REGIONAL WASTEWATER TREATMENT CONSOLIDATION STUDY

Phase 1 Report: Long List of Regional Wastewater System Alternatives

B&V PROJECT NO. 198910

PREPARED FOR

Naugatuck Valley Council of Governments

22 March 2019

BLACK & VEATCH
Building a world of difference.

Table of Contents

Appendices

EXECUTIVE SUMMARY

ES-1 Background and Objectives

1.1 The Naugatuck Valley Council of Governments (NVCOG) is undertaking a wastewater regionalization study that involves five municipalities in the region: Derby, Ansonia, Seymour, Beacon Falls and Naugatuck. A goal of this study is to identify the potential for economic efficiencies that regionalization may offer.

1.2 Under the existing setup, each of the five communities in the study has its own wastewater treatment plant, along with an associated collection system consisting of sewers and pumping stations. Regionalization alternatives, which would combine systems to reduce the number of treatment plants, offers the potential to reduce capital and operating expenses for the local communities through consolidating infrastructure and sharing staff resources.

1.3 The regionalization study is being performed in two phases. The first phase of the study (summarized here within the Phase 1 Report) developed the 20-year projected wastewater flows and loads for the five communities, and assessed the needs for capital expenditures over that planning horizon under the "base case" scenario of no regionalization.

1.4 The current report also identifies and describes a "long list" of regionalization alternatives that appear to have merit. The intent in Phase 2 is to screen the long list of alternatives, thereby creating a "short list" of favorable regionalization alternatives that can be further developed and compared to the base case, leading to final recommendations regarding regionalization.

ES-2 Population, Flow and Load Projections

2.1 The projected populations and flows and loads for the five communities were developed in Technical Memorandum No. 1, which is included as an appendix to this report.

2.2 Currently, the average flows to the treatment plants in each of the five communities are approximately half of the design permitted capacity.

2.3 According to the Connecticut State Data Center (CSDC), Ansonia and Derby are projected to grow by a total of approximately 6% by 2040; the other communities are projected to have lower growth. For the purpose of this study, CSDC projections were adjusted based on input from local officials to allow for modest, anticipated growth over the 20 year period of study.

2.4 With the exception of Beacon Falls, all of the communities in this study have older collection systems that are plagued with high infiltration and inflow (I/I). This results in very high peak flows to the treatment plants. The Derby treatment plant is unable to treat peak wet weather flows. Two of the communities are under Orders to reduce I/I from their collection systems.

ES-3 Condition Assessment of Existing Wastewater Infrastructure

3.1 A wastewater system condition assessment was conducted for each of the five communities. While some significant data gaps exist, this effort allowed for a high-level summary of the condition of existing wastewater treatment and collection system facilities, based on review of existing reports, interviews and site visits.

3.2 The Ansonia treatment plant is in good condition following a major upgrade completed in 2011. However, the other four plants are in fair to poor condition, and require major upgrades in the near future. In the case of Derby, this could approach full replacement of the plant.

3.3 In general, improvements to the collection system have been deferred for many years. As a result, this will require a period of catch-up for replacing and repairing pipes, followed by a sustained annual capital improvements program for buried infrastructure.

3.4 The condition assessment, which also projected planning-level capital costs for the 20-year planning study horizon under the base case of no regionalization, is summarized Technical Memorandum No. 2 which is provided as an appendix to this report.

3.5 The table below indicates the proposed capital expenditures that would be required for each of the five communities over the 20-year planning period, under the base case of no regionalization.

Projected 20-Year Wastewater Expenditures, Base Case (If No Regionalization)

	Derby	Ansonia	Seymour	Beacon Falls	Naugatuck	Total
Water Pollution Control Facility	$ 70.0M	$ 15.0M	$ 40.0M	$ 14.0M	$ 55.0M	$ 194.0M
Collection System	$ 8.0M	$ 10.3M	$ 8.5M	$ 3.1M	$ 18.5M	$ 48.4M
Large Pumping Stations	$ 4.2M	$ 3.0M	$ 2.0M	$ 0.5M	$ 1.0M	$ 10.7M
TOTAL	$ 82.2M	$ 28.3M	$ 50.5M	$ 17.6M	$ 74.5M	$ 253.1M

ES-4 “Long List” of Regionalization Alternatives

4.1 Phase 1 of this study also identified 12 regionalization alternatives (examples: sending all Derby flow to Ansonia; or sending all flow from Seymour and Ansonia to Derby). Some of those alternatives also included a variation involving a more aggressive approach to I/I reduction.

4.2 Planning level sewer pipeline corridors were identified for major system interconnection trunk sewers or force mains. These would allow the communities to interconnect for regionalization purposes. In some cases, multiple interconnection sewer or force main routing options were identified.

4.3 During the initial rough screening of the long list of alternatives, one of the regional wastewater alternatives was identified as clearly inferior to other alternatives, and therefore rejected from further consideration.

4.4 The remaining 11 alternatives are of potential interest, depending on the relative costs of construction and operation. During Phase 2 of this study, this list of 11 alternatives would be screened further to a shorter list of preferred alternatives, which then would undergo more detailed study and analysis. A recommendation(s) would be made at the end of Phase 2.

1.0 Purpose and Background

The Naugatuck Valley Council of Governments (NVCOG) is undertaking a regional wastewater treatment consolidation study comprising five municipalities in the region: Naugatuck, Beacon Falls, Seymour, Ansonia and Derby. Investigations on the viability of wastewater regionalization are not entirely new to the region, as there have been reviews and study on this subject in the past, involving several of the study communities.

Each of the five communities has their own wastewater system, where several of the wastewater treatment plants are in need of significant upgrade to replace major equipment and systems that have reached the end of their useful life, and also to incorporate new treatment systems for the reduction of phosphorous from their effluent discharge as a result of new regulations by the CT Department of Energy and Environmental Protection (DEEP). Prior studies of the wastewater collection systems for some of these communities have also revealed the need for upgrade and rehabilitation, including the abatement of infiltration and inflow (I/I). Some of the communities have Orders issued to them by DEEP and/or EPA requiring them to undertake capital and O&M improvements to provide for greater levels of wastewater treatment, improvements within the collection system and overall strengthening of systems reliability. Taken together, the plant and collection system upgrades will be a significant cost to these communities individually.

An important goal of this study is to identify the potential for economic efficiencies that regionalization may offer, as compared with each of the municipalities continuing to go it alone. Regionalization's attractiveness lies in its basis that sharing costs for wastewater infrastructure, operations and management will be less while meeting desired environmental objectives.

The regionalization study is being performed in two phases. The principal goal of Phase 1 (the current phase) is to define the practical universe of regional wastewater treatment alternatives, identifying a workable "long list" of alternatives that merit more in-depth evaluation and study in Phase 2. Screening criteria, to be used in Phase 2 to compare the regional alternatives are also defined in this Phase 1 report. These criteria include the following categories: technical feasibility, operations and maintenance, efficiency, community-based, environmental, schedule, regulatory and permitting, and cost.

Phase 1 work has developed 20-year projected wastewater flows and loads for the study communities. A planning level assessment of the wastewater treatment and collections systems of the five communities has also been undertaken. To the extent practical, this work has relied heavily on existing planning and engineering reports related to the technical needs and costs of the wastewater collection and treatment facilities in the five communities. However, significant gaps exist in the data to properly describe the infrastructure capital projects and costs of these communities out to 2040, the planning level horizon year of this study. On-site reviews and meetings with community representatives were utilized to help fill some but not all of the gaps in the available information. These assessments, identified as the *Base Case*, serve to identify the treatment and collection system needs and associated capital costs for each of the five communities. The Base Case will continue to be developed more fully in Phase 2 and will be compared against regional wastewater alternatives to assess cost effectiveness, reliability and compliance with environmental requirements. The flows and loads projections are included as Appendix A to this report, and the infrastructure Base Case determinations are included as Appendix B to this report.

This Phase 1 report identifies and describes a long list of regional wastewater alternatives that appear to have initial merit for regionalization. The intent is that this long list of alternatives will be carried into

Phase 2 where a screening-out evaluation of alternatives will be conducted to identify and eliminate the least promising alternatives which appear to have less attractive attributes as compared to other peer alternatives. This would result in a “short list” of regional alternatives. The screened list of regional alternatives, or short list in Phase 2, will be compared to the ‘Base Case’ alternative for final analysis and recommendation. Cost and non-cost criteria will be used to evaluate the regionalization alternatives versus the Base Case where each community acts individually to meet their wastewater infrastructure needs.

A more detailed condition assessment of treatment plant systems will also be undertaken in Phase 2. Targeted flow monitoring may be conducted within certain parts of the collection systems. This work, along with other analyses, will better define the flows, I/I contribution, costs, schedule, environmental and permitting requirements, as well as other pertinent complexities related to the regional short list of alternatives. Phase 2 will also present a preferred alternative from the short list of alternatives including its selection basis.

2.0 Identification of Alternatives

2.1 Approach

Regionalization is attractive because of the economies of scale in the cost of building, upgrading and operating wastewater treatment facilities. Therefore, regionalization allows for a sharing of physical infrastructure, as well as sharing management, operations, and administration. However, there are two additional cost factors which must be considered in a regional alternative. One is the cost of piping, and possibly pumping, to a regional facility; the other is the potential cost of providing higher levels of treatment at the regional facility due to discharging a greater wastewater load in a particular area of the receiving water. This latter scenario may require careful consideration as more wastewater discharged at a given point on the river may impose a greater impact on water quality for that specific area. Therefore, it is the purpose of this regional study to combine the above considerations into definable, regional alternatives, and to compare them to the base case on a life-cycle cost basis, taking into consideration environmental benefits and cost efficiencies, while working with NVCOG, DEEP and all stakeholders to determine if regional solutions have merit. These financial comparisons will be made in Phase II of this study.

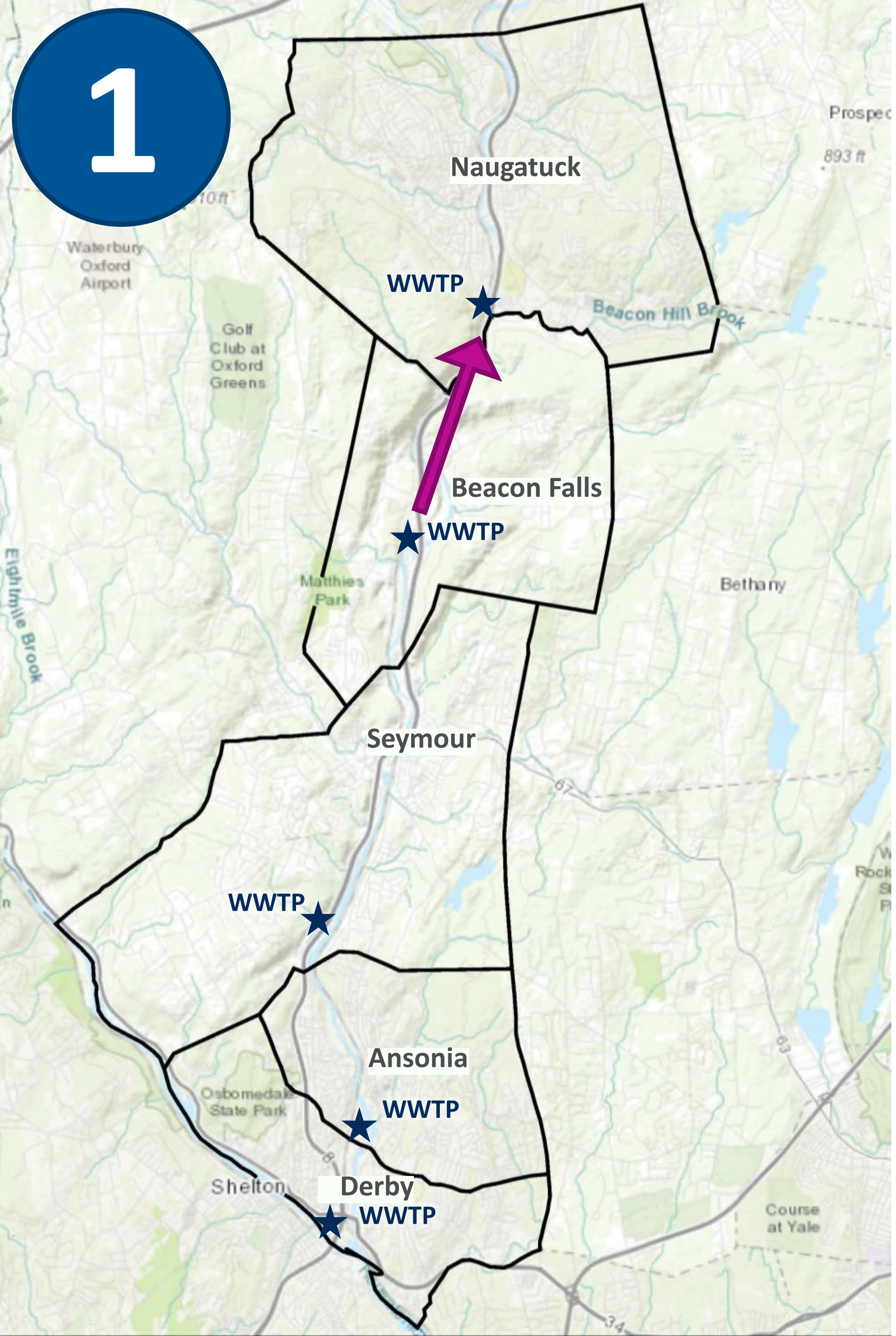
2.2 Initial List of Regional Wastewater System Alternatives

Regionalization alternatives among the five communities in this study will need to physically connect their sewerage collection systems with conveyance pipelines and pump stations. Constructing pipelines over long distances with pump stations capable of moving a community's wastewater miles away can be expensive. Thus, the cost of the connecting pipelines and pump stations will be considered in Phase II, when the regionalization alternatives are compared to the Base Case, where each community continues to act alone to invest and manage its existing wastewater infrastructure (i.e. plants and sewer collection system).

Identification of regional wastewater alternatives was not limited in any way as part of this report; however, the initial list of alternatives generally targeted adjacent communities (e.g. Seymour and Beacon Falls or Derby and Ansonia) as opposed to communities that are not adjacent or close to each other (e.g. Naugatuck and Derby). The initial list of regional wastewater alternatives is identified in Table 1. Some of the alternatives are variations of each other in that one alternative would convey current wastewater flows and its sister alternative calls for reduction in flow through implementation of an intensive I/I control program. Each alternative is presented in greater detail in tabular summaries following Table 1.

Table 1 Initial List of Regional Wastewater Alternatives

Alternative No.	Description	Abbreviated Description
1	Beacon Falls to Naugatuck	BF→N
2	Beacon Falls to Seymour	BF→S
2a	Beacon Falls to Seymour, I/I Reduction	BF→S, I/I
3	Derby to Ansonia	D→A
3a	Derby to Ansonia, I/I Reduction	D→A, I/I
4	Derby to Ansonia, Effluent Pumped to Housatonic	D→A→H
4a	Derby to Ansonia, I/I Reduction, Effluent Pumped to Housatonic	D→A→ H, I/I
5	Derby and Seymour to Ansonia	D&S→A
5a	Derby and Seymour to Ansonia, I/I Reduction	D&S→A, I/I
5b	Derby and Seymour to Ansonia, Effluent to Housatonic	D&S→A→H
5c	Derby and Seymour to Ansonia, I/I Reduction, Effluent to Housatonic	D&S→A→H, I/I
6	Derby to Seymour and Ansonia	D→S, D→A
6a	Derby to Seymour and Ansonia, I/I Reduction	D→S, D→A, I/I
7	Derby to Seymour, Ansonia, and Derby	D→S, D→A, D→D
7a	Derby to Seymour, Ansonia, and Derby, with I/I Reduction	D→S, D→A, D→D, I/I
8	Ansonia to Derby	A→D
8a	Ansonia to Derby, I/I Reduction	A→D, I/I
9	Seymour and Ansonia to Derby	S&A→D
9a	Seymour and Ansonia to Derby, I/I Reduction	S&A→D, I/I
10	Seymour to Ansonia, Part of Ansonia to Derby	S→A, A→D
10a	Seymour to Ansonia, Part of Ansonia to Derby, I/I Reduction	S→A, A→D, I/I
11	Beacon Falls and Seymour to Ansonia, Part of Ansonia to Derby	BF,S→A, A→D
11a	Beacon Falls and Seymour to Ansonia, Part of Ansonia to Derby, I/I Reduction	BF,S→A, A→D, I/I
12	Beacon Falls, Seymour, and Ansonia to Derby	BF,S,A→D
12a	Beacon Falls, Seymour, and Ansonia to Derby, I/I Reduction	BF,S,A→D, I/I



Beacon Falls to Naugatuck

Treatment Plants

Naugatuck | ~~Beacon Falls~~ | Seymour | Ansonia | Derby

Overview
Under this alternative, the Beacon Falls WPCF would be decommissioned and replaced with a pumping station, to pump all wastewater flow to the Naugatuck WPCF.

Treatment Capacity
Since the Naugatuck WPCF has been operating at less than half of its annual average design capacity, that plant has available capacity to receive all of the flow from Beacon Falls (0.45 MGD annual average, 1.525 peak hydraulic flows) and to accommodate projected population growth, without further expansion.

Collection System

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

Collection System Rehabilitation
The base case assumes maintenance for each collection system necessary to improve the system to a basic level of reliability and performance consistent with the I/I reduction assumptions in the flows and loads analysis. This alternative does not include additional collection system improvements.

Operations & Maintenance
In this alternative, there could be minor savings in the maintenance of the collection system in Beacon Falls by relying on greater resources and potentially efficiency of Naugatuck O&M (Veolia), but this is not necessarily the case.

Lift Stations & Conveyance

Naugatuck ← Beacon Falls | Seymour | Ansonia | Derby

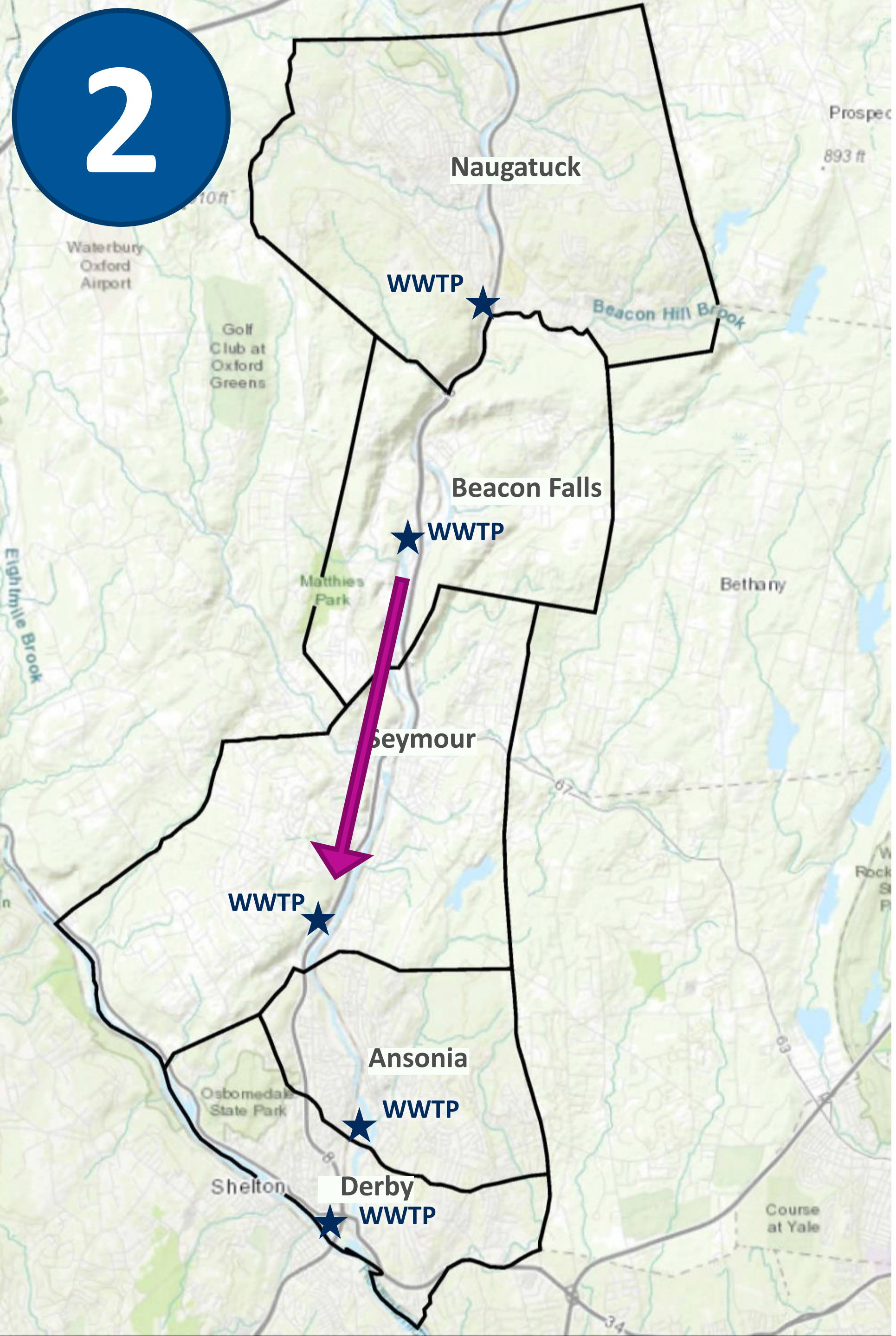
Capacity
A lift station and force main would be required to convey flow from Beacon Falls to Naugatuck. It is assumed that the new Beacon Falls pumping station would be designed for the peak hydraulic flow (1.525 MGD), unless it is more cost-effective to reduce peak pumping capacity by providing some wet weather flow equalization storage at the pump station.

Conveyance Corridors
The elevation differential between Beacon Falls (138 ft) and Naugatuck (178 ft) is 40 ft, however, the terrain and existing rights of way pose significant constraints to this alternative.

Four preliminary alternative pipe routes were identified. The primary alternatives involve (a) going over or around Toby's Rock Mountain, with a peak alignment elevation up to 780 ft or (b) following the Naugatuck River, either along the railroad or the Route 8 right of way. Pipe lengths could range from approximately 17,000 ft to 28,000 ft.

Potential routing corridors are discussed in greater detail in Section 3.

This alternative is not mutually exclusive with alternatives involving Seymour, Ansonia, and Derby.



Beacon Falls to Seymour

Treatment Plants

Naugatuck | ~~Beacon Falls~~ | **Seymour** | Ansonia | Derby

Overview
Under this alternative, the Beacon Falls WPCF would be decommissioned and replaced with a pumping station. All Beacon Falls wastewater would be pumped to the Seymour WPCF.

Treatment Capacity
Although the Seymour WPCF has available capacity to accommodate all flow from Beacon Falls under average annual and max month conditions, the peak flows due to I/I from Seymour and Beacon Falls would exceed the hydraulic capacity of the existing plant.

Increased plant capacity, high rate treatment, or storage (or some combination thereof) would be required.

Collection System

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

Collection System Rehabilitation
The base case assumes maintenance for each collection system necessary to improve the system to a basic level of reliability and performance consistent with the I/I reduction assumptions in the flows and loads analysis. This alternative does not include additional collection system improvements.

Operations & Maintenance
In this alternative, there could be minor savings in the maintenance of the collection system in Beacon Falls by relying on O&M resources and Seymour O&M (Veolia), but this is not necessarily the case.

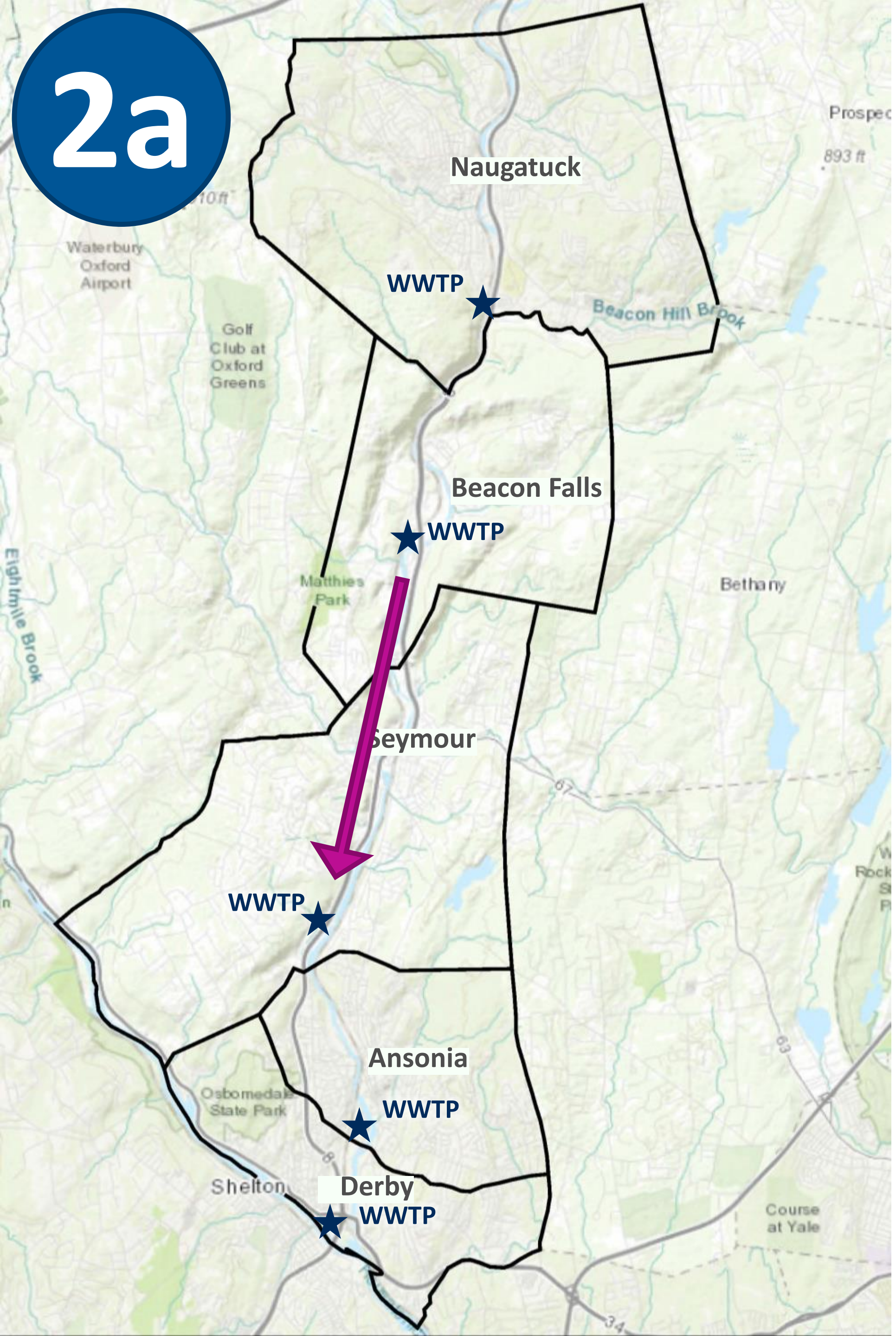
Lift Stations & Conveyance

Naugatuck | **Beacon Falls** → **Seymour** | Ansonia | Derby

Capacity
It is assumed that the new Beacon Falls pumping station would be designed for the peak hydraulic flow (1.525 MGD), unless it is more cost-effective to reduce peak pumping capacity by providing some wet weather flow equalization storage at the pump station.

Conveyance Corridors
The elevation differential between Beacon Falls (138 ft) and Seymour (71 ft) is 67 ft. However, even with this elevation difference, the average slope of the shortest route (0.2%) would likely require a lift station.

