108 for approximately 1.5 miles. Before it reaches the Route 108/33 intersection, it will connect to the Power and Gas line corridor near Butterfield Lane. The interceptor will travel approximately 6 miles within this corridor, until it reaches Route 33 in Greenland near the Travels Center of America complex. Once on Route 33, the interceptor follows the same path as Alternative 1 to the Pease WWTF on Corporate Drive.

Advantages

- Shorter distance than Alternative 1
- More of the construction will be outside of public areas.
  - Less traffic interruptions
  - Less road repair (minor road/driveway crossings within Utility ROW)
  - Possibly faster construction

Disadvantages

- Most of the project would be within private ROWs.
  - Additional costs and time to gain permission for ROW access may be needed.
- Limited space is available inside of the Utilities ROW.
- Most of the construction and maintenance would be remote and not as easily accessible.
- Will require more directional drilling than Alternative 1.

4.3.3 Conveyance - Alternative 3

Alternative 3 (Appendix A, Figure 5) is the shortest alternative at 11.3 miles. This alternative initially avoids public highways and roads by using a gas utility corridor near the Exeter WWTF. After using this corridor for approximately 3.2 miles, the interceptor merges onto the same utility corridor as Alternative 2. From there the interceptor uses the same route as Alternative 2 to connect to the Pease WWTF.

Advantages

- Shortest Distance of all the Alternatives
- Most of construction will be outside of public areas.
  - Less traffic interruptions
  - Less road repair
  - Possibly faster construction

Disadvantages

- Most of the project would be within private ROWs.
  - Additional costs and time to gain permission for ROW access may be needed.
- Limited space is available inside of the Utilities ROW.
- Most of the construction and maintenance would be remote and not as easily accessible.
- Will require more directional drilling than Alternative 1.

Table 2 provides a summary of each of the Routes:

Table 2: Segment Length for Each Conveyance Alternative from the Exeter WWTF to the Pease WWTF

Corridor Segment	Alternative 1	Alternative 2	Alternative 3
Gas Line Corridor	3,800	3,800	16,900
Route 101	1,300	1,300	0
Private Drive	1,500	1,600	0
Route 108	9,800	7,700	0
PSNH/Gas	0	31,700	24,000
Route 33	38,500	6,800	6,800
Grafton Road	5,300	5,300	5,300
Corporate Drive	6,900	6,900	6,900
TOTAL	**67,100 ft. 12.7 Miles**	**65,100 ft. 12.3 miles**	**58,900 ft. 11.2 miles**
Opinion of Cost	**$32.8 M**	**$31.4 M**	**$29.6 M**

For the purposes of this evaluation, Alternative #1 is recommended because it is located within existing road right of ways (Town and NHDOT). Alternatives #2 and #3 required significant land acquisition efforts; which may impact the costs and schedules due to co-locating a force main within gas and power line corridors.

4.4 Pease WWTF Improvements

Based on meetings and discussions with NHDES and the City of Portsmouth, the Pease WWTF would need to be designed to meet an effluent limit of 8 mg/L Total Nitrogen. Previous work has been done to consider Pease as a regional WWTF (Brown and Caldwell with Weston and Sampson, 2010). The costs and improvements from the Brown and Caldwell report were the basis for identifying the needed improvements as part of this evaluation. Specifically, Cost Estimate Scenario 3B of the Wastewater Master Plan was the basis for the costs (Appendix E). In summary, the improvements needed to accommodate the 20-year design flows of 4.35 MGD, are as follows:

- Construction of a new headworks
- Construction of new sequencing batch reactors (SBR) based on equalized flow from Exeter.
- Construct additional primary clarification
- Other modifications including disinfection, biosolids processing, and storage

4.5 Pease Effluent Conveyance and Outfall

The Pease WWTF effluent is conveyed to the Piscataqua River through an approximately 1.5 mile long gravity sewer main. The outfall itself is constructed of 8 diffusers and was installed in

1999. An evaluation of the Pease Outfall was not completed. However, it was assumed that 50% of the conveyance system to the outfall would require improvements to accommodate the 20-year flows. In summary the following was included in this cost evaluation:

- Replace 50% (+/-) of gravity conveyance system to outfall
- Extend or modify outfall

Since the permitting requirements of increasing the discharge to the outfall at this location are unknown, it is possible that the effluent would have to be conveyed to the Peirce Island WWTF outfall. Previous studies (Brown and Caldwell and Weston and Sampson, 2010) have identified the cost of this option to be $14M. This would avoid the need to construct outfall improvements at Pease ($4M), so the net cost impact to the project would be $10M which is included in the high range of the costs below.

5.0 Opinion of Costs and Schedule

5.1 Opinion of Costs

Table 3 provides a summary of the capital and O&M costs. These preliminary costs are for planning purposes only, based on the assumptions in this report. A further break down of the WWTF, conveyance and O&M costs can be found in Appendix E. The costs are presented with a high and low range to establish a potential cost range due to the possibility of additional outfall improvements.

Table 3: Opinion of Costs Based on Routing Option #1 Buildout Flows (5.025 MGD)

	Summary of Low Range Opinion of Costs	Summary of High Range Opinion of Costs
Conveyance and Exeter PS	$33M	$33M
Pease WWTF and Outfall	$34M	$44M
Total Capital Costs	**$67M**	**$77M**
O&M (Exeter Pumping Station)	$0.7M	$0.7M
O&M Pease WWTF	$3.0M	$4.0M
Total O&M	$3.7M	$4.7M
Present Worth (50 Years)	$151M	$182M

Note: 1. Present worth is based on i= 4%

Table 4 provides a 20 year cost of this project adjusted for the 20-year flows of 4.35 MGD.

Table 4: Opinion of Costs Based on Routing Option #1 and 20-Year Flows (4.35 MGD)

	Summary of Low Range Opinion of Costs	Summary of High Range Opinion of Costs
Conveyance and Exeter PS	$33M	$33M
Pease WWTF and Outfall	$33M	$43M
Total Capital Costs	**$66M**	**$76M**
O&M (Exeter Pumping Station)	$0.7M	$0.7M
O&M Pease WWTF	$2.9M	$3.9M
Total O&M	$3.6M	$4.6M
Present worth (20 Years)	$133M	$156M

Note: 1. Present worth based on i= 4%

A summary of the costs is listed below:

- Installation of an interceptor from Exeter WWTF to Pease WWTF
- Construction of a new pumping station at Exeter WWTF
- Construction of a dry weather equalization tank at Exeter WWTF and lagoon decommissioning
- Construction of a new headworks and primary clarifiers at Pease WWTF
- Construction of new SBRs at Pease WWTF
- Modifications to Pease WWTF outfall
- Construction of additional structures/modifications at Pease WWTF
- Operating and Maintenance costs (Exeter conveyance and Pease WWTF)

Note: the cost of Stratham's collection system is not included.

5.2 Project Schedule

Due to the limits set by Exeter's AOC there is a time table that needs to be met. The AOC (Appendix E) states that construction shall begin by June 30, 2016 and by June 30, 2018 achieve substantial completion of the WWTF. Table 5 describes the probable time-line for the regional option, once all parties agree. The AOC would likely need to be modified if a regional option is pursued.

Table 5: Project Schedule

	Year 1	Year 2	Year 3	Year 4	Year 5
Design Conveyance					
Design Pease Treatment					
Permitting/IMA					
Construct Conveyance					
Construct Treatment					
Begin Operations					*

6.0 Opportunities and Challenges

There may be other opportunities and challenges associated with a regional option. Some of them are identified here.

- Opportunities
    - Although this evaluation has not included the flows, the conveyance system may be adequate to accommodate additional minor flows such as Newfields and Greenland. The force main could also be enlarged to include additional flows such that might come from Newmarket, Durham, Raymond or Epping.
    - Eliminates direct WWTF discharge into the Squamscott River and Great Bay and moves the discharge to the Piscataqua River where there is greater dilution.
    - By utilizing the existing lagoons as storage, this option (or any option that doesn't need the lagoons) could reduce or eliminate Exeter's CSO (Combined Sewer Overflow)
    - A regional solution provides a larger user base, which could reduce rates.
    - May improves the treatment process at Pease because of Exeter's equalized flow that is primarily residential (non-industrial)
    - Solution is consistent with the Southeast Watershed Alliance mission statement (investigate regional solutions)
    - Conveying Pierce Island sanitary flows to Pease for treatment could provide further economy of scale. Although not part of this study, if Portsmouth were to also convey Peirce Island sanitary flows to Pease, there would likely be significant additional benefits to all of the communities for this regional option.Local regional solution may foster further advocacy of larger regional solution such as a Hampton connection and a new ocean outfall or utilize existing Seabrook station outfall.
- Challenges
    - Is increased flow at existing Pease outfall acceptable to regulatory agencies and/or other agencies such as the Food and Drug Administration (FDA)?
    - Need to obtain approvals between the communities (IMA). This will require cooperation and political will.

- Possible private ROW access depending on chosen interceptor route alternative.
- Timing of work (need to comply with AOC deadline).

7.0 Conclusions

1. Project Drivers
   a. Exeter is currently under an EPA Administrative Order on Consent to meet discharge limits set by their NPDES Permit.
   b. Compliance must be by June 2018.
   c. Both Exeter and Stratham are interested in identifying the most cost effective solution for wastewater treatment and disposal.
   d. This study evaluated a regional wastewater option by conveying Exeter and Stratham's wastewater to the Pease WWTF.
2. Conveyance System
   a. This evaluation assumed one pumping station located at the Exeter WWTF. The design point is: 2,600 gpm (3.7 MGD).
   b. Stratham would connect by pumping their wastewater to the Exeter WWTF headworks.
   c. A 20" HDPE force main is proposed.
   d. Three alternatives were considered that varied in length (11.2 miles to 12.7 miles).
   e. Two of the routes considered existing utility corridors (PSNH and Unitil) because they are shorter and avoid traffic issues.
   f. Alternative 1 is the longest interceptor route evaluated at 12.7 miles, but is the most practical route because of unknown and costly easement issues in the other two alternatives.
      i. Regional Interceptor would be installed within the shoulder of the NHDOT ROW
      ii. Construction and maintenance would be easily accessible.
3. Pease WWTF
   a. A new headworks would be constructed to handle the additional flow from the regional interceptor.
   b. Additonal sequencing batch reactors would be constructed.
   c. Additional primary clarifiers may be needed to handle disinfection and solids.
   d. The Pease WWTF outfall would have to be modified to handle additional flow.
   e. Permitting issues with expanding the Pease outfall may require a portion of the Pease effluent to be conveyed to the Peirce Island WWTF. This would require additional capital and O&M costs.

4. Opportunities
    a. Environmental benefits may be realized by relocating discharge point downstream of the Great Bay.
    b. Future permitting requirements will be better managed with regional solution.
    c. Provides a regional solution to wastewater treatment with a larger user base and potential lower user rates.
5. Challenges
    a. Permitting increased flow at Pease WWTF outfall may be problematic.
    b. Private ROW issues depending on conveyance paths.
    c. Project could take 5 years to complete given need to work with neighboring communities.
    d. Intermunicipal cooperation may be time consuming.

8.0 Recommendations

Based on this evaluation, the following is recommended:

- Compare regional costs from this study to those costs presented in the pending Facility Plan.
- Continue to discuss opportunity with Portsmouth.
- Monitor Portsmouth's discussion on conveying Peirce Island's sanitary waste to Pease. This may provide additional cost incentives to a regional Pease option.

Appendices

A. Figures

- **Node Map**
- **Alternatives 1,2,3**

B. Meeting Notes

C. Case Studies

D. NHDES Administrative Order on Consent

E. Opinion of Costs

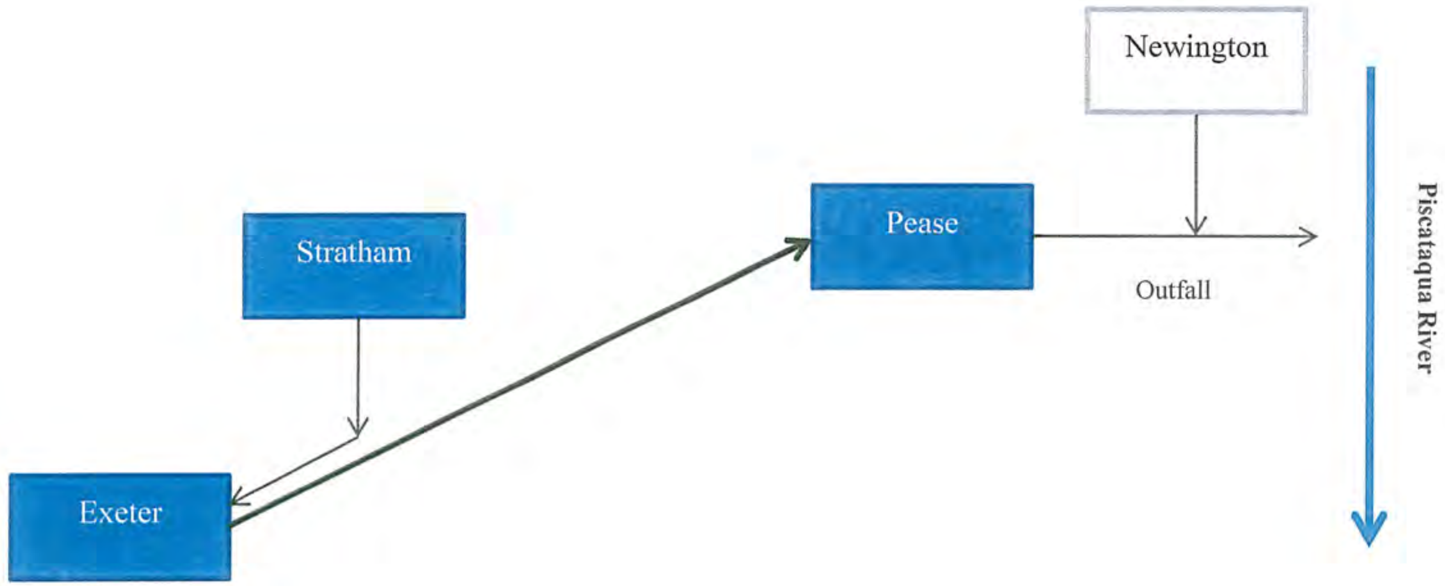
- **WWTF Costs**
- **Conveyance Costs**

F. Calculations

- **Pump Calculations**
- **Conveyance Calculations**
- **Flow Calculations**

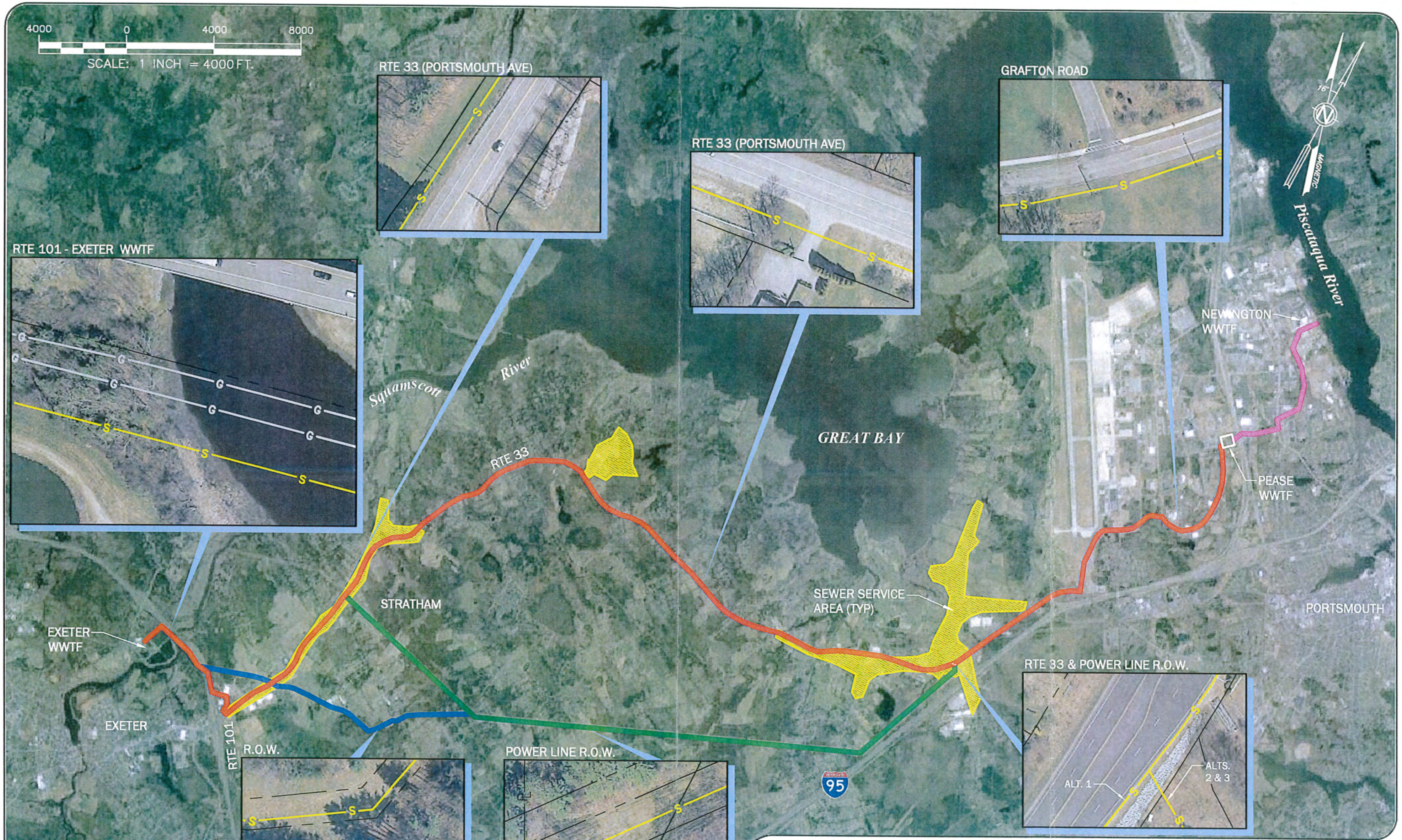
Appendix A: Figures

Figure 1: Regional Disposal Node Map Evaluation



Note: Although, not evaluated in this study, additional communities could potentially connect to this force main such as Newfield, Newmarket, Durham and Greenland. Portsmouth is also considering the conveyance of Peirce Island WWTF to Pease WWTF.

(blue box)	Evaluated Communities
(white box)	Existing Connection



DATE 11/21/14	UNDERWOOD engineers	OVERVIEW – WORK PLAN	FIG.
PROJECT 1834	25 Vaughan Mall, Portsmouth, N.H. 03801 Tel. 603-436-6192 Fax. 603-431-4733	REGIONAL WASTEWATER DISPOSAL EVALUATION EXETER – STRATHAM, NH	2

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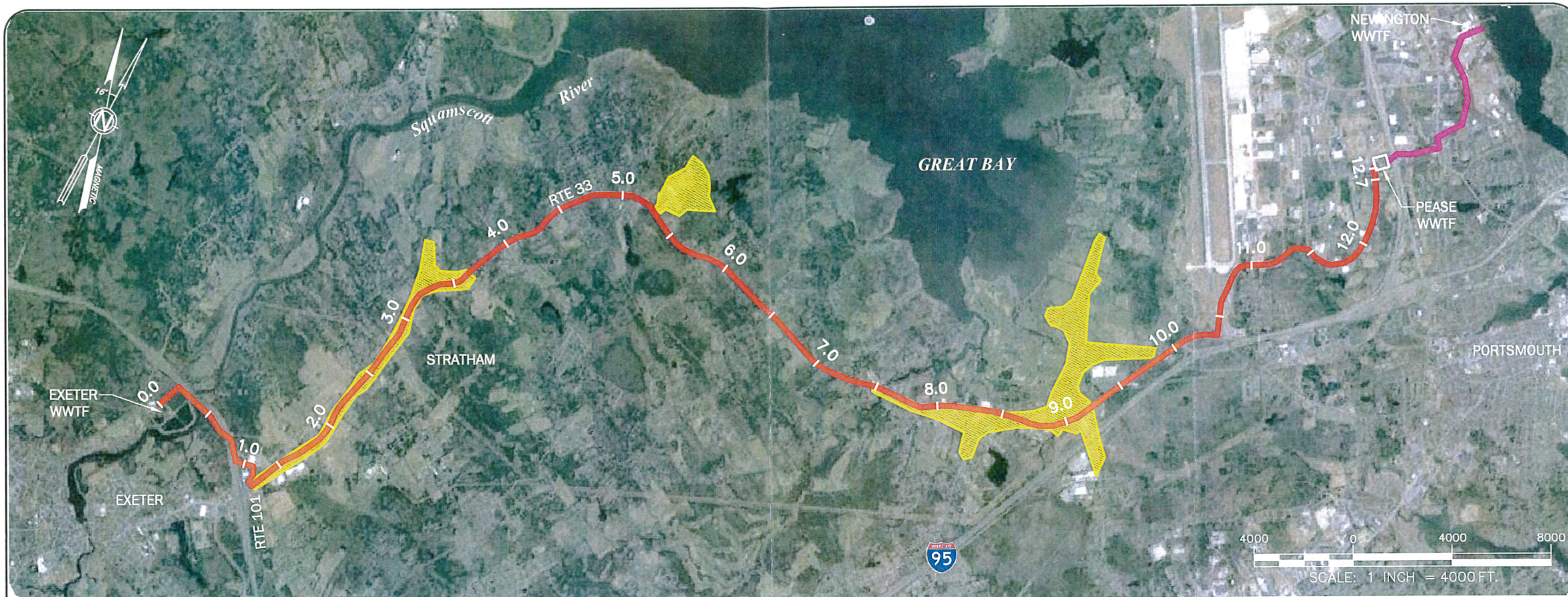

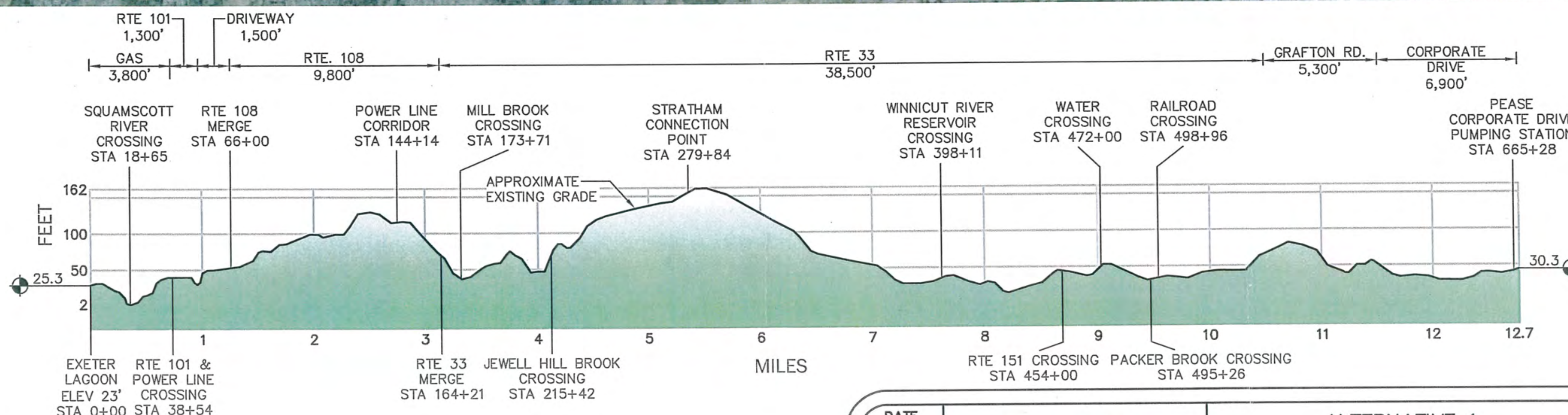

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11/14/14		REGIONAL WASTEWATER DISPOSAL EVALUATION	3
PROJECT	25 Vaughan Mall, Portsmouth, N.H. 03801	EXETER – STRATHAM, NH	
1834	Tel. 603-436-6192 Fax. 603-431-4733		

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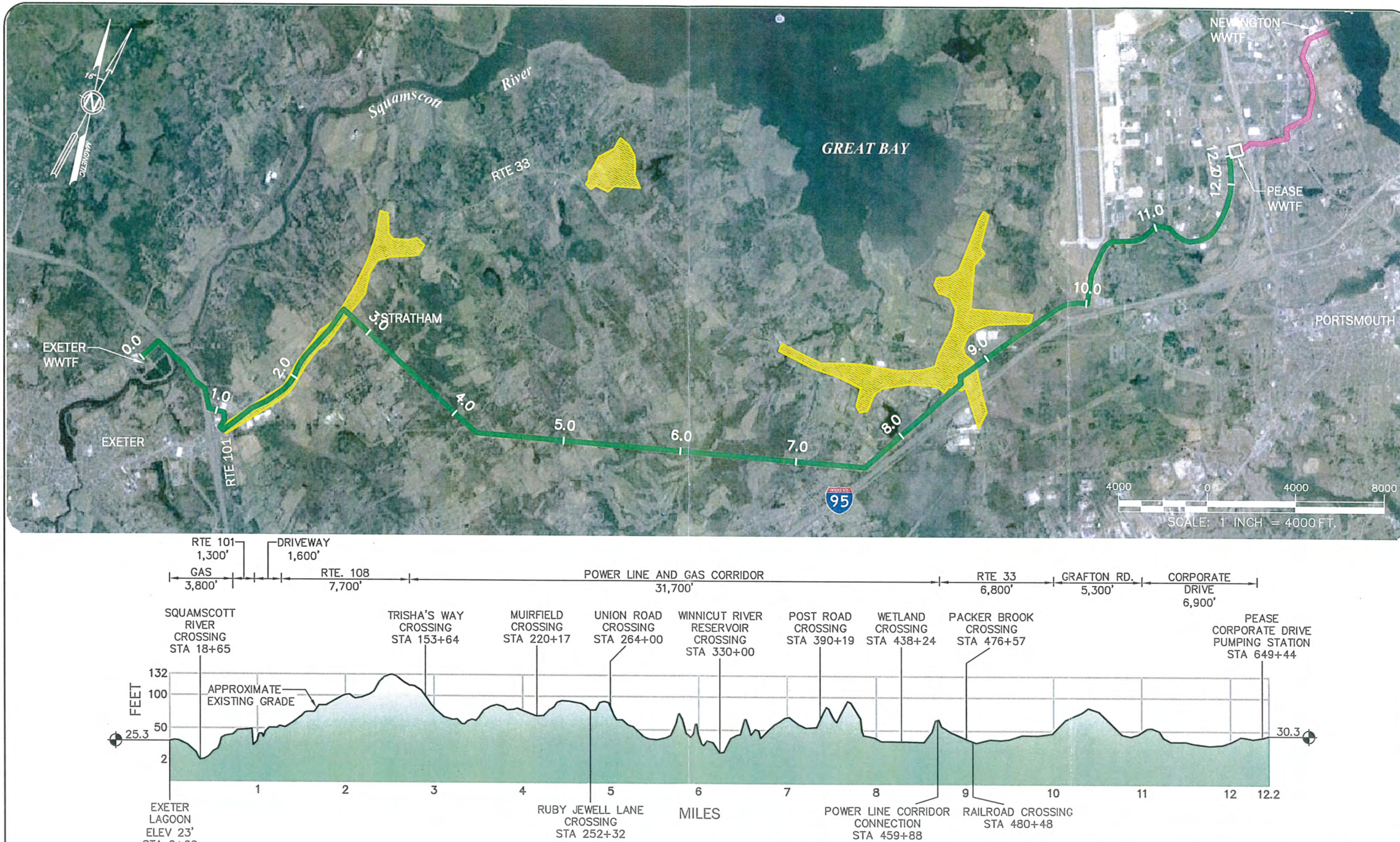

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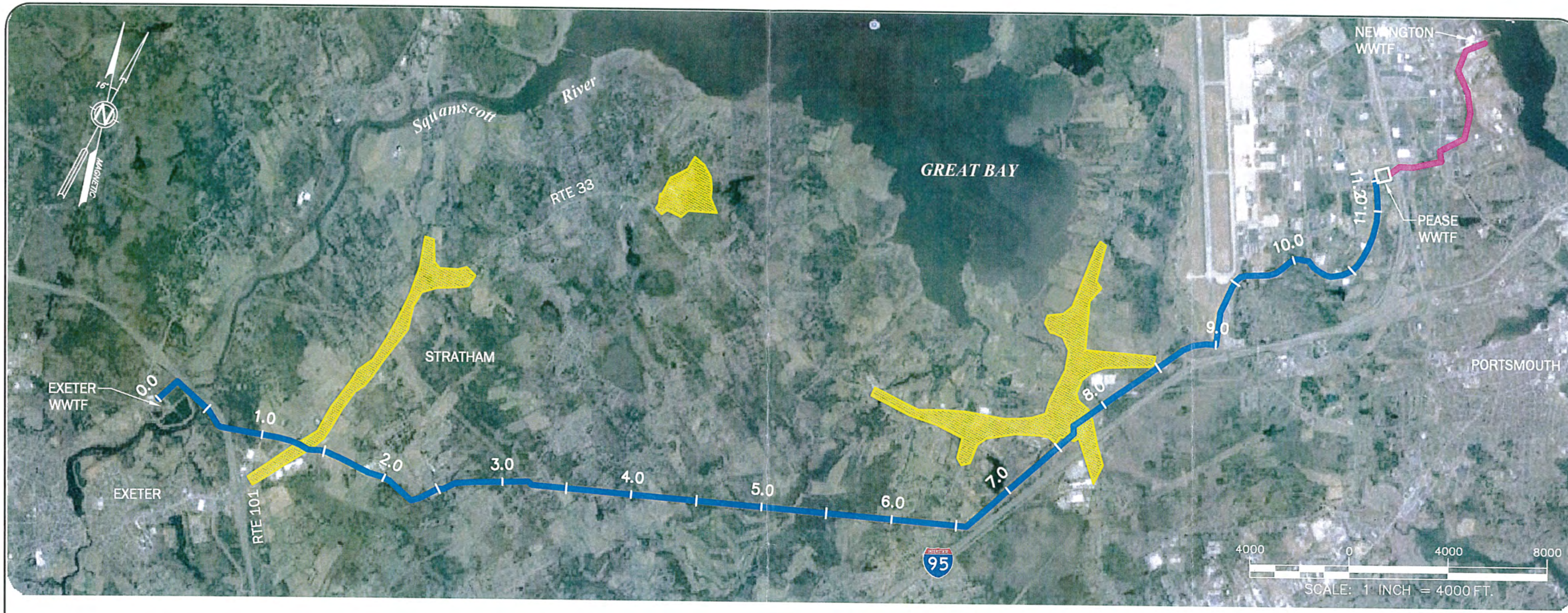

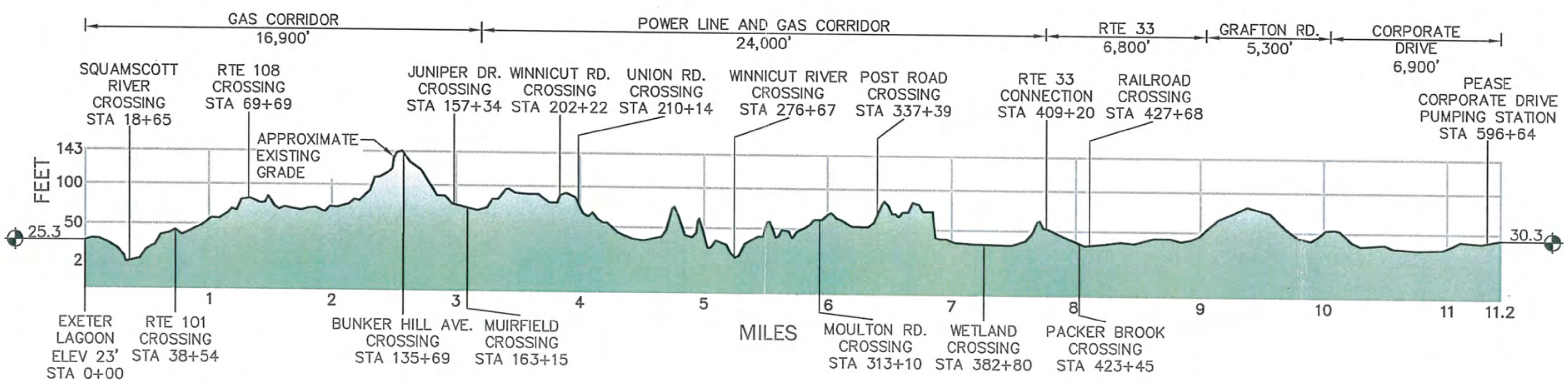

DATE		ALTERNATIVE 3	FIG.
11/14/14	UNDERWOOD engineers	REGIONAL WASTEWATER DISPOSAL EVALUATION	5
PROJECT 1834	25 Vaughan Mall, Portsmouth, N.H. 03801 Tel. 603-436-6192 Fax. 603-431-4733	EXETER – STRATHAM, NH	

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Appendix B: Meeting Notes

Fact Finding Meeting Notes

NHDOT

Regional Wastewater Disposal Options
Exeter and Stratham NH

June 18, 2014

Attendance: Chad M. Hayes, NHDOT District 6, Utilities Engineer
Frank G. Underwood, Underwood Engineers, Founder
Keith A. Pratt, Underwood Engineers, President
Erik B. Nichols, Underwood Engineers, Project Engineer

1. **Overview:** Keith Pratt started off the meeting with introductions and describing the project and key points for the meeting:
    a. Of the three routes being considered for this project, Alternative 1 requires the use of NHDOT ROW.
    b. The purpose of the meeting was a fact finding mission to determine any key features and or issues that could arise from installing a Sewer FM along that route.
2. **Topics Discussed:** The following information was discussed with Chad Hayes from NHDOT:
    a. The NHDOT ROW at Route 108 has limited space and the proposed FM would need to be placed under pavement in many locations to stay within the ROW.
    b. Discussion over future expansion of the sewer line by including additional surrounding cities (Greenland, Newfield, Newmarket, etc.).
    c. Due to the private sewer lines of the Lowes/Target shopping center and the Travel Center, the area on Route 33 and 151 may be congested with the addition of another sewer line. Possible incorporation of private sewers into Alternative 1 may be necessary to reduce the number of sewer lines in the area.
    d. There are different ROW types along the Alternative 1 route.
        i. Route 101 has Limited Access (LA) ROW, FM cannot run parallel to 101 within ROW crossings are permitted.
        ii. Route 108 has full access ROW.
        iii. Route 33
            1. Squamscott Rd to Greenland town line LA ROW
            2. Roughly 100 feet north of the Winnicut River Crossing to just North of Portsmouth Avenue is regular ROW.
            3. Portsmouth Ave to Grafton Road is Controlled Access (CA) ROW.
    e. In order to use the NHDOT ROW, a more specific plan would have to be produced with bridge crossings, and sewer installation locations. This would have to be approved by the Commissioner of DOT.
    f. A Use and Occupancy Permit will be required if this route is pursued.
3. **Next Steps/Actions**

   a. Erik Nichols will get in contact with Chad Hayes to obtain available drawings of the areas in consideration.
   b. Underwood Engineers will submit a letter to NHDOT summarizing the project.

4. **Attachments**
   a. Agenda and Figures
   b. Excerpts of the NHDOT utilities Manual provided by Chad Hayes.

Fact Finding Meeting

NHDOT

Regional Wastewater Disposal Options
Exeter and Stratham NH

June 18, 2014

1. **Purpose of today's meeting:**
   a. Fact Finding
   b. Identify opportunities and challenges to locate a sewer force main in NHDOT Route 108 and NHDOT Route 108.

2. **Background:**
   a. Exeter is currently under an EPA Administrative Order by Consent to design and construct a new WWTF to meet new regulatory discharge limits
   b. Stratham desires to provide municipal wastewater service in their commercial and gateway districts (Route 108)
   c. The Towns of Stratham and Exeter desired to cooperatively evaluate regional wastewater disposal options.
   d. Underwood Engineers (UE) is under contract with both Town's to investigate the technical feasibility and costs associated with regional options.

3. **Goals and Objectives**:
   a. Identify the technical feasibility of a joint wastewater collection system to convey wastewater from Exeter and Stratham to the City of Portsmouth Pease WWTF.
      i. Conveyance system (force main, wastewater pumping, screening, odor control, screening, piping, metering, etc.) for the interceptor
      ii. Easements (ROW)
      iii. Permitting – Regulatory Issues/Talking Points Only
   b. Compare the opinion of costs (and pros/cons) of this regional option to previously identified solutions. Costs shall consider capital and long-term O&M (i.e., present worth).

4. **Previous Reports** – Referenced Reports include the following:
   a. Wastewater Management Concept Plan (WP, March 2011)

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5. **Basis of Design** - Design Flows (hydraulics only)
   a. Summary of flows (ADF) – Buildout
      i. Stratham – 675,000 gpd
      ii. Exeter – 3,000,000 gpd
      iii. TOTAL = 3,675,000 gpd
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   b. Interceptor
      i. 20" HDPE (SDR 9/SDR 11):
      ii. One pumping station at Exeter WWTF site
      iii. Construction:
         1. Open cut – 5 to 6 feet deep
         2. Directional drill, if necessary
   c. Appurtenances – access is needed
      i. Air relief structures at high points
      ii. Cleanout/blow-off structures at every mile (+/-)

6. **Routing Options**

	Alternative #1	Alternative #2	Alternative #3
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Gas line corridor	3,800	3,800	16,900
Route 101	1,300	1,300	0
Private Drive	1,500	1,600	0
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PSNH/Gas	0	31,700	24,000
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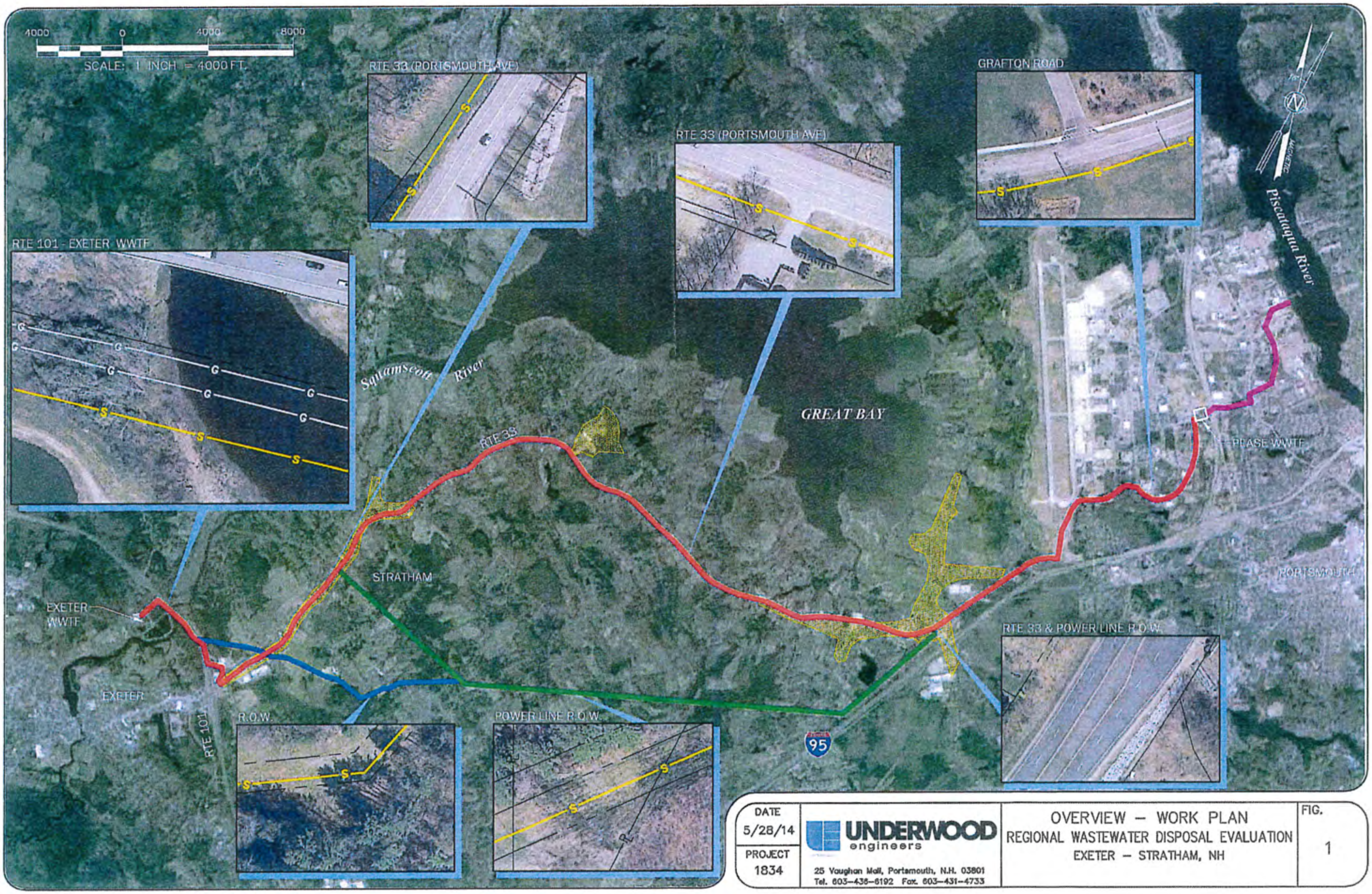
Grafton road	5,300	5,300	5,300
Corporate Drive	6,900	6,900	6,900
Pease WWTF			

7. **Schedule and Next Steps**
    d. Engineering Report
        i. UE Regional Evaluation report - July 2014
        ii. Exeter Facility Plan – Fall 2014 (+/-)
        iii. Selected solution operational – 3 to 4 years

8. **Discussion and Q&A**



DATE			FIG.
5/28/14	UNDERWOOD engineers	OVERVIEW - WORK PLAN REGIONAL WASTEWATER DISPOSAL EVALUATION EXETER - STRATHAM, NH	1
PROJECT 1834	25 Vaughan Mall, Portsmouth, N.H. 03801 Tel. 603-436-6192 Fax. 603-431-4733		

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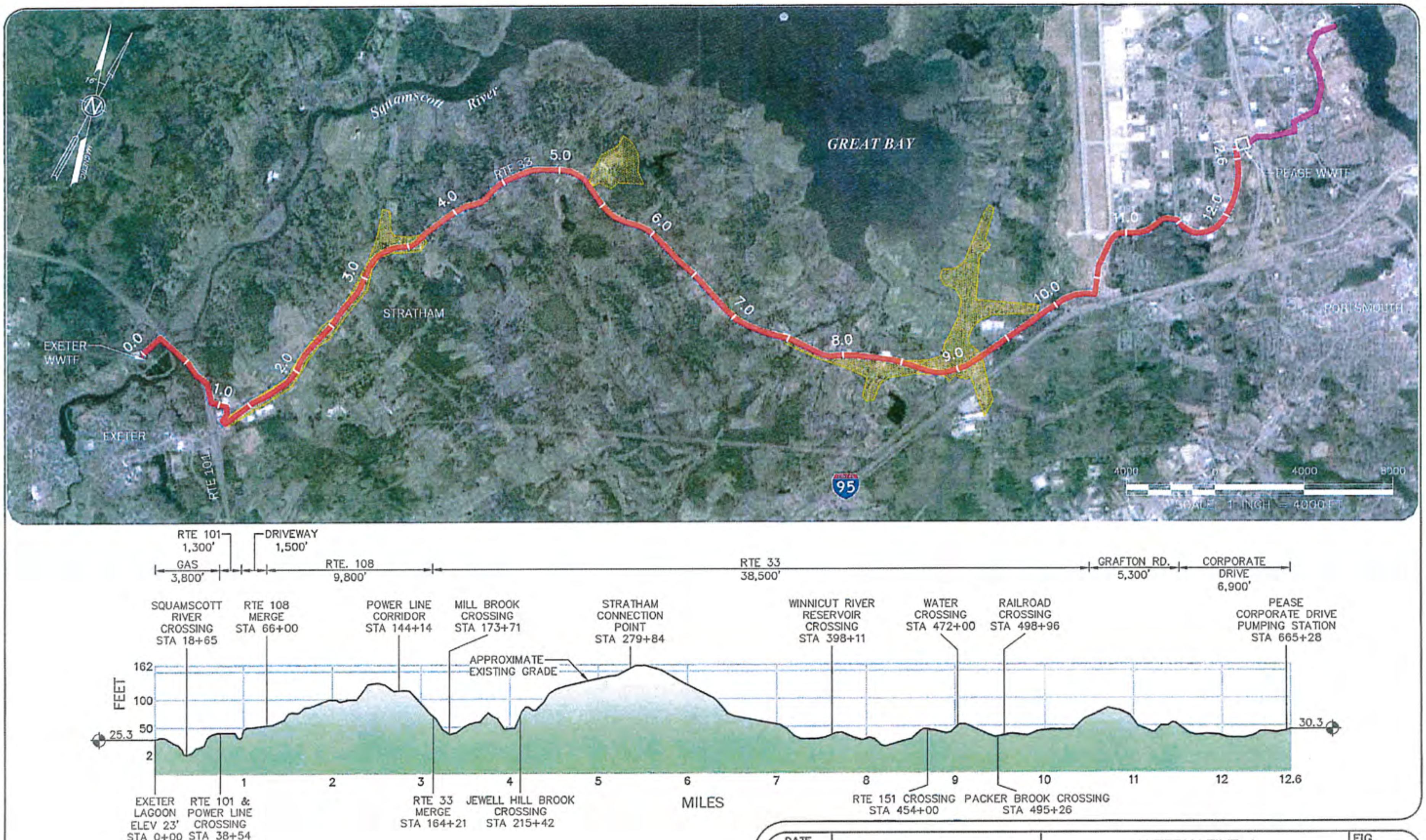

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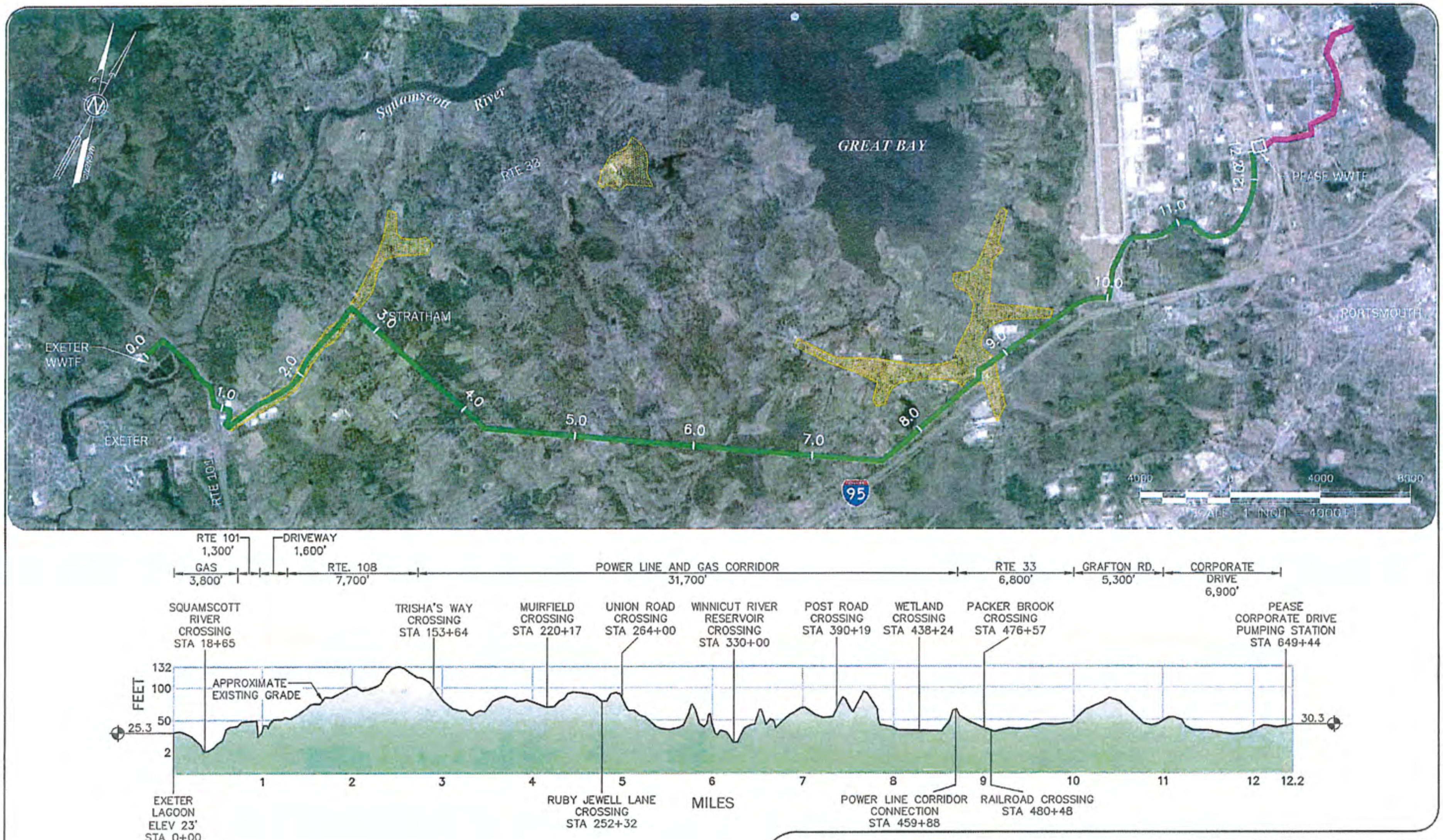

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PROJECT 1834	25 Vaughan Mall, Portsmouth, N.H. 03801 Tel. 603-436-6192 Fax. 603-431-4733	REGIONAL WASTEWATER DISPOSAL EVALUATION EXETER – STRATHAM, NH	3

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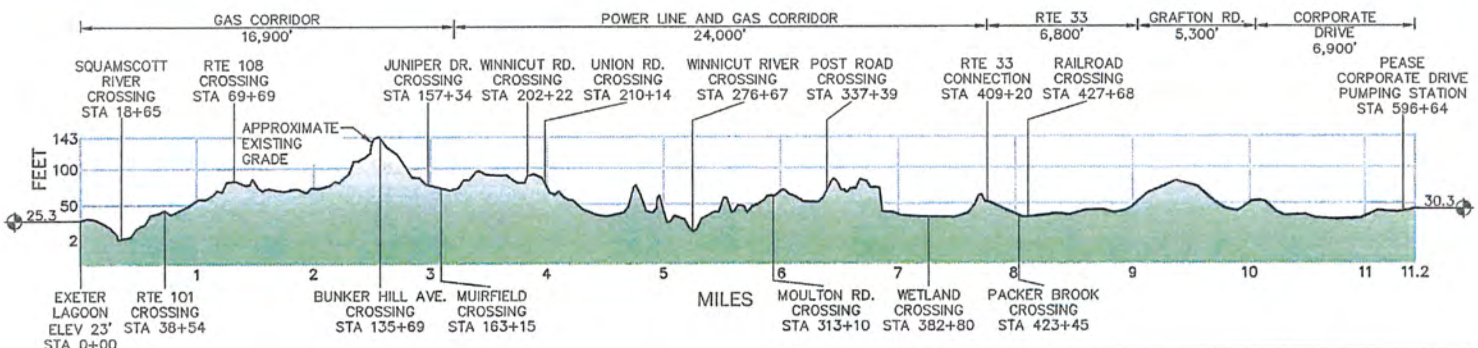

DATE			FIG.
5/28/14	UNDERWOOD engineers	ALTERNATIVE 3	
PROJECT	25 Vaughan Mall, Portsmouth, N.H. 03801	REGIONAL WASTEWATER DISPOSAL EVALUATION	4
1834	Tel. 603-436-6192 Fax. 603-431-4733	EXETER – STRATHAM, NH	

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www.nh.gov/dot
Leftside: Divisions/Bureaus/Districts → Bureau of Highway Design → Document library → Utilities Accomodation Manual.