Three potential routes were identified for comparison. The primary alternatives involve (a) going over or around the hills west of the Naugatuck River, with peak alignment elevations of approximately 470 ft to 640 ft, or (b) following the Naugatuck River, either along the railroad or the Route 8 right of way. Pipe lengths could range from approximately 26,000 ft to 48,000 ft.



Beacon Falls to Seymour, I/I Reduction

Treatment Plants

Naugatuck | ~~Beacon Falls~~ | Seymour | Ansonia | Derby

Under this alternative, the Beacon Falls WPCF would be decommissioned and replaced with a pumping station. All Beacon Falls wastewater would be pumped to the Seymour WPCF.

Treatment Capacity
Since the Seymour WPCF has been operating at less than half of its annual average design capacity, it has available capacity to accommodate all flow from Beacon Falls under average annual and max month conditions, through 2040. Depending on the extent of I/I removal, additional measures may be required to accommodate peak hourly flows, such as increased wet weather treatment capacity at the Seymour WPCF or storage facilities.

Collection System

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

Collection System Rehabilitation
Implementing an aggressive I/I program in Seymour and Beacon Falls could reduce peak hydraulic flows from the combined collection systems to approximately 7.3 MGD, to reduce or eliminate the need for WPCF expansion to accommodate peak flows. Storage may also be considered to manage peak flows in conjunction with I/I removal.

Operations & Maintenance
In this alternative, there could be minor savings in the maintenance of the collection system in Beacon Falls by relying on O&M resources and Seymour O&M (Veolia), but this is not necessarily the case.

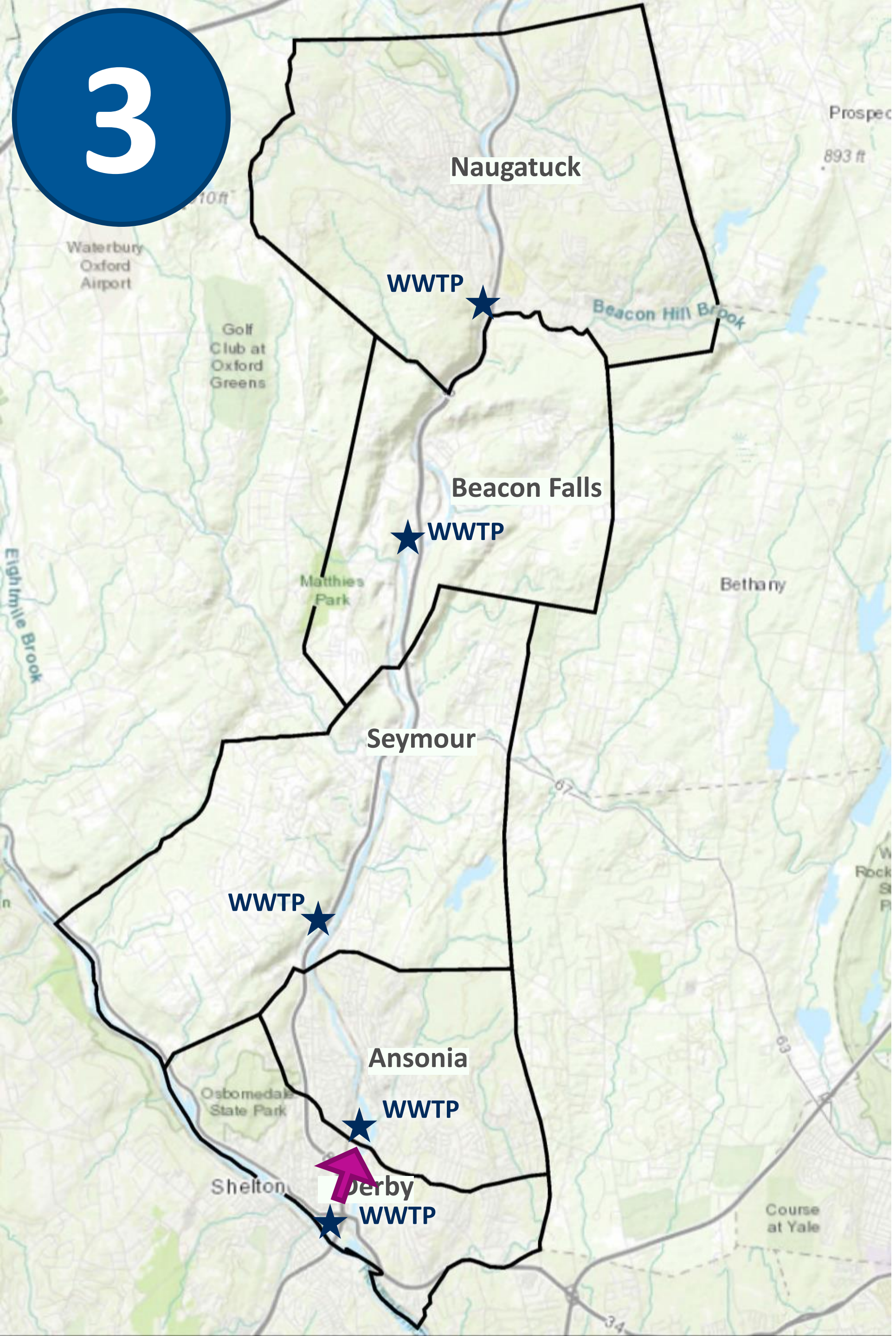
Lift Stations & Conveyance

Naugatuck | Beacon Falls → Seymour | Ansonia | Derby

Capacity
It is assumed that the new Beacon Falls pumping station would be designed for the peak hydraulic flow (1.525 MGD), unless it is more cost-effective to reduce peak pumping capacity by providing some wet weather flow equalization storage at the pump station.

Conveyance Corridors
The elevation differential between Beacon Falls (138 ft) and Seymour (71 ft) is 67 ft. However, even with this elevation difference, the average slope of the shortest route (0.2%) would likely require a lift station.

Three potential routes were identified for comparison. The primary alternatives involve (a) going over or around the hills west of the Naugatuck River, with peak alignment elevations of approximately 470 ft to 640 ft, or (b) following the Naugatuck River, either along the railroad or the Route 8 right of way. Pipe lengths could range from approximately 26,000 ft to 48,000 ft.



Derby to Ansonia

Treatment Plants

Naugatuck | Beacon Falls | Seymour | Ansonia | ~~Derby~~

Under this alternative, the Derby WPCF would be decommissioned and replaced with a pumping station. All Derby wastewater would be pumped to the Ansonia WPCF.

Wet Weather Capacity
The Ansonia WPCF currently has sufficient capacity to accept the annual average flows from Derby. However, due to high wet weather flows in both Ansonia and Derby, the Ansonia WPCF does not have the capacity to handle the combined peak flows. Therefore, this alternative would require upgrading the WPCF and/or providing storage or high rate treatment to increase wet weather capacity.

Phosphorus Treatment
The Ansonia WPCF discharges to the Naugatuck River, while the existing Derby WPCF discharges to the Housatonic River. Therefore, this alternative would involve an increase in costs associated with advanced treatment for Derby wastewater.

Collection System

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

Collection System Rehabilitation
The base case assumes maintenance for each collection system necessary to improve the system to a basic level of reliability and performance consistent with the I/I reduction assumptions in the flows and loads analysis.

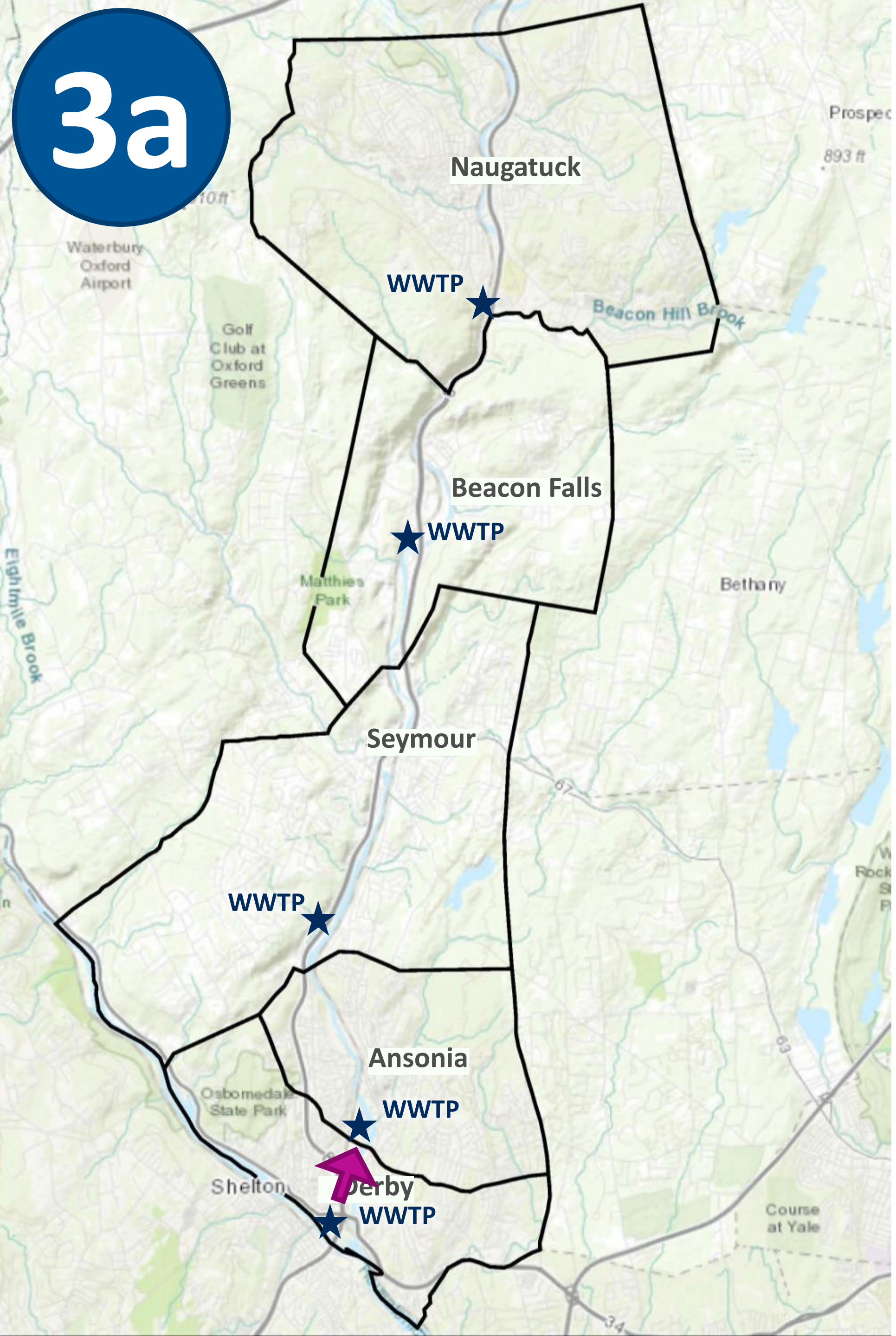
Lift Stations & Conveyance

Naugatuck | Beacon Falls | Seymour | Ansonia ← Derby

Capacity
The new pumping station in Derby would be sized, along with any storage at that location, to handle anticipated peak hydraulic flow from the Derby wastewater collection system. This alternative might also include a headworks facility for grit and screenings removal at the new Derby pumping station..

Conveyance Corridors
There is a nominal 5 ft elevation difference between the Ansonia and Derby WPCFs, and a distance between 8,000 to 9,000 ft.

Two routes were identified in preliminary review. The primary alternatives would be to follow the Naugatuck River from plant to plant, which would involve crossing wetlands, or following existing town roads, which would include a high point of approximately 89 ft and require a pump station, but would not have as many permitting constraints.



Derby to Ansonia, I/I Reduction

Treatment Plants

Naugatuck | Beacon Falls | Seymour | Ansonia | ~~Derby~~

Under this alternative, the Derby WPCF would be decommissioned and replaced with a pumping station. All Derby wastewater would be pumped to the Ansonia WPCF.

Wet Weather Capacity
The Ansonia WPCF currently has sufficient capacity to accept the annual average flows from Derby. However, due to high wet weather flows in both Ansonia and Derby, the Ansonia WPCF does not have the capacity to handle the combined peak flows. Therefore, this alternative would require upgrading the WPCF to increase wet weather capacity.

With aggressive I/I reduction in Derby and Ansonia, as well as storage and/or high rate treatment capacity, the required increase in capacity could be reduced.

Phosphorus Treatment
The Ansonia WPCF discharges to the Naugatuck River, while the existing Derby WPCF discharges to the Housatonic River. Therefore, this alternative would involve an increase in costs associated with advanced treatment for Derby wastewater.

Collection System

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

Collection System Rehabilitation
Due to excessive peak flows in both Derby and Ansonia, aggressive I/I reduction would be required in both systems. I/I reduction could be mitigated with the use of storage. The extent of I/I reduction would need to be balanced with marginal cost of treatment and marginal cost of storage.

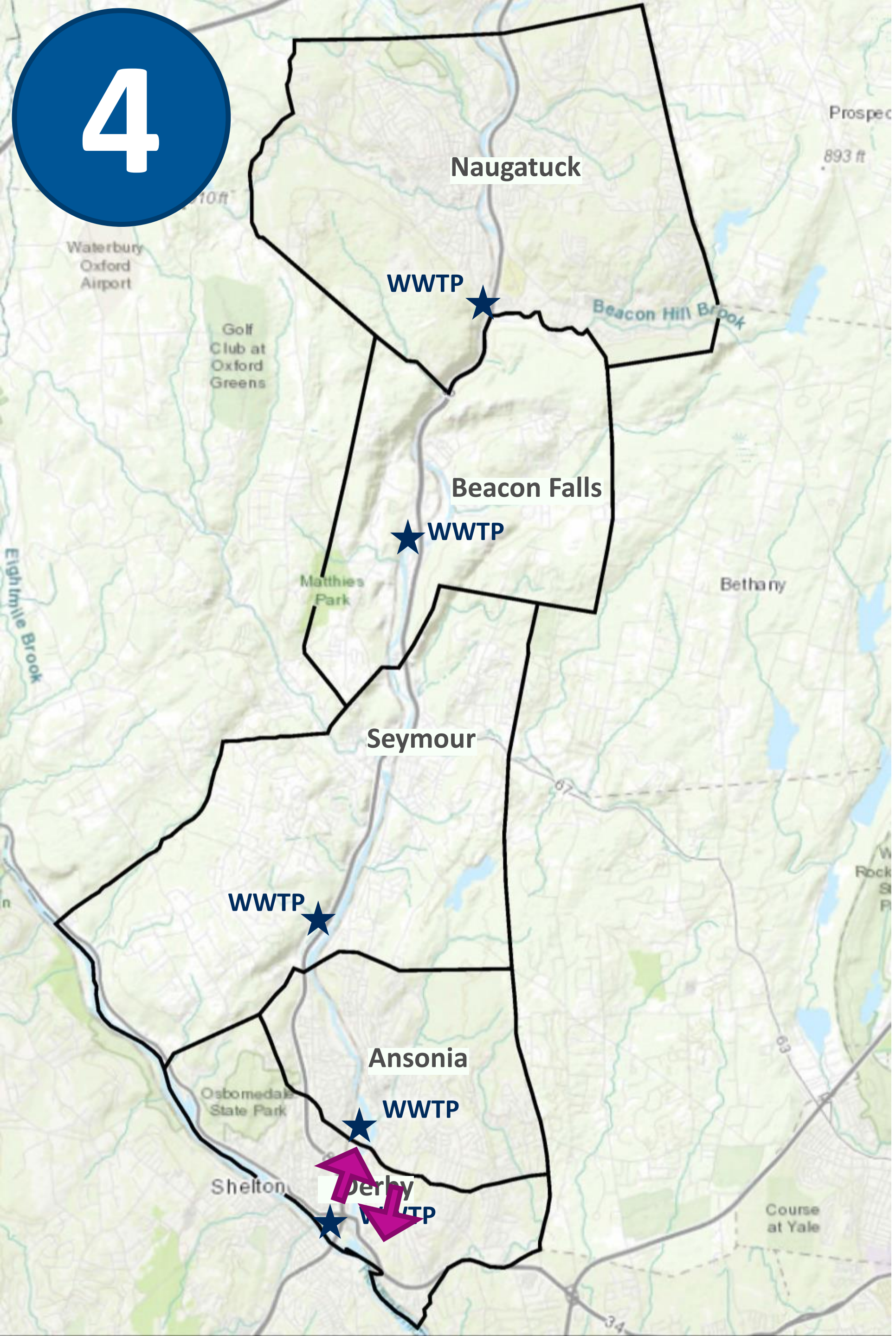
Lift Stations & Conveyance

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

Capacity
The new pumping station in Derby would be sized, along with any storage at that location, to handle anticipated peak hydraulic flow from the Derby wastewater collection system. With aggressive I/I reduction, this peak flow would be reduced. This alternative might also include a headworks facility for grit and screenings removal at the new Derby pumping station.

Conveyance Corridors
There is a nominal 5 ft elevation difference between the Ansonia and Derby WPCFs, and a distance between 8,000 to 9,000 ft.

Two routes were identified in preliminary review. The primary alternatives would be to follow the Naugatuck River from plant to plant, which would involve crossing wetlands, or following existing town roads, which would include a high point of approximately 89 ft and require larger pumps, but would not have as many permitting constraints.



Derby to Ansonia
Effluent Pumped to Housatonic

Treatment Plants

Naugatuck | Beacon Falls | Seymour | **Ansonia** | ~~Derby~~

Under this alternative, the Derby WPCF would be decommissioned and replaced with a pumping station. All Derby wastewater would be pumped to the Ansonia WPCF.

Wet Weather Capacity
The Ansonia WPCF currently has sufficient capacity to accept the annual average flows from Derby. However, due to high wet weather flows in both Ansonia and Derby, the Ansonia WPCF does not have the capacity to handle the combined peak flows. Therefore, this alternative would require upgrading the WPCF and/or providing storage or high rate treatment to increase wet weather capacity.

Phosphorus Treatment
This alternative would include a new effluent discharge line back to Derby, for discharge to the Housatonic River, which could eliminate the need for phosphorus removal.

Collection System

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

Collection System Rehabilitation
The base case assumes maintenance for each collection system necessary to improve the system to a basic level of reliability and performance consistent with the I/I reduction assumptions in the flows and loads analysis.

Lift Stations & Conveyance

Naugatuck | Beacon Falls | Seymour | **Ansonia** | **Derby**

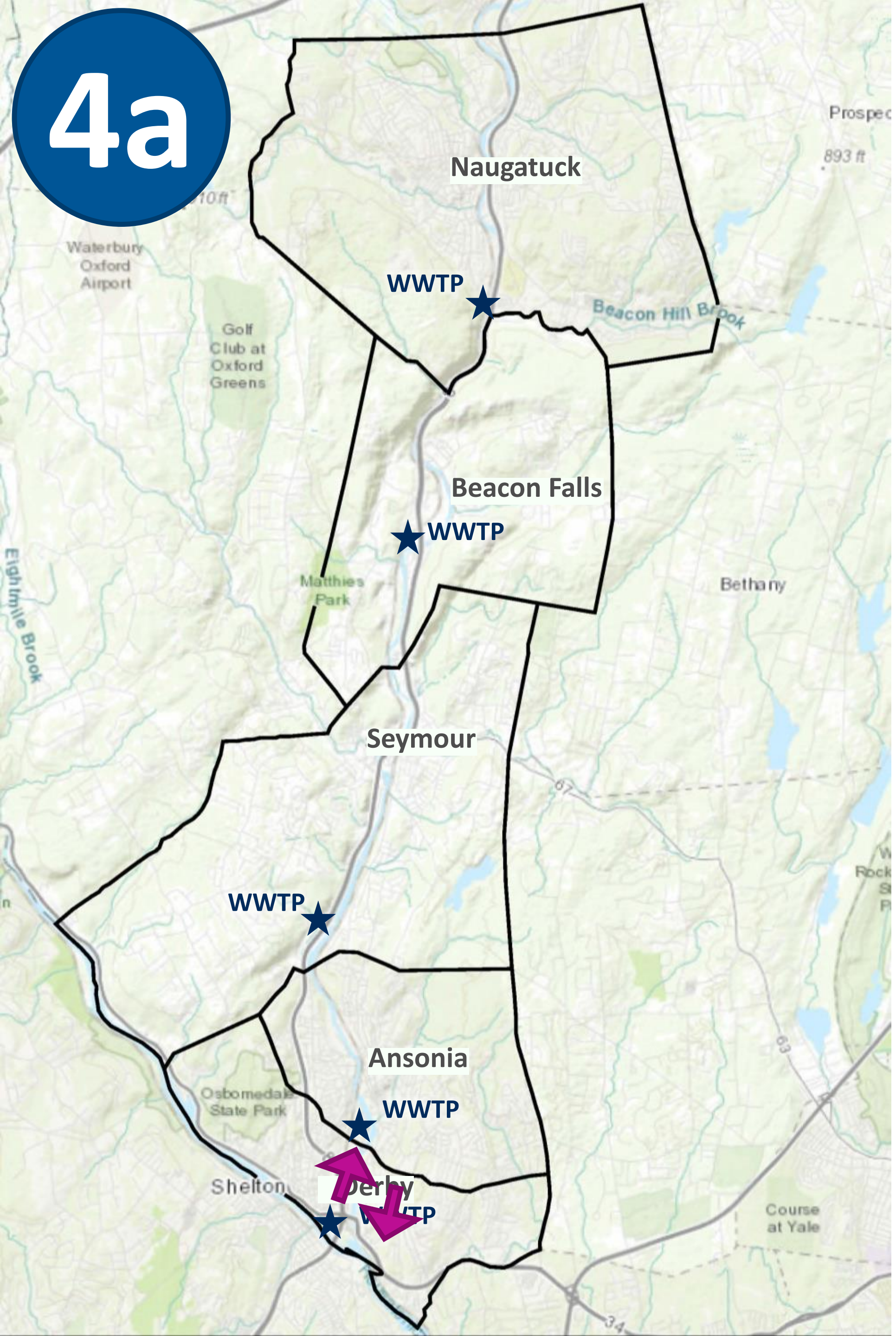
Capacity
The new pumping station in Derby would be sized, along with any storage at that location, to handle anticipated peak hydraulic flow from the Derby wastewater collection system. This alternative might also include a headworks facility for grit and screenings removal at the new Derby pumping station..

Conveyance Corridors
With a nominal 5 ft elevation difference between the Ansonia and Derby WPCFs, and a distance between 8,000 to 9,000 ft, a lift station would be required.

Two routes were identified in preliminary review. The primary alternatives would be to follow the Naugatuck River from plant to plant, which would involve crossing wetlands, or following existing town roads, which would include a high point of approximately 89 ft and require larger pumps, but would not have as many permitting constraints.

Discharge to Housatonic
The same pipe route would be used for effluent discharge to the Housatonic River.

4a



Derby to Ansonia, I/I Reduction Effluent Pumped to Housatonic

Treatment Plants

Naugatuck | Beacon Falls | Seymour | **Ansonia** | ~~Derby~~

Under this alternative, the Derby WPCF would be decommissioned and replaced with a pumping station. All Derby wastewater would be pumped to the Ansonia WPCF.

Wet Weather Capacity
The Ansonia WPCF currently has sufficient capacity to accept the annual average flows from Derby. Depending on the extent of I/I removal, additional measures may be required to accommodate peak flows, such as increased wet weather treatment capacity at the Ansonia WPCF or storage facilities.

Phosphorus Treatment
This alternative would include a new effluent discharge line back to Derby, for discharge to the Housatonic River, which could eliminate the need for phosphorus removal.

Collection System

Naugatuck | Beacon Falls | Seymour | **Ansonia** | **Derby**

Collection System Rehabilitation
Due to excessive peak flows in both Derby and Ansonia, aggressive I/I reduction would be required in both systems. I/I reduction could be mitigated with the use of storage. The extent of I/I reduction would need to be balanced with marginal cost of treatment and marginal cost of storage.

Lift Stations & Conveyance

Naugatuck | Beacon Falls | Seymour | **Ansonia** ← **Derby**

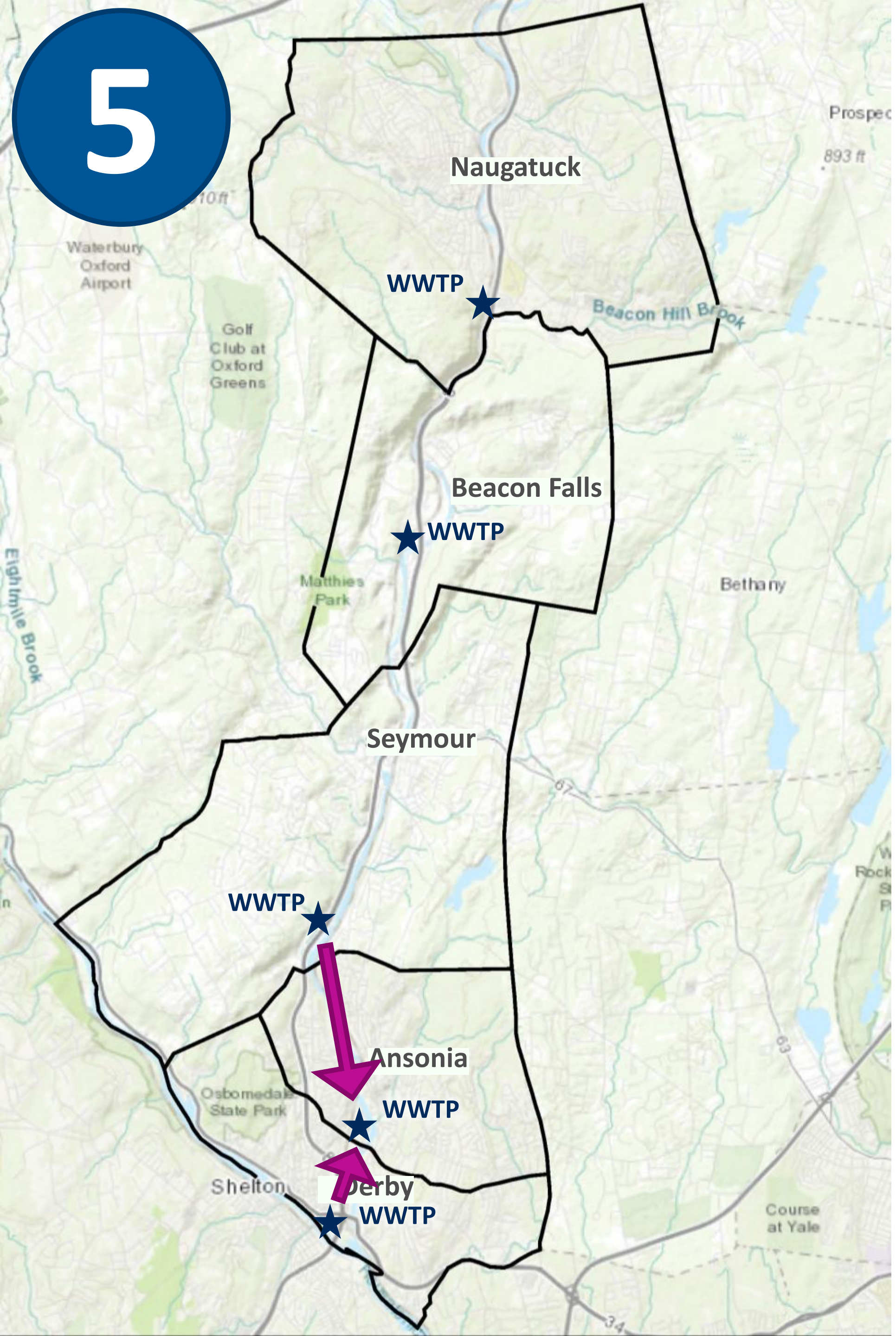
Capacity
The new pumping station in Derby would be sized, along with any storage at that location, to handle anticipated peak hydraulic flow from the Derby wastewater collection system. With aggressive I/I reduction, this peak flow would be reduced. This alternative might also include a headworks facility for grit and screenings removal at the new Derby pumping station.