Left side column under "Engineering/ Technical Information" Sub heading: Manuals

XIII STANDARDS FOR HIGHWAYS WITH FREEWAY CHARACTERISTICS

A. General

All highways with freeway characteristics are dedicated to allow for optimum mobility and safety of through traffic. The basic element in the design and operation of these highways to achieve this end is the limiting of access to the highway.

1. Basic Principle

Under the full control of access, principle utility use of limited access rights-of-way shall be restricted as specified within the following sections. Highways with such rights-of-way shall be referred to as freeways in this text. These requirements also govern highways defined by Controlled Access Right of Way. The provisions in this section are in addition to all other general standards contained in this policy.

2. Permit Requirements

a) All utility accommodations as may be warranted shall only be in accordance with an approved Excavation Permit (issued by Districts) and Encroachment Permit (issued by Turnpikes) and a Use and Occupancy Agreement issued by the Department. A sample copy of a Use and Occupancy Agreement is contained in Appendix H.

b) Advance arrangements shall be made between the Utility and the Department for emergency repair procedures as set forth in the Use and Occupancy Agreement.

c) All permits shall include adequate provisions for allowing access to the utility work zone, traffic control, and protection of both utility workers and the traveling public.

d) Service connections to adjacent properties will not be permitted from longitudinal utility installations located within the limited access lines of a freeway. Service connections to adjacent properties in Controlled Access ROW may be permitted provided they are limited to supplying the service to a single residence or single commercial operation. All other installations will require a Use and Occupancy Agreement.

6. Exceptions

Only the Commissioner or their designee may authorize special case exceptions for longitudinal installations. However, in no instance will utilities be allowed to be installed longitudinally within the median area of freeways.

Any utility which proposes a special case exception for a longitudinal installation shall file a written application describing the facility to the Commissioner including therewith preliminary drawings and any attachments or addendums required to make the application complete. All filings with the Department shall be done through the Commissioner or their designee.

The Utility, in its request, must demonstrate that an extreme hardship would be imposed on the utility and/or the consumer should approval be denied.

The Utility shall present its proposal in both written and plan form, demonstrating to the Commissioner's satisfaction that:

a) The accommodation will not adversely affect the safety, design, construction, operation, maintenance, or stability of the freeway.

b) The accommodation will not interfere with or impair the present use or future expansion of the freeway.

c) Alternate locations are not available or cannot be implemented at reasonable cost from the standpoint of providing efficient utility services in a manner conducive to safety, durability, and economy of maintenance and operations.

d) Disapproval of the use of the right-of-way would result in the loss of productive agricultural land, or loss of productivity of agricultural land, if any. In this case, the utility must provide information on the direct and indirect environmental and economic effects of such loss, which effects will be evaluated and considered by the Commissioner.

e) The accommodation satisfies the conditions of "Access for Constructing and/or Servicing Utilities" as follows:

C. Crossing Facilities

Crossings will not be allowed if access for servicing is accomplished from the highway or ramps. Exceptions must comply with B.6. above (Exceptions).

1. New Aerial Crossings

Installation of new aerial facilities that cross LAROW lines are permitted provided that the facilities are located approximately at right angles to the highway. Facilities should span the LAROW without placing supporting structures within said limits. Should a clear span be unattainable, all support structures allowed within the LAROW shall:

a) Be located the required offset, 30' (9 m) beyond the outer edge of existing or planned roadway traveled way and 20' (6 m) from the outer edge of any existing or planned ramp traveled way (see Appendix C, Table C1).

b) Not be located within a median of 80' (24 m) or less in width.

c) Not impair sight distance from any point on the through roadway or ramps.

The minimum vertical clearance from the high point of the roadway finished grade to the lowest point of any aerial cable shall be at least 18' (5.5 m) under maximum temperature conditions affecting its catenary unless required to be greater by the current National Electrical Safety Code, the New Hampshire Public Utilities Commission, or other regulations.

2. Existing Aerial Crossings

Existing aerial facilities that cross proposed LAROW lines may remain in their location provided that the conditions in Paragraph C.1 above are satisfied. Reasonable latitude will be exercised regarding the angle of crossing of existing lines, which are otherwise qualified to remain.

4. Crossings under the separation structure are permitted if designed such that future bridge rehabilitation and widening projects and maintenance of the structure will not be impaired.

   a) Also see conditions under "Pipelines" Section IX.A.1.a for encasement requirements.

   b) Undergrounding is preferred. Aerial line crossings under separation structures will be considered on an individual basis.

5. Relocations required by future widening or rehabilitation work will be accomplished by the utility at their expense.

E. **Utilities along Roads or Streets at Freeway Interchanges**

1. Aerial facilities are permitted if:

   a) Access for installation or maintenance is not from the through roadway or ramps.

   b) There is a lateral clearance of 20' (6 m) from the edge of the ramp traveled way.

   c) Sight distance from the freeway, roadway, or ramps is not impaired.

   d) The lateral and vertical clearances from the through roadway set forth in this section are met.

2. Underground facilities are permitted if:

   a) Access for installation or maintenance is not from the through roadway or ramps of the freeway.

   b) All applicable conditions pertaining to pipelines, underground power, or underground communication lines in this Manual are met.

6. Where a pipeline on or in a structure is encased, the casing shall be effectively opened or vented at each end to prevent possible build-up of pressure and to detect leakage of gases or fluids.

7. Where a casing is not provided for a pipeline on or in a structure, additional protective measures shall be taken, such as employing a higher factor of safety in the design, construction, and testing of the pipeline than would normally be required for encased construction.

8. Pipeline shut-offs, preferably automatic, shall be required within close proximity of structure installations unless other sectionalizing devices can isolate segments of the lines.

9. It is agreed by the utility companies that any maintenance, servicing, repair, or relocation of the utility lines will be their responsibility.

10. When a utility company requests permission to attach a pipeline to an existing or proposed bridge, sufficient information should be furnished to allow a stress analysis to determine the effect of the added load on the structure. Other details of the proposed attachment as they affect safety, maintenance, and structural integrity must also be presented including hanger details. If the bridge structure is not of adequate strength to carry the increased weight or forces with safety, the attachment will not be permitted.

c) When work proposed would occur within the LAROW (including CAROW) of a highway four (4) sets of plans and a complete description of the proposed work shall be submitted to the District Engineer. The District or the Bureau of Turnpikes will review and send two (2) sets of the complete package along with their comments to the Chief of Design Services for approval. The submission should be made a minimum of 60 days in advance of any proposed work.

d) All utility permit and license applications shall, at a minimum, contain the following:

1. A description of the size, type, capacity, nature, and extent of the utility installation;

2. Plans, drawings, or dimensioned sketches showing the proposed location with respect to the edge of pavement and the right-of-way lines, and the depth of cover for all underground facilities;

3. Additional requirements under Section IX Pipelines, when applicable;

4. The responsible person within the utility company to be contacted; and

5. A Traffic Control Plan, subject to approval by the Department, for the protection of the traveling public (see Standards to Provide Traffic Safety, Section V).

e) All permits and licenses issued by the State will, as a minimum, specify the following:

1. Requirements for location, construction, restoration, protection of traffic, maintenance or access restrictions, and any special conditions applicable;

2. A statement defining the liability and responsibility associated with future adjustments or relocations of the utility facility due to highway improvements; and

3. The responsible Department person to be contacted should an emergency arise.

e) When the utility work is accomplished during the highway project's construction, a permit will not be necessary if the Utilities Engineer has given approval. This approval will not replace the license required for poles, structures, conduit and cables, which must be obtained from the District Engineer, or the Municipality upon completion of the project. A license will be issued by the Department for facilities installed at locations approved by the Chief of Design Services or Contract Administrator.

f) The Department strongly recommends the use of Subsurface Utility Engineering when proposing to place a new utility in an existing roadway. This further insures conflicts with other utilities will be identified during the design of the proposed utility and enables resolution prior to commencing construction.

3. **Concurrent Utility and Highway Construction**

a) The Department encourages utility companies to provide for future expansions of their facilities during highway improvement projects. All applicable standards of this policy shall be met in the proposal before the Department's approval is given.

b) The provisions contained in Paragraphs 2a through 2e of this section will additionally apply to this type of accommodation.

c) For accommodation on structures, the provisions of Section XIV Utility Installations on Structures, shall apply.

B. **Sufferance**

1. The use and occupancy of the State Highway right-of-way shall be considered to be by sufferance only, unless:

   a) The utility has a valid right-of-way, either by easement or fee ownership of the property, within the highway right-of-way;

   b) Easement rights have been reserved for the utility company in the right-of-way acquisition; or

   c) The utility company has some property interest in the highway right-of-way as determined by the State Attorney General's office.

2. When the utility facility is occupying the State's right-of-way by sufferance, Common law places the obligation of costs associated with installations, alterations, relocations, and/or protection on the utility owner. Opinion of the Justices, 101 N.H. 527.529, (1957)

C. **Tree Clearing/Trimming Responsibility**

Utilities, by State statute, are responsible for tree clearing and trimming required to install and maintain aerial facilities.

Should utility facilities have to be relocated due to highway improvements, the responsibility for clearing and trimming is an inherent component of that relocation.

The need for relocations varies from direct interference with construction to compliance with safe offset criteria. Relocations are to be undertaken in a timely fashion prior to or concurrently with the project construction as may be required by the Department. On most projects, the Department may allow relocations to be scheduled immediately after completion of the clearing operations required to construct the highway improvement. It is the responsibility of the utility to acquire all necessary permits, easements, and property rights for any additional trimming and clearing for utility accommodation beyond the limits necessary for the project.

E. Sanitary Sewer Lines

1. Cover

The cover for sanitary sewer lines shall be a minimum of 60" (1500 mm). In addition, within pavement structure limits, installations shall be a minimum of 18" (450 mm) or one-half the pipe diameter whichever is greater, beneath the subgrade.

The utility owner is responsible to assure that all sewer lines have proper cover, or are suitably insulated to protect against freezing.

2. Encasement

Encasement requirements as stipulated in Water Lines, Section IX.D.2, shall apply for all pressurized sewer lines and any existing gravity line which does not comply with material or cover requirements.

3. Manholes

Manholes serving sewer lines up to 24" (600 mm) in diameter shall have a minimum inside diameter of 48" (1200 mm). For any increase in line size or number of pipes, the inside diameter of the manhole may be required to be increased a like amount. Manholes for large interceptor sewers should be specially designed, keeping the overall dimensions to a minimum. The outside diameter of the manhole chimney at the ground level shall not exceed 36" (900 mm). Any manholes allowed within the pavement shall be set flush with the pavement and will not be in the vehicular wheel path.

4. Drains

Sanitary sewer line encasement drains shall not outfall into roadway drainage ditches, natural watercourses, or the right-of-way.

5. Plastic Pipe

Where nonmetallic pipe is installed, a durable metal wire shall be installed concurrently or other means shall be provided for detection purposes.

6. Exception for Existing Lines in Urban Areas

The Department may permit existing lines in urban areas to remain in place provided the line is of satisfactory quality and depth, manholes are adjusted in conformance with general requirements herein, and provisions are made to assure that future service lines will not be in violation of access control or disturb any roadway.

Fact Finding Meeting Notes

Unitil, PSNH and M&N Operating Company

Regional Wastewater Disposal Options
Exeter and Stratham NH

June 4, 2014

Attendees:

Roger Barham, UNITIL
John Davis, UNITIL
Russell Maille, PSNH
Bob Kelly, Exeter Water/Sewer Advisory Committee
John Boisvert, Chair, Stratham, Public Works Commission
Keith Pratt, Underwood Engineers
Erik Nichols, Underwood Engineers
Jennifer Perry, Director, Exeter Public Works
Dave Hanbury, M&N Operating Company
Paul Deschaine, Stratham Town Administrator

1. **Overview:** Keith Pratt started off the meeting thanking everyone for joining, passed out the attached Agenda and Figures, began discussing the Stratham/Exeter Regional Wastewater Disposal Options and the following:
    a. Underwood Engineers are pursuing a study to connect the Exeter WWTF with the Pease WWTF.
    b. There are currently three routes being considered by Underwood Engineers. Two of which involve the ROW of Unitil, PSNH, and M&N.
    c. The purpose of the meeting was to have Underwood Engineers, the Towns of Exeter and Stratham, Unitil, PSNH, and M&N come together and identify what opportunities and challenges there may be by locating a sewer force main in their existing easements.
2. **Unitil Input:** Roger Barham and John Davis provided the following input to a sewer force main being used within the Unitil easement:
    a. The project would require a joint use agreement.
    b. In general, the land located in the "southeastern" part of the ROW could be available for use. There are currently existing utilities occupying the "northwestern" portion of the ROW.
    c. Roger Barham then used AutoCAD to project their ROW layout, showing where the utilities are located and possible open space for a FM. Roger also displayed a

few areas (Horse Farm, easement corners, substation, Exeter WWTF access) where space is tight and may require additional land from landowners to fit a FM.

d. Unitil informed Underwood that the land is not owned by Unitil and that in order to install a FM, each individual landowner would have to notified to gain easement rights which would add to costs. Unitils easement is mortgaged and holds a value to the stockholders. Installing a FM would alter that value and have to go through their board of directors as well add to the budget. Unitil stated that they would provide landowner lists to Underwood for this study.

e. Unitil also offered to provide GIS data, wetland data, soil data, and easement layouts (without utilities shown) to help with this study.

3. **M&N Input:** Dave Hanbury represented M&N at this meeting a provided the following input:
    a. M&N was concerned about the force load that the FM could handle and whether they would be able to drive over the FM to handle maintenance for their gas line. FM pipe would be buried below ground and the SDR9 pipe would be strong enough for general loads.
    b. M&N piping holds a charge, any other metal in the area not rated to handle a charge would easily corrode. It was determined that due to HDPE being used as the FM pipe it wouln't be affected although valves and other apparatuses might.
    c. M&N also generalized as to the available space within their ROW. They would require a more specific layout showing where the FM would be placed in order to approve easement use.
    d. M&N offered the use of their GIS data and plans to help further this study.
    e. Areas where the FM crosses the other utilities would have accounted for.
4. **Next Steps/Actions**
    a. M&N and Unitil would provide GIS, property information, easement information at the request of Underwood Engineers.
    b. PSNH wished to hold another meeting to discuss this project and assist with more input from their colleagues.
    c. After the meeting Stratham, Exeter, and Underwood stayed back to discuss how to move forward. Stratham and Exeter wished to proceed with further study and move onto the next phase.
5. **Attachments**
    a. Agenda
    b. Work Plans

Fact Finding Meeting

Unitil, PSNH and M&N Operating Company

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Exeter and Stratham NH

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Russell Maille, PSNH
Lara Bailey, Spectra Energy for M&N Operating Company
Bob Kelly, Exeter Water/Sewer Advisory Committee
John Boisvert, Chair, Stratham, Public Works Commission
Keith Pratt, Underwood Engineers
Erik Nichols, Underwood Engineers

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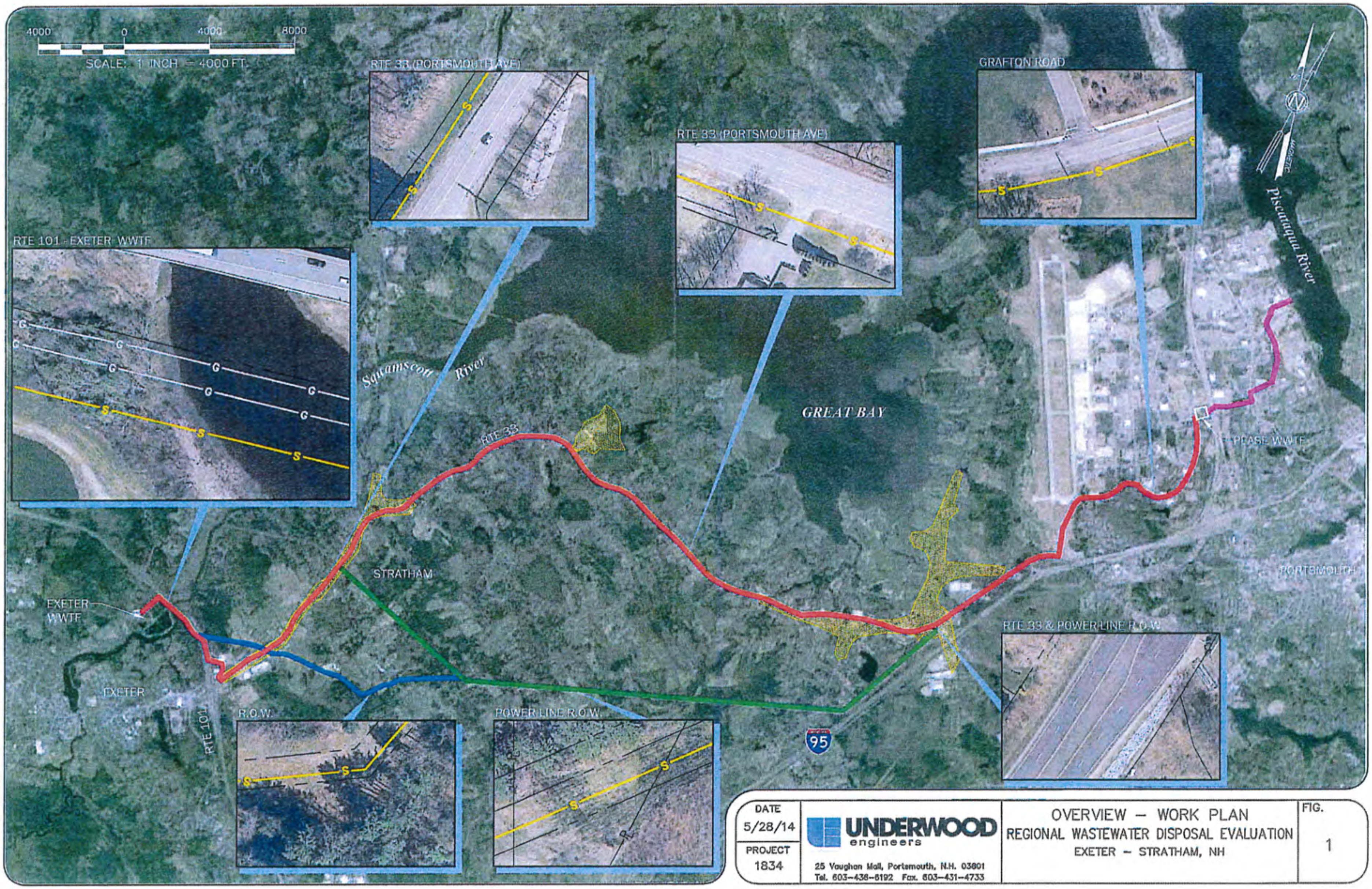

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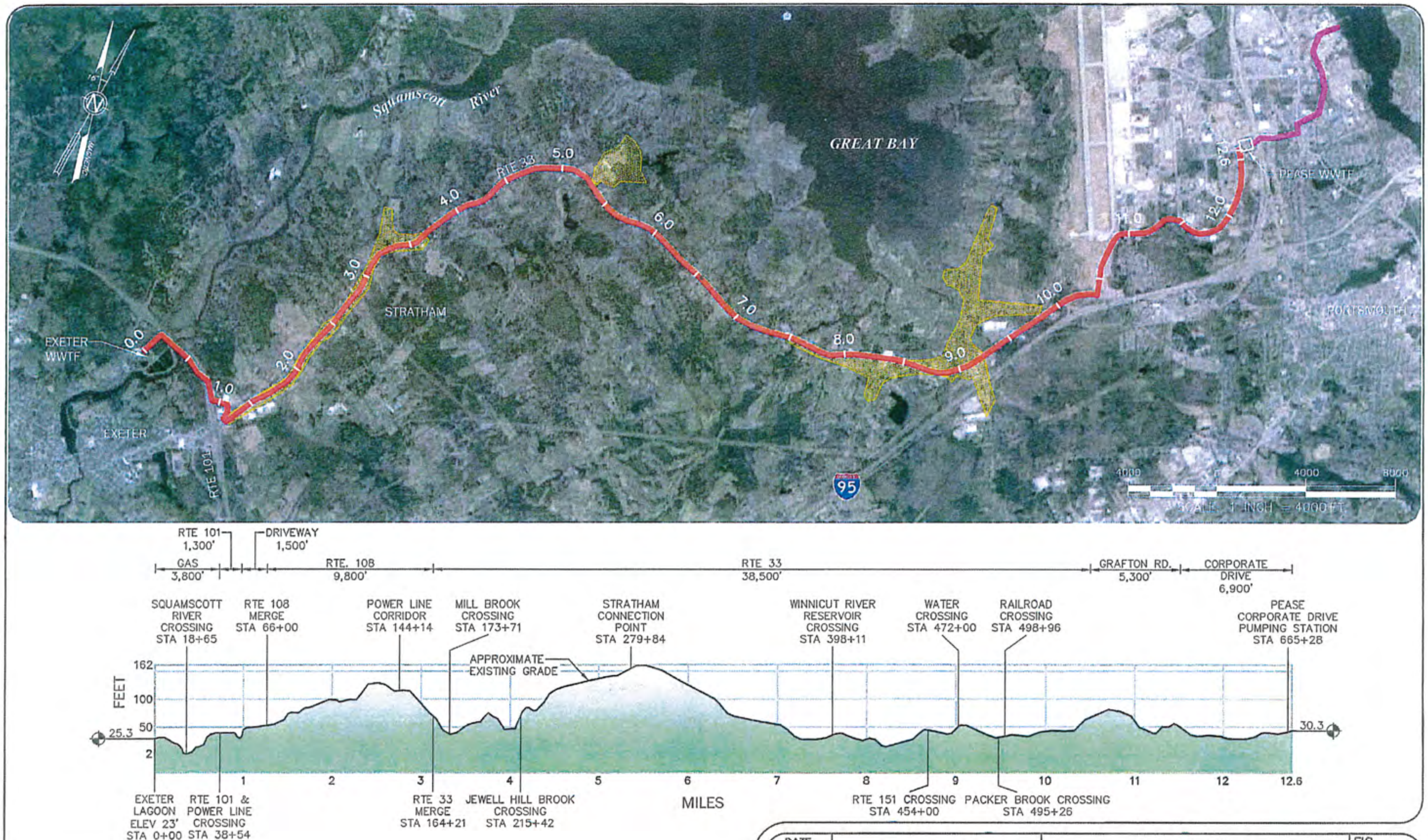

DATE		ALTERNATIVE 1	FIG.
5/28/14	UNDERWOOD engineers	REGIONAL WASTEWATER DISPOSAL EVALUATION	2
PROJECT	25 Vaughan Mall, Portsmouth, N.H. 03801	EXETER – STRATHAM, NH	
1834	Tel. 603-436-6192 Fax. 603-431-4733		