Conveyance Corridors
With a nominal 5 ft elevation difference between the Ansonia and Derby WPCFs, and a distance between 8,000 to 9,000 ft, a lift station would be required.

Two routes were identified in preliminary review. The primary alternatives would be to follow the Naugatuck River from plant to plant, which would involve crossing wetlands, or following existing town roads, which would include a high point of approximately 89 ft and require a pump station, but would not have as many permitting constraints.

Discharge to Housatonic
The same pipe route would be used for effluent discharge pipeline to the Housatonic River.

5



Derby and Seymour to Ansonia

Treatment Plants

Naugatuck | Beacon Falls | ~~Seymour~~ | Ansonia | ~~Derby~~

Under this alternative, the Derby WPCF and Seymour WPCF would be decommissioned and replaced with pumping to the Ansonia WPCF.

Treatment Capacity
The Ansonia WPCF would have to be upgraded from its current capacity of 3.5 MGD to a new design capacity of 4.9 MGD (annual average) to handle flows from all three towns through 2040. Furthermore, the treatment plant upgrade would need to accommodate significantly higher wet weather flows (10.4 MGD max month, 19.8 MGD peak day), likely also in combination with one or more wet weather storage facilities.

Phosphorus Treatment
The Ansonia WPCF discharges to the Naugatuck River, while the existing Derby WPCF discharges to the Housatonic River. Therefore, this alternative would involve an increase in costs associated with advanced treatment for Derby wastewater.

Collection System

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

Collection System Rehabilitation
The base case assumes maintenance for each collection system necessary to improve the system to a basic level of reliability and performance consistent with the I/I reduction assumptions in the flows and loads analysis.

Lift Stations & Conveyance

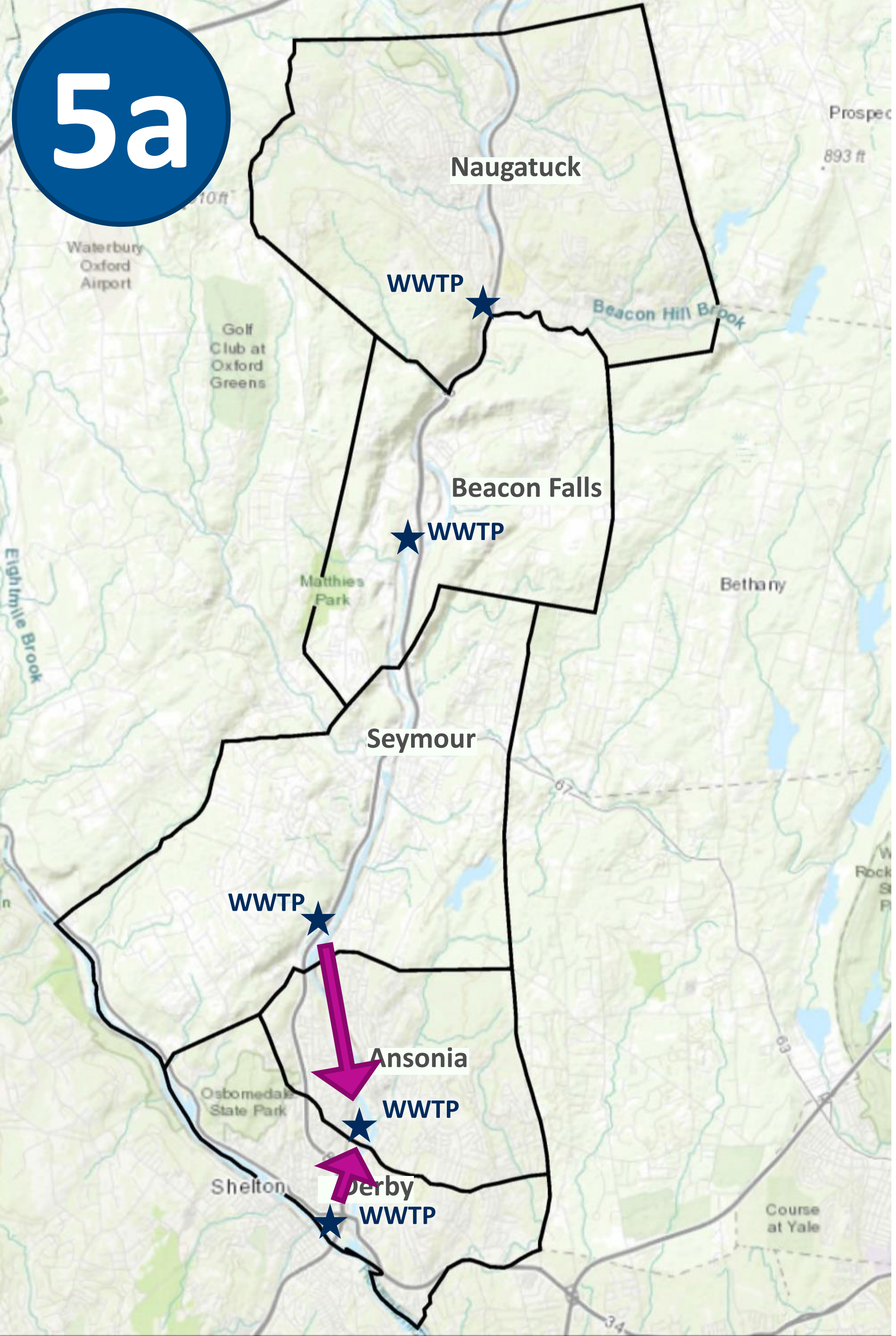
Naugatuck | Beacon Falls | Seymour → Ansonia ← Derby

Capacity
The new pumping stations in Seymour and Derby would be sized, along with any storage at that location, to handle anticipated peak hydraulic flow from their respective wastewater collection systems. This alternative might also include headworks facilities for grit and screenings removal at the new Seymour and Derby pumping stations.

Conveyance Corridors
Two separate pipes would be required: Seymour to Ansonia and Derby to Ansonia.

Seymour to Ansonia could be routed along town roads without major topographic obstructions, with a maximum elevation of approximately 130 ft and a length of nearly 14,000 ft.

Derby to Ansonia has multiple potential routings of approximately 8,000 to 9,000 ft with a maximum elevation up to nearly 90 ft.



Derby and Seymour to Ansonia I/I Reduction

Treatment Plants

Naugatuck | Beacon Falls | ~~Seymour~~ | Ansonia | ~~Derby~~

Under this alternative, the Derby WPCF and Seymour WPCF would be decommissioned and replaced with pumping to the Ansonia WPCF. This alternative would include aggressive I/I reduction and storage to reduce peak flows.

Treatment Capacity
The Ansonia WPCF would have to be upgraded from its current capacity of 3.5 MGD to a new design capacity of 4.9 MGD (annual average) to handle flows from all three towns through 2040. Furthermore, the treatment plant upgrade would need to accommodate significantly higher wet weather flows (depending on extent of I/I reduction, up to 10.4 MGD max month, 19.8 MGD peak day), possibly in combination with one or more wet weather storage facilities.

Phosphorus Treatment
The Ansonia WPCF discharges to the Naugatuck River, while the existing Derby WPCF discharges to the Housatonic River. Therefore, this alternative would involve an increase in costs associated with advanced treatment for Derby wastewater.

Collection System

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

Collection System Rehabilitation
Due to excessive peak flows in Derby, Seymour, and Ansonia, aggressive I/I reduction would be required in all three systems. I/I reduction could be mitigated with the use of storage. The extent of I/I reduction would need to be balanced with marginal cost of treatment and marginal cost of storage.

Lift Stations & Conveyance

Naugatuck | Beacon Falls | Seymour ➡ Ansonia ⬅ Derby

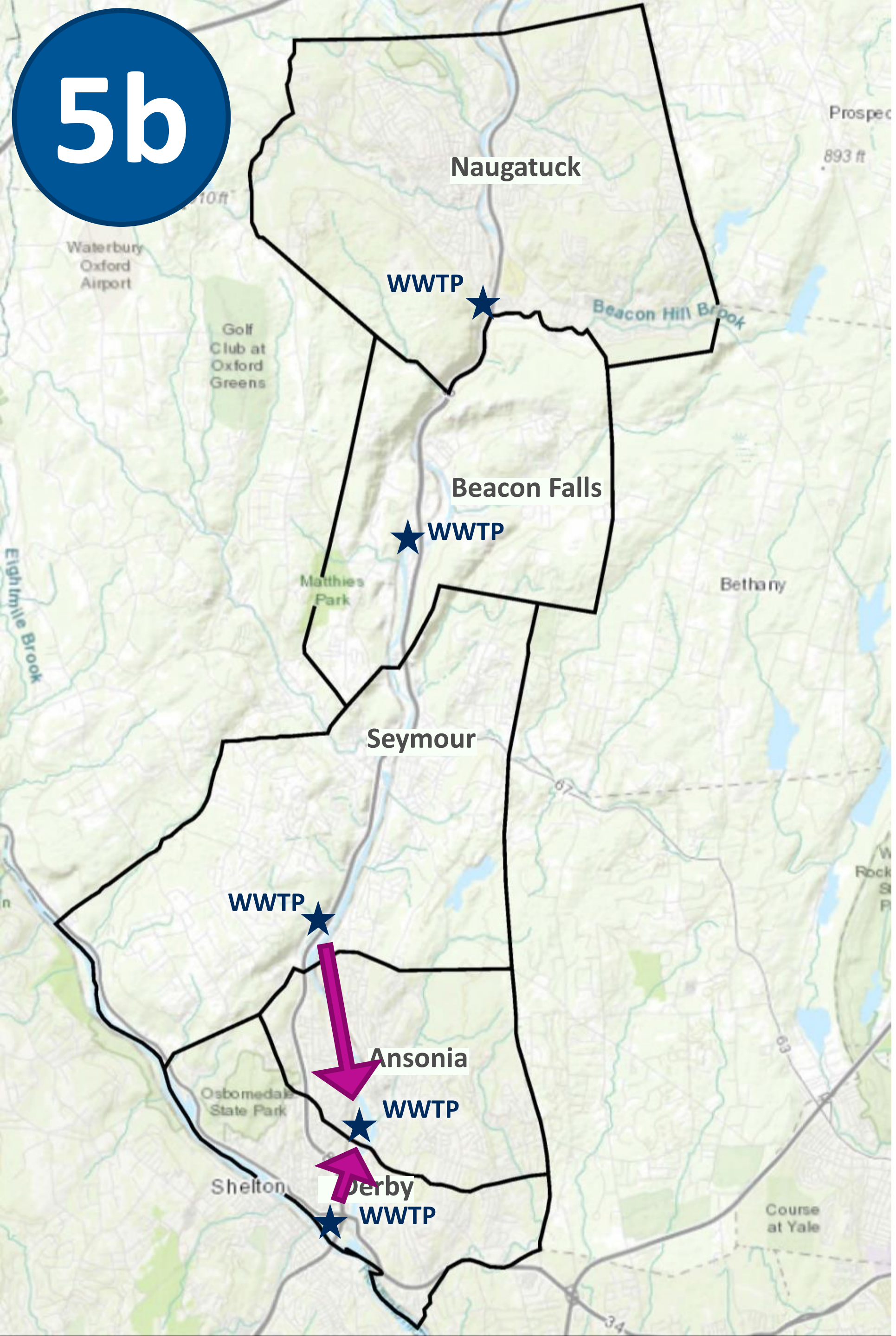
Capacity
The new pumping stations in Seymour and Derby would be sized, along with any storage at that location, to handle anticipated peak hydraulic flow from their respective wastewater collection systems. This alternative might also include headworks facilities for grit and screenings removal at the new Seymour and Derby pumping stations.

With aggressive I/I removal, the necessary pumping capacity would be reduced.

Conveyance Corridors
Two separate pipes would be required: Seymour to Ansonia and Derby to Ansonia.

Seymour to Ansonia could be routed along town roads without major topographic obstructions, with a maximum elevation of approximately 130 ft and a length of nearly 14,000 ft.

Derby to Ansonia has multiple potential routings of approximately 8,000 to 9,000 ft with a maximum elevation up to nearly 90 ft.



Derby and Seymour to Ansonia, Effluent to Housatonic

Treatment Plants

Naugatuck | Beacon Falls | ~~Seymour~~ | Ansonia | ~~Derby~~

Under this alternative, the Derby WPCF and Seymour WPCF would be decommissioned and replaced with pumping to the Ansonia WPCF.

Treatment Capacity
The Ansonia WPCF would have to be upgraded from its current capacity of 3.5 MGD to a new design capacity of 4.9 MGD (annual average) to handle flows from all three towns through 2040. Furthermore, the treatment plant upgrade would need to accommodate significantly higher wet weather flows (10.4 MGD max month, 19.8 MGD peak day), likely also in combination with one or more wet weather storage facilities.

Phosphorus Treatment
This alternative would include a new effluent discharge line back to Derby, for discharge to the Housatonic River, which could eliminate the need for phosphorus removal.

Collection System

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

Collection System Rehabilitation
The base case assumes maintenance for each collection system necessary to improve the system to a basic level of reliability and performance consistent with the I/I reduction assumptions in the flows and loads analysis.

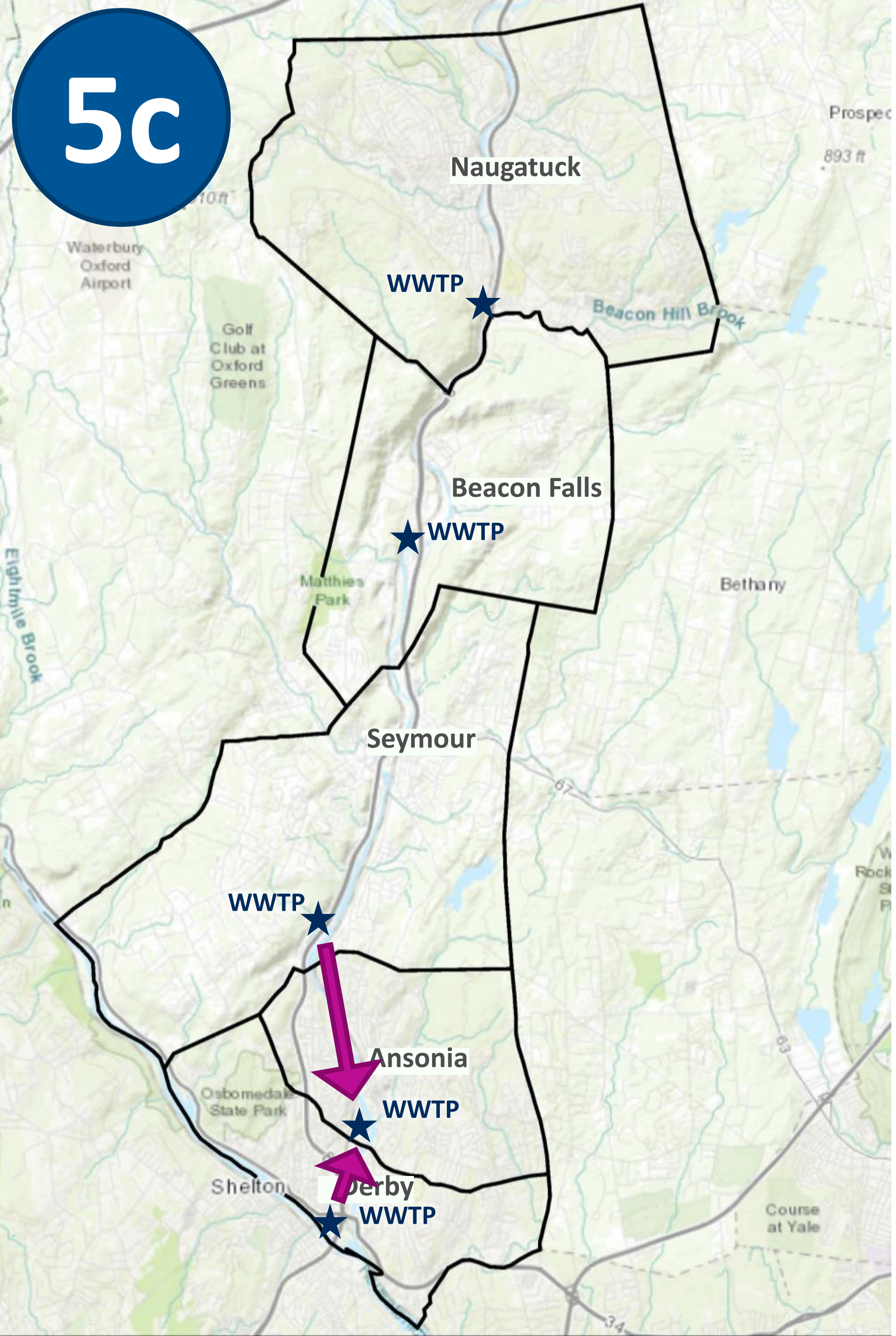
Lift Stations & Conveyance

Naugatuck | Beacon Falls | Seymour → Ansonia ← Derby

Capacity
The new pumping stations in Seymour and Derby would be sized, along with any storage at that location, to handle anticipated peak hydraulic flow from their respective wastewater collection systems. This alternative might also include headworks facilities for grit and screenings removal at the new Seymour and Derby pumping stations. With aggressive I/I removal, the necessary pumping capacity would be reduced.

Conveyance Corridors
Two separate pipes would be required: Seymour to Ansonia and Derby to Ansonia. Seymour to Ansonia could be routed along town roads without major topographic obstructions, with a maximum elevation of approximately 130 ft and a length of nearly 14,000 ft. Derby to Ansonia has multiple potential routings of approximately 8,000 to 9,000 ft with a maximum elevation up to nearly 90 ft.

Discharge to Housatonic
The same pipe route would be used for effluent discharge to the Housatonic River.



Derby and Seymour to Ansonia I/I Reduction, Effluent to Housatonic

Treatment Plants

Naugatuck | Beacon Falls | ~~Seymour~~ | Ansonia | ~~Derby~~

Under this alternative, the Derby WPCF and Seymour WPCF would be decommissioned and replaced with pumping to the Ansonia WPCF. This alternative would include aggressive I/I reduction and storage to reduce peak flows.

Treatment Capacity
The Ansonia WPCF would have to be upgraded from its current capacity of 3.5 MGD to a new design capacity of 4.9 MGD (annual average) to handle flows from all three towns through 2040. Furthermore, the treatment plant upgrade would need to accommodate significantly higher wet weather flows (depending on the extent of I/I removal, up to 10.4 MGD max month, 19.8 MGD peak day), possibly also in combination with one or more wet weather storage facilities.

Phosphorus Treatment
This alternative would include a new effluent discharge line back to Derby, for discharge to the Housatonic River, which could eliminate the need for phosphorus removal.

Collection System

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

Collection System Rehabilitation
Due to excessive peak flows in Derby, Seymour, and Ansonia, aggressive I/I reduction would be required in all three systems. I/I reduction could be mitigated with the use of storage. The extent of I/I reduction would need to be balanced with marginal cost of treatment and marginal cost of storage.

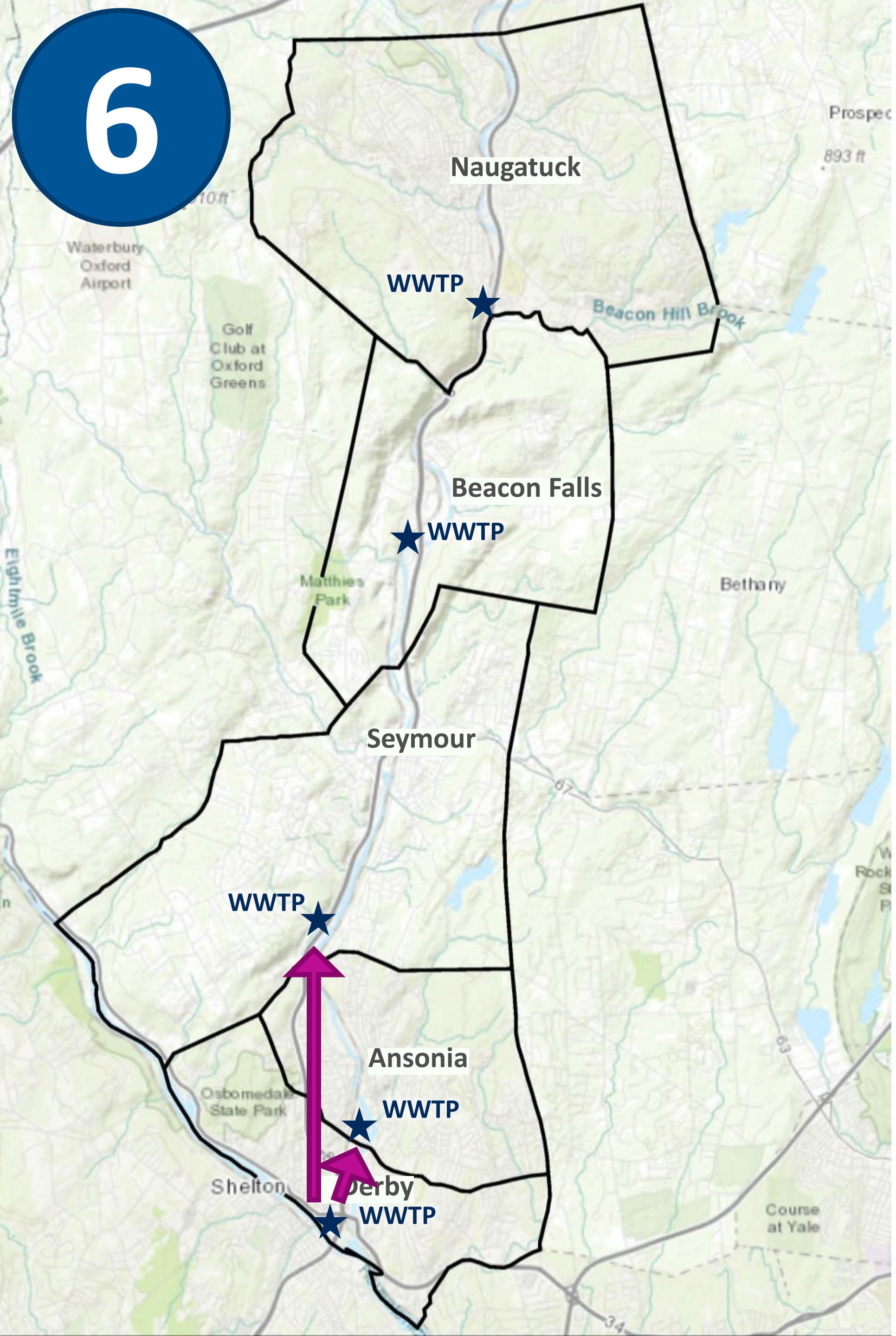
Lift Stations & Conveyance

Naugatuck | Beacon Falls | Seymour → Ansonia ← Derby

Capacity
The new pumping stations in Seymour and Derby would be sized, along with any storage at that location, to handle anticipated peak hydraulic flow from their respective wastewater collection systems. This alternative might also include headworks facilities for grit and screenings removal at the new Seymour and Derby pumping stations. With aggressive I/I removal, the necessary pumping capacity would be reduced.

Conveyance Corridors
Two separate pipes would be required: Seymour to Ansonia and Derby to Ansonia. Seymour to Ansonia could be routed along town roads without major topographic obstructions, with a maximum elevation of approximately 130 ft and a length of nearly 14,000 ft.
Derby to Ansonia has multiple potential routings of approximately 8,000 to 9,000 ft with a maximum elevation up to nearly 90 ft.

Discharge to Housatonic
The same pipe route would be used for effluent discharge to the Housatonic River



Derby to Seymour and Anisonia

Treatment Plants

Naugatuck | Beacon Falls | Seymour | Ansonia | ~~Derby~~

The Derby WPCF would be decommissioned and replaced with a pumping station. A portion of Derby's wastewater would be pumped to the Ansonia WPCF, with the remainder pumped to the Seymour WPCF.

Treatment Capacity

If approximately 40-60% of the Derby flow is pumped to the Seymour WPCF, with the remainder pumped to the Ansonia WPCF, those two plants would have adequate capacity to handle the additional flows from Derby under average annual and max month conditions. However, the capacities of both plants would be exceeded during peak hydraulic flow conditions. Therefore, both treatment plants would need to be modified or upgraded to process higher wet weather flows, possibly in combination with storage.

Phosphorus Treatment

Ansonia and Seymour discharge to the Naugatuck River, while Derby discharges to the Housatonic River. Therefore, this alternative would involve an increase in costs for advanced treatment for Derby wastewater.

Collection System

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

Collection System Rehabilitation

The base case assumes maintenance for each collection system necessary to improve the system to a basic level of reliability and performance consistent with the I/I reduction assumptions in the flows and loads analysis.

Lift Stations & Conveyance

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

Capacity

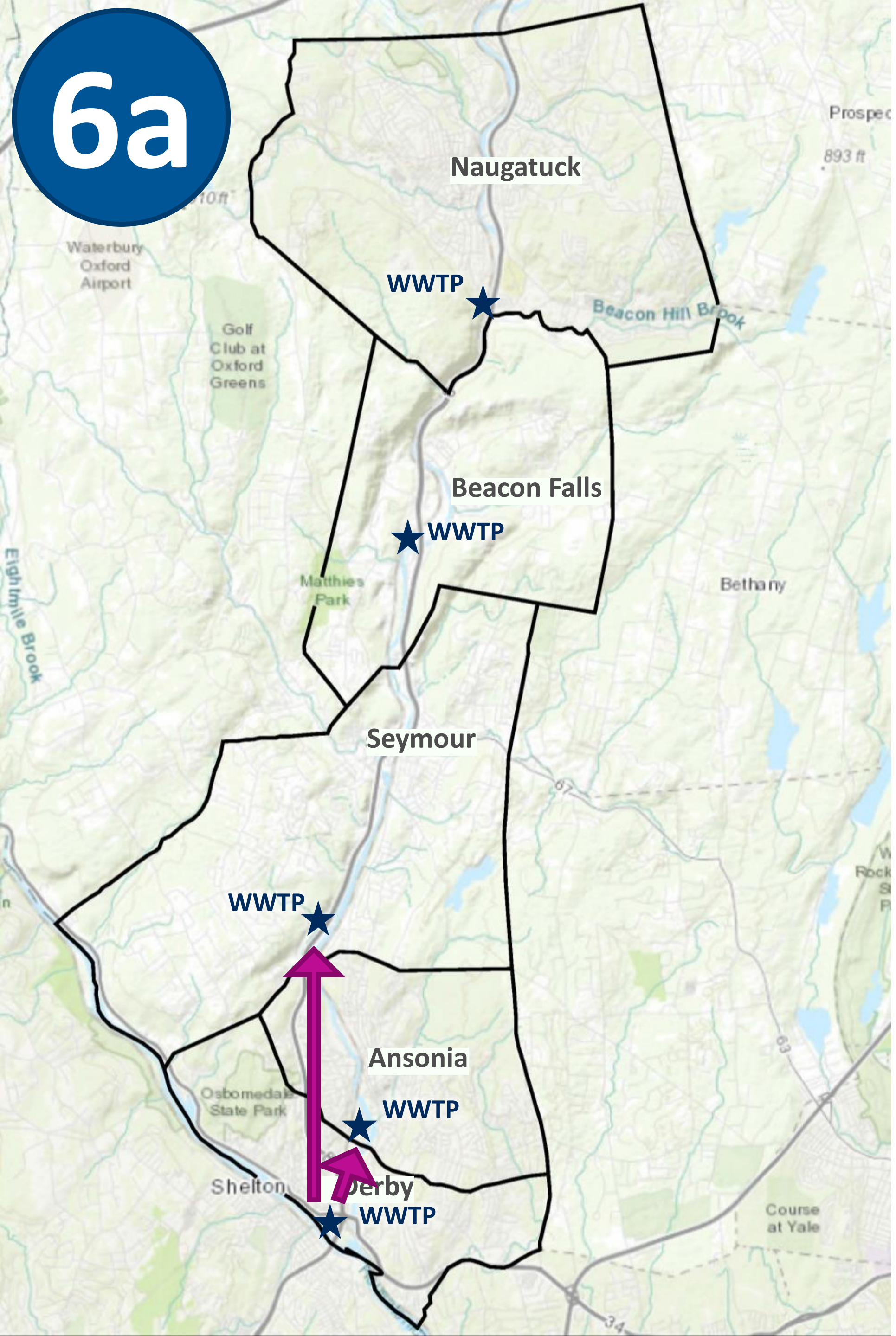
The new pumping station(s) in Derby would be sized, along with any storage at that location, to handle anticipated peak hydraulic flow from the Derby wastewater collection systems. This alternative might also include headworks facilities for grit and screenings removal at the new Derby pumping station(s).