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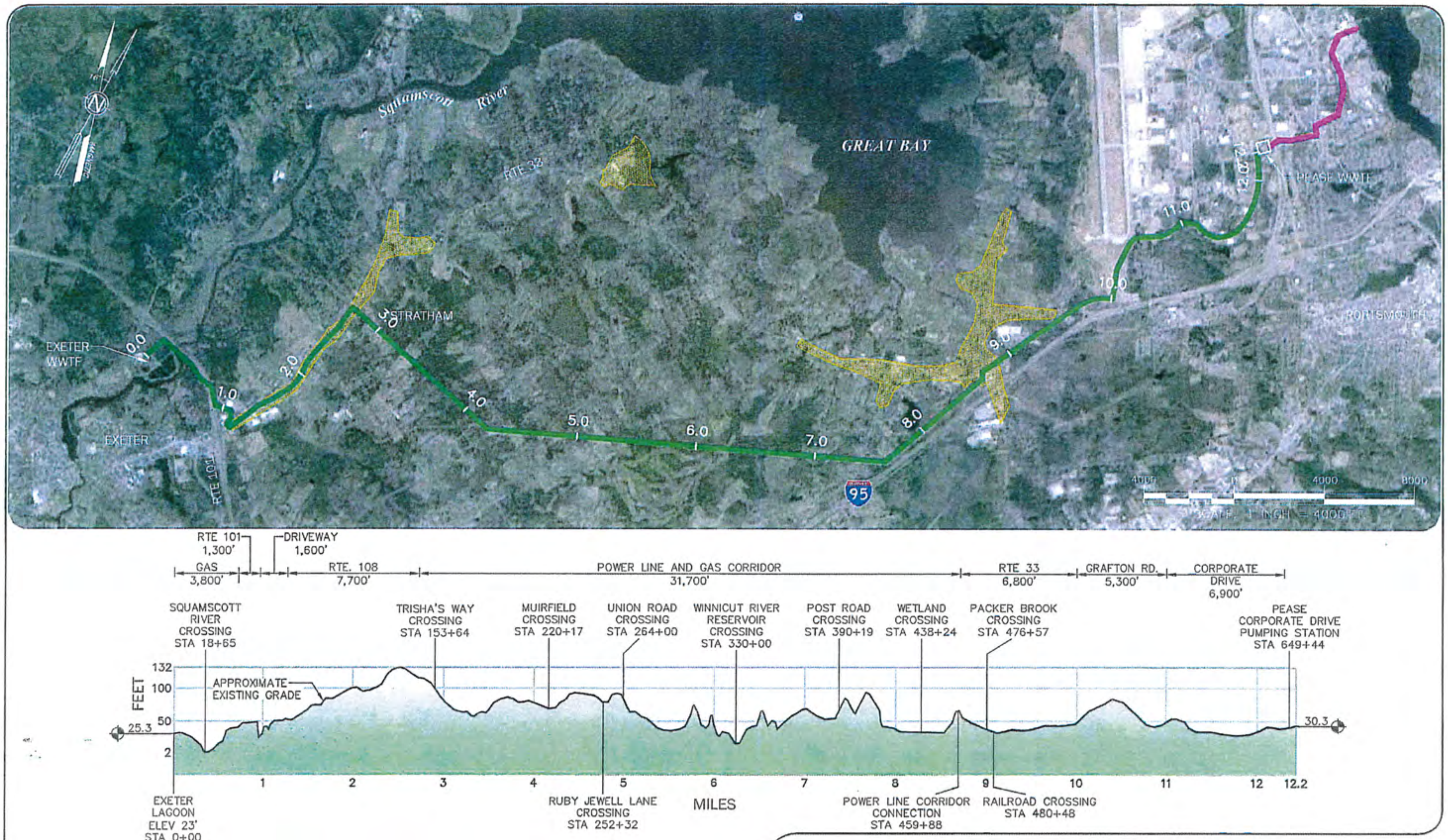

DATE		ALTERNATIVE 2	FIG.
5/28/14	UNDERWOOD engineers	REGIONAL WASTEWATER DISPOSAL EVALUATION	3
PROJECT	25 Vaughan Mall, Portsmouth, N.H. 03801	EXETER – STRATHAM, NH	
1834	Tel. 603-436-6192 Fax. 603-431-4733		

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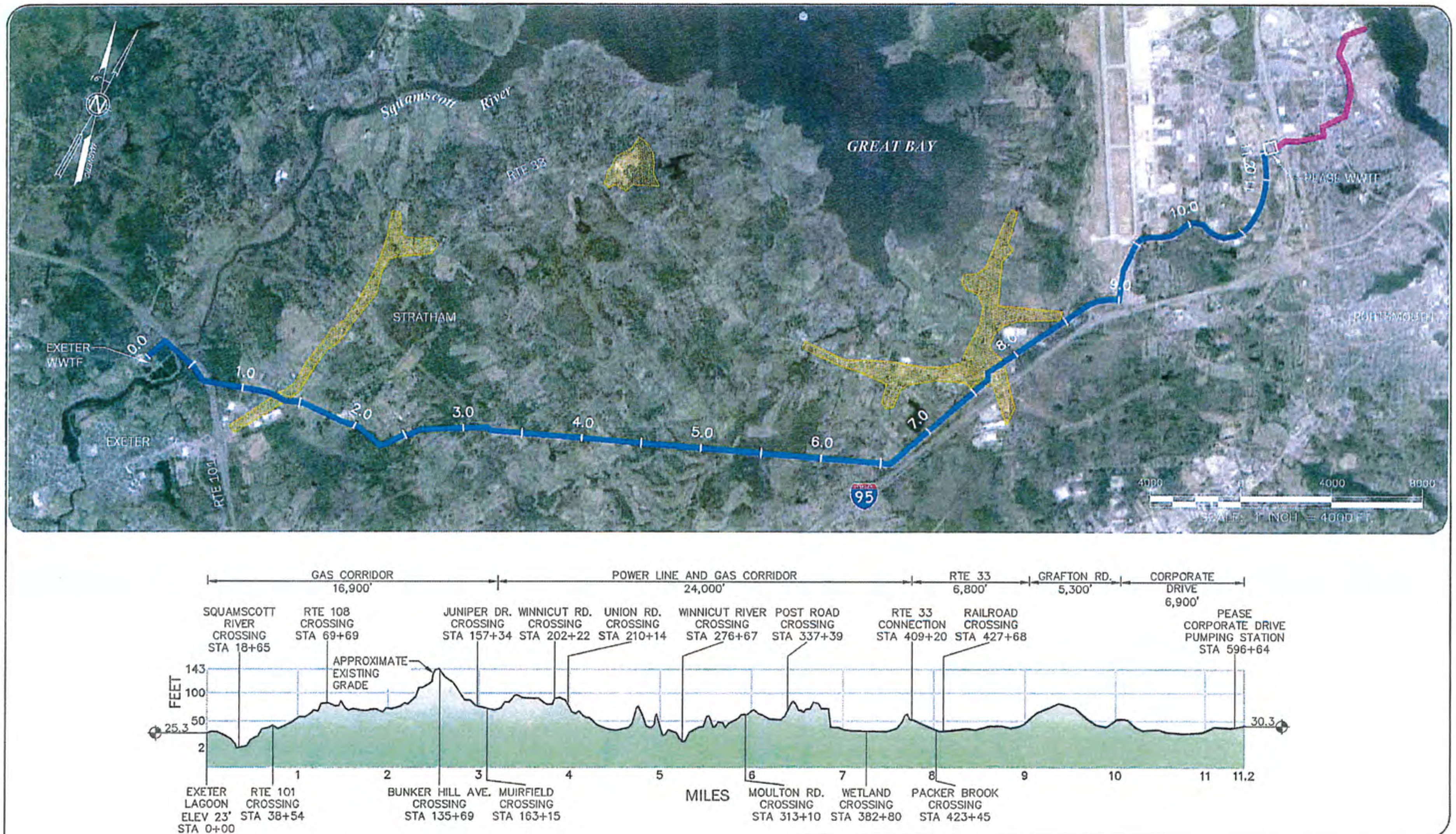


DATE	UNDERWOOD engineers	ALTERNATIVE 3	FIG.
5/28/14	25 Vaughan Mall, Portsmouth, N.H. 03801	REGIONAL WASTEWATER DISPOSAL EVALUATION	4
PROJECT 1834	Tel. 603-436-6192 Fax. 603-431-4733	EXETER – STRATHAM, NH	

Fact Finding Meeting Notes

PSNH Energy Park

Regional Wastewater Disposal Options
Exeter and Stratham NH

June 10, 2014

Attendance: Russell B. Maille, PSNH, Engineering Technician
James F. Mayo, PSNH, Civil Engineering Supervisor
Donald S. Di Buono III, PSNH, Supervisor- Civil Engineering
James J. Jiottis, PSNH, Manager
Eugenia N. Snyder, PSNH, Real Estate Agent
Keith Pratt, Underwood Engineers, President
Erik Nichols, Underwood Engineers, Project Engineer

1. **Overview**: After introductions were made, Keith Pratt thanked everyone for coming and Russell Maille for putting this meeting together. For those who did not attend the Unitil meeting on June 4th 2014, Keith described the following project:
   a. Underwood Engineers are pursuing a study to connect the Exeter WWTF with the Pease WWTF.
   b. There are currently three routes being considered by Underwood Engineers. Two of which involve the ROW of Unitil, PSNH, and M&N.
   c. The purpose of the meeting was to have Underwood Engineers, and PSNH come together and identify what opportunities and challenges there may be by locating a sewer force main in their existing easements.
2. **Topics Discussed**: The following information was discussed with PSNH over their ROW.
   a. PSNH ROW is roughly 265 feet wide.
   b. As stated in the Unitil meeting, the area in the southeastern portion of the ROW would possibly be available.
   c. All structures and pipe require H20 loading.
   d. Best location for the FM would be 10' away from the easement edge. Keith Pratt discussed how the FM would require a 30' (20' permanent, 10' temporary) easement for construction, maintenance, blowout structures etc. PSNH noted that outside angles require anchors for the towers/poles and these structures would need to be accommodated or PSNH would have to use different towers
   e. It was stated that 30' would come close to PSNH structures in certain spots. PSNH builds its structure 45' from the edge of the easement line. Part of that structure is 7' off center leaving 38' of space for a possible FM installation.

f. As in the Unitil meeting, Cathodic issues were discussed. The ground in the ROW holds a charge due to the utilities. Any metal install would be affected.

g. Some areas would most likely require additional easement space to be obtained in order to fit multiple utilities. As with Unitil, PSNH does not own the land, Land owners would have to be notified for permission to use the ROW. This would add to the budget. The use of PSNH ROW would also add to the budget due to its worth to PSNH.

h. PSNH has used land appraisals in the past, and would provide contact information to Underwood to help with determining costs in this study.

i. PSNH noted that no construction observer would be required from PSNH. However, all of Town's contractors must be OSHA certified.

j. PSNH noted that in addition to any acquisition costs the Town needs to pay to property owners, PSNH may charge an "assemblage premium" to recover some of their costs in creating the ROW.

k. A joint use agreement or lease will be required.

l. PSNH is currently evaluating new or expanded corridors in the area so they recognize the benefit of working with the Town's to accommodate a sewer force main.

3. Next Steps/Actions

a. PSNH would provide plans, appraisal information, and assistance with a formal letter from Underwood Engineers. (Underwood Engineers sent a letter to PSNH on June 14, 2014)

4. Attachments

a. Meeting Agenda

b. Work Plans

Fact Finding Meeting

PSNH Energy Park

Regional Wastewater Disposal Options
Exeter and Stratham NH

June 10, 2014

1. **Purpose of today's meeting:**
   a. Fact Finding
   b. Identify opportunities and challenges to locate a sewer force main in existing PSNH utility easements.

2. **Background:**
   a. Exeter is currently under an EPA Administrative Order by Consent to design and construct a new WWTF to meet new regulatory discharge limits
   b. Stratham desires to provide municipal wastewater service in their commercial and gateway districts (Route 108)
   c. The Towns of Stratham and Exeter desired to cooperatively evaluate regional wastewater disposal options.
   d. Underwood Engineers (UE) is under contract with both Towns to investigate the technical feasibility and costs associated with regional options.

3. **Goals and Objectives:**
   a. Identify the technical feasibility of a joint wastewater collection system to convey wastewater from Exeter and Stratham to the City of Portsmouth Pease WWTF.
      i. Conveyance system (force main, wastewater pumping, screening, odor control, screening, piping, metering, etc.) for the interceptor
      ii. Easements (ROW)
      iii. Permitting – Regulatory Issues/Talking Points Only
   b. Compare the opinion of costs (and pros/cons) of this regional option to previously identified solutions. Costs shall consider capital and long-term O&M (i.e., present worth).

4. **Previous Reports** – Referenced Reports include the following:
   a. Wastewater Management Concept Plan (WP, March 2011)

b. Exeter-Stratham Intermunicipal Water and Wastewater System Evaluation Study (Kleinfelder, December 2012)
c. Sewer Extension Study Town of Greenland (Tighe and Bond, July 2012)
d. Pending 201 Facility Plan Update Exeter (Wright Pierce, ongoing)
e. 201 Facilities Plan Update Portsmouth (UE, June 30, 1999)
f. NPDES Permit Modification – Outfall Improvements Pease (UE, May 1997)
g. Wastewater Master Plan and LTCP Update Portsmouth (B-C, November 2010)

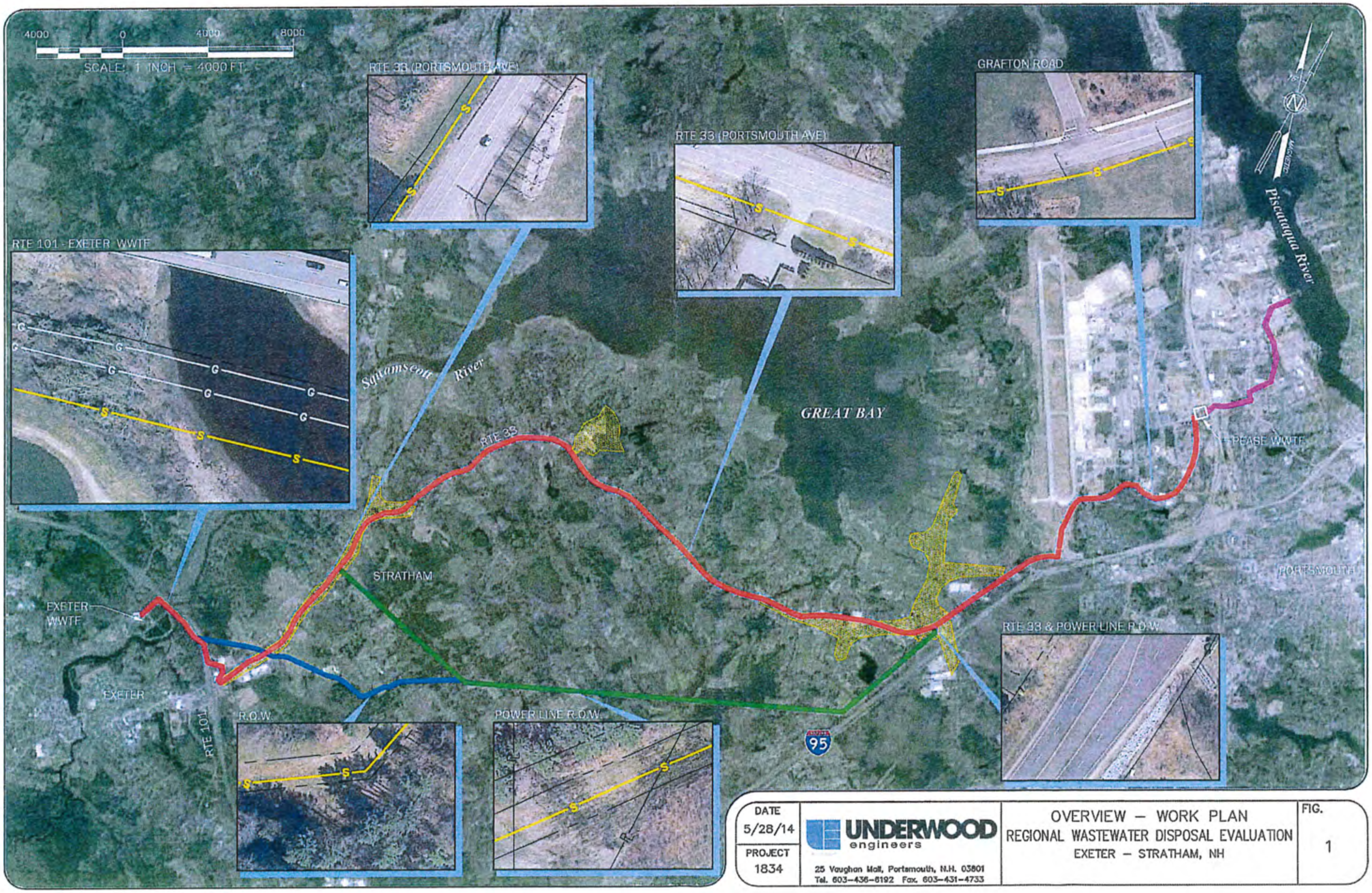
5. **Basis of Design** - Design Flows (hydraulics only)
   a. Summary of flows (ADF) – Buildout
      i. Stratham – 675,000 gpd
      ii. Exeter – 3,000,000 gpd
      iii. TOTAL = 3,675,000 gpd
      iv. Greenland would add 339,600 gpd (probable separate connection)
   b. Interceptor
      i. 20" HDPE (SDR 9/SDR 11):
      ii. One pumping station at Exeter WWTF site
      iii. Construction:
         1. Open cut – 5 to 6 feet deep
         2. Directional drill at significant crossings (wetlands, rivers, streams, highways).
   c. Appurtenances – access is needed
      i. Air relief structures at high points
      ii. Cleanout/blow-off structures at every mile (+/-)
      iii.

6. **Routing Options**

	Alternative #1	Alternative #2	Alternative #3
	12.7 miles	12.3 miles	11.3 miles
Exeter WWTF			
Gas line corridor	3,800	3,800	16,900
Route 101	1,300	1,300	0
Private Drive	1,500	1,600	0
Route 108	9,800	7,700	0
PSNH/Gas	0	31,700	24,000
Route 33	38,500	6,800	6,800
Grafton road	5,300	5,300	5,300
Corporate Drive	6,900	6,900	6,900
Pease WWTF			

7. **Schedule and Next Steps**
    d. Engineering Report
        i. UE Regional Evaluation report - July 2014
        ii. Exeter Facility Plan – Fall 2014 (+/-)
        iii. Selected solution operational – 3 to 4 years

8. **Discussion and Q&A**



DATE 5/28/14	UNDERWOOD engineers	OVERVIEW – WORK PLAN	FIG.
PROJECT 1834	25 Vaughan Mall, Portsmouth, N.H. 03801 Tel. 603-436-6192 Fax. 603-431-4733	REGIONAL WASTEWATER DISPOSAL EVALUATION EXETER – STRATHAM, NH	1

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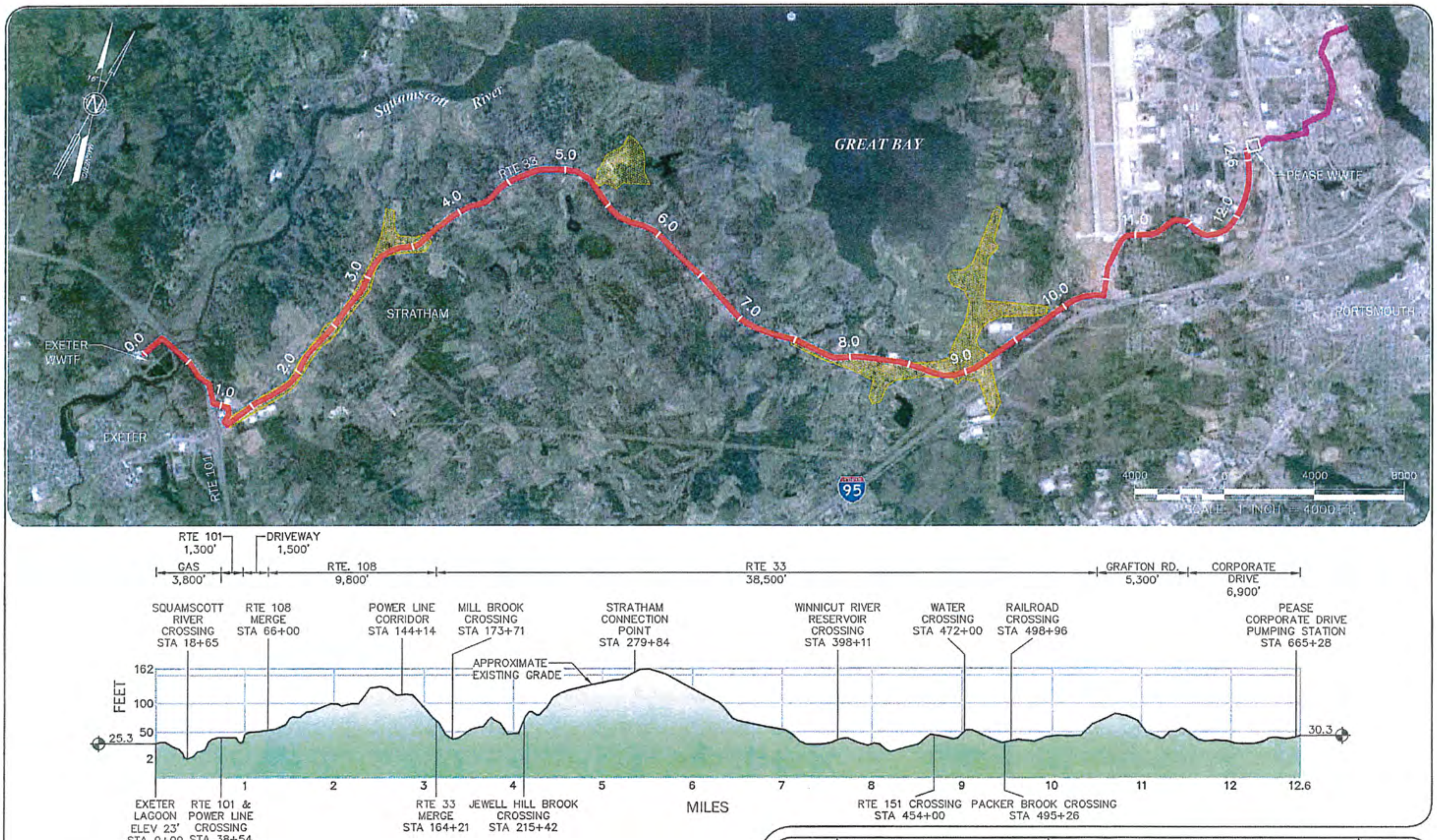

DATE	UNDERWOOD engineers	ALTERNATIVE 1	FIG.
5/28/14	25 Vaughan Mall, Portsmouth, N.H. 03801 Tel. 603-436-6192 Fax. 603-431-4733	REGIONAL WASTEWATER DISPOSAL EVALUATION EXETER – STRATHAM, NH	2
PROJECT 1834			

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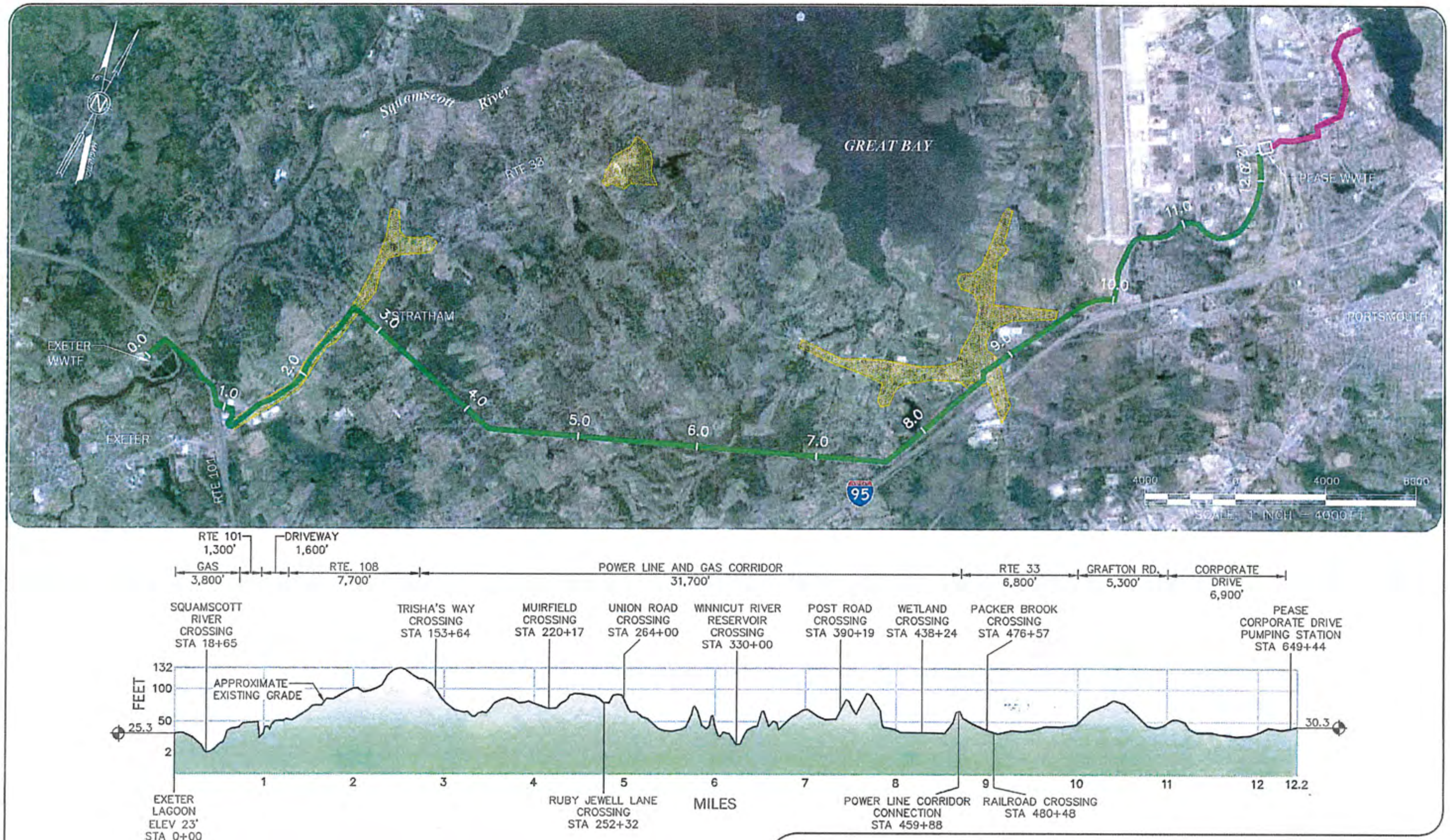
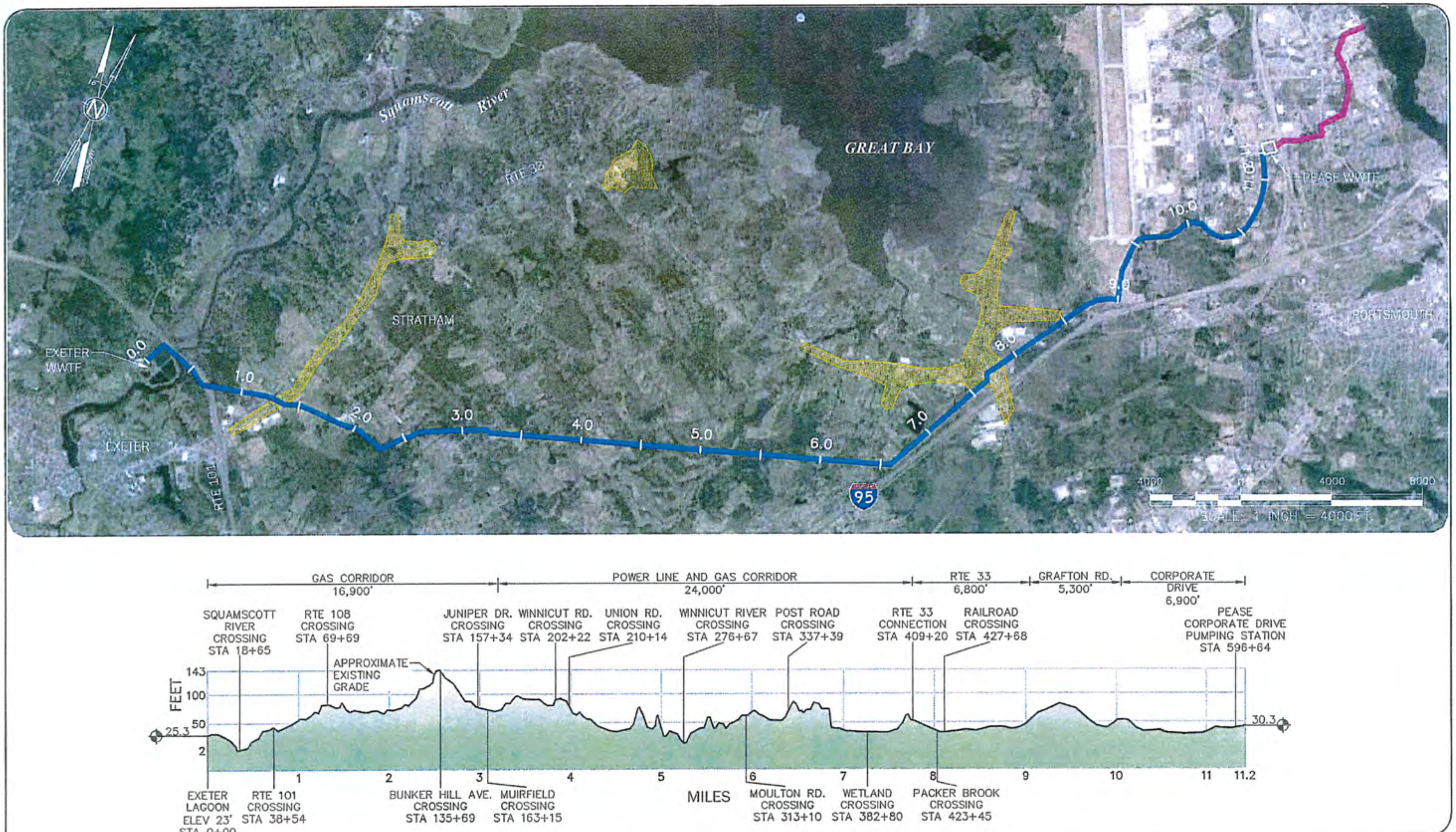


DATE	UNDERWOOD engineers	ALTERNATIVE 2	FIG.
5/28/14	25 Vaughan Mall, Portsmouth, N.H. 03801	REGIONAL WASTEWATER DISPOSAL EVALUATION	3
PROJECT 1834	Tel. 603-436-6192 Fax. 603-431-4733	EXETER – STRATHAM, NH	



DATE	UNDERWOOD engineers	ALTERNATIVE 3	FIG.
5/28/14	25 Vaughan Mall, Portsmouth, N.H. 03801	REGIONAL WASTEWATER DISPOSAL EVALUATION	4
PROJECT 1834	Tel. 603-436-6192 Fax. 603-431-4733	EXETER – STRATHAM, NH	

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Appendix C: Case Studies

Case Studies
1834 Regional Wastewater Disposal
HDPE Case Study Examples
June 24, 2014

Underwood Engineers is in the planning phase of a 13 mile long FM sewer line connecting the WWTFs of Exeter and Portsmouth. This project is focusing on using 20" HDPE SDR9 piping with a mixture of open trench and HDD installation. In order to ascertain the viability of a long distance FM sewer line using HDPE piping, the following suppliers were contacted and provided examples of similar projects.

1. **Scott E. Lindsay, Director-Global EPC Sales, ISCO Industries:** Mr. Lindsay provided examples of both water a wastewater uses for HDPE piping.
    a. **HDPE Pipe to bring water to San Antonio, TX**: HDPE piping was used to connect San Antonio to an aquifer over 50 miles away. Approximately 13 million gallons of water per day would be transported through the pipeline. A total length of 122,149 feet of various sized piping including 24" SDR9 was used.
    b. **Wichita Falls, Texas Water Reuse Pipeline:** Approximately 12 miles of 32" HDPE pipeline was installed connecting two Wastewater Treatment Facilities in Wichita Falls, Texas. This pipeline was installed in less than 4 months and traveled through drainage channels right of ways, and ditches from one end of the city to the other.
    c. **Dalton, Georgia Wastewater Distribution System:** Approximately 65 miles of the towns land application piping (LAS) network was replaced with HPDE piping to upgrade Dalton's wastewater distribution system. Various sizes were installed throughout this project including 8-16 inch gravity mains.

Along with these examples, Scott Lindsay provided links to the ISCO website with further examples and case studies.

2. **Casey Cords and Erica Howard, Performance Pipe:** After speaking with Erica Howard at length about our project, she placed me in contact with Casey Cords, North East Sales Representative for Performance Pipe. Casey provided the following information as well as contact information with Plastics Pipe Institute (PPI):
    a. **Wastewater Replacement Project Uses HDPE Pipe to Protect Natural Resources:** This project in Fairfield, ID replaced older PVC piping with HDPE 4 to 12 inch SDR17 and 21 piping.

More examples and case studies similar to our project are being looked into by Performance Pipe. The following link was provided by Casey Cords to the PPI website containing more case studies with HDPE pipe.

http://plasticpipe.org/municipal_pipe/index.html

HDPE Pipe Used to Bring Water to San Antonio, TX

San Antonio, Texas

Overview

This project provides a long-term solution for San Antonio, Texas, one of the fastest-growing cities in the United States. San Antonio currently obtains more than 90 percent of its water from the Edwards Aquifer. This project diversifies its water sources. San Antonio Water Systems (SAWS) is tapping into the Carrizo Aquifer, located approximately 50 miles from San Antonio in Gonzales County. SAWS is using more than 122,000 feet of HDPE to bring the water from the aquifer to an integration point where the water will enter the SAWS distribution system. There are 10 wells drilled 1,500-2,000 feet deep into the Carrizo Aquifer. The water and soils are highly corrosive and have an average temperature of 98° F.

Problem

With the increased population comes the need for an increased water supply. There is no shortage in water in the state of Texas; it's just not in the right places. SAWS needed to tap into the Carrizo Aquifer approximately 50 miles away and bring that water to them. ISCO Industries helped them solve this problem.

Solution

The remote location of the project in relation to the rest of the SAWS infrastructure dictated the use of a low-maintenance material, hence HDPE and stainless steel materials were chosen. SAWS liked the ability to field bend the pipe, saving money not having to purchase elbows. The durability of HDPE allowed it to curve and maneuver around trees and obstructions, causing minimal environmental disturbance. Also, the ability to fuse pipe above ground in long lengths ahead of the installation crew allowed for lower overall cost and less work in the ditch, therefore making it safer.

Quality control was a huge concern for SAWS. ISCO was able to provide highly trained and qualified field fusion technicians to fuse pipe on site.

ISCO representative viewing a string of 24-inch DR 9 pipe on the SAWS project

ISCO provided all the proper material certifications from the pipe manufacturer Performance Pipe, including the traceability of resin, McElroy DataLogger™ use and in-field tensile testing. This was a huge issue for SAWS and would have been very costly with coated steel pipe. HDPE proved to be a leak-free, corrosion-free pipe material, with no cathodic protection required, leading to lower maintenance costs. SAWS especially liked the environmentally friendly nature of HDPE in general.

Conclusions

Initially this project was specified for steel pipe and ductile iron. Working diligently, ISCO Industries offered an alternate solution to SAWS to use HDPE for this project. ISCO provided a detailed analysis showing that HDPE is more cost effective, mostly due to the 50- to 100-year lifespan. Also, due to the corrosive nature of the groundwater, HDPE was determined to be a better choice. Once completed, this project is estimated to provide water to 60,000 households.

Project Facts

(From SAWS.org):

- The Regional Carrizo Project will assist in diversifying San Antonio's water supply, reducing dependence on existing Edwards Aquifer supplies.
- The project will provide water to help meet San Antonio's short- and mid-term water needs.
- Up to 13 million gallons per day (mgd) of water produced from this well field will be transported by pipeline to an integration point in northeast San Antonio where it will enter the SAWS distribution system.

ISCO provided approximately 328 truckloads of HDPE pipe, totaling more than 11 million pounds. The total length was 122,149 feet in various sizes. ISCO provided various McElroy machines, including 1648s, 1236s, Poly Horses and DataLoggers ™.

Quality control was a top priority for SAWS and ISCO. An ISCO field fusion technician logs information using a McElroy DataLogger™. The pipe is 24-inch DR 9.

Staging of the pipe was imperative in a project as large as this one. Although this only shows a small portion of the pipe used, the ISCO team was highly organized to move large quantities of pipe as efficiently as possible.

FIELD REPORT

Wichita Falls, Texas builds emergency HDPE water reuse pipeline

ISCO
INDUSTRIES
Coming through.

Access to water in the United States is often seen not as a privilege, but as a right. One of the inalienable few – alongside life, liberty and the pursuit of happiness.

But water is increasingly hard to come by, especially in Texas. More than 83 percent of the state was in severe (D-3) to exceptional (D-5) drought conditions in 2012, and the city of Wichita Falls in particular has lost 70 percent of their water supply in the past two years.

"It's just disastrous," said Kerry Maroney, a civil engineer with Biggs & Mathews, Inc. and a consulting engineer for the city. "In the past 114 years, we've never had two consecutive years of less than 20-inches of rainfall a year. It is unprecedented."

DROUGHT DISASTER

Some states worry about sudden tornados appearing with little warning or powerful hurricanes and flash flooding. In Texas, and much of the arid Western United States, drought emergencies may be less volatile. But they can still be disastrous.

In 2011, there were more than 100 consecutive days with over 100 degree temperatures and no rain.

The combined capacity of the city's water supply, Lakes Arrowhead and Kickapoo, has dropped 25 percent in the last nine months. The city is not only rapidly losing its ability to provide water to its citizens and industries, but it is losing its ability to supply wholesale water to surrounding municipalities and utilities that are experiencing similar drought conditions.

That's more than 140,000 people affected by the city's drought conditions.

Residents are restricted to "domestic only use," which includes necessities like drinking water. All outdoor watering and irrigation is banned, and the surcharge on excess domestic water use tripled. The city has issued 2,360 tickets for water violations this year.

"The citizens of Wichita Falls are doing a superior job of conservation – without that we'd be running through 23 million gallons a day and now, on good days, we're using half that," Maroney said. "But we can't conserve our way out of this."

Wichita Falls first declared stage one drought conditions in September 2011, which only restricted the city's parks department to twice-weekly watering and initiated a public information campaign to educate residents on water conservation. The situation progressed from there to stage three in February 2013 when the lake levels fell to 40 percent. Then a short nine months later the city declared a stage four drought disaster.

There was no question the city needed to find another way to source water. So they started looking for an answer that didn't come from the clouds.

"The bottom line is, we got to a point where we needed to take immediate action," said Shawn Garcia, an engineer with Wichita Falls' Public Works Department.

CUSTOMER
Bowles Construction (Wichita Falls, Texas)

LOCATION
Wichita Falls, Texas

PROBLEM
Stage Four Drought. The city of Wichita Falls lost 70 percent of its water supply in the past two years.

SOLUTION
A 32-inch, 12-mile HDPE water reuse pipeline laid and fused in less than four months

"The rate at which ISCO delivered the HDPE pipe and fused the pipeline together, while maintaining quality, surpassed my expectations."

- Kerry Maroney, Engineer
Biggs & Matthews Inc.

ISCO INDUSTRIES

926 Baxter Avenue
P.O. Box 4545
Louisville, KY 40204
800-345-ISCO (4726)

A SOLUTION FROM AN UNLIKELY SOURCE

After researching their options, the city came up with an unusual solution – a direct potable water reuse (DPR) project. With water levels dropping and no rain in sight, it was a project that needed to be done, and done quickly.

Wichita Falls-based Bowles Construction, the contractor for the water reuse project, hired ISCO Industries to provide a turn-key solution using high-density polyethylene pipe (HDPE).

"ISCO provided Bowles Construction with the full force of our expertise and quality assurance, to ensure this project was completed quickly and ensure the city it was done correctly," said Steve Garber, ISCO Regional Sales Manager.

The water reuse project will take purified water, created from the 7 to 10 million gallons of treated wastewater that is normally released into the Wichita River every day, and send it through a 12-mile HDPE pipeline constructed by ISCO Industries to the Cypress Water Treatment Plant. It will then go through extensive filtration, reverse osmosis, and clarification, and be mixed with raw surface water. The 50/50 mixture will go through another treatment process and finally be supplied to the public.

Bowles helped city officials develop the project and determine the route for the pipeline, and oversaw the project to make sure things ran smoothly and were completed on time.

"We knew we had to find water somehow, this drought is affecting everybody," said Andy Bowles. "We are a regular utility contractor for the city and we were happy to bring our knowledge and experience to bear on this situation."

After reviewing both HDPE and fusible PVC pipe for the pipeline, HDPE was the clear choice for the terrain, the variable weather conditions, the flexibility of HDPE material, and the durability of the fusion process.

Two weeks after the contract was signed, ISCO delivered the first truckload of pipe. Two days later, ISCO's field technicians began fusing the pipe using one McElroy T-900 fusion machine and three McElroy 1236 units.

"We have no groundwater source, we continue to see the lakes go down, and we can't jump out there and build a lake,"

Maroney said. "This project is the quickest way to pick up another seven to eight million gallons a day.

"This was an emergency solution, and the rate at which ISCO delivered the HDPE pipe and fused the pipeline together, while maintaining quality, surpassed my expectations."

About 80 percent of the total withdrawals in the United States are from surface water resources, and the U.S. population generates an estimated 32 billion gallons per day of municipal wastewater.

According the 2012 EPA Guidelines for Water Reuse, arid regions like Texas are natural candidates for water reclamation and significant projects, like the Wichita Falls water reuse project, are already underway throughout much of the region.

For Wichita Falls, the temporary reuse project will supply 40 to 50 percent of the water supply.

In less than four months, ISCO supplied 65,000 feet of 32-inch HDPE pipe. The temporary pipeline travels from a wastewater treatment plant on the east side of the city through drainage channels, right-of-ways, and ditches to the newly-constructed Cypress Water Treatment Plant on the city's west side. The city will reuse the pipe for a permanent water reuse project to be completed within the next four to five years.

"ISCO's breadth of resources allows us to be responsive in time-sensitive situations," said Vince Tyra, ISCO President. "We were able to put manpower and machines from a half dozen states on site quickly and finish the reuse project significantly under deadline without sacrificing quality."

"There is a lot at stake for Wichita Falls and you want to do all you can to help solve the problem."

DALTON GA

HDPE Pipe Serves Many Needs in Georgia Town

(Dalton, Georgia) Located in Whitfield County, between Atlanta and Chattanooga in Northwest Georgia, the city of Dalton is not to be outdone by its larger neighbors. For years, Dalton Utilities has capitalized on the many advantages of high-density polyethylene pipe (HDPE) as an integral component of its gas distribution system. More recently, HDPE pipe has been the primary component in maintaining and upgrading existing potable and wastewater systems.

Dalton Utilities serves the needs of their community with carefully planned growth strategies, and HDPE pipe. It offers construction advantages and economic benefits that cannot be achieved with other pipe materials.

Dalton Utilities treated wastewater is distributed through a land application piping (LAS) network. For years, the original aluminum piping system had been a source of repeated maintenance headaches. Steve Bratton, supervisor of Dalton Utilities - Gas, Water & Wastewater, explained that corrosion and leakage at the joints of the 20-foot pipe segments kept crews tied up and caused system inefficiencies that the utility could no longer tolerate.

Bob Seaton, VP of Business Alliances, and Millard Etling, VP of Engineering, sought to provide a remedy to the problem. Mr. Seaton appreciated the performance polyethylene pipe in Dalton's gas distribution system, and the trenchless construction and pipe rehabilitation applications for polyethylene were decided advantages. Mr. Etling, who had utilized HDPE in his previous experiences at Dow Chemical, appreciated the joint-free advantages of HDPE pipe. It was determined that HDPE pipe was the best product for Dalton Utilities' needs.

Replacement of the aluminum (LAS) piping system was completed one year ahead of schedule. Sixty-five miles of 4-inch and 6-inch HDPE pipe form the primary arteries of the system. Reynolds Construction sustained an ambitious construction schedule in completing system. On a typical day they installed over 11,000-feet of the pipe. Discharge from the LAS emits from 27,000 sprinkler heads set atop HDPE risers. The system serves to promote the growth of a 9,200-acre harvest timber forest. Wildlife such as deer, turkey and fox flourish in the area.

Satisfaction bred from familiarity has since led Dalton to employ HDPE as the primary pipe material for its potable and wastewater system expansions and potable waterline and sewer rehabilitation work. Among a series of water system expansion projects are the Westside Water Expansion and the Murray County Expansion. These projects combined account for over 600,000-feet of 4-inch - 8-inch HDPE pipe. Poor quality well water provides the motivation for the projects. And Dalton Utilities, pleased with its growing range of experiences with HDPE, specified the product for the mains and service connections. Overall, the projects are part of a four-year plan. The Murray County job is an excellent example of the advantages of HDPE. Large diameter coils of high-density polyethylene pipe have allowed contractors, M&M Construction, and its sub, Ellis Construction, to achieve over 70% completion of the project in less than 1/3 the allotted 270 days.

The Westside project is also progressing rapidly. Potable waterline rehabilitation projects include replacement of hundreds of 2 ¼-inch cast iron and 2-inch galvanized steel pipelines.

More than 40,000-feet of existing 4-inch and 6-inch mains are also being replaced. All of these projects will enhance Dalton Utilities' service to its existing customer base, and provide clean, safe drinking water to almost 2000 new homes. Future projects promise service to thousands more customers.

As aging clay and iron pipes deteriorated, the wastewater collection systems also needed upgrading. Video inspections indicated serious infiltration into the Dalton treatment system. This problem was not limited to a piping concern, but threatened to overburden the wastewater treatment plants with groundwater infiltration. Enhanced by directional drilling and other trenchless construction methods, Dalton Utilities is renewing its sewage collection system. More than 20,000-feet of 8-inch - 16-inch gravity mains are being replaced.

Pipe bursting technology is enabling Dalton to upgrade some mains from 10-inch to 16-inch lines. Directional drilling and pipe bursting have reduced the costs and inconvenience typical of such dramatic infrastructure improvements. Joint less leak-free, HDPE pipe eliminates infiltration and consequently saves the utility millions in wastewater treatment plant expansions.

The leak-free aspect of HDPE is so appreciated that Dalton Utilities is urging the use of the product up to and including the sewer service connections to new homes.

Dalton Utilities sets high standards for the service it provides to its customers. By enlisting HDPE pipe for this wide variety of applications, they are achieving their goal of providing superior service while exercising acute economic judgment.

READ MORE (../../../workspace/uploads/dalton ga.pdf)

NEWSROOM

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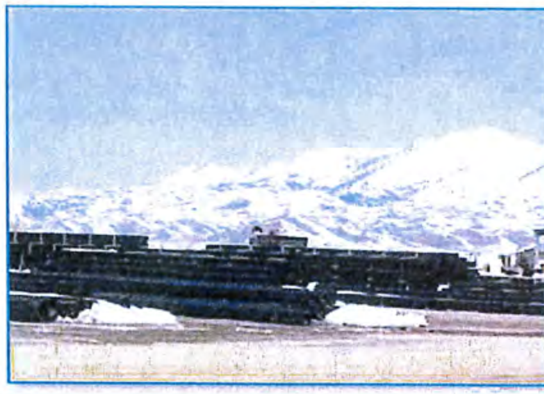
DRISCOPLEX

Wastewater Replacement Project Uses HDPE Pipe to Protect Natural Resources

The Project: Fairfield, ID is known for its abundance of outdoor recreational activities and beautiful snowcapped mountains. So when studies uncovered that old, cracking wastewater pipe was leaking raw sewage into the area's pristine lakes and streams, city leaders immediately took action. Studies showed that Fairfield's aging infrastructure was incapable of supporting new growth, making it impossible to issue new wastewater connections and essentially halting any new development. Armed with a grant and low-interest loan from the USDA and Idaho Department of Commerce, the city of Fairfield chose to replace its entire wastewater system.



The Specifications: In 1964, Fairfield installed concrete pipe; however the pipe's tendency to develop cracks and holes was exacerbated by Fairfield's extreme cold and icy winters. In the mid-1980's, Fairfield replaced the concrete with PVC pipe which should have lasted up to 50 years. Unfortunately the poorly installed PVC pipe began to crack. In an effort to find a long-term solution, the city of Fairfield elected to use Performance Pipe's HDPE pipe for its flexibility and leak-free reliability, and ease of use in trenchless installation. "We wanted a fused pipe system free of joints without infiltration or exfiltration to reduce the possibility of Willow tree root intrusion which has been a big problem," said J.L. Staley, Public Works Superintendent, City of Fairfield, ID.

The Solution: Performance Pipe manufactured 4-, 6-, 8-, 10-, and 12-inch DR 17 and DR 21 for the main sewer lines. Trenchless pipe bursting was selected as the method of repair. "For trenchless applications, HDPE pipe is the material of choice. I wouldn't use anything else," said Brian Jones, Technician for Titan Technologies, a contracting firm in Boise, ID.

The Benefits: HDPE pipe provided the City of Fairfield with both financial and environmental benefits. "Utilizing trenchless pipe bursting instead of traditional open cut methods saved the city at least $1.5MM," explained Scott Marolf, Fairfield City Councilman. "This project will save the community untold future dollars from infiltration problems and will protect the environment from the release of raw untreated sewage," said Terry Lee, Fairfield City Councilman.

AWWA MEMBER

NSF

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Rely on Us!

Performance Pipe, a division of Chevron Phillips Chemical Company LP
5085 W. Park Blvd, Suite 500 | Plano, TX 75093 | 800.527.0662 | fax 972.599.7348

Kansas Town Gets State-of-the Art Water System with DriscoPlex™ by Performance Pipe div. Chevron Phillips Chemical Company LP

High-Density Polyethylene Pipe Unmatched in Flexibility and Resilience

It's not every day that an entire town gets a brand new water system. But in Maize, KS, that's exactly what happened.

The small wheat belt town, founded in 1886, is located less than two miles outside of Wichita. With a population of only 2,000, Maize is a friendly place where people know their neighbors and take pride in their community. For many residents, life there was idyllic – except for the water.

Maize was stifled in its growth potential because it lacked a public water system, said City Administrator Carol Bloodworth. "The entire town relied on private well water, which prevented a lot of businesses from moving into the area."

The project called for 97,000 feet of distribution lines, 108 fire hydrant assemblies, 804 service connections (not including schools) and more than 400 operating gate valves

What's more, the well water was a health concern. "It had high nitrate levels," Bloodworth said, which can be particularly harmful to children, pregnant women and the elderly.