Conveyance Corridors

It would be possible to convey this flow in two stages: Derby to Ansonia and Ansonia to Seymour.

Seymour to Ansonia could be routed along town roads without major topographic obstructions, with a maximum elevation of approximately 130 ft and a length of nearly 14,000 ft.

Derby to Ansonia has multiple potential routings of approximately 8,000 to 9,000 ft with a maximum elevation up to nearly 90 ft.



Derby to Seymour and Ansonia, I/I Reduction

Treatment Plants

Naugatuck | Beacon Falls | Seymour | Ansonia | ~~Derby~~

The Derby WPCF would be decommissioned and replaced with a pumping station. A portion of Derby's wastewater would be pumped to the Ansonia WPCF, with the remainder pumped to the Seymour WPCF.

Treatment Capacity
If approximately 40-60% of the Derby flow is pumped to the Seymour WPCF, with the remainder pumped to the Ansonia WPCF, those two plants would have adequate capacity to handle the additional flows from Derby under average annual and max month conditions. Depending on the extent of I/I removal, additional measures may be required to accommodate peak flows, such as increased wet weather treatment capacity at the WPCFs or storage facilities.

Phosphorus Treatment
Ansonia and Seymour discharge to the Naugatuck River, while Derby discharges to the Housatonic River. Therefore, this alternative would involve an increase in costs for advanced treatment for Derby wastewater.

Collection System

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

Collection System Rehabilitation
Due to excessive peak flows in Derby, Seymour, and Ansonia, aggressive I/I reduction would be required in all three systems. I/I reduction could be mitigated with the use of storage. The extent of I/I reduction would need to be balanced with marginal cost of treatment and marginal cost of storage.

Lift Stations & Conveyance

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

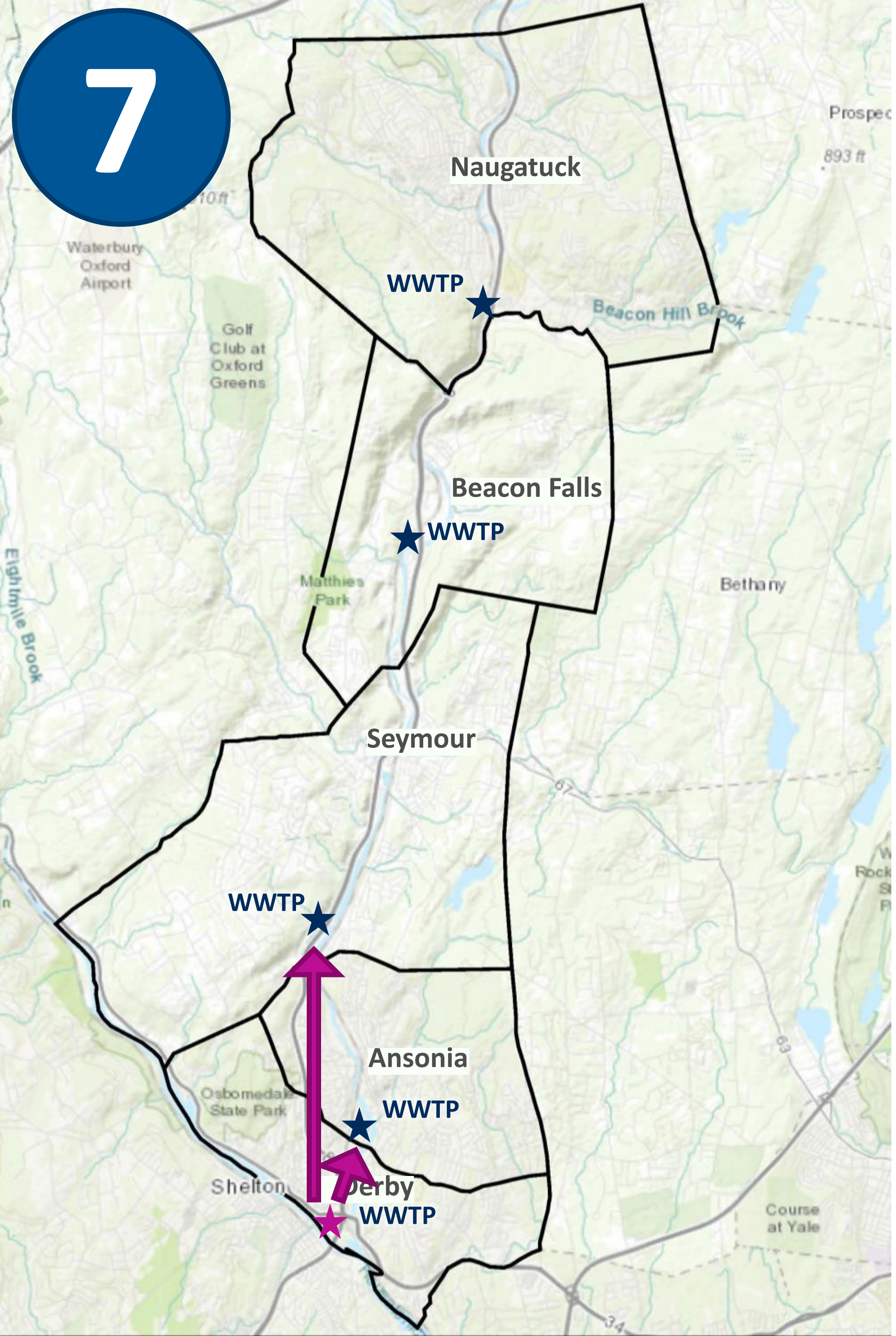
Capacity
The new pumping station(s) in Derby would be sized, along with any storage at that location, to handle anticipated peak hydraulic flow from the Derby wastewater collection systems. This alternative might also include headworks facilities for grit and screenings removal at the new Derby pumping station(s).

With aggressive I/I removal, the necessary pumping capacity would be reduced.

Conveyance Corridors
It would be possible to convey this flow in two stages: Derby to Ansonia and Ansonia to Seymour.

Seymour to Ansonia could be routed along town roads without major topographic obstructions, with a maximum elevation of approximately 130 ft and a length of nearly 14,000 ft.

Derby to Ansonia has multiple potential routings of approximately 8,000 to 9,000 ft with a maximum elevation up to nearly 90 ft.



Derby to Seymour and Ansonia and Derby

Treatment Plants

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

There is no advantage to this alternative over the base case, if the Derby WPCF is not demolished. Therefore, this alternative is not considered further.

Collection System

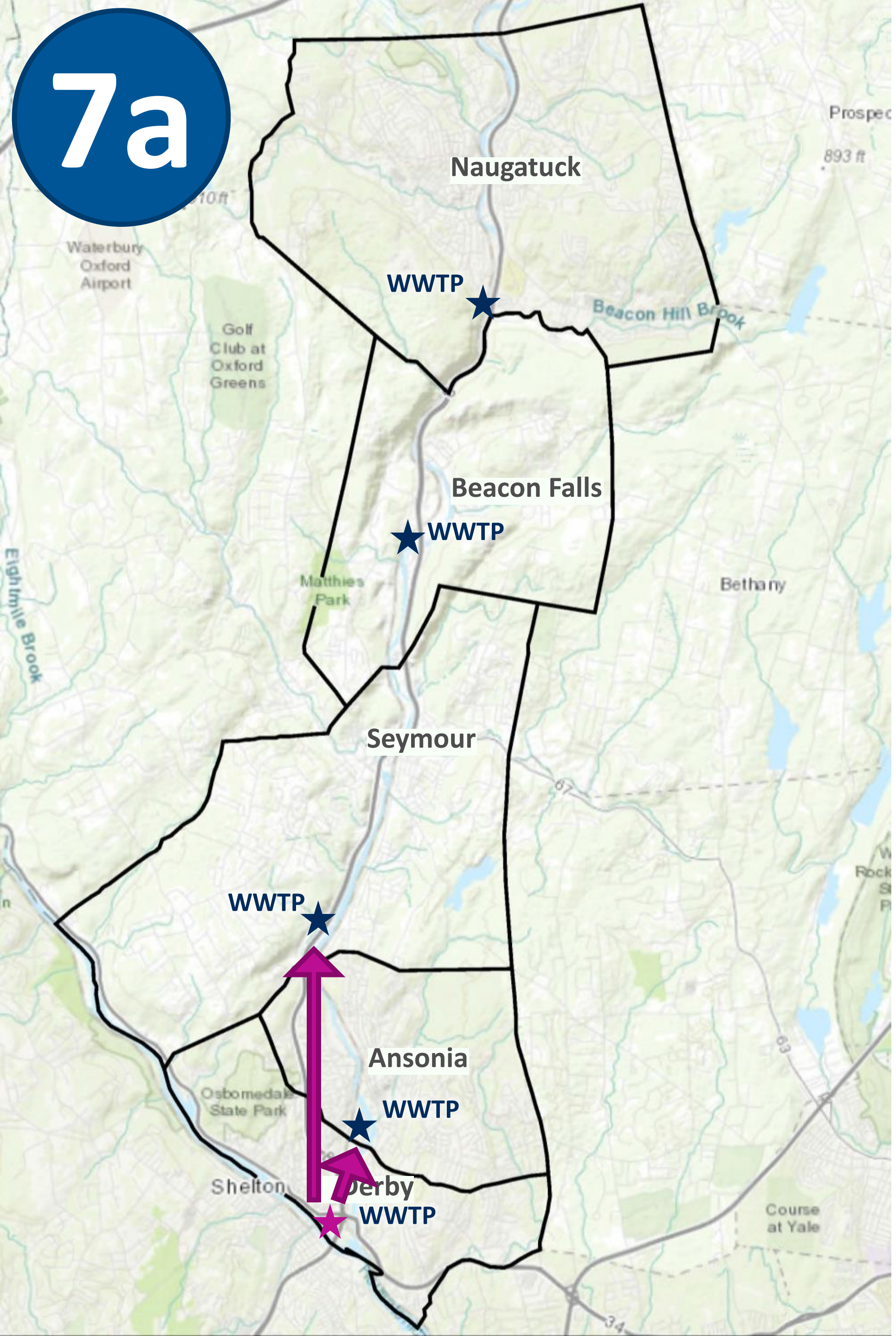
Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

There is no advantage to this alternative over the base case, if the Derby WPCF is not demolished. Therefore, this alternative is not considered further.

Lift Stations & Conveyance

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

There is no advantage to this alternative over the base case, if the Derby WPCF is not demolished. Therefore, this alternative is not considered further.



Derby to Seymour and Ansonia and Derby, I/I Reduction

Treatment Plants

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

There is no advantage to this alternative over the base case, if the Derby WPCF is not demolished. Therefore, this alternative is not considered further.

Collection System

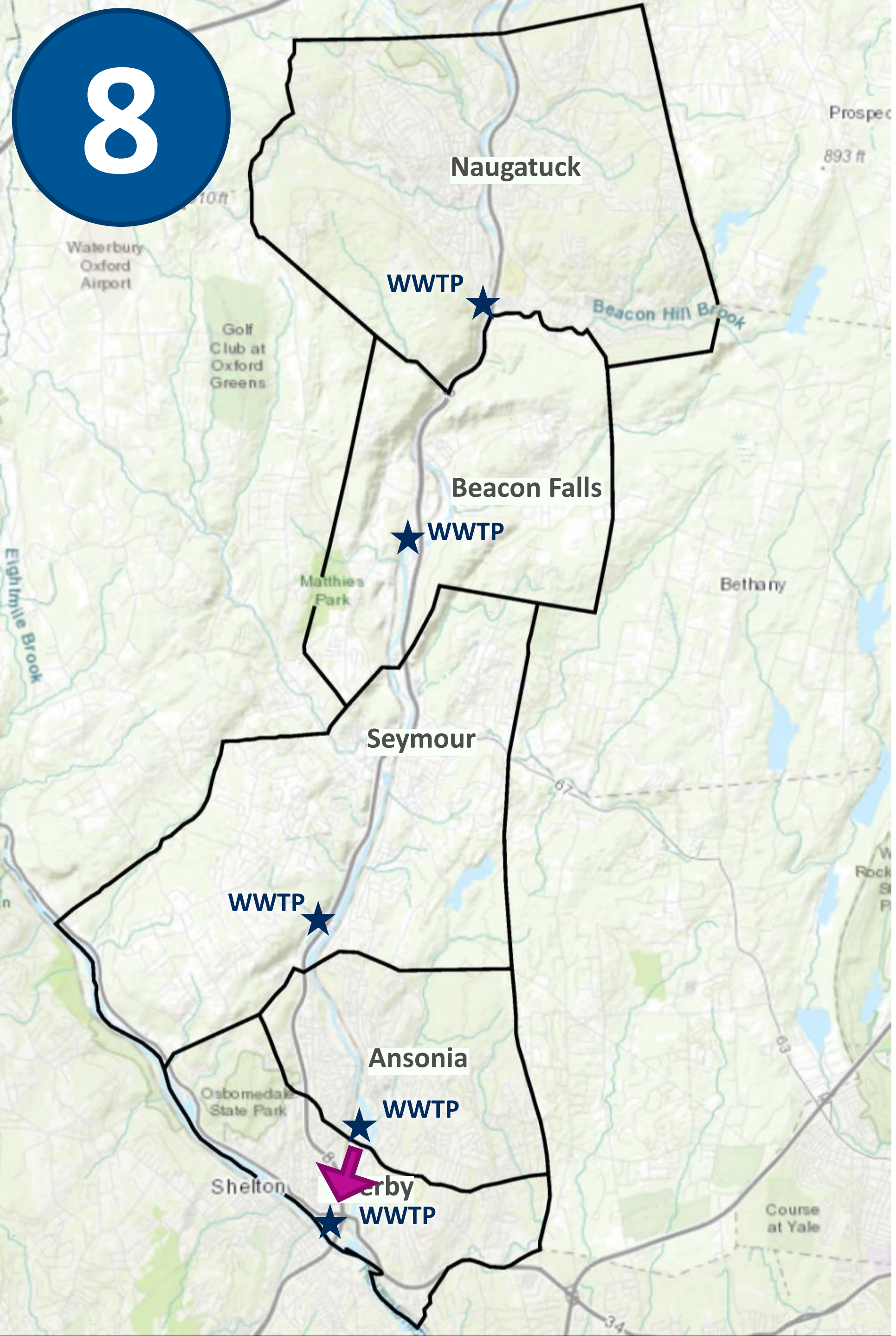
Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

There is no advantage to this alternative over the base case, if the Derby WPCF is not demolished. Therefore, this alternative is not considered further.

Lift Stations & Conveyance

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

There is no advantage to this alternative over the base case, if the Derby WPCF is not demolished. Therefore, this alternative is not considered further.



Ansonia to Derby

Treatment Plants

Naugatuck | Beacon Falls | Seymour | ~~Ansonia~~ | Derby

The Ansonia WPCF would be decommissioned and replaced with a pumping station. All Ansonia wastewater would be pumped to the Derby WPCF. Since the Ansonia WPCF was upgraded relatively recently (completed 2011), this alternative might not be fully implemented until closer to the end of the planning period.

Treatment Capacity
The Derby WPCF currently has sufficient capacity to accept the annual average flows from Ansonia. However, due to high wet weather flows, the Derby WPCF does not have the capacity to handle the combined wet weather flows. Therefore, this would require upgrading the Derby WPCF, possibly in combination with providing storage.

Phosphorus Treatment
Since the Derby WPCF discharges to the Housatonic River, where phosphorus removal is not required, this alternative would reduce some of the costs associated with advanced treatment for Ansonia wastewater.

Collection System

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

Collection System Rehabilitation
The base case assumes maintenance for each collection system necessary to improve the system to a basic level of reliability and performance consistent with the I/I reduction assumptions in the flows and loads analysis.

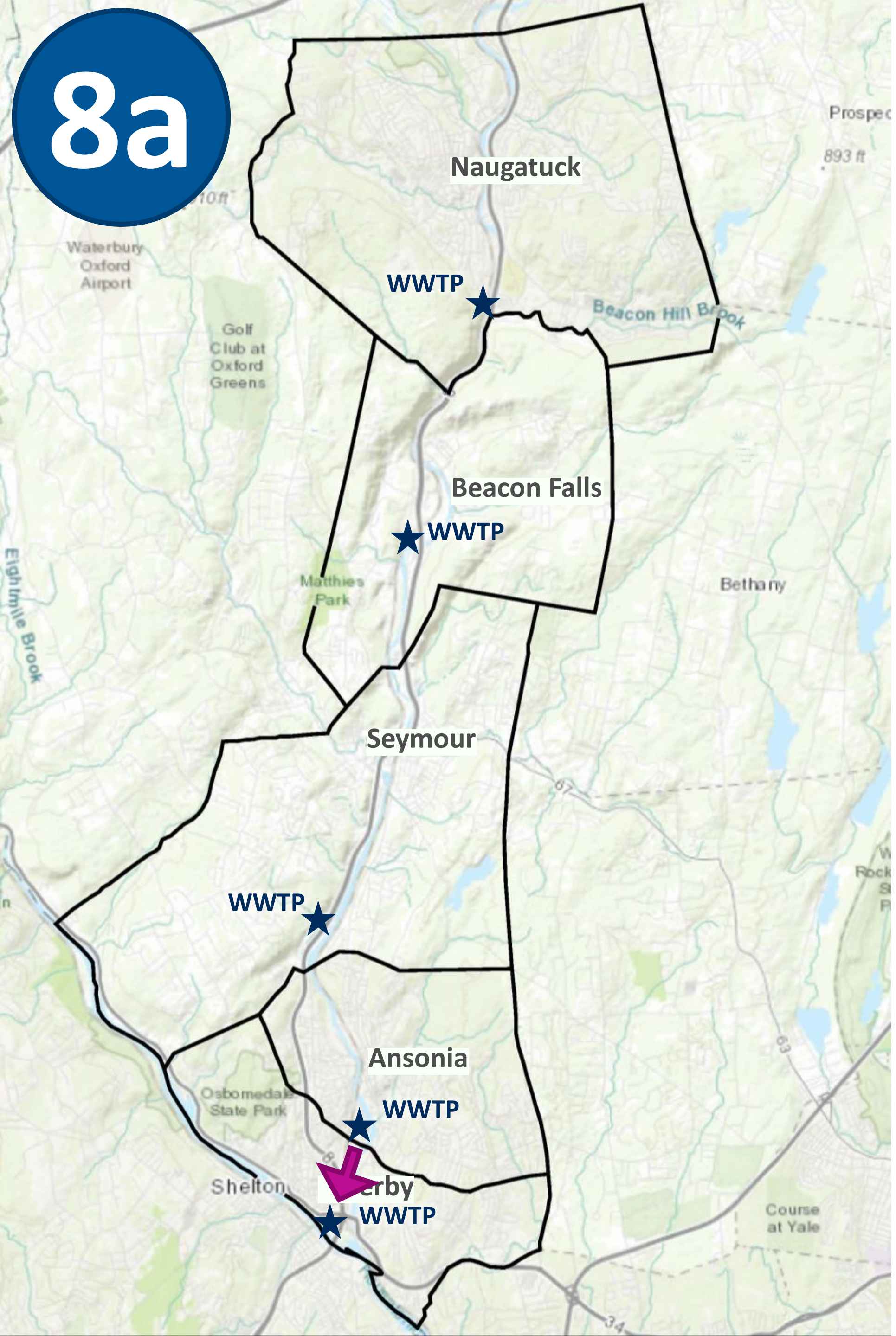
Lift Stations & Conveyance

Naugatuck | Beacon Falls | Seymour | Ansonia → Derby

Capacity
The new pumping station in Ansonia would be sized, along with any storage at that location, to handle anticipated peak hydraulic flow from the Ansonia wastewater collection system. This alternative might also include a headworks facility for grit and screenings removal at the new Ansonia pumping station.

Conveyance Corridors
With a nominal 5 ft elevation difference between the Ansonia and Derby WPCFs, and a distance between 8,000 to 9,000 ft, a lift station would be required.

Two routes were identified in preliminary review. The primary alternatives would be to follow the Naugatuck River from plant to plant, which would involve crossing wetlands, or following existing town roads, which would include a high point of approximately 89 ft and require larger pumps, but would not have as many permitting constraints.



Ansonia to Derby, I/I Reduction

Treatment Plants

Naugatuck | Beacon Falls | Seymour | ~~Ansonia~~ | Derby

The Ansonia WPCF would be decommissioned and replaced with a pumping station. All Ansonia wastewater would be pumped to the Derby WPCF. Since the Ansonia WPCF was upgraded relatively recently (completed 2011), this alternative might not be fully implemented until closer to the end of the planning period.

Treatment Capacity
The Derby WPCF currently has sufficient capacity to accept the annual average flows from Ansonia. Depending on the extent of I/I removal, additional measures may be required to accommodate peak flows, such as increased wet weather treatment capacity at the Derby WPCF or storage facilities.

Phosphorus Treatment
Since the Derby WPCF discharges to the Housatonic River, where phosphorus removal is not required, this alternative would reduce some of the costs associated with advanced treatment for Ansonia wastewater.

Collection System

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

Collection System Rehabilitation
Due to excessive peak flows in Derby and Ansonia, aggressive I/I reduction would be required in both systems. I/I reduction could be mitigated with the use of storage. The extent of I/I reduction would need to be balanced with marginal cost of treatment and marginal cost of storage.

Lift Stations & Conveyance

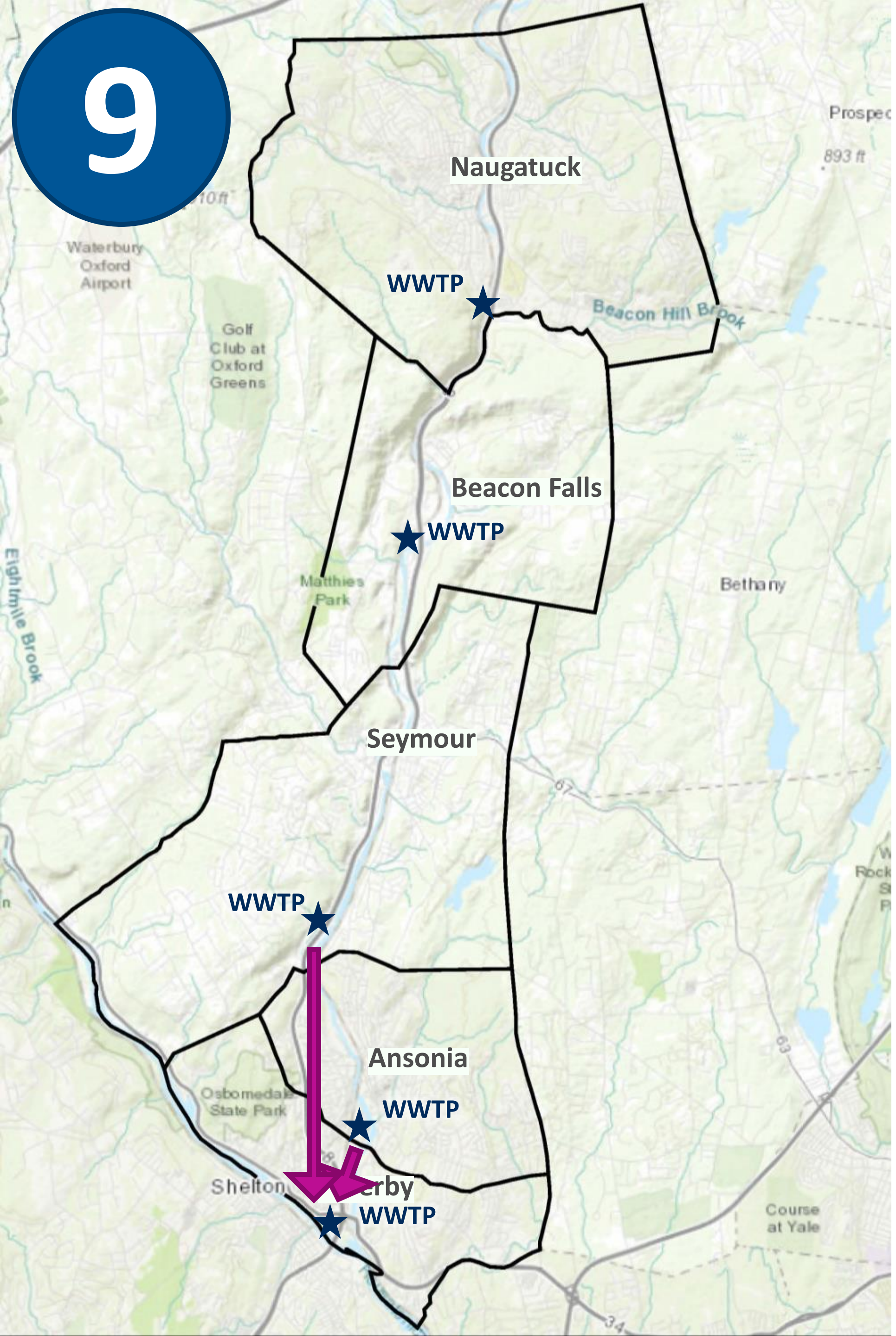
Naugatuck | Beacon Falls | Seymour | Ansonia → Derby

Capacity
The new pumping station in Ansonia would be sized, along with any storage at that location, to handle anticipated peak hydraulic flow from the Ansonia wastewater collection system. This alternative might also include a headworks facility for grit and screenings removal at the new Ansonia pumping station.

With aggressive I/I removal, the necessary pumping capacity would be reduced.

Conveyance Corridors
With a nominal 5 ft elevation difference between the Ansonia and Derby WPCFs, and a distance between 8,000 to 9,000 ft, a lift station would be required.

Two routes were identified in preliminary review. The primary alternatives would be to follow the Naugatuck River from plant to plant, which would involve crossing wetlands, or following existing town roads, which would include a high point of approximately 89 ft and require larger pumps, but would not have as many permitting constraints.



Seymour and Ansonia to Derby

Treatment Plants

Naugatuck | Beacon Falls | ~~Seymour~~ | ~~Ansonia~~ | Derby

Under this alternative, the Seymour and Ansonia WPCFs would be decommissioned and replaced with pumping stations. All wastewater from those communities would be conveyed to the Derby WPCF for treatment. Since the Ansonia WPCF was upgraded relatively recently (completed 2011), the Ansonia to Derby part of this alternative might not be implemented until closer to the end of the planning period.

Treatment Capacity
The capacity of the Derby WPCF would have to be increased as part of a major upgrade to the facility. Due to high wet weather flows, this alternative would require significantly increasing the wet weather treatment capacity. This alternative also might storage facilities.

Phosphorus Removal
Since the Derby WPCF discharges to the Housatonic River, where phosphorus removal is not required, this alternative would reduce some of the costs associated with advanced treatment for wastewater from Seymour and Ansonia.

Collection System

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

Collection System Rehabilitation
The base case assumes maintenance for each collection system necessary to improve the system to a basic level of reliability and performance consistent with the I/I reduction assumptions in the flows and loads analysis.

Lift Stations & Conveyance

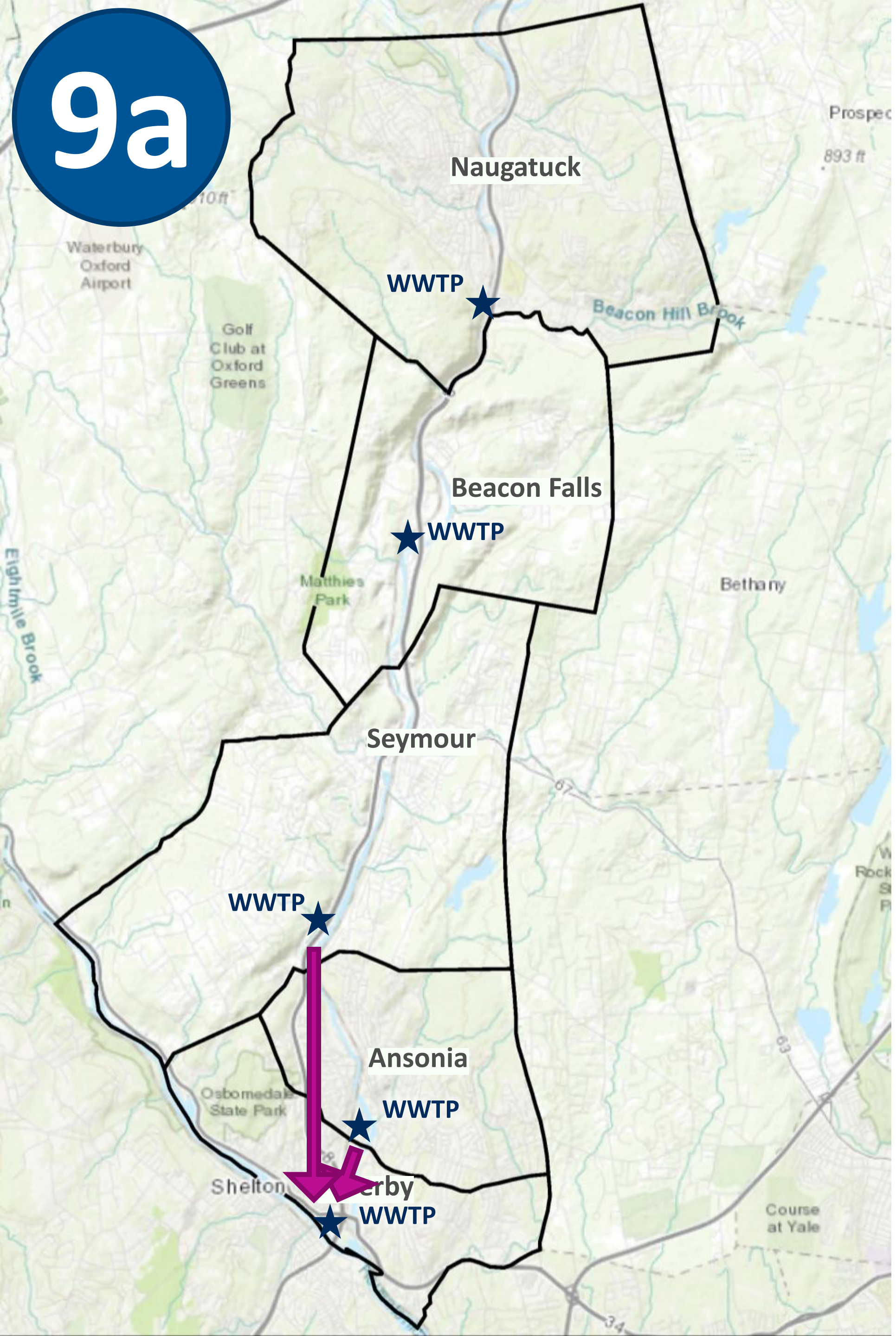
Naugatuck | Beacon Falls | Seymour ➡ Ansonia ➡ Derby

Capacity
The new pumping stations in Seymour and Ansonia would be sized, along with any storage at that location, to handle anticipated peak hydraulic flow from its respective wastewater collection system (for Seymour PS: 6.7 MGD peak day, 7.4 MGD peak hour; for Ansonia PS: 5.4 MGD peak day, 9.5 MGD peak hour). This alternative might also include a headworks facility for grit and screenings removal at one or both of the new pumping stations.

Conveyance Corridors
It would be possible to convey this flow in two stages: Seymour to Ansonia and Ansonia to Derby.

Seymour to Ansonia could be routed along town roads without major topographic obstructions, with a maximum elevation of approximately 130 ft and a length of nearly 14,000 ft.

Ansonia to Derby has multiple potential routings of approximately 8,000 to 9,000 ft with a maximum elevation up to nearly 90 ft.



Seymour and Ansonia to Derby, I/I Reduction

Treatment Plants

Naugatuck | Beacon Falls | ~~Seymour~~ | ~~Ansonia~~ | **Derby**

Under this alternative, the Seymour and Ansonia WPCFs would be decommissioned and replaced with pumping stations. All wastewater from those communities would be conveyed to the Derby WPCF for treatment. Since the Ansonia WPCF was upgraded relatively recently (completed 2011), the Ansonia to Derby part of this alternative might not be implemented until closer to the end of the planning period.

Treatment Capacity

The capacity of the Derby WPCF would have to be increased as part of a major upgrade to the facility. Depending on the extent of I/I removal, additional measures such as storage facilities may be required.

Phosphorus Removal

Since the Derby WPCF discharges to the Housatonic River, where phosphorus removal is not required, this alternative would reduce some of the costs associated with advanced treatment for wastewater from Seymour and Ansonia.

Collection System

Naugatuck | Beacon Falls | **Seymour** | **Ansonia** | **Derby**

Collection System Rehabilitation

Due to excessive peak flows in Derby, Seymour, and Ansonia, aggressive I/I reduction would be required in all three systems. I/I reduction could be mitigated with the use of storage. The extent of I/I reduction would need to be balanced with marginal cost of treatment and marginal cost of storage.

Lift Stations & Conveyance

Naugatuck | Beacon Falls | **Seymour** → **Ansonia** → **Derby**

Capacity

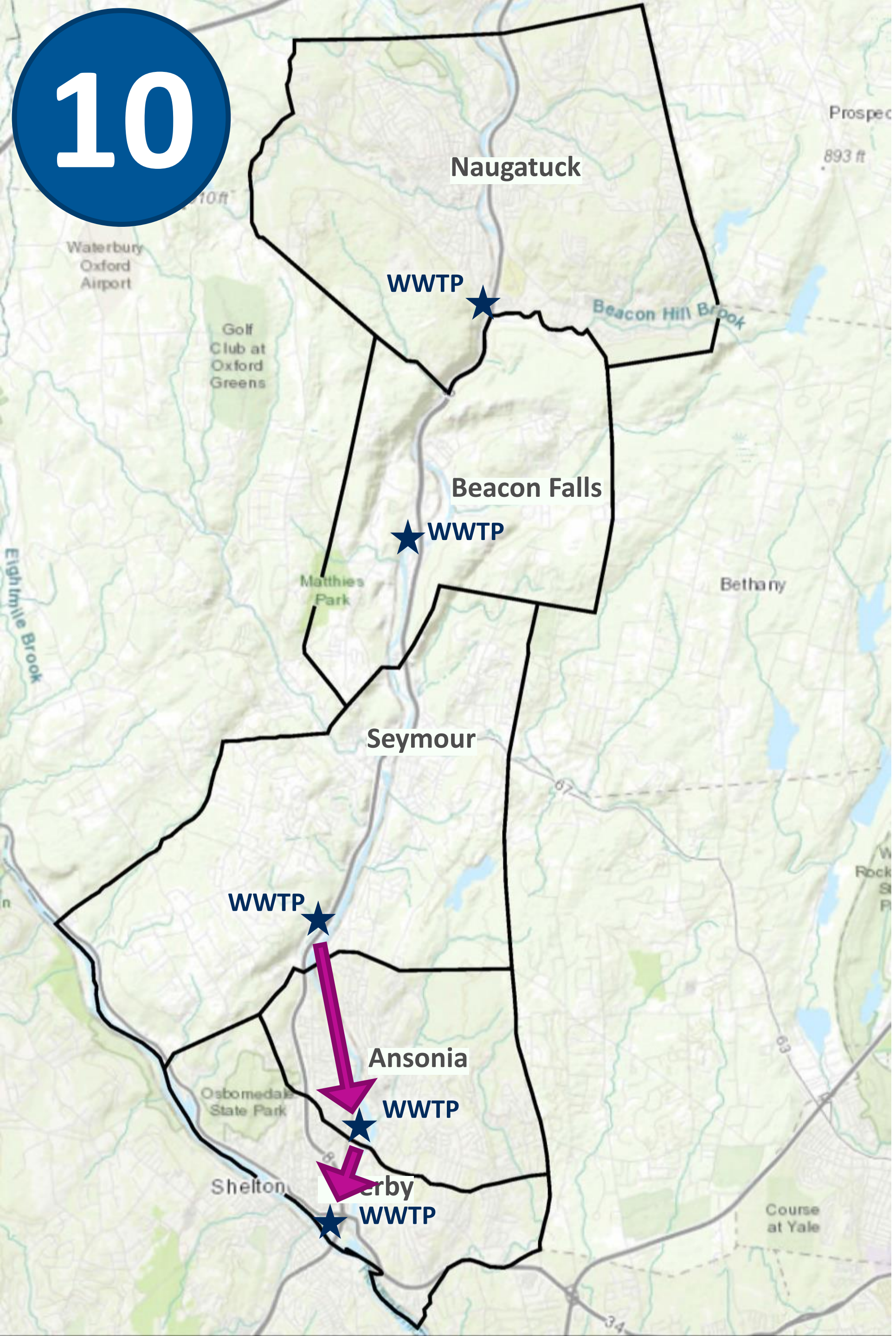
The new pumping stations in Seymour and Ansonia would be sized, along with any storage, to handle anticipated peak hydraulic flow from its respective collection system (for Seymour PS: 6.7 MGD peak day, 7.4 MGD peak hour; for Ansonia PS: 5.4 MGD peak day, 9.5 MGD peak hour). This alternative might also include a headworks facility for grit and screenings removal at one or both of the new pumping stations. With aggressive I/I removal, the necessary pumping capacity could be reduced.

Conveyance Corridors

It would be possible to convey this flow in two stages: Seymour to Ansonia and Ansonia to Derby.

Seymour to Ansonia could be routed along town roads without major topographic obstructions, with a maximum elevation of approximately 130 ft and a length of nearly 14,000 ft.

Ansonia to Derby has multiple potential routings of approximately 8,000 to 9,000 ft with a maximum elevation up to nearly 90 ft.



Seymour to Ansonia
Part of Ansonia to Derby

Treatment Plants

Naugatuck | Beacon Falls | ~~Seymour~~ | Ansonia | Derby

Under this alternative, the Seymour WPCF would be decommissioned and replaced with a pumping station. All wastewater from Seymour would be conveyed to the Ansonia WPCF for treatment. Also, Bartholomew Pump Station in Ansonia would be decommissioned, and all flow going to it would be diverted to flow by gravity to the Derby WPCF.

If the hydraulic constrictions at the Ansonia WPCF are eliminated to restore its design peak flow capacity to 12.0 MGD, the Ansonia WPCF would be able to handle the annual average, max month flows, but not the peak flows from Seymour. Modifications to increase wet weather treatment capacity and/or storage would be needed at the Ansonia WPCF, and possibly also at the Derby WPCF.

Phosphorus Removal
Since the Derby WPCF discharges to the Housatonic River, where phosphorus removal is not required, this alternative would reduce some of the costs associated with advanced treatment for wastewater from Ansonia.

Collection System

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

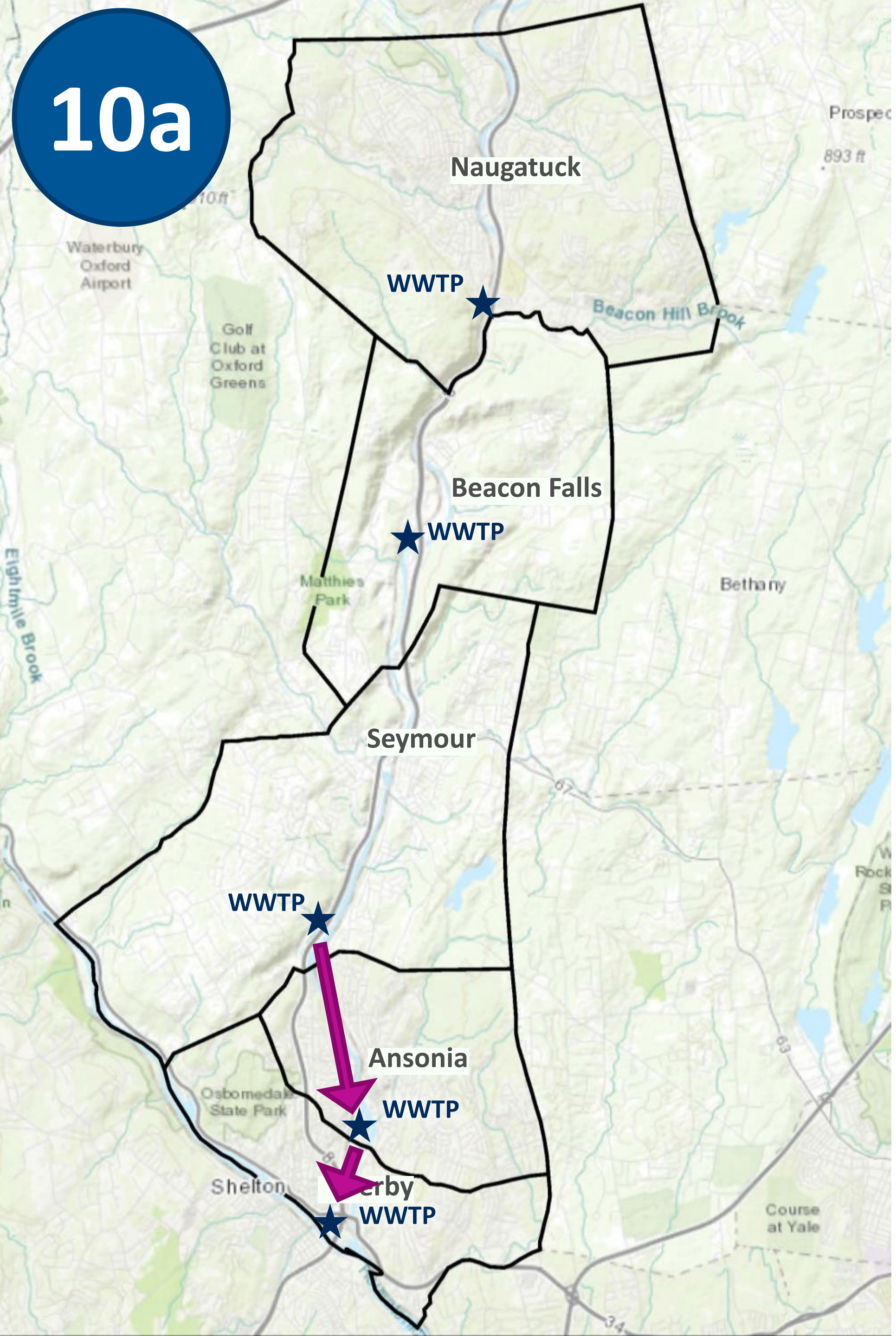
Collection System Rehabilitation
The base case assumes maintenance for each collection system necessary to improve the system to a basic level of reliability and performance consistent with the I/I reduction assumptions in the flows and loads analysis. This alternative does not include additional collection system improvements.

Lift Stations & Conveyance

Naugatuck | Beacon Falls | Seymour → Ansonia → Derby

Capacity
The new Seymour pump station would be designed to pump all flow from Seymour (2040 design flows 6.7 MGD for peak day, and 7.4 MGD for peak hour), possibly with some storage provided at the pump station to mitigate peak flows and reduce max pumping capacity.

Conveyance Corridors
Seymour to Ansonia could be routed along town roads without major topographic obstructions, with a maximum elevation of approximately 130 ft and a length of nearly 14,000 ft.
Ansonia to Derby has multiple potential routings of approximately 8,000 to 9,000 ft with a maximum elevation up to nearly 90 ft.



Seymour to Ansonia, Part of Ansonia to Derby, I/I Reduction

Treatment Plants

Naugatuck | Beacon Falls | ~~Seymour~~ | Ansonia | Derby

Under this alternative, the Seymour WPCF would be decommissioned and replaced with a pumping station. All wastewater from Seymour would be conveyed to the Ansonia WPCF for treatment. Also, Bartholomew Pump Station in Ansonia would be decommissioned, and all flow going to it would be diverted to flow by gravity to the Derby WPCF.

If the hydraulic constrictions at the Ansonia WPCF are eliminated to restore its design peak flow capacity to 12.0 MGD, Ansonia WPCF would be able to handle the annual average, max month flows, but not the peak flows from Seymour. Depending on the extent of I/I removal, modifications to increase wet weather treatment capacity and/or storage may be needed at the Ansonia WPCF, and possibly also at the Derby WPCF.

Phosphorus Removal
Since the Derby WPCF discharges to the Housatonic River, where phosphorus removal is not required, this alternative would reduce some of the costs associated with advanced treatment for wastewater from Ansonia.

Collection System

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

Collection System Rehabilitation
Due to excessive peak flows in Derby, Seymour, and Ansonia, aggressive I/I reduction would be required in all three systems. I/I reduction could be mitigated with the use of storage. The extent of I/I reduction would need to be balanced with marginal cost of treatment and marginal cost of storage.

Lift Stations & Conveyance

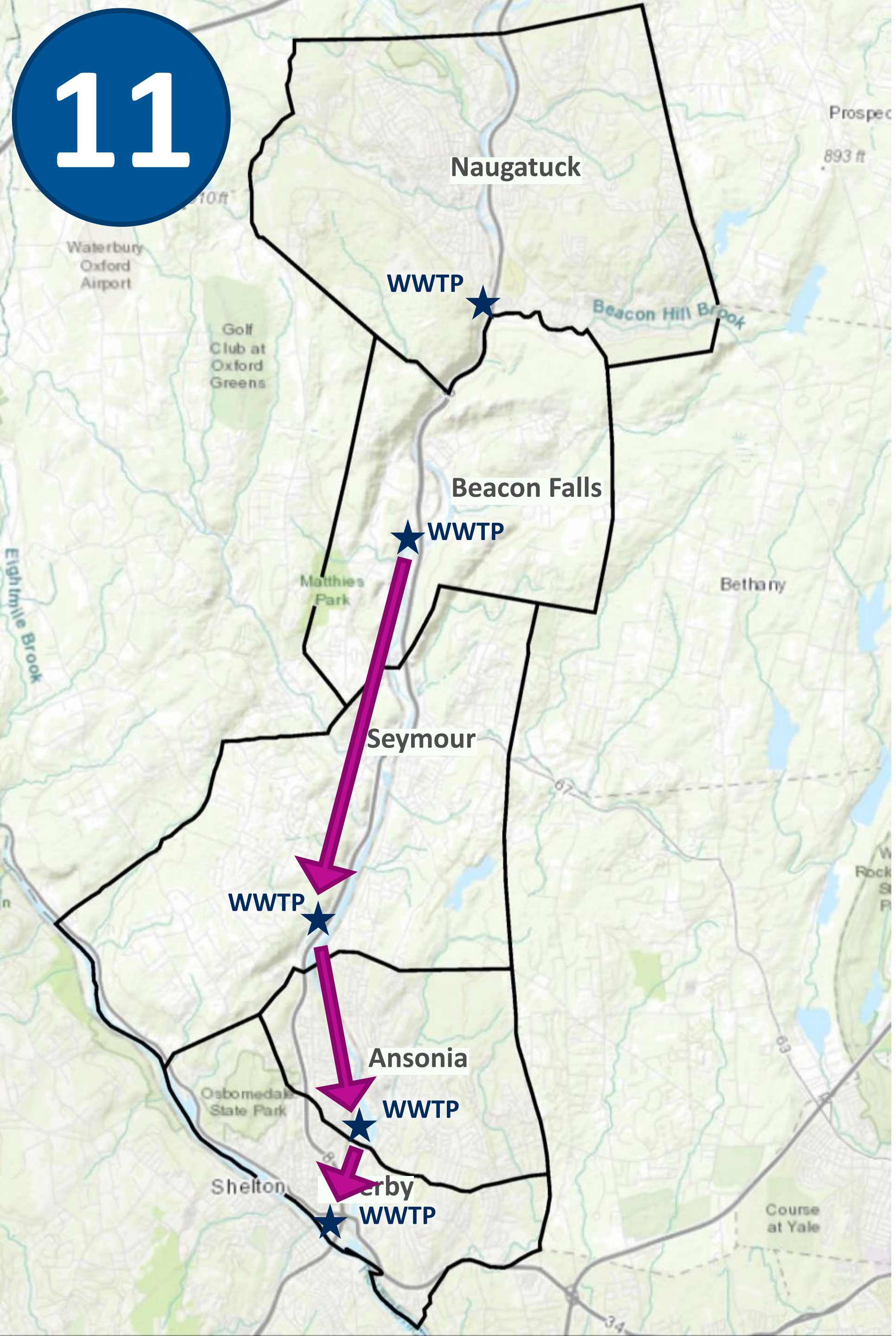
Naugatuck | Beacon Falls | Seymour ➔ Ansonia ➔ Derby

Capacity
The new Seymour pump station would be designed to pump all flow from Seymour (2040 design flows 6.7 MGD for peak day, and 7.4 MGD for peak hour), possibly with some storage provided at the pump station to mitigate peak flows and reduce max pumping capacity.

With aggressive I/I removal, the necessary pumping capacity would be reduced.

Conveyance Corridors
Seymour to Ansonia could be routed along town roads without major topographic obstructions, with a maximum elevation of approximately 130 ft and a length of nearly 14,000 ft.

Ansonia to Derby has multiple potential routings of approximately 8,000 to 9,000 ft with a maximum elevation up to nearly 90 ft.



Beacon Falls and Seymour to Ansonia Part of Ansonia to Derby

Treatment Plants

Naugatuck | ~~Beacon Falls~~ | ~~Seymour~~ | Ansonia | Derby

Under this alternative, the Beacon Falls and Seymour WPCF would be decommissioned and replaced with pumping stations. This wastewater would be conveyed to the Ansonia WPCF for treatment. Also, Bartholomew Pump Station in Ansonia would be decommissioned, and all flow going to it would be diverted to flow by gravity to the Derby WPCF.

If the hydraulic constrictions at the Ansonia WPCF are eliminated to restore its design peak flow capacity to 12.0 MGD, the Ansonia WPCF would be able to handle the annual average and max month flows from Seymour and Beacon Falls. However, additional measures such as treatment plant modifications to increase wet weather capacity at the Ansonia WPCF, possibly also combined with storage, would be required to accommodate the peak day and peak hour flows.

Phosphorus Removal
Since the Derby WPCF discharges to the Housatonic River, where phosphorus removal is not required, this alternative would reduce some of the costs associated with advanced treatment for wastewater from Ansonia.

Collection System

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

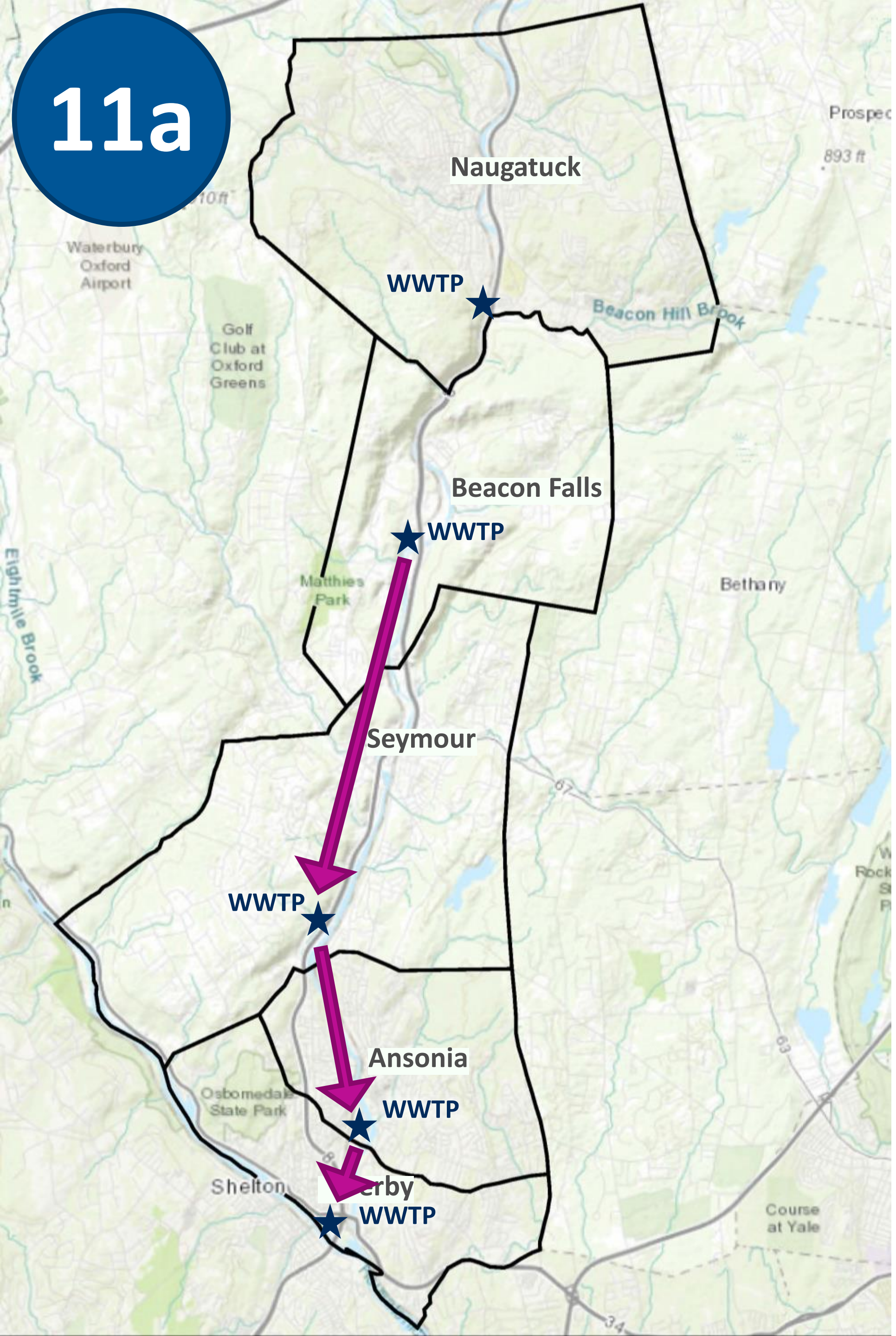
Collection System Rehabilitation
The base case assumes maintenance for each collection system necessary to improve the system to a basic level of reliability and performance consistent with the I/I reduction assumptions in the flows and loads analysis.