Compounding the problem was the fact that the city's population triples each day during the school year. The Maize school system educates approximately 6,000 students – many of whom come from nearby Wichita, a portion of which is in the Maize school district.

The City of Maize realized something had to be done not only to improve the water quality but also to modernize the entire water system. It turned to George Butler Associates, a Lenexa, KS, engineering and architecture firm, and CAS Construction, a Topeka, KS, general contractor, for help.

Numerous Challenges

According to Bill Carter, vice president at George Butler Associates, the project presented some unusual challenges. "The biggest hurdle was servicing a city that had all its utilities in place," he said.

Jesse Wright, CAS Construction project superintendent, agreed. "In most situations, you're just adding a subdivision to the water system. This project was on a much larger scale."

Another challenge was providing the service with as little disturbance to the public as possible. "We had to work in ways that kept disruption to residents and businesses to a minimum," said Carter.

That wasn't easy, Bloodworth joked. "When you're retrofitting pipe, it's an equal opportunity project. We cut up everyone's yard."

The $5.3 million dollar job began in January 2002. It called for 97,000 feet of distribution lines, 108 fire hydrant assemblies, 804 service connections (not including schools) and more than 400 operating gate valves as well as a 500,000-gallon elevated storage tank and two deep wells.

The bulk of the work was performed using horizontal directional drilling, in which a surface-mounted drill rig with tracking and steering capabilities launches and places a drill string at a shallow angle to the surface.

Although this drilling method is more expensive than conventional open trenching, it was the best alternative for the Maize project, said Wright. "Conventional open trenching would have destroyed property, making the cost of restoration astronomical and adding another eight or nine months to the job."

What's more, he said, ripped-up lawns, driveways and streets would have created a public relations nightmare for the city. "With directional drilling, people could continue with their daily activities without a lot of disturbance."

DriscoPlex™ Ideal for Job

However, directional drilling does limit the type of pipe that can be used on a project. "You can't use standard PVC split-joint connections," said Carter. "They aren't designed for applications like this.

Carter specified high-density polyethylene pipe (HDPE) for the job, and CAS Construction then selected DriscoPlex™ manufactured by Performance Pipe division of Chevron Phillips Chemical Company LP and supplied by Industrial Sales Company, Inc.

The pipe was delivered to the job site in 50-foot lengths. Duling Construction Company, subcontractor on the project, then fused it together and put it into place.

DriscoPlex™ has an unsurpassed record of outstanding performance in municipal water systems and is preferred for water distribution due to its long-term strength, resilience, flexibility and impact-resistance. It also requires fewer fittings. "It can be cold-bent in the field to follow contours and and easements," Wright said. What's more, DriscoPlex™ can withstand corrosive chemicals and is resistant to both ultraviolet and thermal degradation. "The fuse joints are stronger than the pipe itself," said Wright.

"The fuse joints are stronger than the pipe itself," said Wright.

DriscoPlex™ also has an extremely long life expectancy, thus reducing – or eliminating – maintenance costs. And, in many instances, high-density polyethylene pipe is more cost effective than its steel casing counterparts. Wright noted a highway crossing where he used DriscoPlex™ as casing pipe to save money. "I got approval from the state to use 14-inch HDPE instead of steel casing," he explained. "We made a 780-foot bore, and to complete that using conventional steel casing would have cost a fortune. HDPE is less expensive and just as good."

Minimal Disruption to Schools

The pipe was delivered to the job site in 50-foot lengths. Duling Construction Company, subcontractor on the project, then fused it together and put it into place.

According to Ron Duling, general superintendent, the job crew laid about 1,000 feet of pipe each week. Most bores, which were approximately 500 feet long and at least 42 inches deep, took more than a day to complete.

Duling fabricated unique custom rollers to keep the pipe off the ground in areas where it might have been damaged during pull-back. In some cases, the company even attached the rollers to front loaders and elevated the pipe high enough for a school bus to drive beneath it.

Workers tackled the majority of north-to-south installations during the school year, because bus routes run in the opposite direction. "That reduced traffic problems," said Duling. The job crew concentrated on east-to-west installations during the summer months.

CAS Construction held weekly neighborhood meetings to keep residents updated on water system progress.

From January through July, CAS Construction held weekly neighborhood meetings in its construction office trailer to keep residents updated on water system progress. The company also hired a community relations representative to inform homeowners of the latest developments and to find out where they wanted water meters and hookups.

Fabricated unique custom rollers kept the pipe off the ground in areas where it might have been damaged during pull-back.

That attention to detail paid off with residents. "We had good turnouts at the meetings, and homeowners felt like they had a voice in what was going on in the community," said Wright.

Big Return on Investment

In January 2003, a year after the project began, the work was completed. Within two weeks after that, the City of Maize took over water system operations.

So far, so good, said City Administrator Bloodworth. "Things are running smoothly. We have a state-of-the-art water system, and it makes a world of difference in what the town has to offer."

In years past, it was impossible for the community to recruit new business. With the new water system in place, she said, "I'm inundated with requests for information, and several companies are considering building here."

All of which is good for Maize's economic future. "Now, we can grow our tax base," said Bloodworth. "I'm expecting a big return on our investment."

Appendix D: NHDES Administrative Order on Consent

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 1
5 Post Office Square, Suite 100
Boston, MA 02109-3912

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

JUN 24 2013

Mr. Russell Dean
Town Manager
10 Front Street
Exeter, NH 03833

Re: NPDES Permit No. NH0100871.
Administrative Order on Consent Docket No. 13-010

Dear Mr. Dean:

Enclosed is the executed Administrative Order on Consent in the matter of the Town of Exeter, New Hampshire.

Sincerely,

Susan Studlien

Susan Studlien, Director
Office of Environmental Stewardship

Enclosure

cc: Attorney Dana Bisbee
Tracy Wood, NHDES

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I

IN THE MATTER OF:	)	DOCKET NO. 13-010
	)	
Town of Exeter, New Hampshire NPDES Permit No. NH0100871	)	FINDINGS OF VIOLATION
	)	AND
Proceedings under Sections 308 and 309(a)(3) of the Clean Water Act, as amended, 33 U.S.C. §§ 1318 and 1319(a)(3)	)	ADMINISTRATIVE ORDER ON CONSENT

I. STATUTORY AUTHORITY

The following FINDINGS are made and ORDER on CONSENT ("Order") issued pursuant to Sections 308(a) and 309(a)(3) of the Clean Water Act, as amended (the "Act"), 33 U.S.C. §§ 1318 and 1319(a)(3). Section 309(a)(3) of the Act grants to the Administrator of the U.S. Environmental Protection Agency ("EPA") the authority to issue orders requiring persons to comply with Sections 301, 302, 306, 307, 308, 318, and 405 of the Act and any permit condition or limitation implementing any of such sections in a National Pollutant Discharge Elimination System ("NPDES") permit issued under Section 402 of the Act, 33 U.S.C. § 1342. Section 308(a) of the Act, 33 U.S.C. § 1318(a), authorizes EPA to require the submission of any information required to carry out the objectives of the Act. These authorities have been delegated to the EPA, Region I Administrator, and in turn, to the Director of the EPA, Region I Office of Environmental Stewardship ("Director").

The Order herein is based on findings of violation of Section 301 of the Act, 33 U.S.C. § 1311, and the conditions of NPDES Permit No. NH0100871 and is issued with the consent of the Town of Exeter, New Hampshire. Pursuant to Section 309(a)(5)(A) of the Act, 33 U.S.C. § 1319(a)(5)(A), the Order provides a schedule for compliance that the Director has determined to be reasonable.

II. DEFINITIONS

Unless otherwise defined herein, terms used in this Order shall have the meaning given to those terms in the Act, 33 U.S.C. § 1251 *et seq.*, the regulations promulgated thereunder, and any applicable NPDES permit. For the purposes of this Order, "NPDES Permit" means the Town of Exeter's NPDES Permit, No. NH0100871, and all amendments or modifications thereto and renewals thereof as are applicable and in effect at the time.

III. FINDINGS

The Director makes the following findings of fact:

1. The Town of Exeter, New Hampshire ("Exeter" or "Town") is a municipality, as defined in Section 502(4) of the Act, 33 U.S.C. § 1362(4), established under the laws of the State of New Hampshire.
2. The Town is a person under Section 502(5) of the Act, 33 U.S.C. § 1362(5). The Town is the owner and operator of a Publicly Owned Treatment Works ("POTW"), which includes a wastewater collection system ("Collection System") and a wastewater treatment facility ("WWTF"), from which pollutants, as defined in Section 502(6) and (12) of the Act, 33 U.S.C. §§ 1362(6) and (12), are discharged to the Squamscott River.
3. The WWTF is a 3.0 million gallons per day ("MGD") secondary treatment facility that serves a population of approximately 10,000.
4. Section 301(a) of the Act, 33 U.S.C. § 1311(a), makes unlawful the discharge of pollutants to waters of the United States except, among other things, in compliance with the terms and conditions of an NPDES permit issued pursuant to Section 402 of the Act, 33 U.S.C. § 1342.
5. On December 12, 2012, the Town was issued the NPDES Permit by EPA under the authority of Section 402 of the Act, 33 U.S.C. § 1342. The NPDES Permit became effective on March 1, 2013 and superseded a permit issued on July 5, 2000. The NPDES Permit expires on March 1, 2018.
6. The NPDES Permit authorizes the Town to discharge pollutants from WWTF Outfall 001, a point source as defined in Section 502(14) of the Act, 33 U.S.C. § 1362(14), to the Squamscott River subject to the effluent limitations, monitoring requirements and other conditions specified in the NPDES Permit.
7. The Squamscott River flows into Great Bay, which drains into the Piscataqua River, which flows into to the Atlantic Ocean. All are waters of the United States under Section 502(7) of the Act, 33 U.S.C. § 1362(7), and the regulations promulgated thereunder.
8. Part I.A.1.a. of the NPDES Permit requires that total nitrogen in the discharges from WWTF Outfall 001 not exceed 3.0 milligrams per liter (mg/l).
9. Nitrogen is a pollutant as defined in Sections 502(6) and (12) of the Act, 33 U.S.C. §§ 1362(6) and (12).
10. The Town routinely discharges effluent from WWTF Outfall 001 containing total nitrogen in excess of 3.0 mg/l.

11. The Town's routine discharges of effluent from WWTF Outfall 001 containing total nitrogen in excess of 3 mg/l occur in violation of the NPDES Permit and Section 301(a) of the Act, 33 U.S.C. § 1311(a).

12. In accordance with Exeter's town charter, the funding for the new wastewater treatment facilities referenced in Section IV.A below must be approved by the Exeter Town Meeting. The Exeter Board of Selectmen will pursue that approval at the earliest possible date.

IV. ORDER

Accordingly, pursuant to Sections 308 and 309(a)(3) of the Act, it is hereby ordered that the Town shall:

A. WASTEWATER TREATMENT FACILITIES

1. By June 30, 2016, in accordance with New Hampshire Department of Environmental Services (NHDES) approval, the Town shall initiate construction of the wastewater treatment facilities necessary to achieve interim effluent limits set forth in Attachment 1.a of this Order.

2. By June 30, 2018, achieve substantial completion of construction of the WWTF in accordance with NHDES approval.

B. INTERIM EFFLUENT LIMITATIONS

1. From the effective date of this Order until the total nitrogen concentration limit included in Attachment 1.a of this Order becomes effective pursuant to Paragraph IV.B.2., below, the Town shall comply with the interim total nitrogen effluent limitations and monitoring requirements contained in Attachment 1 of this Order.

2. By June 30, 2019 or until 12 months after substantial completion of construction pursuant to Paragraph IV.A.2., above, whichever is sooner, the Town shall comply with the interim total nitrogen effluent limit and monitoring requirements contained in Attachment 1.a of this Order.

3. The interim limits in Attachment 1.a shall be in effect unless and until EPA determines that the Town has not complied with the milestones set forth in this Order. If and when EPA determines that the interim limits shall no longer remain in effect, the Town shall fund, design, construct and

operate additional treatment facilities to meet the NPDES Permit limit of 3.0 mg/l as soon as possible, and no later than 5 years from EPA's determination.

4. The Town shall operate the WWTF in a manner so as to maximize removal efficiencies and effluent quality, using all necessary treatment equipment available at the facility for optimization at the flow and load received but not requiring methanol or other carbon addition.

C. REPORTING (WASTEWATER TREATMENT FACILITIES)

1. Until July 15, 2018, the Town shall submit quarterly reports to EPA and the NHDES summarizing its compliance with the provisions of Paragraphs IV.A and IV.B of this Order. Progress reports shall be submitted on, or before, April 15th, July 15th, October 15th, and January 15th of each year. Each progress report submitted pursuant to this paragraph shall: a) describe activities undertaken during the reporting period directed at achieving compliance with this Order; b) identify all plans, reports, and other deliverables required by this Order that have been completed and submitted during the reporting period; and c) describe the expected activities to be taken during the next reporting period in order to achieve compliance with this Order.

D. NON-POINT SOURCE AND STORMWATER POINT SOURCE ACTIVITIES

1. Upon the effective date of this Order, the Town shall begin tracking all activities[1] within the Town that affect the total nitrogen load to the Great Bay Estuary. This includes, but is not limited to, new/modified septic systems, decentralized wastewater treatment facilities, changes to the amount of effective impervious cover, changes to the amount of disconnected impervious cover[2], conversion of existing landscape to lawns/turf and any new or modified Best Management Practices.

2. Upon the effective date of this Order, the Town shall begin coordination with the NHDES, other Great Bay communities, and watershed organizations in NHDES's efforts to develop and utilize a comprehensive subwatershed-based tracking/accounting system for quantifying the total nitrogen

[1] Pertains to activities that the Town should reasonably be aware of, e.g., activities that involve a Town review/approval process or otherwise require a notification to the Town.
[2] Impervious cover includes pavement and buildings.

loading changes associated with all activities within the Town that affect the total nitrogen load to the Great Bay Estuary.

3. Upon the effective date of this Order, the Town shall begin coordination with the NHDES to develop a subwatershed community-based total nitrogen allocation.

4. By September 30, 2018, submit to EPA and the NHDES a total nitrogen non-point source and point source stormwater control plan ("Nitrogen Control Plan"), including a schedule of at least five years for implementing specific control measures as allowed by state law to address identified non-point source and stormwater Nitrogen loadings in the Town of Exeter that contribute total nitrogen to the Great Bay estuary, including the Squamscott River. If any category of de-minimis non-point source loadings identified in the tracking and accounting program are not included in the Nitrogen Control Plan, the Town shall include in the Plan an explanation of any such exclusions. The Nitrogen Control Plan shall be implemented in accordance with the schedules contained therein.

E. REPORTING

1. Beginning January 31, 2014 and annually thereafter, the Town shall submit Total Nitrogen Control Plan Progress Reports to EPA and the NHDES that address the following:

   a. The pounds of total nitrogen discharged from the WWTF during the previous calendar year;

   b. A description of the WWTF operational changes that were implemented during the previous calendar year;

   c. The status of the development of a total nitrogen non-point source and storm water point source accounting system;

   d. The status of the development of the non-point source and storm water point source Nitrogen Control Plan,

   e. A description and accounting of the activities conducted by the Town as part of its Nitrogen Control Plan; and

   f. A description of all activities within the Town during the previous year that affect the total nitrogen load to the Great Bay Estuary. The annual report shall include sufficient information such that the nitrogen loading change to the watershed associated with these activities can be quantified upon development of the non-point source/point source storm water accounting system.

2. By December 31, 2023, the Town shall submit an engineering evaluation that includes recommendations for the implementation of any additional measures necessary to achieve compliance with the NPDES Permit, or a justification for leaving the interim discharge limit set forth in Attachment 1.a in place (or lower the interim limit to a level below 8.0 mg/l but still above 3.0 mg/l) beyond that date. Such justification shall analyze whether:
   a. Total nitrogen concentrations in the Squamscott River and downstream waters are trending towards nitrogen targets;[3]
   b. Significant improvements in dissolved oxygen, chlorophyll a, and macroalgae levels have been documented; and
   c. Non-point source and storm water point source reductions achieved are trending towards allocation targets and appropriate mechanisms are in place to ensure continued progress.

V. NOTIFICATION PROCEDURES

1. Where this Order requires a specific action to be performed within a certain time frame, the Town shall submit a written notice of compliance or noncompliance with each deadline. Notification must be mailed within fourteen (14) calendar days after each required deadline. The timely submission of a required report shall satisfy the requirement that a notice of compliance be submitted.
2. If noncompliance is reported, notification shall include the following information:
   a. A description of the noncompliance.
   b. A description of any actions taken or proposed by the Town to comply with the lapsed schedule requirements.
   c. A description of any factors that explain or mitigate the noncompliance.
   d. An approximate date by which the Town will perform the required action.
3. After a notification of noncompliance has been filed, compliance with the past-due requirement shall be reported by submitting any required documents or providing EPA and NHDES with a written report indicating that the required action has been achieved.

[3] The Town shall account for precipitation in the trend analysis and baseline measurement.

4. Submissions required by this Order shall be in writing and shall be mailed to the following addresses:

United States Environmental Protection Agency
Region I – New England
5 Post Office Square - Suite 100
Boston, MA 02109-3912
Attn: Joy Hilton, Water Technical Unit (Mail Code: OES04-3)

New Hampshire Department of Environmental Services
Water Division
Wastewater Engineering Bureau
P.O. Box 95 - 29 Hazen Drive
Concord, NH 03302-0095
Attn: Tracy L. Wood, P.E.

VI. GENERAL PROVISIONS

1. The Town may, if it desires, assert a business confidentiality claim covering part or all of the information requested, in the manner described by 40 C.F.R. § 2.203(b). Information covered by such a claim will be disclosed by EPA only to the extent set forth in 40 C.F.R. Part 2, Subpart B. If no such claim accompanies the information when it is received by EPA, the information may be made available to the public by EPA without further notice to the Town. The Town should carefully read the above-cited regulations before asserting a business confidentiality claim since certain categories of information are not properly the subject of such a claim. For example, the Act provides that "effluent data" shall in all cases be made available to the public. See Section 308(b) of the Act, 33 U.S.C. § 1318(b).
2. This Order does not constitute a waiver or a modification of the terms and conditions of the NPDES Permit. The NPDES Permit remains in full force and effect. EPA reserves the right to seek any and all remedies available under Section 309 of the Act, 33 U.S.C. § 1319, as amended, for any violation cited in this Order.
3. The Town waives any and all claims for relief and otherwise available rights or remedies to judicial or administrative review which the Town may have with respect to any issue of fact or law set forth in this Order on Consent, including, but not limited to, any right of judicial review of the Section 309(a)(3) Compliance Order on Consent under the Administrative Procedure Act, 5 U.S.C. §§ 701-708.

4. This Order shall become effective upon receipt by the Town.

06/20/13
Date

Susan Studlien
Susan Studlien, Director
Office of Environmental Stewardship
U.S. Environmental Protection Agency, Region I

6/17/13
Date

Russell
Russell Dean, Town Manager
Town of Exeter, New Hampshire

ATTACHMENT 1

Interim Effluent Limits and Monitoring Requirements

	Mass		Concentration			
	Average Monthly (lbs/day)	Daily Maximum (lbs/day)	Average Monthly (mg/l)	Daily Maximum (mg/l)	Frequency	Type
Total Nitrogen[1]	Report	Report	Report	Report	1/Week	24-hour composite

[1] Total Nitrogen shall be calculated by adding the total kjeldahl nitrogen (TKN) to the total nitrate (NO_3-N) and nitrite (NO_2-N).

ATTACHMENT 1.a.

Interim Effluent Limits and Monitoring Requirements

	Mass		Concentration			
	Average Monthly (lbs/day)	Daily Maximum (lbs/day)	Average Monthly (mg/l)	Daily Maximum (mg/l)	Frequency	Type
Total Nitrogen[1] November 1st through March 31st	Report	Report	Report	Report	1/Week	24-hour composite
Total Nitrogen[1] April 1st through October 31st	Report	Report	8 mg/l[2]	Report	1/Week	24-hour composite

[1] Total Nitrogen shall be calculated by adding the total kjeldahl nitrogen (TKN) to the total nitrate (NO_3-N) and nitrite (NO_2-N). The permittee shall optimize the operation of the treatment facility for the removal of total nitrogen during the period but not requiring methanol or other carbon addition.

[2] Calculated on a 214 day seasonal rolling average.

Appendix E: Opinion of Costs

Regional Wastewater Evaluation (20 Year Flows, High Range) 5/16/2014
Exeter-Stratham-Portsmouth, NH KAP
Alternative 1 Outfall (MGD) 3.825
SDR 9 - 20" WWTF (MGD) 5.025
CAPTIAL COSTS

Item	Unit	Unit Price	Quantity	Extended Total
CONVEYANCE (Exeter to Pease)				
HDPE Force Main - Open Cut (NHDOT ROW) - 20"	LF	$250	48286	$12,071,500
HDPE Force Main - Open Cut (Town ROW) - 20"	LF	$240	13700	$3,288,000
HDPE Force Main - Open Cut (Gas ROW) - 20"	LF	$250	3150	$787,500
HDPE Force Main - Open Cut (PSNH ROW) - 20"	LF	$250	0	$0
HDPE Force Main - Directional Drill - 24" (additional footage cost)	LF	$500	1964	$982,000
Pumping Station	EA	$4,000,000	1	$4,000,000
Surge Suppression System	EA	$250,000	1	$250,000
Air Relief Structure	EA	$25,000	15	$375,000
Clean-out Structure	EA	$15,000	12	$180,000
Rock Removal	CY	$80	4000	$320,000
Exeter WWTF Improvements/Decommissioning including EQ				
- Dry Weather EQ concrete tank	EA	$1,500,000	1	$1,500,000
- Lagoon CSO storage and lagoon decommissioning	EA	$500,000	1	$500,000
Subtotal				*$24,254,000*
Contingency			15%	$3,638,100
Total Construction				*$27,892,100*
Engineering Design and Construction			15%	$4,183,815
Stratham WWTF (0.675 MGD)				$250,000
Land Acquisition				$200,000
Administration and Legal				$250,000
Total Construction & Engineering (Conveyance)				$32,775,915

Regional Wastewater Evaluation 5/16/2014
Exeter-Stratham-Portsmouth, NH KAP
Alternative 2 Outfall (MGD) 3.825
SDR 9 - 20" WWTF (MGD) 5.025
CAPTIAL COSTS

Item	Unit	Unit Price	Quantity	Extended Total
CONVEYANCE (Exeter to Pease)				
HDPE Force Main - Open Cut (NHDOT ROW) - 20"	LF	$250	15439	$3,859,750
HDPE Force Main - Open Cut (Town ROW) - 20"	LF	$240	13800	$3,312,000
HDPE Force Main - Open Cut (Gas ROW) - 20"	LF	$250	3150	$787,500
HDPE Force Main - Open Cut (PSNH ROW) - 20"	LF	$240	30557	$7,333,680
HDPE Force Main - Directional Drill - 24" (additional footage cost)	LF	$500	2154	$1,077,000
Pumping Station	EA	$4,000,000	1	$4,000,000
Surge Suppression System	EA	$250,000	1	$250,000
Air Relief Structure	EA	$25,000	5	$125,000
Clean-out Structure	EA	$15,000	20	$300,000
Rock Removal	CY	$80	1500	$120,000
Exeter WWTF Improvements/Decommissioning including EQ				
- Dry Weather EQ concrete tank	EA	$1,500,000	1	$1,500,000
- Lagoon CSO storage and lagoon decommissioning	EA	$500,000	1	$500,000
Subtotal				*$23,164,930*
Contingency			15%	$3,474,740
Total Construction				*$26,639,670*
Engineering Design and Construction			15%	$3,995,950
Special Permitting and Regulatory - Place holder				$250,000
Land Acquisition				$300,000
Administration and Legal				$250,000
Total Construction & Engineering (Conveyance)				$31,435,620

Regional Wastewater Evaluation 5/16/2014
Exeter-Stratham-Portsmouth, NH KAP
Alternative 3 Outfall (MGD) 3.825
SDR 9 - 20" WWTF (MGD) 5.025

CAPTIAL COSTS

Item	Unit	Unit Price	Quantity	Extended Total
CONVEYANCE (Exeter to Pease)				
HDPE Force Main - Open Cut (NHDOT ROW) - 20"	LF	$240	6439	$1,545,360
HDPE Force Main - Open Cut (Town ROW) - 20"	LF	$230	12200	$2,806,000
HDPE Force Main - Open Cut (Gas ROW) - 20"	LF	$240	16250	$3,900,000
HDPE Force Main - Open Cut (PSNH ROW) - 20"	LF	$240	22857	$5,485,680
HDPE Force Main - Directional Drill - 24" (additional footage cost)	LF	$500	2154	$1,077,000
Pumping Station	EA	$4,000,000	1	$4,000,000
Surge Suppression System	EA	$250,000	1	$250,000
Air Relief Structure	EA	$25,000	5	$125,000
Clean-out Structure	EA	$15,000	20	$300,000
Rock Removal	CY	$80	1500	$120,000
Exeter WWTF Improvements/Decommissioning including EQ				
- Dry Weather EQ concrete tank	EA	$1,500,000	1	$1,500,000
- Lagoon CSO storage and lagoon decommissioning	EA	$500,000	1	$500,000
Subtotal				*$21,609,040*
Contingency			15%	$3,241,356
Total Construction				*$24,850,396*
Engineering Design and Construction			15%	$3,727,559
Special Permitting and Regulatory - Place holder				$250,000
Land Acquisition				$500,000
Administration and Legal				$250,000
Total Construction & Engineering (Conveyance)				$29,577,955