Lift Stations & Conveyance

Naugatuck | Beacon Falls → Seymour → Ansonia → Derby

Capacity
The new pumping stations in Beacon Falls and Seymour would be sized, along with any storage at that location, to handle anticipated peak hydraulic flow from their respective wastewater collection systems. This alternative might also include a headworks facility for grit and screenings removal at one or both of the new upstream pumping stations.

Conveyance Corridors
Conveyance would be expected to utilize similar corridors to prior alternatives for each leg of conveyance.



Beacon Falls and Seymour to Ansonia Part of Ansonia to Derby, I/I Reduction

Treatment Plants

Naugatuck | ~~Beacon Falls~~ | ~~Seymour~~ | Ansonia | Derby

Under this alternative, the Beacon Falls and Seymour WPCF would be decommissioned and replaced with a pumping stations. This wastewater would be conveyed to the Ansonia WPCF for treatment. Also, Bartholomew Pump Station in Ansonia would be decommissioned, and all flow going to it would be diverted to flow by gravity to the Derby WPCF.

If the hydraulic constrictions at the Ansonia WPCF are eliminated to restore its design peak flow capacity to 12.0 MGD, the Ansonia WPCF would be able to handle the annual average and max month flows from Seymour and Beacon Falls. Depending on the extent of I/I reduction, additional measures such as treatment plant modifications to increase wet weather capacity, possibly also combined with storage, may be required to accommodate the peak flows.

Phosphorus Removal
Since the Derby WPCF discharges to the Housatonic River, where phosphorus removal is not required, this alternative would reduce some of the costs associated with advanced treatment for wastewater from Ansonia.

Collection System

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

Collection System Rehabilitation
Due to excessive peak flows, aggressive I/I reduction would be required in all four systems. I/I reduction could be mitigated with the use of storage. The extent of I/I reduction would need to be balanced with marginal cost of treatment and marginal cost of storage.

Lift Stations & Conveyance

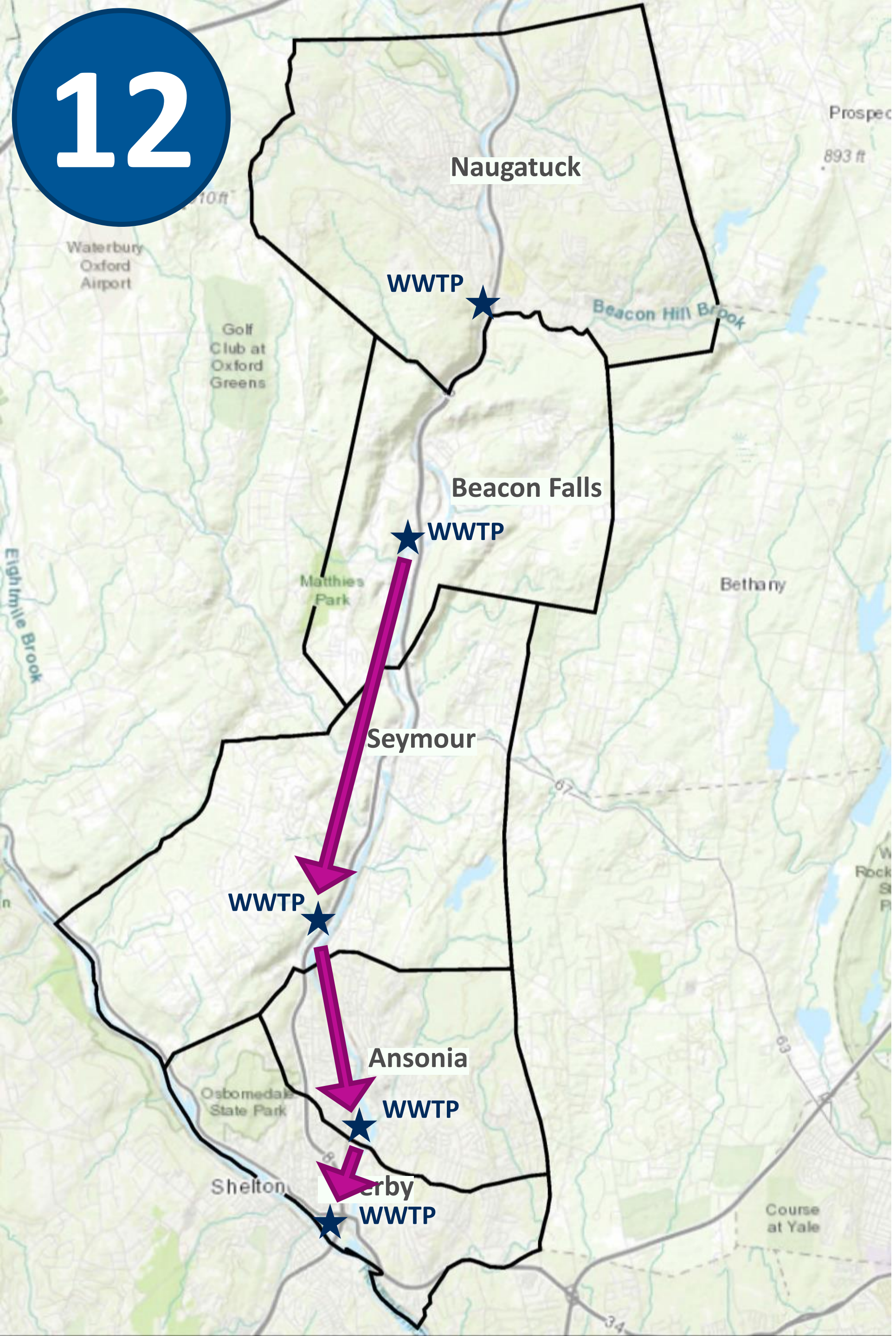
Naugatuck | Beacon Falls → Seymour → Ansonia → Derby

Capacity
The new pumping stations in Beacon Falls, Seymour and Ansonia would be sized, along with any storage at that location, to handle anticipated peak hydraulic flow from their respective wastewater collection systems. This alternative might also include a headworks facility for grit and screenings removal at one or more of the new upstream pumping stations.

With aggressive I/I removal, the necessary pumping capacity would be reduced.

Conveyance Corridors
Conveyance would be expected to utilize similar corridors to prior alternatives for each leg of conveyance.

12



Beacon Falls, Seymour, and Ansonia to Derby

Treatment Plants

Naugatuck | ~~Beacon Falls~~ | ~~Seymour~~ | ~~Ansonia~~ | Derby

Under this alternative, the Beacon Falls, Seymour and Ansonia WPCFs would be decommissioned and replaced with pumping stations. All wastewater from those communities would be conveyed to the Derby WPCF for treatment. Since the Ansonia WPCF was upgraded relatively recently (completed 2011), this alternative might not be fully implemented until closer to the end of the planning period.

The capacity of the Derby WPCF would have to be increased as part of a major upgrade to the facility, to provide sufficient treatment capacity for flows from all four communities through 2040. Storage may also be required for peak flows.

Phosphorus Removal
Since the Derby WPCF discharges to the Housatonic River, where phosphorus removal is not required, this alternative would reduce some of the costs associated with advanced treatment for wastewater from Beacon Falls, Seymour and Ansonia.

Collection System

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

Collection System Rehabilitation
The base case assumes maintenance for each collection system necessary to improve the system to a basic level of reliability and performance consistent with the I/I reduction assumptions in the flows and loads analysis.

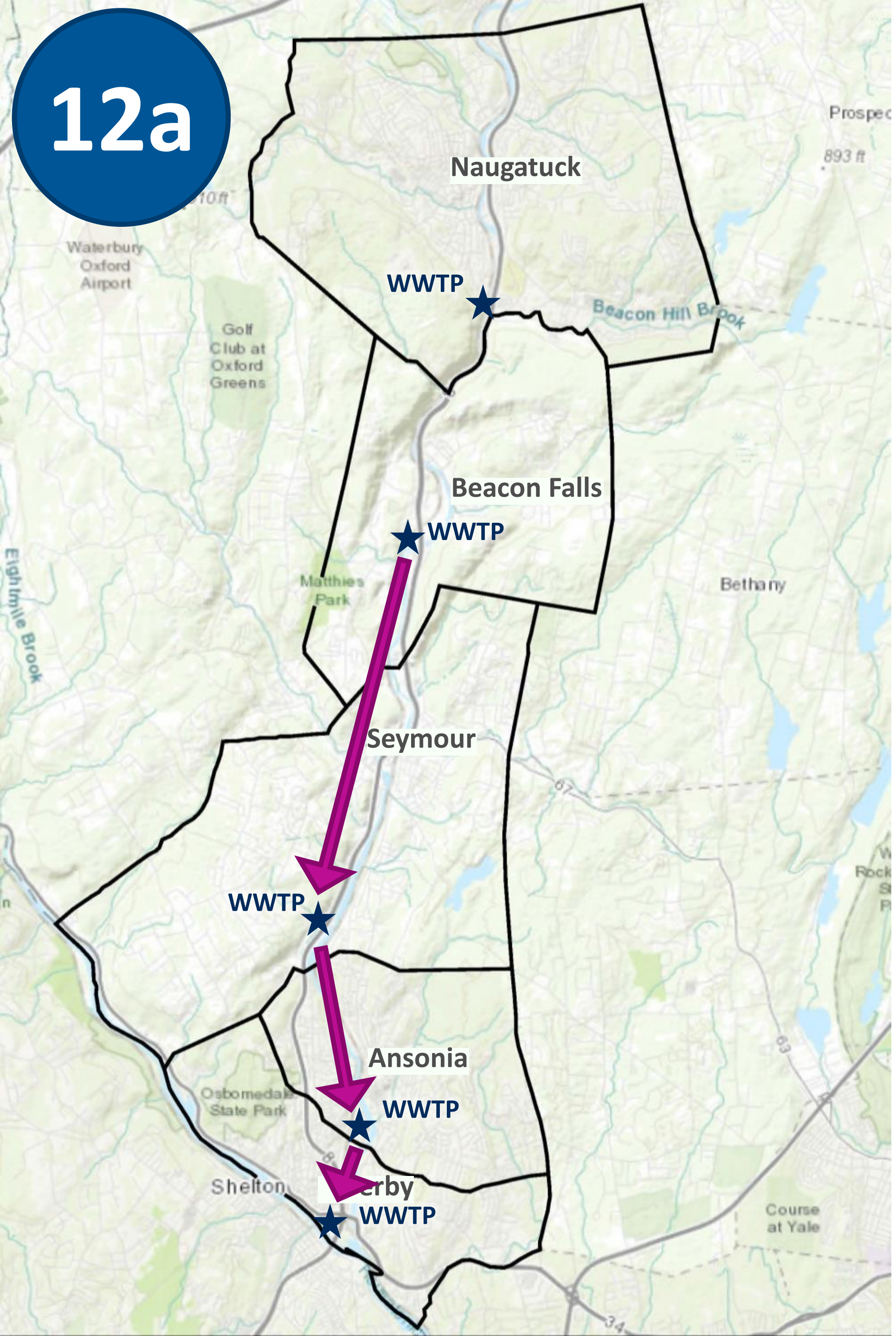
Lift Stations & Conveyance

Naugatuck | Beacon Falls → Seymour → Ansonia → Derby

Capacity
The new pumping stations in Beacon Falls, Seymour and Ansonia would be sized, along with any storage at that location, to handle anticipated peak hydraulic flow from their respective wastewater collection systems. This alternative might also include a headworks facility for grit and screenings removal at one or more of the new upstream pumping stations.

Conveyance Corridors
Conveyance would be expected to utilize similar corridors to prior alternatives for each leg of conveyance.

12a



Beacon Falls, Seymour, and Ansonia to Derby, I/I Reduction

Treatment Plants

Naugatuck | ~~Beacon Falls~~ | ~~Seymour~~ | ~~Ansonia~~ | Derby

Under this alternative, the Beacon Falls, Seymour and Ansonia WPCFs would be decommissioned and replaced with pumping stations. All wastewater from those communities would be conveyed to the Derby WPCF for treatment. Since the Ansonia WPCF was upgraded relatively recently (completed 2011), this alternative might not be fully implemented until closer to the end of the planning period. The capacity of the Derby WPCF would have to be increased as part of a major upgrade to the facility, to provide for flows from all four communities through 2040. Due to high wet weather flows in the collection systems, particularly in Derby, Ansonia and Seymour, this alternative would require significantly increasing the wet weather capacity and possibly also storage.

Phosphorus Removal
Since the Derby WPCF discharges to the Housatonic River, where phosphorus removal is not required, this alternative would reduce some of the costs associated with advanced treatment for wastewater from Beacon Falls, Seymour and Ansonia.

Collection System

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

Collection System Rehabilitation
Due to excessive peak flows, aggressive I/I reduction would be required in all four systems. I/I reduction could be mitigated with the use of storage. The extent of I/I reduction would need to be balanced with marginal cost of treatment and marginal cost of storage.

Lift Stations & Conveyance

Naugatuck | Beacon Falls | Seymour | Ansonia | Derby

Capacity
The new Seymour pump station would be designed to pump all flow from Seymour (2040 design flows 6.7 MGD for peak day, and 7.4 MGD for peak hour), possibly with some storage provided at the pump station to mitigate peak flows and reduce max pumping capacity. With aggressive I/I removal, the necessary pumping capacity would be reduced.

Conveyance Corridors
Conveyance would be expected to utilize similar corridors to prior alternatives for each leg of conveyance.

3.0 Interconnection Conveyance Route Options

3.1 Approach

Initial potential route options were investigated at a high level using available GIS data layers from the State of Connecticut. This analysis generally considered potential alignments from WPCF to WPCF following existing roads or rights of way. The intent of this investigation was not to optimize potential routes, but to identify options for routing that would help characterize the viability of each regionalization alternative. Route identification will be conducted in greater detail for selected alternatives as part of Phase 2.

Routes were identified as segments from WPCF to WPCF. Therefore, some alternatives that involve more than one community may include multiple segments of routes.

Additionally, some alternatives included routes that would not extend from plant to plant, such as from the Bartholomew pump station in Ansonia to the Derby WPCF or from the plant's outfall to the Housatonic River. These particular routes were not explored in this analysis and will be undertaken for short-listed alternatives in Phase 2.

The following GIS data layers were used as the basis for this analysis:

- Proposed Interconnector Routes measured length in Feet in NAD 1983 State Plane Connecticut
- Aquifer Protection Area
- Critical Habitat (USFWS)
- Protected Open Space
- Floodplains
- Hydrography
- Elevation

None of the conveyance route options are within any of the Aquifer Protection Areas.

At Derby, Protected Open Space is railroad property along the Naugatuck River.

3.2 Beacon Falls to Naugatuck

The Beacon Falls to Naugatuck route is likely the most challenging segment in the study. Steep slopes limit available space along the Naugatuck River, and Toby's Rock Mountain poses a major constraint for routing.

Four routing options were identified, as shown in Figure 3-1.

Options 1 and 3 attempt to follow the shortest path and minimize elevation constraints, but to accomplish this, they are aligned in major rights of way (ROW) for the railroad and Route 8. Options 2 and 4 recognize the difficulties of the rights of way and utilize routes around the mountain.

Following are brief summaries of each option.

3.2.1 Option 1: Railroad ROW

With a length of nearly 18,000 ft, this option would provide the most direct path with the smallest elevation differential. However, obtaining permission to use the railroad ROW may be insurmountable.

3.2.2 Option 2: Transmission ROW

It would likely be easier to obtain permission to use the existing power transmission right of way around Toby's Rock Mountain, but this route adds substantial length and multiple changes in elevation that would likely require multiple pump stations. The length of this alignment is nearly 28,000 ft, with a maximum elevation of 780 ft. Although this may be technically feasible, it is not expected to be the preferred option.

3.2.3 Option 3: Route 8 ROW

Although the length of this option, nearly 28,000 ft, is long, it provides an approach with less elevation differential than options around Toby's Rock Mountain. The route would for the most part follow the Route 8 right of way and use existing bridges for river crossing. The maximum elevation is approximately 270 ft. Although construction would be difficult in the major transportation right of way, this may be the most viable option.

3.2.4 Option 4: Around Toby's Rock Mountain

This option would rely on mountain roads to route past Toby's Rock Mountain. With a length of over 28,000 ft, the route has less overall variation in elevation than Option 2, as well as a somewhat lower maximum elevation of approximately 740 ft. Although this alignment would likely require less pumping than Option 2, the elevation differential is expected to lead to high pumping costs, and while possible, this is not expected to be the preferred option for routing.

3.3 Beacon Falls to Seymour

The Beacon Falls to Seymour route features similar constraints to the Naugatuck Route, but less extreme in terms of slopes and elevations. The railroad ROW and the Route 8 ROW still occupy central locations for the preferred routing. Three options were identified for routing and are presented in Figure 3-2.

3.3.1 Option 1: Avoid the Railroad ROW

This option recognizes that the railroad ROW is likely an insurmountable obstacle and provides the most direction option that avoids the railroad. It has a length of approximately 28,000 ft, and it has a significant hill, with a maximum elevation of approximately 470 ft. A significant portion of the alignment would be parallel to and likely use the Route 8 ROW.

3.3.2 Option 2: Use the Railroad ROW

This option is the most direct path with a length of just over 26,000 ft. The peak elevation of approximately 170 ft also provides the least elevation differential, which would be beneficial for pumping costs. However, the likelihood of using the railroad ROW is not good.

3.3.3 Option 3: Avoid both Railroad and Route 8 ROW

This option avoids the major rights of way, but that significantly increases the length of the alignment as well as the elevation differential. With a length of approximately 48,000 ft and a maximum elevation of approximately 640 ft, this route or similar possible routes do not appear desirable unless there is significant resistance to using the Route 8 ROW.

3.4 Seymour to/from Ansonia

The alignment from Seymour to or from Ansonia is less problematic than the routes to Beacon Falls because there are more town roads and less hills, so there is less need to use major rights of way. A typical route is shown in Figure 3-3, but there are multiple variations that are possible based on other factors, such as traffic disruption, planned road repairs, etc. The alignment shown is under 14,000 ft, and it has a maximum elevation of approximately 130 ft, making this alignment feasible.

3.5 Seymour to/from Derby

The alignment from Seymour to/from Derby would most likely be routed through Ansonia as shown in Figure 3-4. Alternative routes are possible if needed, but they are not likely to be preferred.

3.6 Ansonia to/from Derby

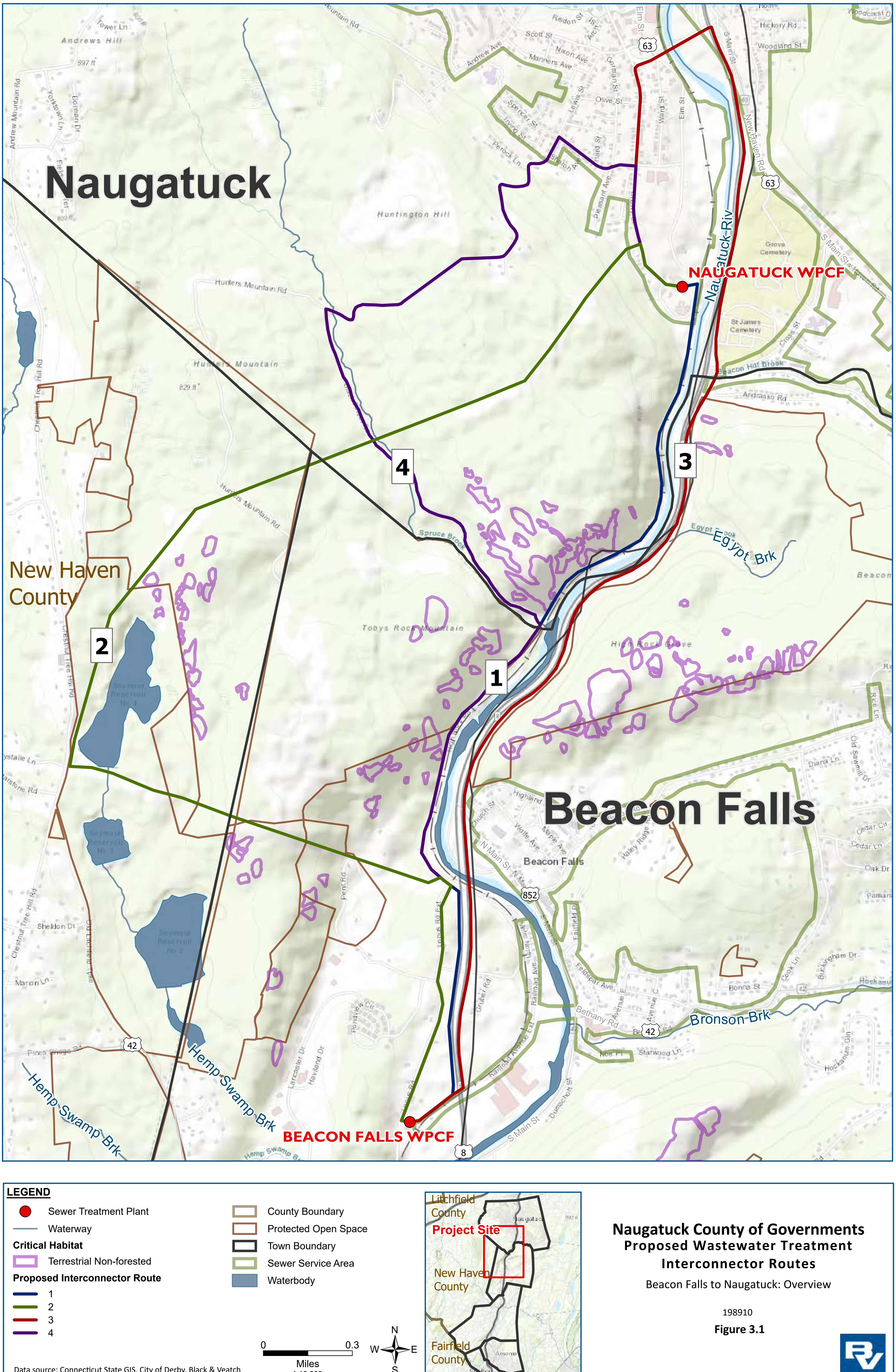
There are multiple potential routes between Ansonia and Derby that have been investigated previously. Two of the options are highlighted here and are shown in Figure 3-5.

3.6.1 Option 1: Pershing Street and Town Roads

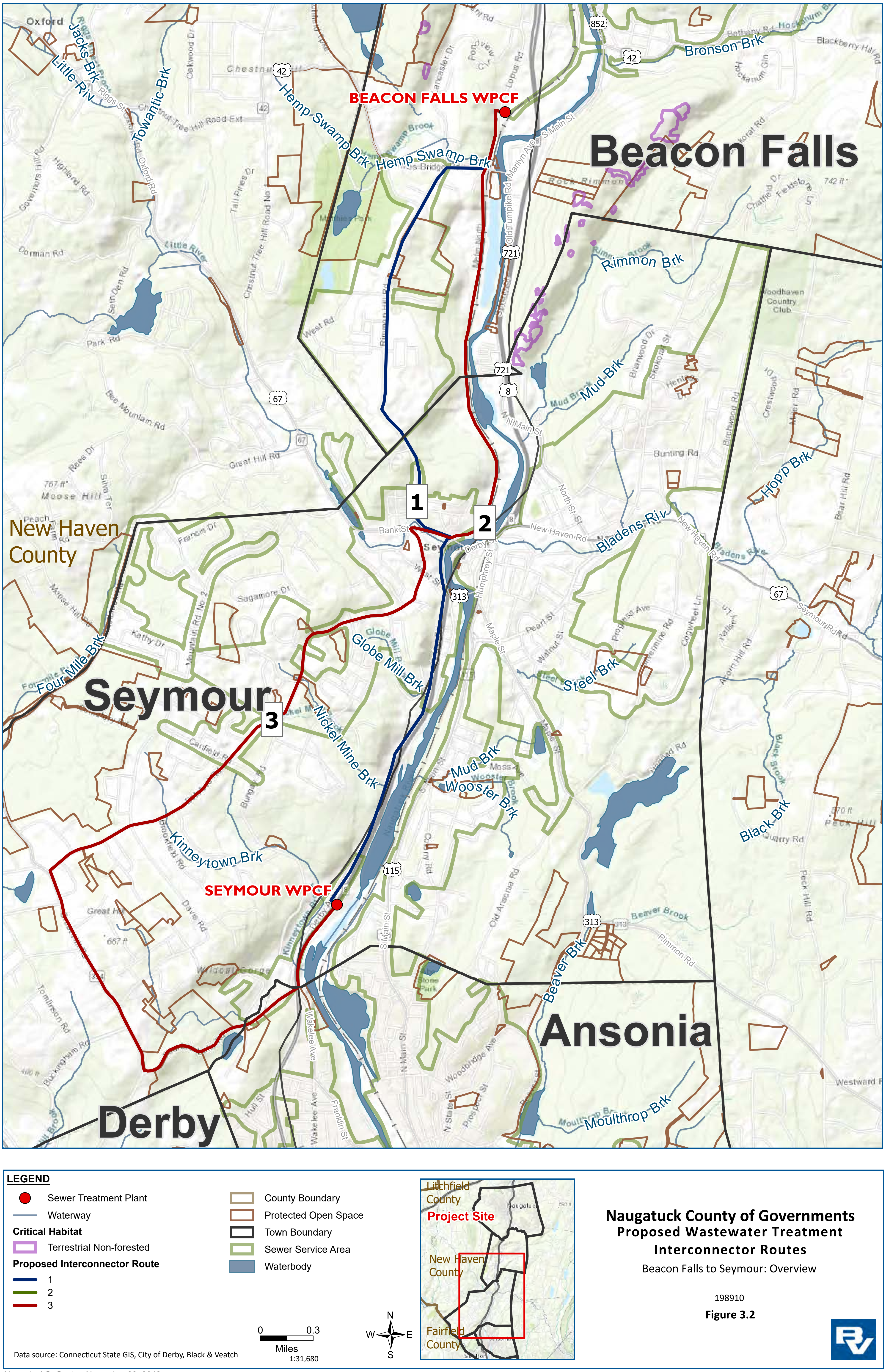
This route, with a total length of somewhat over 8,000 ft and a maximum elevation of approximately 90 ft, is likely the preferred route because it avoids conflicts with existing rights of way and wetlands. However, the potential disruption due to construction could be a factor favoring other routes.