Regional Wastewater Evaluation (Buildout, Low Range) 5/16/2014
Exeter-Stratham-Portsmouth, NH KAP
Alternative 1 Outfall (MGD) 3.825
SDR 9 - 20" WWTF (MGD) 5.025

CAPTIAL COSTS

Item	Unit	Unit Price	Quantity	Extended Total
CONVEYANCE (Exeter to Pease)				
HDPE Force Main - Open Cut (NHDOT ROW) - 20"	LF	$250	48286	$12,071,500
HDPE Force Main - Open Cut (Town ROW) - 20"	LF	$240	13700	$3,288,000
HDPE Force Main - Open Cut (Gas ROW) - 20"	LF	$250	3150	$787,500
HDPE Force Main - Open Cut (PSNH ROW) - 20"	LF	$250	0	$0
HDPE Force Main - Directional Drill - 24" (additional footage cost)	LF	$500	1964	$982,000
Pumping Station	EA	$4,000,000	1	$4,000,000
Surge Suppression System	EA	$250,000	1	$250,000
Air Relief Structure	EA	$25,000	15	$375,000
Clean-out Structure	EA	$15,000	12	$180,000
Rock Removal	CY	$80	4000	$320,000
Exeter WWTF Improvements/Decommissioning including EQ				
- Dry Weather EQ concrete tank	EA	$1,500,000	1	$1,500,000
- Lagoon CSO storage and lagoon decommissioning	EA	$500,000	1	$500,000
Subtotal				*$24,254,000*
Contingency			15%	$3,638,100
Total Construction				*$27,892,100*
Engineering Design and Construction			15%	$4,183,815
Stratham WWTF (0.675 MGD)				$250,000
Land Acquisition				$200,000
Administration and Legal				$250,000
Total Construction & Engineering (Conveyance)				$32,775,915
Range -5% to 10%			*$31,137,119*	*$36,053,507*
Total cost per foot			$478	$554
TREATMENT				
Pease Improvements				$30,182,129
Sensitivity # Low Range				**$0**
Pease Outfall Improvements (Converyance and Disposal				$4,062,500
Effluent Pumping to PI Outfall ($12m-$15m WMP Report)				
Total Construction and Engineering (Treatment)				$34,244,629
TOTAL CAPITAL COST				***$67,020,544***

OPERATION AND MAINTENANCE

Item	Annual Cost
CONVEYANCE	
Annual Costs - Pumping Station and Force Main	
Labor	$250,000
Heat	$25,000
Electricity (at Q = 3.0 MGD and 20" HDPE SDR 9)	$150,000
Headworks	$200,000
Other O&M (Cleaning, CIP, Maintenance)	$100,000
Subtotal Annual Costs (Conveyance)	*$725,000*
TREATMENT	
Pease WWTF	$3,000,000
Sensitivity # Low Range	**$0**
Pease Outfall Improvements (Converyance and Disposal	
Effluent Pumping to PI Outfall ($95,000 annually)	
Subtotal Annual Costs (treatment)	$3,000,000
Total Operation and Maintenance	$3,725,000
Range -5% to 10%	*$3,538,750*

PRESENT WORTH CALCULATIONS

Item	Annual Cost	Multiplier (n=50, i=4%)	Present Worth
CONVEYANCE			
Annual Costs - Pumping Station and Force Main			
Labor	$250,000	21.482	$5,370,500
Heat	$25,000	21.482	$537,050
Electricity (at Q = 3.0 MGD and 20" HDPE SDR 9)	$150,000	21.482	$3,222,300
Headworks	$200,000	21.482	$4,296,400
Other O&M (Cleaning, CIP, Maintenance)	$100,000	21.482	$2,148,200
Subtotal Annual Costs	*$725,000*	21.482	*$15,574,450*
TREATMENT			
Pease WWTF	$3,000,000	21.482	$64,446,000
Effluent Pumping to PI Outfall ($1.5 M)		21.482	$0
Future Costs - Conveyance			
Pump Replacement - Year 15	$250,000	0.5553	$138,825
Pump Replacement - Year 30	$300,000	0.3083	$92,490
Pump Replacement - Year 45	$350,000	0.1712	$59,920
Subtotal Future Costs	*$900,000*		*$291,235*
Future Costs Treatement Upgrades			
WWTF Modifications - Year 15	$2,000,000	0.5553	$1,110,600
WWTF Modifications - Year 30	$4,000,000	0.3083	$1,233,200
WWTF Modifications - Year 45	$6,000,000	0.1712	$1,027,200
Subtotal Future Costs	*$12,000,000*		*$3,371,000*
Subtotal Present Worth			*$83,683,000*
TOTAL PROJECT COST PRESENT WORTH			***$150,703,544***
Range -5% to 10%		*$143,168,366*	*$165,773,898*

Assumptions:
Exeter Headworks to remain
One lagoon is used as EQ

Notes:
Capital costs for treatment include 20% for engineering and 30% for contingency

Regional Wastewater Evaluation (Buildout, High Range) 5/16/2014
Exeter-Stratham-Portsmouth, NH KAP
Alternative 1 Outfall (MGD) 3.825
SDR 9 - 20" WWTF (MGD) 5.025

CAPTIAL COSTS

Item	Unit	Unit Price	Quantity	Extended Total
CONVEYANCE (Exeter to Pease)				
HDPE Force Main - Open Cut (NHDOT ROW) - 20"	LF	$250	48286	$12,071,500
HDPE Force Main - Open Cut (Town ROW) - 20"	LF	$240	13700	$3,288,000
HDPE Force Main - Open Cut (Gas ROW) - 20"	LF	$250	3150	$787,500
HDPE Force Main - Open Cut (PSNH ROW) - 20"	LF	$250	0	$0
HDPE Force Main - Directional Drill - 24" (additional footage cost)	LF	$500	1964	$982,000
Pumping Station	EA	$4,000,000	1	$4,000,000
Surge Suppression System	EA	$250,000	1	$250,000
Air Relief Structure	EA	$25,000	15	$375,000
Clean-out Structure	EA	$15,000	12	$180,000
Rock Removal	CY	$80	4000	$320,000
Exeter WWTF Improvements/Decommissioning including EQ				
- Dry Weather EQ concrete tank	EA	$1,500,000	1	$1,500,000
- Lagoon CSO storage and lagoon decommissioning	EA	$500,000	1	$500,000
Subtotal				*$24,254,000*
Contingency			15%	$3,638,100
Total Construction				*$27,892,100*
Engineering Design and Construction			15%	$4,183,815
Stratham WWTF (0.675 MGD)				$250,000
Land Acquisition				$200,000
Administration and Legal				$250,000
Total Construction & Engineering (Conveyance)				$32,775,915
Range -5% to 10%			*$31,137,119*	*$36,053,507*
Total cost per foot			$478	$554
TREATMENT				
Pease Improvements				$30,182,129
Sensitivity # High Range (i.e. additional outfall improvements)				$10,000,000
Pease Outfall Improvements (Converyance and Disposal				$4,062,500
Effluent Pumping to PI Outfall ($12m-$15m WMP Report)				
Total Construction and Engineering (Treatment)				$44,244,629
TOTAL CAPITAL COST				*$77,020,544*

OPERATION AND MAINTENANCE

Item	Annual Cost
CONVEYANCE	
Annual Costs - Pumping Station and Force Main	
Labor	$250,000
Heat	$25,000
Electricity (at Q = 3.0 MGD and 20" HDPE SDR 9)	$150,000
Headworks	$200,000
Other O&M (Cleaning, CIP, Maintenance)	$100,000
Subtotal Annual Costs (Conveyance)	*$725,000*
TREATMENT	
Pease WWTF	$3,000,000
Sensitivity # High Range	$1,000,000
Pease Outfall Improvements (Converyance and Disposal	
Effluent Pumping to PI Outfall ($95,000 annually)	
Subtotal Annual Costs (treatment)	$4,000,000
Total Operation and Maintenance	$4,725,000
Range -5% to 10%	*$4,488,750*

PRESENT WORTH CALCULATIONS

Item	Annual Cost	Multiplier (n=50, i=4%)	Present Worth
CONVEYANCE			
Annual Costs - Pumping Station and Force Main			
Labor	$250,000	21.482	$5,370,500
Heat	$25,000	21.482	$537,050
Electricity (at Q = 3.0 MGD and 20" HDPE SDR 9)	$150,000	21.482	$3,222,300
Headworks	$200,000	21.482	$4,296,400
Other O&M (Cleaning, CIP, Maintenance)	$100,000	21.482	$2,148,200
Subtotal Annual Costs	*$725,000*	21.482	*$15,574,450*
TREATMENT			
Pease WWTF	$4,000,000	21.482	$85,928,000
Effluent Pumping to PI Outfall ($1.5 M)		21.482	$0
Future Costs - Conveyance			
Pump Replacement - Year 15	$250,000	0.5553	$138,825
Pump Replacement - Year 30	$300,000	0.3083	$92,490
Pump Replacement - Year 45	$350,000	0.1712	$59,920
Subtotal Future Costs	*$900,000*		*$291,235*
Future Costs Treatement Upgrades			
WWTF Modifications - Year 15	$2,000,000	0.5553	$1,110,600
WWTF Modifications - Year 30	$4,000,000	0.3083	$1,233,200
WWTF Modifications - Year 45	$6,000,000	0.1712	$1,027,200
Subtotal Future Costs	*$12,000,000*		*$3,371,000*
Subtotal Present Worth			***$105,165,000***
TOTAL PROJECT COST PRESENT WORTH			*$182,185,544*
Range -5% to 10%		*$173,076,266*	*$200,404,098*

Assumptions:
Exeter Headworks to remain
One lagoon is used as EQ

Notes:
Capital costs for treatment include 20% for engineering and 30% for contingency

Regional Wastewater Evaluation (20 Year Flows, Low Range)				5/16/2014
Exeter-Stratham-Portsmouth, NH				KAP
Alternative 1			Outfall (MGD)	3.825
SDR 9 - 20"			WWTF (MGD)	5.025
CAPTIAL COSTS				
Item	**Unit**	**Unit Price**	**Quantity**	**Extended Total**
CONVEYANCE (Exeter to Pease)				
HDPE Force Main - Open Cut (NHDOT ROW) - 20"	LF	$250	48286	$12,071,500
HDPE Force Main - Open Cut (Town ROW) - 20"	LF	$240	13700	$3,288,000
HDPE Force Main - Open Cut (Gas ROW) - 20"	LF	$250	3150	$787,500
HDPE Force Main - Open Cut (PSNH ROW) - 20"	LF	$250	0	$0
HDPE Force Main - Directional Drill - 24" (additional footage cost)	LF	$500	1964	$982,000
Pumping Station	EA	$4,000,000	1	$4,000,000
Surge Suppression System	EA	$250,000	1	$250,000
Air Relief Structure	EA	$25,000	15	$375,000
Clean-out Structure	EA	$15,000	12	$180,000
Rock Removal	CY	$80	4000	$320,000
Exeter WWTF Improvements/Decommissioning including EQ				
- Dry Weather EQ concrete tank	EA	$1,500,000	1	$1,500,000
- Lagoon CSO storage and lagoon decommissioning	EA	$500,000	1	$500,000
Subtotal				*$24,254,000*
Contingency			15%	$3,638,100
Total Construction				*$27,892,100*
Engineering Design and Construction			15%	$4,183,815
Stratham WWTF (0.675 MGD)				$250,000
Land Acquisition				$200,000
Administration and Legal				$250,000
Total Construction & Engineering (Conveyance)				$32,775,915
Range -5% to 10%			*$31,137,119*	*$36,053,507*
Total cost per foot			$478	$554
TREATMENT				
Pease Improvements				$29,400,000
Sensitivity # Low Range				**$0**
Pease Outfall Improvements (Converyance and Disposal				$4,062,500
Effluent Pumping to PI Outfall ($12m-$15m WMP Report)				
Total Construction and Engineering (Treatment)				$33,462,500
TOTAL CAPITAL COST				***$66,238,415***

OPERATION AND MAINTENANCE	
Item	**Annual Cost**
CONVEYANCE	
Annual Costs - Pumping Station and Force Main	
Labor	$250,000
Heat	$25,000
Electricity (at Q = 3.0 MGD and 20" HDPE SDR 9)	$150,000
Headworks	$200,000
Other O&M (Cleaning, CIP, Maintenance)	$100,000
Subtotal Annual Costs (Conveyance)	*$725,000*
TREATMENT	
Pease WWTF	$2,900,000
Sensitivity # Low Range	**$0**
Pease Outfall Improvements (Converyance and Disposal	
Effluent Pumping to PI Outfall ($95,000 annually)	
Subtotal Annual Costs (treatment)	$2,900,000
Total Operation and Maintenance	$3,625,000
Range -5% to 10%	*$3,443,750*

PRESENT WORTH CALCULATIONS			
Item	**Annual Cost**	**Multiplier (n=20, i=4%)**	**Present Worth**
CONVEYANCE			
Annual Costs - Pumping Station and Force Main			
Labor	$250,000	13.59	$3,397,500
Heat	$25,000	13.59	$339,750
Electricity (at Q = 3.0 MGD and 20" HDPE SDR 9)	$150,000	13.59	$2,038,500
Headworks	$200,000	13.59	$2,718,000
Other O&M (Cleaning, CIP, Maintenance)	$100,000	13.59	$1,359,000
Subtotal Annual Costs	*$725,000*	13.59	*$9,852,750*
TREATMENT			
Pease WWTF	$3,900,000	13.59	$53,001,000
Effluent Pumping to PI Outfall ($1.5 M)		13.59	$0
Future Costs - Conveyance			
Pump Replacement - Year 15	$250,000	0.5553	$138,825
Pump Replacement - Year 30	$300,000	0.3083	$92,490
Pump Replacement - Year 45	$350,000	0.1712	$59,920
Subtotal Future Costs	*$900,000*		*$291,235*
Future Costs Treatement Upgrades			
WWTF Modifications - Year 15	$2,000,000	0.5553	$1,110,600
WWTF Modifications - Year 30	$4,000,000	0.3083	$1,233,200
WWTF Modifications - Year 45	$6,000,000	0.1712	$1,027,200
Subtotal Future Costs	*$12,000,000*		*$3,371,000*
Subtotal Present Worth			***$66,516,000***
TOTAL PROJECT COST PRESENT WORTH			*$132,754,415*
Range -5% to 10%		*$126,116,694*	*$146,029,857*

Assumptions:
Exeter Headworks to remain
One lagoon is used as EQ

Notes:
Capital costs for treatment include 20% for engineering and 30% for contingency

Regional Wastewater Evaluation (20 Year Flows, High Range) 5/16/2014
Exeter-Stratham-Portsmouth, NH KAP
Alternative 1 Outfall (MGD) 3.825
SDR 9 - 20" WWTF (MGD) 5.025

CAPTIAL COSTS

Item	Unit	Unit Price	Quantity	Extended Total
CONVEYANCE (Exeter to Pease)				
HDPE Force Main - Open Cut (NHDOT ROW) - 20"	LF	$250	48286	$12,071,500
HDPE Force Main - Open Cut (Town ROW) - 20"	LF	$240	13700	$3,288,000
HDPE Force Main - Open Cut (Gas ROW) - 20"	LF	$250	3150	$787,500
HDPE Force Main - Open Cut (PSNH ROW) - 20"	LF	$250	0	$0
HDPE Force Main - Directional Drill - 24" (additional footage cost)	LF	$500	1964	$982,000
Pumping Station	EA	$4,000,000	1	$4,000,000
Surge Suppression System	EA	$250,000	1	$250,000
Air Relief Structure	EA	$25,000	15	$375,000
Clean-out Structure	EA	$15,000	12	$180,000
Rock Removal	CY	$80	4000	$320,000
Exeter WWTF Improvements/Decommissioning including EQ				
- Dry Weather EQ concrete tank	EA	$1,500,000	1	$1,500,000
- Lagoon CSO storage and lagoon decommissioning	EA	$500,000	1	$500,000
Subtotal				*$24,254,000*
Contingency			15%	$3,638,100
Total Construction				*$27,892,100*
Engineering Design and Construction			15%	$4,183,815
Stratham WWTF (0.675 MGD)				$250,000
Land Acquisition				$200,000
Administration and Legal				$250,000
Total Construction & Engineering (Conveyance)				$32,775,915
Range -5% to 10%			*$31,137,119*	*$36,053,507*
Total cost per foot			$478	$554
TREATMENT				
Pease Improvements				$29,400,000
Sensitivity # High Range (i.e. additional outfall improvements)				$10,000,000
Pease Outfall Improvements (Converyance and Disposal				$4,062,500
Effluent Pumping to PI Outfall ($12m-$15m WMP Report)				
Total Construction and Engineering (Treatment)				$43,462,500
TOTAL CAPITAL COST				***$76,238,415***

OPERATION AND MAINTENANCE

Item	Annual Cost
CONVEYANCE	
Annual Costs - Pumping Station and Force Main	
Labor	$250,000
Heat	$25,000
Electricity (at Q = 3.0 MGD and 20" HDPE SDR 9)	$150,000
Headworks	$200,000
Other O&M (Cleaning, CIP, Maintenance)	$100,000
Subtotal Annual Costs (Conveyance)	*$725,000*
TREATMENT	
Pease WWTF	$2,900,000
Sensitivity # High Range	$1,000,000
Pease Outfall Improvements (Converyance and Disposal	
Effluent Pumping to PI Outfall ($95,000 annually)	
Subtotal Annual Costs (treatment)	$3,900,000
Total Operation and Maintenance	$4,625,000
Range -5% to 10%	*$4,393,750*

PRESENT WORTH CALCULATIONS

Item	Annual Cost	Multiplier (n=20, i=4%)	Present Worth
CONVEYANCE			
Annual Costs - Pumping Station and Force Main			
Labor	$250,000	13.59	$3,397,500
Heat	$25,000	13.59	$339,750
Electricity (at Q = 3.0 MGD and 20" HDPE SDR 9)	$150,000	13.59	$2,038,500
Headworks	$200,000	13.59	$2,718,000
Other O&M (Cleaning, CIP, Maintenance)	$100,000	13.59	$1,359,000
Subtotal Annual Costs	*$725,000*	13.59	*$9,852,750*
TREATMENT			
Pease WWTF	$4,900,000	13.59	$66,591,000
Effluent Pumping to PI Outfall ($1.5 M)		13.59	$0
Future Costs - Conveyance			
Pump Replacement - Year 15	$250,000	0.5553	$138,825
Pump Replacement - Year 30	$300,000	0.3083	$92,490
Pump Replacement - Year 45	$350,000	0.1712	$59,920
Subtotal Future Costs	*$900,000*		*$291,235*
Future Costs Treatement Upgrades			
WWTF Modifications - Year 15	$2,000,000	0.5553	$1,110,600
WWTF Modifications - Year 30	$4,000,000	0.3083	$1,233,200
WWTF Modifications - Year 45	$6,000,000	0.1712	$1,027,200
Subtotal Future Costs	*$12,000,000*		*$3,371,000*
Subtotal Present Worth			***$80,106,000***
TOTAL PROJECT COST PRESENT WORTH			***$156,344,415***
Range -5% to 10%		*$148,527,194*	*$171,978,857*

Assumptions:
Exeter Headworks to remain
One lagoon is used as EQ

Notes:
Capital costs for treatment include 20% for engineering and 30% for contingency

5.025 MGD Scenario

	Flows (mgd)	Baseline				Item Totals
Portsmouth	1.35	1.2	Engineering	20%	Yard Piping	12%
Exeter	3	3	Contingency	30%	Electrical	22%
Stratham	0.675	0.675	Total	50%	Instrumentation and Controls	6%
Total	5.025	4.875			Site Work and Landscaping	7%
					Total	47%

SUMMARY

	Portsmouth	Exeter	Stratham	Total
Baseline Cost	$1,002,172	$2,505,431	$563,722	$4,071,325
Phase 1 - Headworks	$833,490	$1,852,200	$416,745	$3,102,435
Phase 2 - Control Bldg	$550,921	$1,224,269	$275,460	$2,050,650
Phase 3 - Stratham Treatment	$462,058	$1,026,802	$4,507,053	$5,995,913
Phase 4 - Exeter Treatment	$406,556	$10,193,972	$203,278	$10,803,805
Long Term Upgrades	$1,117,075	$2,482,388	$558,537	$4,158,000
Total WWTP	$4,372,272	$19,285,061	$6,524,796	$30,182,129
Outfall	$159,314	$3,186,275	$716,912	$4,062,500
Total	$4,531,585	$22,471,336	$7,241,707	$34,244,629

Baseline Cost

	Portsmouth	Exeter	Stratham	Total
Total Baseline Cost	$1,002,172	$2,505,431	$563,722	$4,071,325

PEASE WWTF UPGRADE CAPITAL COST ESTIMATE - Phase 1 WWTF 1.2 MGD

Phase 1 7.9 MGD Cost	$2,192,750		7.9	MGD	
per MGD	$280,000				
	Portsmouth	Exeter	Stratham	Total	
Headworks	$378,000	$840,000	$189,000	$1,407,000	<- total allocated based on flow
Equipment and Support	$177,660	$394,800	$88,830	$661,290	
E & C	$277,830	$617,400	$138,915	$1,034,145	
Phase 1 Capital	$833,490	$1,852,200	$416,745	$3,102,435	

PEASE WWTF UPGRADE CAPITAL COST ESTIMATE - Phase 2 WWTF 1.8 MGD

	Portsmouth	Exeter	Stratham	Total	
SBR, additional 0.6 MGD capacity				N/A	
Additional Structures/Mods	$249,851	$555,224	$124,925	$930,000	<- total allocated based on flow
Biosolids Upgrade				N/A	
CSO Treatment				N/A	
Item Total	$117,430	$260,955	$58,715	$437,100	
E & C	$183,640	$408,090	$91,820	$683,550	
Phase 2 Capital - Control Bid	$550,921	$1,224,269	$275,460	$2,050,650	

PEASE WWTF UPGRADE CAPITAL COST ESTIMATE - Phase 3 WWTF 2.4 MGD

	Portsmouth	Exeter	Stratham	Total	
Primary Clarifiers			$764,735	$764,735	
SBR, additional 0.6 MGD capacity			$1,174,500	$1,174,500	One new SBR
Sanitary Disinfection	$209,550	$465,670	$104,780	$780,000	<- total allocated based on flow
PIT Biosolids Processing				$0	<- See long term costs
Additional Structures/Mods				$0	<- See long term costs
Item Total	$98,489	$218,865	$960,687	$1,278,040	
E & C	$154,019	$342,267	$1,502,351	$1,998,638	
Phase 3 Capital	$462,058	$1,026,802	$4,507,053	$5,995,913	

PEASE WWTF UPGRADE CAPITAL COST ESTIMATE - Phase 4 WWTF 5.15 MGD

Phase 1 7.9 MGD Cost	$8,618,420		7.9	MGD	
per MGD	$1,090,939				
	Portsmouth	Exeter	Stratham	Total	
Primary Clarifiers		$764,735			
SBR, additional 2.75 MGD capacity		$3,448,650			2 new SBR's
Deep Bed Denit Filter (for TN = 3 mg/L)	$0	$0	$0	$0	<- total allocated based on flow
Additional Structures/Mods	$184,379	$409,731	$92,190	$686,300	<- total allocated based on flow
Item Total	$86,658	$2,172,865	$43,329	$322,561	
E & C	$135,519	$3,397,991	$67,759	$504,431	
Phase 4 Total	$406,556	$10,193,972	$203,278	$10,803,805	

PEASE WWTF UPGRADE CAPITAL COST ESTIMATE - Long Term Upgrades

	Portsmouth	Exeter	Stratham	Total	
Preliminary Treatment	$9,134	$20,299	$4,567	$34,000	<- total allocated based on flow
Primary Treatment	$207,403	$460,896	$103,701	$772,000	<- total allocated based on flow
SBR's/Blower/Dewatering Bldg		Expansions Separate			
Equalization	$64,746	$143,881	$32,373	$241,000	<- total allocated based on flow
Activated Sludge	$40,030	$88,955	$20,015	$149,000	<- total allocated based on flow
Sludge Storage/Chlorine Analyzer	$19,612	$43,582	$9,806	$73,000	<- total allocated based on flow
Sludge Dewatering/Disposal	$776,149	$1,724,776	$388,075	$2,889,000	<- total allocated based on flow
Long Term Upgrades Total	$1,117,075	$2,482,388	$558,537	$4,158,000	

TOTAL OPERATING EXPENSES – PEASE
From Job 1177

	@ 5 mgd	@ 4 mgd
Salaries (Estimated @ 5 mgd)	$839,738	$839,738
Vehicles	$36,493	$36,493
Maintenance	$60,000	$60,000
Fuel	$20,000	$20,000
Electricity	$772,708	$695,437
Water	$3,700	$3,700
Chemical	$391,791	$352,612
Sludge	$856,957	$771,261
Office	$11,275	$11,275
Laboratory	$40,212	$40,212
TOTAL ANNUAL OPERATING COSTS	*$3,032,874*	*$2,830,728*

USE $3.0 M $2.9M

Cost Estimate Scenario 3B - Pease Alternative TN 3
Phased SBR Secondary Treatment at PIT Site (7.9 MGD) Peirce Island Outfall

This Table is from the Portsmouth Wastewater Master Plan (2010) and is the basis for developing costs at the Pease WWTF.

PIT WWTF UPGRADE CAPITAL COST ESTIMATE - Phase 1 WWTF 1.2 MGD

ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	SUBTOTAL
PIT Headworks - 7.9 MGD Capacity					
Structure	2500	SF	$ 300.00	$ 750,000.00	
Equipment:					
Carbon Odor Control	1	EA	$ 60,000.00	$ 87,000.00	
Bar Screens	2	EA	$ 250,000.00	$ 725,000.00	
Screenings Washer & Compactor	2	EA	$ 50,000.00	$ 145,000.00	
Grit Pumps	3	EA	$ 35,000.00	$ 152,250.00	
Vortex Grit Removal	2	EA	$ 75,000.00	$ 217,500.00	
Grit Classifier & Washer	2	EA	$ 40,000.00	$ 116,000.00	
					$ 2,192,750.00
Biomag Pilot					
Equipment and Support	1	LS	$ 500,000.00	$ 500,000.00	$ 500,000.00
PHASE 1 WWTF ITEM TOTAL					$ 2,692,750.00
Yard Piping (12%)					$ 323,130.00
Electrical (22%)					$ 592,405.00
Instrumentation and Controls (6%)					$ 161,565.00
Site Work and Landscaping (7%)					$ 188,492.50
PHASE 1 WWTF CAPITAL					$ 3,958,342.50
Deer St					
Pump Station Upgrades including Automated Flow Redire	1	LS	$ 300,000.00	$ 300,000.00	
Two 20" Force Mains	9650	LF	$ 250.00	$ 2,412,500.00	
Directional Drilling - Two Locations	1200	LF	$ 250.00	$ 300,000.00	
					$ 3,012,500.00
PHASE 1 COLLECTION SYSTEM CAPITAL					$ 3,012,500.00
PHASE 1 CAPITAL					$ 6,970,842.50
Engineering (20%)					$ 1,394,168.50
Contingency (30%)					$ 2,091,252.75
TOTAL PHASE 1 CAPITAL					**$ 10,500,000**

PIT WWTF UPGRADE CAPITAL COST ESTIMATE - Phase 2 WWTF 1.8 MGD

ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	SUBTOTAL
SBR Secondary Treatment - Additional 0.6 MGD Capacity					
Structure (includes Excavation, Backfill and Concrete)	1	EA	580,000.00	$ 580,000.00	
Equipment:	1	EA	$ 525,000.00	$ 761,250.00	
Rehab Existing Basins	1	EA	$ 200,000.00	$ 290,000.00	
					$ 1,631,250.00
Additional Structures and Modifications					
Lab/Office Expansion	1	EA	$ 100,000.00	$ 100,000.00	
Pump Building - Demo Existing	1	EA	$ 50,000.00	$ 50,000.00	
Rehabilitate Shop Building	1	EA	$ 500,000.00	$ 500,000.00	
Garage	2240	SF	$ 125.00	$ 280,000.00	
					$ 930,000.00
PI Biosolids Upgrade - Interim Treatment					
Structure					
Equipment:					
Odor Control	1	EA	$ 250,000.00	$ 362,500.00	
Dewatering Screw Press	1	EA	$ 400,000.00	$ 580,000.00	
Conveyors	1	EA	$ 50,000.00	$ 72,500.00	
					$ 1,015,000.00
PI Additional Structures and Modifications - CSO Treatment					
Existing Headworks Mods (Reuse for CEPT Chemical Sto	1	EA	$ 100,000.00	$ 100,000.00	
Primary Clarifier Drive Replacement	2	EA	$ 175,000.00	$ 507,500.00	
					$ 607,500.00
PHASE 2 WWTF ITEM TOTAL					$ 4,183,750.00
Yard Piping (12%)					$ 502,050.00
Electrical (22%)					$ 920,425.00
Instrumentation and Controls (6%)					$ 251,025.00
Site Work and Landscaping (7%)					$ 292,862.50
PHASE 2 WWTF CAPITAL					$ 6,150,112.50
Additional Structures and Modifications					
Outfall Modifications				$ 1,000,000.00	$ 1,000,000.00
PHASE 2 COLLECTION SYSTEM CAPITAL					$ 1,000,000.00
PHASE 2 CAPITAL					$ 7,150,112.50
Engineering (20%)					$ 1,430,022.50
Contingency (30%)					$ 2,145,033.75
TOTAL PHASE 2 CAPITAL					**$ 10,700,000**

PIT WWTF UPGRADE CAPITAL COST ESTIMATE - Phase 3 WWTF 2.4 MGD

ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	SUBTOTAL
Primary Clarifiers					
Structure (includes Excavation, Backfill and Concrete)	0.5	EA	$ 1,140,000.00	$ 570,000.00	
Equipment:					
Longitudinal Sludge Collector	2	EA	47,200	$ 136,880.00	
Cross Collector	2	EA	8,375	$ 24,287.50	
Scum Pipes	2	EA	11,575	$ 33,567.50	
					$ 764,735.00
SBR Secondary Treatment - Additional 0.6 MGD Capacity					
Structure (includes Excavation, Backfill and Concrete)	1	EA	580,000.00	$ 580,000.00	
Equipment:	1	EA	$ 410,000.00	$ 594,500.00	
					$ 1,174,500.00
Sanitary Disinfection					
Equipment:					
Pump System	1	EA	$ 130,000.00	$ 130,000.00	
UV Disinfection	1	EA	$ 260,000.00	$ 260,000.00	
					$ 390,000.00
PIT Biosolids Processing					
Structure	0	SF	$ 200.00	$ -	Reuse Existing
Equipment:					
Carbon Odor Control	1	EA	$ 60,000.00	$ 87,000.00	
Rotary Drum Thickener	2	EA	$ 150,000.00	$ 435,000.00	
Dewatering Screw Press	2	EA	$ 400,000.00	$ 1,160,000.00	
Conveyors	2	EA	$ 50,000.00	$ 145,000.00	
					$ 1,827,000.00
Additional Structures and Modifications					
Equipment Building	10000	SF	$ 200.00	$ 2,000,000.00	
Sludge Storage Tank	4360	SF	$ 175.00	$ 763,000.00	
					$ 2,763,000.00
PHASE 3 WWTF ITEM TOTAL					$ 6,919,235.00
Yard Piping (12%)					$ 830,308.20
Electrical (22%)					$ 1,522,231.70
Instrumentation and Controls (6%)					$ 415,154.10
Site Work and Landscaping (7%)					$ 484,346.45
PHASE 3 WWTF CAPITAL					$ 10,171,275.45
Pease Effluent Pump Station and Forcemain					
Pump Station	1	LS	$ 1,500,000.00	$ 1,500,000.00	
36" Forcemain	6750	LF	$ 800.00	$ 5,400,000.00	
36" Forcemain Trench	9400	LF	$ 250.00	$ 2,350,000.00	
36" Forcemain Directional Drilling	850	LF	$ 500.00	$ 425,000.00	
					$ 9,675,000.00
PHASE 3 COLLECTION SYSTEM CAPITAL					$ 9,675,000.00
PHASE 3 CAPITAL					$ 19,846,275.45
Engineering (20%)					$ 3,969,255.09
Contingency (30%)					$ 5,953,882.64
TOTAL PHASE 3 CAPITAL					**$ 29,800,000**

PIT WWTF UPGRADE CAPITAL COST ESTIMATE - Phase 4 WWTF 5.15MGD

ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	SUBTOTAL
Primary Clarifiers					
Structure (includes Excavation, Backfill and Concrete)	0.5	EA	$ 1,140,000.00	$ 570,000.00	
Equipment:					
Longitudinal Sludge Collector	2	EA	47,200	$ 136,880.00	
Cross Collector	2	EA	8,375	$ 24,287.50	
Scum Pipes	2	EA	11,575	$ 33,567.50	
					$ 764,735.00
SBR Secondary Treatment - Additional 2.75 MGD Capacity					
Structure (includes Excavation, Backfill and Concrete)	2	EA	900,000.00	$ 1,800,000.00	
Equipment:	1	EA	$ 1,137,000.00	$ 1,648,650.00	
					$ 3,448,650.00
Deep Bed Denitrification Filter					
Structure (includes Excavation, Backfill and Concrete)	1	EA	$ 570,000.00	$ 570,000.00	
Equipment:					
Internals	7900000	GPD	$ 0.70	$ 8,018,500.00	
Methanol Storage Tanks 45 day Storage (gal)	4637	GAL	$ 1.00	$ 6,723.59	
Methanol Feed Systems	4	EA	$ 4,000.00	$ 23,200.00	
					$ 8,618,423.59
Additional Structures and Modifications					
Methanol Storage Building	900	SF	$ 200.00	$ 180,000.00	
Pump Building - New	1848	SF	$ 200.00	$ 369,600.00	
					$ 549,600.00
PHASE 4 WWTF ITEM TOTAL					$ 13,381,408.59
Yard Piping (12%)					$ 1,605,769.03
Electrical (22%)					$ 2,943,909.89
Instrumentation and Controls (6%)					$ 802,884.52
Site Work and Landscaping (7%)					$ 936,698.60
PHASE 4 WWTF CAPITAL					$ 19,670,670.62
PHASE 4 COLLECTION SYSTEM CAPITAL					$ -
PHASE 4 CAPITAL					$ 19,670,670.62
Engineering (20%)					$ 3,934,134.12
Contingency (30%)					$ 5,901,201.19
TOTAL PHASE 4 CAPITAL					**$ 29,500,000**

PIT WWTF UPGRADE CAPITAL COST ESTIMATE - Phase 5 WWTF 7.9 MGD

ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	SUBTOTAL
CSO CAPITAL COST ESTIMATE - For Consent Decree					
ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	Subtotal
SBR Secondary Treatment - Additional 2.75 MGD Capacity					
Structure (includes Excavation, Backfill and Concrete)	2	EA	900,000.00	$ 1,800,000.00	
Equipment:	1	EA	$ 1,137,000.00	$ 1,648,650.00	
					$ 3,448,650.00
PI Headworks - CSO Treatment					
Structure	0	SF	$ 300.00	$ -	
Equipment:					
Grit Pumps	3	EA	$ 35,000.00	$ 152,250.00	
Vortex Grit Removal	2	EA	$ 75,000.00	$ 217,500.00	
Grit Classifier & Washer	2	EA	$ 40,000.00	$ 116,000.00	
					$ 485,750.00
PHASE 5 WWTF ITEM TOTAL					$ 3,934,400.00
Yard Piping (12%)					$ 472,128.00
Electrical (22%)					$ 865,568.00
Instrumentation and Controls (6%)					$ 236,064.00
Site Work and Landscaping (7%)					$ 275,408.00
PHASE 5 WWTF CAPITAL					$ 5,783,568.00
Debottlenecking					
Parrot Ave	2700	LF	$ 1,000.00	$ 2,700,000.00	
					$ 2,700,000.00
Mechanic St Pump Station					
New Dry Weather Pump Station	1	LS	$ 5,000,000.00	$ 5,000,000.00	
New Flow Diversion Structure	1	LS	$ 500,000.00	$ 500,000.00	
New 12" Force Main	2100	LF	$ 200.00	$ 420,000.00	
					$ 5,920,000.00
Piece Island Newcastle and CSO Washdown Pump Station					
New Pump Station	1	LS	$ 25,000.00	$ 25,000.00	
New 6" Force Main	3200	LF	$ 100.00	$ 320,000.00	
New 6" Force Main - Bridge Crossing	300	LF	$ 300.00	$ 90,000.00	
					$ 435,000.00
PHASE 5 COLLECTION SYSTEM CAPITAL					$ 9,055,000.00
PHASE 5 CAPITAL					$ 14,838,568.00
Engineering (20%)					$ 2,967,713.60
Contingency (30%)					$ 4,451,570.40
TOTAL PHASE 5 CAPITAL					**$ 22,300,000**

Appendix F: Calculations

Exeter Regional Wastewater Disposal Option

Summary of Pump Station and Force Main Evaluation

TGP 5/16/2014

Goals:

- Serve flows ranging from 1332 gpm to 2570 gpm (1.9 MGD to 3.7 MGD)
- Evaluate operating cost of different force main alternatives
- Evaluate capacity range for different force main alternatives

Basis of Design

- Existing ADF for Exeter = 2.0 MGD
- Total system head less than 190' TDH to minimize power and use single stage pump.
- 2 ft/s minimum velocity to keep solids suspended
- 3 ft/s pumping capacity for flushing velocity.
- Pumping capacity for average daily flow with flow equalization
- Or pumping capacity for peak hour flow, if no flow equalization

Force Main Alternatives

- Min flow based on 2 ft/s, max flow based on 190' TDH
- 18" HDPE capacity 1100 – 2000 gpm (2.9 MGD max)
- 20" HDPE capacity 1300 – 2600 gpm (3.7 MGD max)
- 24" HDPE capacity 1900 – 4100 gpm (5.9 MGD max)
- Not feasible to provide capacity for peak hour flows of 7.5 to 10 MGD; need flow equalization, or dual force mains.

Scenario 1: Pumping facilities for Exeter current flows plus future design flows including Stratham

- Steady pump operation, with flow equalization
- ADF 2.0 MGD existing to 3.7 MGD future
- Pump capacity 3.7 MGD = 2570 gpm
- Force main size: 20" HDPE
- VFD controlled pumping range: 1300 to 2570 gpm
- Motor HP: 175 to 300 HP depending on design flows
- Number of pumps: 2 (with 1 redundant) or 3 (with 2 redundant)
- Pump design point: 2570 gpm at 190 ft TDH
- Or operate two pumps at 1300 gpm at 190 Ft each if pumps are available at this design point.

Scenario 2: Reduce Force main size to 18" HDPE

- Capacity limited to about 2.9 MGD.
- Operating costs increase $29,000/year at current flows due to higher head.
- Higher HP pumps required up to 250HP

Scenario 3: Increase Force main size to 24" HDPE

- FM capacity 4100 gpm exceeds design flows.
- Operating costs reduced by $10,000/year at existing flows or $148,000/year at future design flows.
- Lower pump HP required, at 100 to 150HP

Recommendations for future study:

- Evaluate costs of flow equalization facilities vs. facilities to handle peak flows (e.g., dual force mains, additional pumps)
- Evaluate cost effectiveness of different force main sizes.
- Optimize pipe diameter, class, etc. during final design.

Exeter Wastewater Pumping Station Conceptual Design
Regional Wastewater Disposal Option TGP 5/16/2014

Flows

Existing Flows	ADF, MGD	ADF, GPM	PHF, MGD	PHF, GPM
Exeter	2.0	1389	7.50	
Stratham	0.0	0	0	
Total	2.0	1389	7.50	5208

Design Flows	ADF, MGD	ADF, GPM	PHF, MGD	PHF, GPM
Exeter	3.0	2083	7.5	
Stratham	0.675	469	2.5	
Total	3.675	2552	10	6944
Total, gpm				

Basis of Design for Pumping Station
Use existing lagoon for flow equalization.
Pump capacity to met design average daily flow with largest pump out of service.
Pump capacity to provide minimum of 2 ft/s velocity to flush solids or 3 ft/s to resuspend solids.

Basis of Design for Force Main
Large enough diameter so that headloss is not excessive.
Small enough diameter so that velocity is not too low or transit time too long.
Allow minimum velocity of 3 ft/s to suspend solids.
Pipe material assumed: HDPE, ductile iron pipe size, PE4710, DR 9 (250 psi), to be confirmed in final design

Pump Station Conceptual Design

Capacity, mgd	3.70		3.00
Capacity, gpd	2569		2083
Design head, ft	190	See system head worksheet	131
Number of Pumps total	2		2
Number of redundant pumps	1		1
Capacity per pump required, gpm	2569		2083
Capacity per pump required, mgd	3.70		3.00
Pump Design Points	2570 gpm at 190 ft TDH	One pump provides design lfow, with 1 to 2 redundant pumps	
	1300 gpm at 190 ft TDH	For two pump operation if available at this design point.	

VFD controlled for flexible operation
Surge control measures to be determined

Force Main Conceptual Design

Length (Alt. 1 Route 33), miles	12.7	
Length, ft	67056	
Type	HDPE	
Class	DR 9 DIPS PE4710	250 psi rated, ductile iron pipe size
Nominal size, in	20	
Inside diameter, in	16.5	
Flowrate at 2 ft/s, gpm	1332	
Flowrate at 3 ft/s gpm	1998	
Flowrate at 5 ft/s gpm	3330	

Pumps will provide 2 ft/s min, ramping to 3 ft/s at least once per day to flush deposits if necessary

Volume, ft3	99521	
Volume, gal	744414	
Existing ADF, MGD	2.0	
Average transit time, hours	8.9	
Pressure at pump discharge, ft	190	
Pressure at pump discharge, psi	82.3	Working pressure
FM hydrostatic pressure safety factor	2.5	per DES
Pipe design pressure required	206	use DR 9 250 psi

Force main can be optimized in final design by possibly using lower rated pipe in downstream sections with lower pressure.
Perform transient surge analysis to verify design pressure rating.

Structures
Assume 10 to 20 air release structures minimum at high points.
Assume cleanout manholes every 2000' minimum at low points or where no air release.
Assume 30 to 40 structures total.

Exeter Wastewater Pumping Station Conceptual Design - System Curve
Regional Wastewater Disposal Option

5/16/2014

18" HDPE — *Headloss too great*

Flowrate, Q (gpm)	Friction Head: Velocity, v (fps)	Head Loss, h_f [2] (ft)	Elevation Head (ft)	System Head Req'd (ft)
1100	2.0	63.0	5.2	68.2
1200	2.2	74.0	5.2	79.2
1300	2.4	85.9	5.2	91.1
1390	2.6	97.2	5.2	102.4
1400	2.6	98.5	5.2	**103.7**
1600	2.9	126.1	5.2	131.3
1800	3.3	156.8	5.2	162.0
1970	3.6	185.3	5.2	**190.5**

20" HDPE — *Select*

Flowrate, Q (gpm)	HEADLOSS: Velocity, v (fps)	Head Loss, h_f [2] (ft)	Elevation Head (ft)	System Head Req'd (ft)
1300	2.0	52.3	5.2	57.5
1390	2.1	59.2	5.2	**64.4**
1600	2.4	76.8	5.2	82.0
1800	2.7	95.4	5.2	100.6
2100	3.2	126.9	5.2	**132.1**
2500	3.8	175.3	5.2	180.5
2570	3.9	184.4	5.2	**189.6**
2600	3.9	188.4	5.2	193.6

24" HDPE

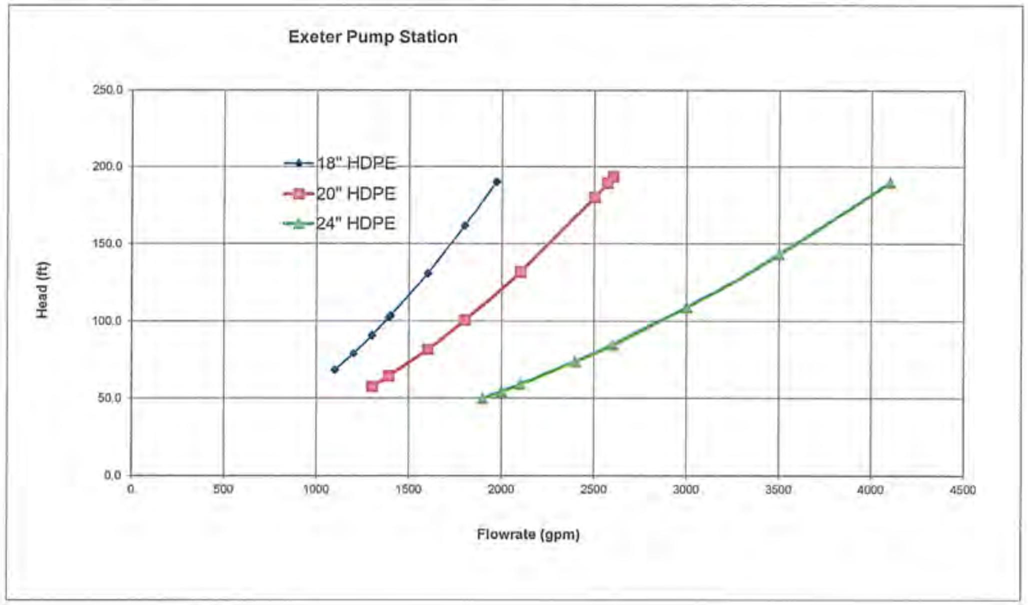
Flowrate, Q (gpm)	HEADLOSS: Velocity, v (fps)	Head Loss, h_f [2] (ft)	Elevation Head (ft)	System Head Req'd (ft)
1900	2.0	44.5	5.2	49.7
2000	2.1	49.0	5.2	54.2
2100	2.2	53.6	5.2	**58.8**
2400	2.5	68.6	5.2	73.8
2600	2.7	79.5	5.2	**84.7**
3000	3.2	103.7	5.2	108.9
3500	3.7	137.9	5.2	143.1
4100	4.3	184.7	5.2	**189.9**

	18" HDPE	20" HDPE	24" HDPE
Force Main			
D_i =	14.9 in	16.5 in	19.7 in
A=	1.21 ft^2	1.48 ft^2	2.12 ft^2
Roughness Coefficient			
C =	140	140	140
Length of Force Main			
L =	67100 ft	67100 ft	67100 ft
Minor Losses (equivalent length)			
Le =	1000 ft	1000 ft	1000 ft
Total Length ($L_T = L + L_e$)			
L_T =	68100 ft	68100 ft	68100 ft

Kinematic Viscosity (assumes same as water @60°F)
υ = 1.22E-05 ft^2/sec
Acceleration Due to Gravity
g_c = 32.2 ft/sec²

Inlet Elevation = 25.3 ft — Exeter Lagoon 1
Outlet Elevation = 30.5 ft — Pease Headworks Invert in
Static Head = 5.2

NOTES:
(1) Value read from Moody Diagram.
(2) Hazen-Williams Equation: h_f = *(10.44*L*Q^1.85)/(C^1.85*d^4.87)*



Exeter Wastewater Pumping Station Conceptual Operating Costs
Regional Wastewater Disposal Option

TGP 5/14/2014

Electricity Cost - 18" Force Main

	Existing Exeter Flow	Exeter Design Flow	Total Design Flow	Notes
Flow, MGD	2.0	2.9		
Flow, gpm	1389	1980	N/A	
TDH, ft	102	190		
Pump efficiency	0.50	0.50		
Motor efficiency	0.90	0.90		
Power, calculated, HP	79.2	210.3		
Power, motor rated, nominal, HP		250		
Power, kW (based on calc. HP)	59.2	157.2		
Pump run time, hrs/day	24.0	24.4		Pump operates
Electricity per day, kW-Hr	1420.5	3836.7		
Cost per kW-Hr, $	$ 0.15	$ 0.15		
Cost per day, $	$ 213.08	$ 575.51		
Cost per year, $	$ **77,772**	$ **210,062**		

Electricity Cost - 20" Force Main

	Existing Exeter Flow	Exeter Design Flow	Total Design Flow	Notes
Flow, MGD	2.0	3.0	3.70	
Flow, gpm	1389	2083	2569	
TDH, ft	64	130	190	
Pump efficiency	0.50	0.50	0.50	
Motor efficiency	0.90	0.90	0.90	
Power, calculated, HP	49.7	151.4	272.9	
Power, motor rated, nominal, HP		175	300	
Power, kW (based on calc. HP)	37.1	113.2	204.0	
Pump run time, hrs/day	24.0	24.0	24.0	Pump operates continously, with flow equalization
Electricity per day, kW-Hr	891.3	2715.7	4895.2	
Cost per kW-Hr, $	$ 0.15	$ 0.15	$ 0.15	
Cost per day, $	$ 133.69	$ 407.35	$ 734.27	
Cost per year, $	$ **48,798**	$ **148,683**	$ **268,010**	

Electricity Cost - 24" Main

	Existing Exeter Flow	Exeter Design Flow	Total Design Flow	Notes
Flow, MGD	2.0	3.0	3.70	
Flow, gpm	1900	2083	2569	
TDH, ft	50	60	85	
Pump efficiency	0.50	0.50	0.50	
Motor efficiency	0.90	0.90	0.90	
Power, calculated, HP	53.1	69.9	122.1	
Power, motor rated, nominal, HP		100	150	
Power, kW (based on calc. HP)	39.7	52.2	91.2	
Pump run time, hrs/day	17.5	24.0	24.0	Pump operates continously, with flow equalization
Electricity per day, kW-Hr	696.3	1253.4	2189.9	except for existing 2.0 MGD flow pump will cycle to mainain min flowr rates'
Cost per kW-Hr, $	$ 0.15	$ 0.15	$ 0.15	
Cost per day, $	$ 104.45	$ 188.01	$ 328.49	
Cost per year, $	$ **38,124**	$ **68,623**	$ **119,899**	
Remarks	Exeter only, 2 MGD		Exeter plus Stratham, 3.675 MGD	

Pump Electricity Cost