3.6.2 Option 2: Naugatuck River

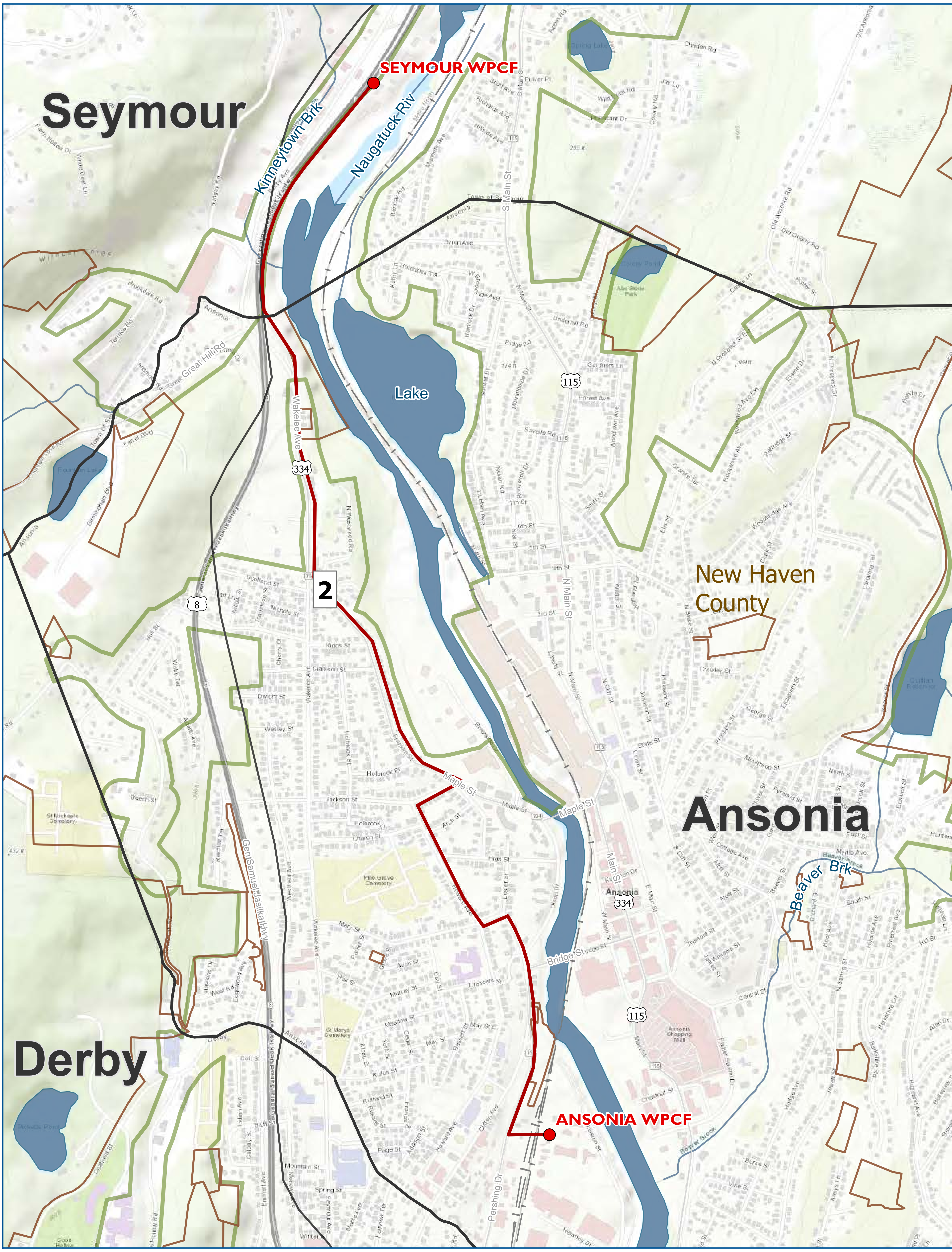
This route, with a total length under 9,000 ft and a maximum elevation under 50 ft, would provide more efficient pumping and less traffic disruption. However, construction along the river would have wetlands, flood control, and transportation obstacles that likely make this option less desirable.



NaugatuckCoGovt November 29, 2018



NaugatuckCoGovt November 29, 2018



LEGEND

- Sewer Treatment Plant
- Waterway

Critical Habitat

- Terrestrial Non-forested

Proposed Interconnector Route

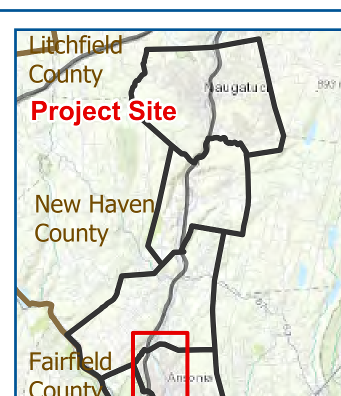
- 2

- County Boundary
- Protected Open Space
- Town Boundary
- Sewer Service Area
- Waterbody

Data source: Connecticut State GIS, City of Derby, Black & Veatch

0 0.15 Miles 1:12,165

N E S W



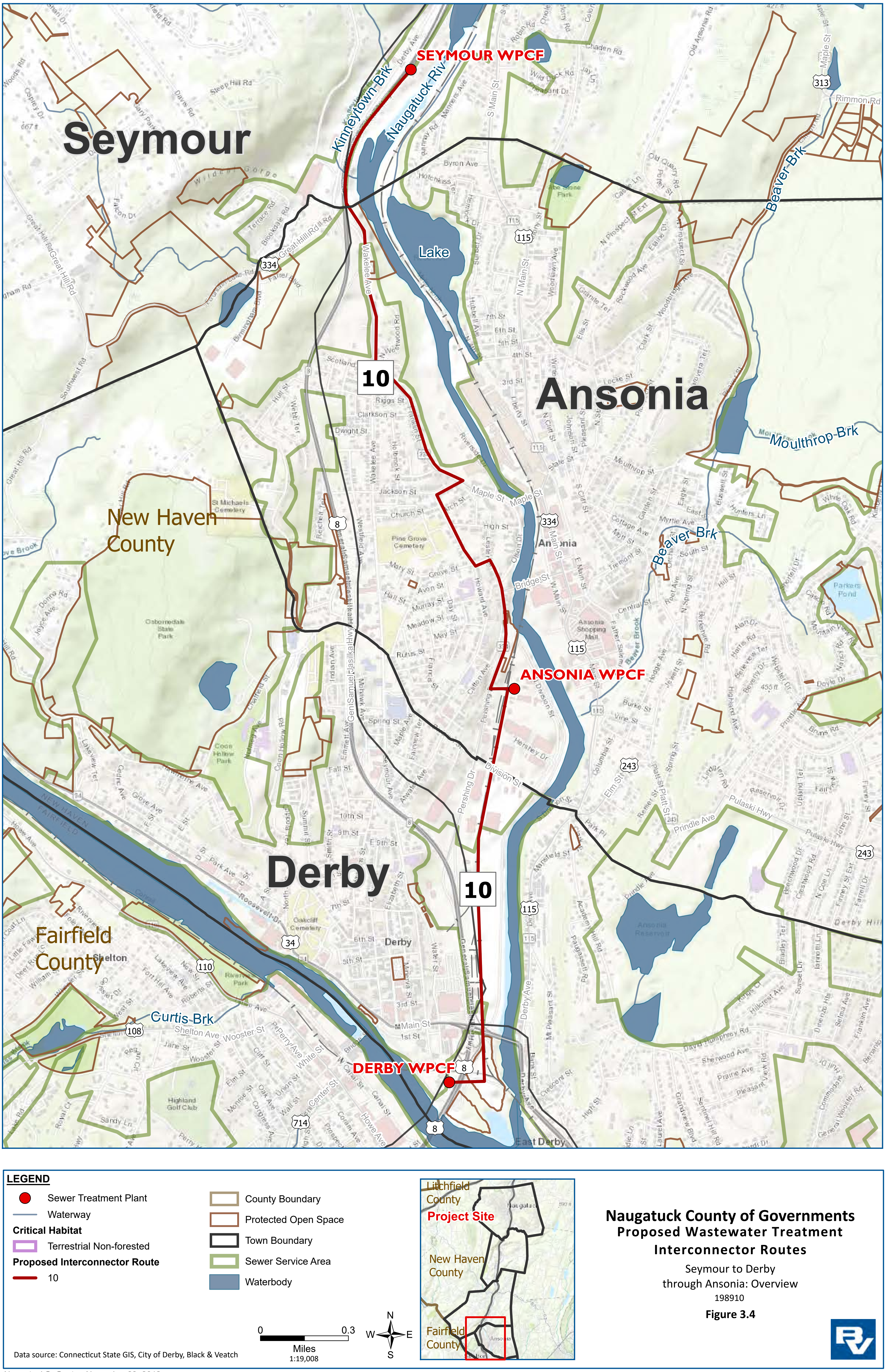
Naugatuck County of Governments
Proposed Wastewater Treatment Interconnector Routes

Seymour to Ansonia: Overview

198910

Figure 3.3

NaugatuckCoGovt November 29, 2018



NaugatuckCoGovt November 29, 2018

LEGEND

- Sewer Treatment Plant
- Waterway

Critical Habitat

- Terrestrial Non-forested

Proposed Interconnector Route

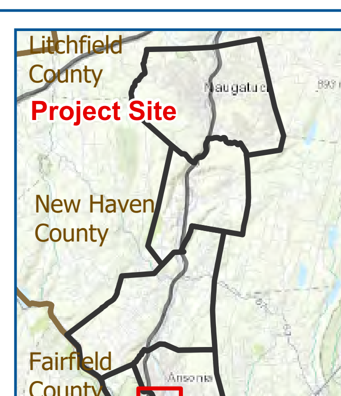
- 1
- 2

- County Boundary
- Protected Open Space
- Town Boundary
- Sewer Service Area
- Waterbody

Data source: Connecticut State GIS, City of Derby, Black & Veatch

0 0.15
Miles
1:9,504

N W E S



Naugatuck County of Governments
Proposed Wastewater Treatment Interconnector Routes

Ansonia to Derby: Overview

198910

Figure 3.5

NaugatuckCoGovt November 29, 2018

4.0 Screening Criteria

The screening criteria presented below will be used to screen out the less preferred regional wastewater alternatives from the previously described initial list of regional wastewater alternatives. It is emphasized that this is a "rough screening" of the alternatives as the alternatives have not been adequately developed to apply the criteria with accuracy; however, the rough screening will allow for identifying fatal flaws among the alternatives. Those alternatives exhibiting fatal flaws will be omitted. Again, it is emphasized that the intent of this rough screening is to identify the long list of alternatives to carry into Phase II.

Additional development of the long list alternatives will be undertaken in Phase II along with further screening of the alternatives with the purpose of identifying a short-list of alternatives for more in-depth study and evaluation.

4.1 Identification of Screening Criteria

- Adequate space at the plant-site to accomplish required treatment
- Ease or difficulty of incorporating the treatment process at the WWTPs considering facilities layout and space requirements.
- Complexity in operation and maintenance. This will address the treatment plant, the collection and pump systems and the pumping and conveyance system required as a result of the regionalization.
- Implementation schedule
- Environmental restrictions
- Regulatory and permitting requirements
- Community benefits
- Capital and O&M costs, and overall life cycle cost (these costs will be macro-level and useful for comparative analysis only)
- Topographic or right-of-way constraints in interconnecting communities

4.2 Initial Screening of Alternatives

Each of the regional wastewater alternatives were compared for each criterion on three levels – green, yellow, and red – with green representing a most favorable rating and red representing a least favorable rating as compared to other alternatives.

Alt No.	Abbreviated Description	Space/ Constraint	Existing Facilities	O&M	Schedule	Env	Reg	Benefits	Relative Cost
1	BF→N	Green	Green	Green	Yellow	Green	Green	Green	Yellow
2	BF→S	Yellow	Yellow	Green	Yellow	Green	Green	Green	Yellow
2a	BF→S, I/I	Green	Green	Green	Yellow	Green	Green	Green	Yellow
3	D→A	Yellow	Yellow	Green	Yellow	Green	Green	Yellow	Yellow
3a	D→A, I/I	Yellow	Yellow	Green	Yellow	Green	Green	Yellow	Yellow
4	D→A→H	Yellow	Yellow	Green	Yellow	Green	Green	Green	Yellow
4a	D→A→ H, I/I	Yellow	Yellow	Green	Yellow	Green	Green	Green	Yellow
5	D&S→A	Yellow	Yellow	Green	Yellow	Green	Green	Yellow	Yellow
5a	D&S→A, I/I	Yellow	Yellow	Green	Yellow	Green	Green	Yellow	Yellow
5b	D&S→A→H	Yellow	Yellow	Green	Yellow	Green	Green	Green	Yellow
5c	D&S→A→H, I/I	Yellow	Yellow	Green	Yellow	Green	Green	Green	Yellow
6	D→S, D→A	Yellow	Yellow	Green	Yellow	Green	Green	Yellow	Yellow
6a	D→S, D→A, I/I	Yellow	Yellow	Green	Yellow	Green	Green	Yellow	Yellow
7	D→S, D→A, D→D	Yellow	Red	Green	Red	Green	Green	Yellow	Red
7a	D→S, D→A, D→D, I/I	Yellow	Red	Green	Red	Green	Green	Yellow	Red
8	A→D	Yellow	Yellow	Green	Yellow	Green	Green	Green	Yellow
8a	A→D, I/I	Yellow	Yellow	Green	Yellow	Green	Green	Green	Yellow
9	S&A→D	Yellow	Yellow	Green	Yellow	Green	Green	Green	Yellow
9a	S&A→D, I/I	Yellow	Yellow	Green	Yellow	Green	Green	Green	Yellow
10	S→A, A→D	Yellow	Yellow	Green	Yellow	Green	Green	Green	Yellow
10a	S→A, A→D, I/I	Yellow	Yellow	Green	Yellow	Green	Green	Green	Yellow
11	BF,S→A, A→D	Yellow	Yellow	Green	Yellow	Green	Green	Green	Yellow
11a	BF,S→A, A→D, I/I	Yellow	Yellow	Green	Yellow	Green	Green	Green	Yellow
12	BF,S,A→D	Yellow	Yellow	Green	Yellow	Green	Green	Green	Yellow
12a	BF,S,A→D, I/I	Yellow	Yellow	Green	Yellow	Green	Green	Green	Yellow

5.0 Conclusions and Recommendations

Based on the initial rough screening according to a qualitative assessment of the screening criteria for each alternative, there are potential advantages or benefits to many of the alternatives. Alternatives with fatal flaws (identified as red in the assessment) were removed from the analysis. In the initial rough screening, this meant that alternatives 7 and 7a were found to be clearly inferior to other alternatives and should be removed from consideration. The remaining alternatives are of potential interest depending on the relative costs of construction and operation and should be considered further. It is recommended that all other alternatives should be carried into Phase II analysis for more detailed study and analysis.

APPENDIX A

Technical Memorandum 1:
Flows and Loads

TECHNICAL MEMORANDUM

Naugatuck Valley Regional Council of Governments | B&V Project 198910
NVCOG Wastewater Regionalization Study | B&V File 43.0010
TM No. 1 – Flows and Loads | October 30, 2018

1.0 PURPOSE AND BACKGROUND

The purpose of this technical memorandum is to establish the flows and loads to be used for each of the five wastewater treatment communities participating in the NVCOG Wastewater Regionalization Study. That includes both average and peak flows to be expected over a 20-year planning period, through 2040. This information will be used as a basis for evaluating the various regionalization alternatives in the study. The projections in this memorandum have been developed based on review of MOR data, rainfall records and population projections, as well as input from officials of the five municipalities.

In each of the five communities, the average flows received to the plant have been significantly below the plant's permitted capacity in recent years, as shown on Table 1-1 below.

Table 1-1 Annual Average (AA) Flow: Actual (2015-2017) vs. Permitted Capacity

Municipal WPCF	Average Annual (AA) Flow, 2015-2017 (MGD)	Permitted AA Design Capacity (MGD)	2015-2017 AA Flow as Percent of Permitted Capacity
Derby	1.3	3.5	37%
Ansonia	1.57	3.5	45%
Seymour	0.97	2.93	33%
Beacon Falls	0.31	0.71	44%
Naugatuck	4.61	10.3	45%

2.0 POPULATION PROJECTIONS FOR THE FIVE COMMUNITIES

The Connecticut State Data Center (CSDC) population projections for the five towns included in this study, through planning year 2040, are summarized in Table 2-1 below. This information was based on recent population projections published by the CSDC, as funded by the Office of Policy and Management (OPM). The US Census data is included in the table as well, for reference.

Table 2-1 CT State Data Center Population Projections to 2040

Municipality	US Census 2010	Based on CT State Data Center Population Projections (published August 31, 2017)				
		2020	2030	2035	2040	Percent increase, 2040 vs. 2020
Derby	12,902	13,251	13,803	13,959	14,082	6.3%
Ansonia	19,249	19,841	20,648	20,890	21,067	6.2%
Seymour	16,540	16,798	16,924	16,852	16,753	-0.3%
Beacon Falls	6,049	6,421	6,587	6,591	6,587	2.6%
Naugatuck	31,862	32,212	32,638	32,372	31,854	-1.1%
TOTAL	86,602	88,523	90,600	90,664	90,343	2.1%

The CSDC is projecting that this region, like most of the rest of the state, will experience very modest growth over the next twenty years.

3.0 APPROACH TO DEVELOPING CURRENT FLOWS AND LOADS

One of the most critical considerations in evaluating regionalization alternatives is peak flows to the wastewater treatment plants. All five of the communities in this study have older collection systems, with significantly higher flows during wet weather conditions, when infiltration and inflow (I/I) cause significant increases in flows to the treatment plants.

Typically, the most useful data to determine current condition baseline flows to the plant would be from the most recent years, as reported in the monthly operator reports (MOR's) submitted by the communities to the State of Connecticut. However, in this case the three most recent years of record (2015-2017) were characterized by unusually low rainfall, in comparison to the overall 2000-2017 period. It is not unusual to review a longer period of flow records when performing future projections; this was done here as explained below.

Rainfall data from local weather stations in the NOAA database were reviewed, to compare recent historic rainfall patterns with observed flows at the water pollution control facilities (WPCF's). Since the available data from the nearby Waterbury-Oxford Airport station had gaps in the period of interest, other nearby weather stations with more complete sets of rainfall data were considered.

The three weather stations in the region with the best data available for the continuous period since 2000 were at the following locations: Meriden Markham Municipal Airport, in Meriden; Tweed Airport, in New Haven; and Igor Sikorsky Memorial Airport, in Stratford. Where overlapping recent rainfall data was available from the Waterbury-Oxford Airport, that was evaluated as well to confirm correlation with weather in the Naugatuck Valley.

Data from the Tweed Airport weather station was very similar to the data from the Meriden Markham Airport station, showing 2015-2017 as an extraordinarily dry period, with 2015 and 2016 annual rainfall totals being the two lowest since the year 2000. Annual rainfall data from the Sikorsky Airport station since 2000 also indicated that 2015-2017 was a relatively dry period. Available NOAA rainfall data from the weather station at Meriden Markham Airport is summarized on Table 3-1.

Table 3-1 Meriden Markham Airport Rainfall Data, 2000-2017

Year	Total Annual Liquid Precipitation (in.)	Peak Day Precipitation (in.)	Date of Peak Precipitation
2000	47.94	2.86	Jul-15
2001	36.21	2.77	Jun-17
2002	46.03	2.27	Aug-29
2003	58.75	3.20	Sep-28
2004	47.36	3.84	Sep-18
2005	(N/A)	(N/A)	(N/A)
2006	58.71	3.23	May-12
2007	45.02	3.03	Apr-15
2008	58.63	3.89	Sep-06
2009	45.39	1.92	Oct-03
2010	43.61	2.88	Dec-12
2011	54.28	2.87	Aug-28
2012	32.10	2.15	Jun-02
2013	37.86	2.97	Jun-07
2014	31.45	1.81	Dec-09
2000-2014 (Avg.)	**45.95**	**2.84**	
2015	21.70	1.47	Sep-30
2016	25.66	1.25	Jan-10
2017	36.07	3.25	Oct-29
2015-2017 (Avg.)	**27.81**	**1.99**	
2000-2017 (Avg.)	**42.75**	**2.69**	
2015-17 Avg. as % of 2000-2017 Avg.	65%	74%	

Observations from this data include:

- 2015-2016 was an extraordinarily dry period: the two driest years by far since 2000, with about half the typical rainfall.
- 2017 rainfall also was well below average for the 2000-2017 period.
- The 2015-2017 period, the three most recent years of record, had only about two-thirds of the average rainfall compared to the overall 2000-2017 period.

In contrast, regional weather reporting indicated particularly intense rainfall periods in 2007 and 2010. For example, CT DEEP identified the storm of April 15-16, 2007 as one of the five worst flooding events to strike the state in the past 100 years, with over 8 inches of rain falling in one 24-hour period in some places (Source: Connecticut's 2010 Natural Hazard Mitigation Plan Update, December 2010). Also, the rain gage at Stevenson Dam, 5 miles WNW of Derby/Ansonia, reported 8.39 inches of rainfall in the month of March 2010. While long-term weather patterns are difficult to predict, it is prudent to consider wastewater flows seen during periods of high rainfall such 2010-2011 as more representative of the high peak flows that could be experienced in the future.

Rainfall data for the first nine months of 2018 was reviewed from four local weather stations, to see if there was any new trend since the end of 2017 that might impact initial conclusions. The data indicates that 2018 may be more typical of the 2000-2014 period, in terms of higher total annual rainfall and higher days of peak rainfall (versus what was seen in the relatively drier period 2015-2017). This confirms the conclusion that the 2015-2017 period should not be considered typical for planning purposes.

The following sections of this Technical Memorandum address each of the five communities, developing the current condition and future (2040) design condition flows and loads.

4.0 DERBY FLOWS AND LOADS

Black & Veatch reviewed available MOR data from the past three years (January 2015 – January 2018). However, as noted previously this flow data was from an extraordinarly dry period. Therefore, wastewater flows from a period with more typical (higher) rainfall also were considered in developing representative baseline flows for Derby.

The 2014 Derby Wastewater Facilities Plan was developed based on flow data from the 2006-2011 period. This included years with higher rainfall, more representative of typical weather conditions seen over the past 20 years.

Approximately 95% of the Town of Derby is served by the wastewater collection system. One small portion of Seymour, along the Route 34/ Roosevelt Drive corridor, contributes flow to the treatment plant. An allocation of 140,000 gpd is reserved for that flow from Seymour. The plant also receives flow from some residences in Ansonia and in the Town of Orange.

The Derby Facilities Plan included future flow projections that assumed an aggressive development program for Derby characterized by significant population growth and several anticipated development projects being constructed. Since the time that the Facilities Plan was prepared, that picture has changed.

Black & Veatch met with Derby representatives (including WPCA chair Jack Walsh, plant supervisor Lindsay King and the mayor's economic development liason Carmen DiCenso) on July 12, 2018. At that meeting, flow projections and future flows were discussed, in connection with the current local forecast for economic development and population growth. These discussions continued through July into early August, with input from Derby representatives.

Based on addional review by Derby representatives, the forecast of development and annual average flows was updated to reflect the most recent expectation of growth by the City. While Derby still foresees growth occurring over the next 20 years, the overall growth projection has been scaled back from what was forecast at the time of the 2014 Facilities Plan. For example, while a 300-500-unit development is anticipated on land adjacent to the treatment plant, Derby now considers it unlikely that the Hitchcock/ Hines Farm, Opera House, and Halo Projects will be developed during the next 20 years. Also, if the Fountain Lake Industrial Park is developed, wastewater flow would be directed to the Ansonia WPCF rather than to Derby.

Taking the foregoing into account, Table 4-1 summarizes existing flow information and future projections for Derby. The last column on the right indicates the flows to the Derby treatment plant recommended to be used for the study horizon year 2040 in the NVCOG Regionalization Study. Maximum month, peak day and peak instantaneous flows were calculated from the average annual flow, using ratios developed in the Facilities Plan.

Table 4-1 Derby Wastewater Flows

Flow to Derby WPCF	Existing Condition		Future Condition	
	From 2015-2017 MOR Data	From 2014 Facilities Plan, Table 9-1	From Facilities Plan, Table 10-2(2), YR 2032	Revised Projection, YR 2040(2)(3)
Annual Average (MGD)	1.3	1.61	2.38	1.92
Maximum Month (MGD)	2.18	3.08	3.81	3.07
Peak Day (MGD)	3.59	8.1	9.5	7.7
Peak Hour (MGD)	10.0(1)	10.0(1)	12.5	10.0

(1) WPCF influent pump station capacity is currently limited to 10.0 MGD; collection system peak may be greater. Flows in excess of 10 MGD have been reported at the WPCF, and it has been reported that actual peak flows could be as high as 13 MGD.

(2) Based on aggressive I/I program implementation to reduce Peaking Factors as follows: MM/AA from current 1.91 to 1.6; PD/AA from 5.03 to 4.0; and PH/AA from 6.21 to 5.25; as projected in the Facilities Plan.

(3) AA flow based on Derby's revised development forecast.

While the maximum recorded influent flow to the plant was 10.0 MGD, it is important to note that this reflects the maximum capacity of the treatment plant influent pump station (also 10.0 MGD). Therefore, it is assumed that during peak rain events, flow has been backing up in the collection system. The influent pump station recorded peak flows of 10.0 MGD during three months in 2010, as well as in January 2016 and May 2017.

As stated in the Facilities Plan, most of the wastewater collection system (150,000 LF out of a total 215,432 LF) consists of VC pipe. Prior inspections of limited sections of VC pipe in Derby have indicated unsatisfactory conditions; this may be characteristic of the VC pipe throughout the system. The 2014 Facilities Plan identified significant I/I issues in the collection system that need to be addressed. The City is currently under a Consent Order with DEEP and USEPA. Derby reportedly plans to spend $270,000/year over the next 15 years to reduce I/I. Therefore, the Facilities Plan projected that the peaking factors for flows will be reduced in the future, as indicated on the projected flows table above. *We recommend that a collection system flow metering program be undertaken to obtain a more accurate estimate of the peak flows to the WPCF.*

Average values for influent wastewater to the plant over the past three years were: 202 mg/L BOD, and 226 mg/L TSS. These are values within the typical range for domestic sewage in an area without significant industrial contributions. It is assumed that similar average concentrations will be seen in the future and can be used for planning purposes.

5.0 ANSONIA FLOWS AND LOADS

Virtually the entire City (approximately 98%) of Ansonia is served by the wastewater collection system. A small portion of Derby, as well as minor sections of Seymour and Woodbridge flow to the Ansonia collection system. These contributions from the adjacent communities are relatively minor, representing only about 3% of the flow to the Ansonia wastewater treatment plant.

The 2004 Facilities Plan reported that average plant flows were approximately 2.2 MGD (based on 1998-2002 data). That Facilities Plan also projected that average annual flows would increase in linear fashion through 2025, to 3.5 MGD. However, the actual trend since the time the Facilities Plan was prepared has shown flows to the plant decreasing since that time. This trend may reflect national trends where water consumption is decreasing due to residential water conservation resulting modern plumbing fixtures and Codes, combined with lower commercial/ industrial water use. The City Housing Authority demolished a multi-unit public housing project since the time that the Facilities Plan was developed, with no plans to replace that facility. The City plans for moderate adaptive reuse of industrial buildings in the central business district to multi-use residential development. It is also noted that it is Connecticut state policy to support new residential development near rail stations in all towns in this study.

Black & Veatch met with Ansonia WPCA representatives (including WPCA chairman Nunzio Parente, and Superintendent Brian Capozzi) on July 12, 2018 to visit the plant and to discuss flows and loads, and to review draft flows and loads for Ansonia that had been developed by Black & Veatch, in preparation for the meeting. The outcome of this meeting was agreement on the following points:

a. No major expansion of the wastewater service area is anticipated.

b. Average annual flow to the plant should be based on the most recent average annual flow data (2015-2017), increased through the year 2040 in proportion to the projected population growth for Ansonia (+6.2%, based on CT State Data Center).

c. For maximum month, peak day and peak hour flows, similar adjustments should be made to data from the 2009-2010 period, which included greater rainfall and more high-intensity rainfall events.

    1. The peak flow projections for 2040 should also take into account the effect of collection system rehabilitation work performed during the past several years, to reduce I/I.

    2. While difficult to quantify, Black & Veatch will assume that the net effect of a 6.2% population increase offset by recent and future I/I reduction will be a slight net decrease (-5%) in max month and peak day flows, and a net decrease of 10% in peak hour flows.

Table 5-1 summarizes the existing and future flows to the Ansonia wastewater treatment plant. The middle column presents design flows that were provided in the Ansonia-Derby Interconnection

Feasibility Study (April 2014). The column at the far right presenting the proposed 2040 wastewater flows to be used in the NVCOG regionalization study.

Table 5-1 Ansonia Wastewater Flows

Flow to Ansonia WPCF	Existing Condition		Future Condition
	From 2015-2017 MOR Data	From 2014 Interconnection Study (2009-2011 Data)	Projection, YR 2040
Annual Average (MGD)	1.57	1.92	1.7
Maximum Month (MGD)	2.6	4.6	4.4
Peak Day (MGD)	3.9	5.73	5.4
Peak Hour (MGD)	6.91[1]	10.5	9.5

[1] Ansonia plant staff report that although the influent pumps are designed for 12 MGD, in recent years the plant is limited to about 7 MGD due to hydraulic limitations between the UV channel and outfall.

As noted in the footnote to the table above, in recent years there has been a hydraulic restriction at the back end of the Ansonia wastewater treatment plant that is limiting peak flow that the plant is able to treat. This is a situation that should be investigated further by Ansonia and corrected as soon as possible, so that the plant will be able to receive flows up to its full capacity during higher wet weather flow events. Also, correcting this problem will maximize the ability of the plant to take additional flow under regionalization alternatives that will be considered in Phase 2 of this study.

Average values for influent wastewater to the plant over the past three years were: 236 mg/L BOD, and 176 mg/L TSS. These are values within the typical range for domestic sewage in an area without significant industrial contributions. It is assumed that similar average concentrations will be seen in the future and can be used for planning purposes.

6.0 SEYMOUR FLOWS AND LOADS

The Nafis and Young Draft Engineering Report on WPCF Phosphorus Planning (May 31, 2016) stated that in addition to serving Seymour, the WPCF also serves parts of Oxford. The total sewered population sending flow to the WPCF is approximately 7,500, according to that report.

The Seymour Plan of Conservation and Development (POCD), dated September 8, 2016 noted that according to inter-municipal agreement, 7% of the total WPCF design capacity is allocated to Oxford. (Note that plant's permitted annual average design flow is 2.93 MGD.)

According to the CT State Data Center population projections, the population of Seymour is forecast to increase by approximately 0.8% (from 16,798 to 16,924) between 2020 and 2030. Thereafter a very slight decline in the local population through 2040.

In the absence of plans showing major expansion of the collection system to serve outlying areas or other significant development that would impact flows, Black & Veatch has assumed that future flows and loads for Seymour will increase in proportion to the projected population growth forecast. On that basis, flows for planning year 2040 are developed from existing condition information in Table 6-1, and presented in the last column to the right.

Table 6-1 Seymour Wastewater Flows

Flow to Seymour WPCF	Existing Condition			Future Condition
	From 1/2015-2/2018 MOR Data	From 2010 MOR Data	Existing Condition (Nafis & Young)[1]	Projection, YR 2040[(2)]
Annual Average (MGD)	0.97	1.22	1.3	1.3
Maximum Month (MGD)	1.93	2.73		2.9
Peak Day (MGD)	3.34	6.3		6.7
Peak Hour (MGD)	7.0	7.2	7.3	7.4
[1] From e-mail communication from Nafis & Young to NVCOG, June 2018.				
[2] Population growth based on CT State Data Center forecast of 0.8% maximum increase. Flows escalated from existing condition AA and PH flows from Nafis & Young. MM and PD flows projected from 1.05 x 2010 MOR data.				

Black & Veatch met with Town of Seymour, WPCA and plant operations representatives (including Annmarie Drugonis, Ben Proto, Jon Livolsi of Seymour and the WPCA, and Walter Royals of Veolia Water) on August 22, 2017 to discuss flows and loads. At this meeting draft flows and loads developed by Black & Veatch in preparation for the meeting, were reviewed and discussed. The outcome of that discussion included the following points:

a. Seymour officials confirmed that almost all of the septic tank issues in the Town have been addressed already. Therefore, they do not anticipate any significant increases in flows to the plant resulting from adding customers currently served by onsite disposal systems.

b. According to the Plan of Conservation and Development for the Town of Oxford, the only developable land in that town that could be served by Seymour in the future is along the Route 67 corridor. Oxford has an existing agreement under which they have reserved up to 250,000 gpd of capacity at the Seymour WPCF.

c. Seymour has been planning to implement an I/I study. To date, Phase 1 of that study, which represents an area of the Town, has been completed. Because this project is still in an early stage, at this time there is no information available to address the potential for I/I removal. However, it is noted that the peak flows seen at the plant (7.0+ MGD) are relatively high relative to annual average flows.

Average values for influent wastewater to the plant over the past three years were: 154 mg/L BOD, and 162 mg/L TSS. These are values on the lower side of the range for domestic sewage in an area without significant industrial contributions, which may reflect infiltration into the collection system. It is assumed that similar average concentrations will be seen in the future and can be used for planning purposes.

7.0 BEACON FALLS FLOWS AND LOADS

The past three years of MOR data for the Town of Beacon Falls water pollution control facility was reviewed. However, as indicated previously, this represented a period of below-average rainfall. Therefore, we have considered existing condition wastewater flow values provided by the 2015 Wastewater Facilities Plan, which were based on a wetter period (September 2009 to October 2012) to be more appropriate to use in this study; since they are more representative of longer-term weather patterns.

Table 7-1 provides a summary of existing flows, as well as the future (2040) flows that Black & Veatch is planning to use in this regionalization study for Beacon Falls.

Table 7-1 Beacon Falls Wastewater Flows

Flow to Beacon Falls WPCF	Existing Condition		Future Condition
	From MOR Data (6/2015-3/2018)	From Facilities Plan[1]	Projection, YR 2040[2]
Annual Average (MGD)	0.31	0.36	0.45
Maximum Month (MGD)	0.48	0.612	0.765
Peak Day (MGD)	0.69	1.01	1.263
Peak Hour (MGD)	1.24	1.22	1.525
[1] From 2015 Wastewater Facilities Plan, based on 9/2009-10/2012 data.			
[2] From DPC Engineering Memo on Beacon Falls WPCF Upgrades Summary, dated October 17, 2018, as basis of design for the proposed upgrade.			

Black & Veatch met with Beacon Falls WPCA representatives and their consultant DPC Engineering on October 18, 2018 to discuss flows and loads as well as plant upgrade plans. At this meeting Black & Veatch was provided with a copy of a memorandum on Beacon Falls WPCF Upgrades Summary, dated October 17, 2017. That memorandum provided estimated existing condition plant flows from the 2015 Wastewater Facilities Plan, as well as the basis of design flows used by DPC for the proposed WPCF upgrade. The basis of design flows contained in that memorandum, included here on Table 7-1 reflect additional sanitary flows, I/I reduction and anticipated water conservation.

Average values for influent wastewater to the plant over the past three years were: 180 mg/L BOD, and 239 mg/L TSS. The plant upgrade basis of design forecasts that at future average annual design flows, influent BOD will be 211 mg/L and TSS will be 199 mg/L on an average annual basis. The loading conditions used for the plant upgrade basis of design will be used for estimated loadings, for planning purposes.

8.0 NAUGATUCK FLOWS AND LOADS

The Naugatuck WPCF serves approximately 90% of Naugatuck, with the remaining 10 percent of the Borough served by on-site septic systems. The Naugatuck WPCF also receives flow from portions of Middlebury and Oxford. Lesser flows come from residences and developments in Beacon Falls and Prospect. The Naugatuck Wastewater Treatment Facilities Plan, prepared Kleinfelder in December 2017, did not note septic tank failure issues in the community. Therefore, it has been assumed that the existing collection system will not be adding significant additional wastewater flow from residents currently served by on-site septic systems.

Future flows and loads (for year 2035) were developed in Section 3 of the Wastewater Treatment Facilities Plan. The Facilities Plan assumed minimal growth in Naugatuck through 2035 (net + 284 people, or + 0.9%); but significant growth in Middlebury (+22.4%). This would result in a net population increase within the collection system service area of +5.4%, as shown on Table 3-5 of that Facilities Plan.

The 2010-2015 period used in developing the existing condition flows includes a wetter period than the three most recent years, and therefore should more representative of the longer-term rainfall patterns. Therefore, Black & Veatch believes that the existing condition flows summarized in the Facilities Plan are appropriate to use for planning purposes in the current NVCOG Wastewater Regionalization study.

The SSES study undertaken by Naugatuck recommended three million dollars of I/I removal over a 4-year period, projected to remove 0.3 MGD of infiltration. The Facilities Plan assumed that the rate of I/I reduction would be offset by the rate of I/I increase over time, due to an aging collection system. Therefore, it assumed that flow peaking factors for future flows would remain the same as obseved, at 3.9 x average flows, into the future.

Annual average (AA) flows developed by contributing area in Section 3 of the Facilities Plan are summarized below in Table 8-1. The third column presents future flows based on projected population growth in the service area; while the fourth (last) column includes the full flow allocations available for towns of Middlebury and Oxford.

Table 8-1 Naugatuck Wastewater Flows, by Area

Contributing Area	Existing Condition (Facilities Plan, Table 3-4)	Projected, 2035 (Based on Facilities Plan, Sec. 3.4.5)	Projected, 2035 (From Facilities Plan, Table 3-6, including full allocations for Middlebury & Oxford)
AA Flow, Naugatuck Borough (MGD)	4.54	4.56	4.56
AA Flow, Middlebury (MGD)	0.62	0.78	1.8
AA Flow, Oxford (MGD)	0.083	0.28	1.0
AA Flow, Chemtura (MGD)	0.16	0.16	0.16
AA Flow, Beacon Falls (MGD)	negl.	0.04	0.04
AA Flow, Prospect (MGD)	negl.	0.004	0.004
AA Flow, TOTAL (MGD)	5.4	5.82	7.56

The design capacity of the Naugatuck WWTF is 10.3 MGD. Therefore, the amount of additional flow that could be taken at the Naugatuck WWTF resulting from regionalization would depend in part on how the Middlebury and Oxford reserve allocations are addressed.

The Bororough of Naugatuck has plans to foster new development in the Borough, within the planning period of this regionalization study, that go beyond what current State Data Center projections in Table 2-1 show. Based on a current population of 32,212 for the Borough of Naugatuck, with approximately 90% served by the wastewater collection system, the current estimated sewered population is 28,990. Based on input from local officials, we have added an allowance for 10% growth in the sewered population. That would add approximately 2,889 more people from Naugatuck Borough to the wastewater collection system by 2040. Assuming the resulting flow contribution is proportional to current flows, this would add an additional +0.45 MGD of average daily flow. Based on this, the reserve capacity available for additonal flows resulting from regionalization would be in the range of 2.29-3.95 MGD, as annual average flows, depending on how the current reserve allocations from Oxford and Middlebury are addressed. This is summarized in Table 8-2 below.

Table 8-2 Naugatuck WPCF 2040 AA Capacity Available for Regionalization

Contributing Area	Existing Condition (Facilities Plan, Table 3-4)	Projected (Based on Facilities Plan, Sec. 3.4.5)	Projected (From Facilities Plan, Table 3-6, including full allocations for Middlebury & Oxford)
2035 AA Flow Total w/o Naugatuck Growth (MGD)	5.4	5.82	7.56
2040 AA Flow Total w/o Naugatuck Growth (MGD)		5.90	7.56
10% Naugatuck Growth Allowance (MGD)		0.45	0.45
2040 AA Flows, with 10% Naugatuck Growth (MGD)		6.35	8.01
Plant Capacity (MGD)		10.30	10.30
Maximum Daily Flow[1]	21.9	24.8	31.2
2040 AA Capacity Available for Regionalization Flows (MGD)		3.95	2.29

NOTE: [1] Future peak flow in 2017 Wastewater Facilities Plan, section 3.4.5, was 29.5 MGD based on future average flow of 7.56 MGD. Future peak flows here use same assumptions for the future: no net change in I/I rate, and no net change in existing flow peaking factor of 3.9.

APPENDIX B

Technical Memorandum 2: Condition Assessment

REGIONAL WASTEWATER TREATMENT CONSOLIDATION STUDY

Technical Memorandum 2: Condition Assessment

B&V PROJECT NO. 198910

PREPARED FOR

Naugatuck Valley Council of Governments

4 February 2019

BLACK & VEATCH
Building a world of difference.

Table of Contents

Appendices

1.0 PURPOSE AND BACKGROUND

The purpose of this technical memorandum is to provide a high-level summary of the condition of existing wastewater treatment and collection system facilities of the five communities participating in this wastewater regionalization study. Information used in this assessment will include review of existing facilities plans and other reports, interviews with knowledgeable wastewater operations and management professionals in the five communities, and site visits by Black & Veatch engineers.

This report will discuss planning-level capital costs to upgrade the five treatment plants and their associated collection systems to meet current regulations, remove excessive I/I, and extend the life of the systems for the 20-year planning study horizon. Where capital costs to upgrade the wastewater facilities are available from previous work performed by the communities, these will also be included. 'Placeholder' type estimates will be assigned where capital costs are not available, and where available capital cost projections do not cover the entire planning period, through 2040.

This technical memorandum is intended to establish baseline conditions for wastewater treatment infrastructure in each of the five wastewater treatment communities in the NVCOG Wastewater Regionalization Study. The baseline conditions should reflect the budgetary level capital costs of infrastructure improvements that would need to be made during the planning period (through 2040), with no further regionalization implemented. This includes capital expenditures that would be required to replace aging infrastructure, to meet regulatory requirements, and to accommodate flow increases due to anticipated population increases within the service areas of the five communities.

During Phase 2 of this Wastewater Regionalization Study, the infrastructure needs and related cost projections associated with this Base Case scenario (no regionalization) will be reviewed, analyzed and updated further with more detail and with additional input from the communities. The Base Case for each of the communities then will be compared to the various regionalization alternatives under consideration.

2.0 DERBY WASTEWATER FACILITIES ASSESSMENT

2.1 DESCRIPTION OF EXISTING FACILITIES – DERBY WATER POLLUTION CONTROL FACILITY

The City of Derby water pollution control facility (WPCF), which discharges to the Housatonic River, was built in 1964. The plant was upgraded to secondary treatment in 1973. Limited upgrades undertaken since the 1973 upgrade include: sludge handing facilities (1986); a mechanical upgrade of the influent pump station and replacement of screenings/grinder (1996); electrical upgrade of the influent pumping station (1996); and new aeration system fine bubble diffusers (1997).

The most recent significant construction project (1998) included: electrical upgrades, replacing the main influent pumps, repairs to the grit basins, repairs to the primary settling tanks, modifications to the aeration basins aeration system, mechanical upgrade of the secondary clarifiers, a new bulk storage facility for sodium hypochlorite, and a new sodium bisulfate feed facility.

The WPCF serves approximately 95% of the residents of the City of Derby, plus a small portion of Orange that includes approximately 144 units in Fieldstone Village. The plant is a conventional secondary treatment plant designed for nitrogen removal via a Modified Ludzack-Ettinger (MLE) process configuration. Seasonal disinfection is provided by hypochlorite addition. Since the plant discharges directly to the Housatonic River, there is currently no permit limit for phosphorus (unlike for WPCF's discharging to the Naugatuck River).

Primary sludge and thickened waste activated sludge (WAS) are dewatered onsite, with the sludge cake trucked offsite for further treatment by incineration and ash disposal.

Black & Veatch reviewed the available drawings of the treatment plant, and the most recent Wastewater Facilities Planning Study (Weston & Sampson, March 2014). That facilities plan included an evaluation of the existing wastewater treatment plant and collection system, and developed a capital expenditures plan to address major anticipated upgrades required over a 20-year planning period. That study also looked at regionalization opportunities with other local communities.

Black & Veatch also visited the Derby WPCF on July 12, 2018, accompanied by Derby plant supervisor Lindsay King. A follow-up discussion at the plant site also included Jack Walsh (WPCA chairman) and Carmen DiCenso (the City's economic development liaison).

Peak flow to the plant is limited to approximately 10.0 MGD, based on the capacity of the plant's influent pump station. However, Derby has noted in the past that actual peak flow from the collection system may be up to 13 MGD. (This is documented in minutes of meeting with CT DEP on August 10, 2010, in Appendix H of the Facilities Planning Study.)

Overall, the treatment plant is very old, and in need of a major overhaul, or possibly a near-complete replacement of almost all major systems. The plant is difficult to operate, creating extraordinarily challenging working conditions for plant operations staff and impacting effluent quality.

The existing WPCF process configuration is described in Section 9.4 of the 2014 Wastewater Facilities Planning Study. An evaluation of the condition of each major system of the plant follows, based on a review of existing reports, observation of the facilities and discussions with WPCA staff.

1. **Influent Trash Racks.** Flow enters the plant via two gravity sewer interceptors. Some screenings are captured with trash racks just upstream of the influent pumps on screens that are located several stories below-grade. The racks are cleaned manually and require manned entry into the inlet structure. The screenings are stored in bins within the inlet structure which are reportedly pulled up to grade when full. The inlet trash rack system is in poor condition in terms of process effectiveness, proper ventilation and safety, and should be corrected as a first priority. The lack of proper screens, grinders and grit removal upstream of the influent pumps results in additional wear and operating challenges for the pumps. A proper headworks should be provided upstream of influent pumping. However, lack of conceptual design makes it difficult to assess the footprint required for a properly functioning preliminary screenings facility. During follow-on study and design this should be investigated, along with the optimal (fine to medium) bar spacing that could be accommodated hydraulically.

Figure 2-1 Derby Trash Racks

2. **Influent Pump Station.** The influent pump station has two pumps with long, problematic shafts (motors on upper level); and one pump with a close-coupled motor. The newer close-coupled pump is the normal duty unit, because of issues with the other two extended shaft units. Due to age and problems at this facility, the influent pump station is in need of a major upgrade, and perhaps a complete replacement. All pumps, piping, valves and controls need

to be replaced at the influent pump station. This facility also needs to be able to handle peak flows from the collection system.

Figure 2-2 Derby Influent Pumps with Extended Shafts

3. **<u>Aerated Grit Chamber</u>.** Downstream of the pump station is a single aerated grit chamber, with no redundancy. Grit is removed from the tank using a clamshell bucket on an overhead monorail. The grit is discharged into an adjacent grit dumpster. The aerated grit tank is partially covered with a steel frame structure with a fiberglass canopy. Certain grating sections were compromised at the top of this structure. This arrangement is ineffective, difficult to operate and a safety concern as well. Overall, the grit system is in poor condition and needs to be completely replaced with an appropriate system that provides at a minimum, capability to bypass the grit removal system when extensive maintenance is required.

Figure 2-3 Derby Grit Facility Overhead Clamshell Hoist

4. **<u>Channel-Mounted Comminutor</u>.** Two channels direct flow from the grit chamber to the primary clarifiers. With a new headworks screening facility, as called for above, the

comminutors would no longer be required and therefore should be removed. This will allow for redundant channels to primary treatment.

Figure 2-4 Derby Comminutor Channel

5. **Primary Clarifiers.** The WPCF has two 90 ft. x 16 ft. x 10.5 ft. side water depth (SWD) rectangular primary settling tanks, which include chain-and-flight sludge collectors and tipping weir scum troughs. Due to the lack of proper headworks facilities, grit tends to collect in these clarifiers and cause operations challenges. It appears the plant has adequate primary clarifier capacity, at least under normal flows. One of the primary clarifiers was down for repair at the time of the site visit; the focus of the repair appeared to be the internal mechanism. Both clarifiers were constructed in 1964, and show some structural cracks due to their age and settlement. Complete replacement of the mechanisms at both clarifiers is recommended. These structures also need to be studied to determine the extent of repairs required.

   Two plunger pumps located in the operations building convey primary sludge to storage.

Figure 2-5 Derby Primary Clarifiers

6. **Aeration Basins.** The plant has three basins for activated sludge secondary treatment. Each basin is configured in two passes, each pass being 100 ft. x 20 ft. x 15 ft. SWD.

Basins No. 2 and 3 were modified in the 1998 upgrade to operate in an MLE process configuration for nitrogen removal (with the first two-thirds of the first pass in each train being converted to an anoxic zone). The third basin, Basin No. 1, was left unmodified. Operations staff report that the two modified basins have provided sufficient capacity for plant wastewater flows. Based on issues discussed in the Facilities Plan, the aeration basin diffuser and blower system should be upgraded to improve overall energy efficiency, and for better DO control to optimize nitrogen removal. Additional investigation is required to confirm whether the existing off-line aeration basin needs to be upgraded.

Figure 2-6 Derby MLE Basins

7. **<u>Aeration Blowers</u>.** Process air to the aeration basins is provided from one variable speed positive displacement blower installed during the 1998 upgrade, and by an ABS variable-speed turbo blower purchased by the City in 2010. The newer, high-speed turbo blower is located in the same room with sludge pumps, which raises concern since the sensitive electronic controls of turbo blowers can be impaired by the presence of hydrogen sulfide.

   Most of the blower system piping is outdated, and is leaking in several locations. The blower system should be updated at the same time that work in the aeration basins is being done in order to replace the aeration piping and to provide redundant blowers that are energy efficient. The blowers may need to be relocated to another building or in a new building if ventilation at the existing location cannot be positively corrected.

Figure 2-7 Derby Aeration Blowers

8. **Secondary Clarifiers.** Secondary settling is accomplished in two 60 ft. dia. x 10 ft. SWD secondary clarifiers with draft tube type sludge removal mechanisms. With only two clarifiers there is no redundancy if one unit is out of service. Also, the flow split between the two is uneven. New mechanisms and improved internal baffling are recommended for both secondary clarifiers, as well as hydraulic modifications upstream to improve flow splitting upstream of the clarifiers. The operations and performance should be reviewed after these modifications are implemented, to assess whether additional capital improvements will be required. The secondary clarifiers are served by three variable-speed centrifugal RAS pumps, all located in a dry pit.

Figure 2-8 Derby Secondary Clarifier

9. **Disinfection.** The Derby WPCF provides seasonal disinfection (May-September) with sodium hypochlorite, fed via peristaltic metering pumps. There are two parallel chlorine contact basins. The Facilities Planning Study noted that this system has been functioning properly overall, but recommended modifications to improve operational flexibility and to optimize the chemical dose. Dechlorination is accomplished by feeding sodium bisulfite. Since the chlorination system was installed over 20 years ago, plans for its renewal should be included as part of the overall plant upgrade.

Figure 2-9 Derby Chlorine Contact Basins

10. **Sludge Processing and Disposal**. Primary sludge is pumped manually to a sludge holding pit in front of the aerobic digesters. There are two rectangular aerobic digesters with coarse bubble diffusers, built in 1972 and located in a fiberglass enclosure with inadequate ventilation. Waste activated sludge (WAS) is thickened in a rotary drum thickener, located in the secondary control building. Thickened WAS is mixed with the primary sludge, and the mixed sludge is dewatered on a 1.5-meter gravity belt filter press, then trucked offsite by Synagro for further treatment and incineration.

    The two circular anaerobic digesters at the plant were built in 1964 and no longer function as digesters, but have been used for sludge storage. There are also two rectangular aerobic digesters at the plant with coarse bubble diffusers, built in 1972 and located in a fiberglass enclosure with inadequate ventilation.

    The Facilities Plan noted that the sludge processing equipment is over 30 years old, having served beyond the end of its useful life. That Plan recommended a complete upgrade of the sludge processing system, including rehabilitation of the old digesters and providing new sludge dewatering facilities, including a sludge cake storage area. However, Black & Veatch believes that the size of this plant is too small to justify this level of capital expenditure for solids processing. Average annual flow for 2015-2017 was only 1.3 MGD. For a plant of this size, we believe a more appropriate solution (one we expect will be lower in life cycle cost and easier to operate) would be to store thickened liquid sludge onsite without dewatering, and to haul it offsite in liquid form, in tanker trucks.

    The approach we recommend would eliminate the need for: anaerobic digesters, aerobic digesters, sludge dewatering systems, sludge cake conveyance, and sludge cake storage and handling. Instead, all that would be required is WAS thickening, primary sludge thickening, thickened liquid sludge pumping, thickened liquid sludge storage and tanker truck loading facilities. The liquid sludge storage facility would require mixing and the ability to decant.

Figure 2-10 Derby Former Anaerobic Digesters

11. **Electrical System.** Most of the electrical equipment at the plant is over 30 years old. The plant upgrade should consider replacing all major MCC's and power and lighting panels.

12. **Plant Controls and SCADA.** The plant is largely operated in manual mode and does not have a functioning Supervisory Control and Data Acquisition (SCADA) system to monitor and control plant operations. A new SCADA system should be included as part of the plant upgrade.

13. **Odor Control.** Odor control will be an increasingly important issue at the plant, especially in view the plant's proximity to the Downtown area, and anticipated development on a site adjacent to the plant. Odor control facilities must be included with the plant upgrade and be integrated with other systems, particularly the headworks, sludge processing areas and other areas that are sources of odorous air.

14. **General, Site-wide Observations.** In addition to the condition assessment observations made related to specific systems, as noted above, there were also general observations made, related to the overall condition of the Derby WPCF.

    Significant concrete spalling and rebar corrosion are noticeable at some of the structures, particularly in the headworks area. Also, there were a number of noticeable safety hazards at the plant. These included: open, unprotected areas above liquid surfaces; solids accumulated in walking areas; and poor ventilation in confined space type areas that had to be entered regularly by plant staff for maintenance (including manually raked bar screens in a lower level space at the headworks). The plant water system is at the end of its useful life and should be replaced with the next major plant upgrade.

    The plant site is largely hemmed in with relatively little room to expand, especially with plans for development on adjacent property.

2.2 DESCRIPTION OF EXISTING FACILITIES – DERBY WASTEWATER COLLECTION SYSTEM

The Derby wastewater collection system, which serves approximately 95% of the properties in the City, dates from the late 1800's. The town's collection system is served by two major interceptors: one serving the area on the west side of the Naugatuck River, and the other serving the area on the east side. The subareas are broken out and described further in Section 5 of the Facilities Plan.

According to Derby's Collection System Capacity, Management, Operation & Maintenance (CMOM) Manual (November 2017), the Derby collection system has approximately 218,172 LF of gravity sewer and 6,770 LF of force main. Overall, sewer pipe sizes in the collection system range from 6-inch to 24-inch. The system also includes four inverted siphons.

From the Wastewater Facilities Planning Study, approximately 70% of the gravity sewers in the collection system consists of vitrified clay (VC) pipe. Based on a review of 20 years of television inspection tapes of existing sanitary sewers in Derby done by Weston & Sampson in 2012, representing approximately 45,600 LF of pipe, by far the more serious defects found in the system per foot were in the VC pipes (see Facilities Plan, section 5.1.3).

The 2014 Facilities Plan identified significant infiltration and inflow (I/I) issues in the collection system. The Phase II Sewer System Evaluation Survey (SSES) (April 2016) investigated 11 sewersheds or subareas of the wastewater collection system, utilizing television inspection, smoke testing, dye water testing, flow monitoring and other standard SSES techniques. Significant inflow was found in five of the subareas, and significant infiltration was found in eight of the 11 subareas. Of more than 160,000 LF of pipeline evaluated, approximately 16,000 LF were identified as candidates for cost-effective repair. A total of $5.4 M in specific improvement projects (2015 dollars) was identified through the Survey, which also recommended additional investigations in the collection system and I/I removal on private property. Derby is committed to an ongoing I/I reduction program, in accordance with an ongoing Clean Water Act Consent Order with DEEP and USEPA (Docket No. CWA-AO-R01-FY16-02). As documented in a letter to CT DEEP on November 22, 2016 related to the Consent Order, the City plans to spend an average of $270,000/year on I/I reduction over the next 15 years, to comply with the Order.

In 2017, Derby replaced 2,000 LF of sewer mains on Emmet Avenue. Other recent work on the collection system included isolating catch basins with indirect connections to the sewer system and replacing manhole covers. However, much additional work remains to be performed to upgrade the collection system.

A major upgrade/ rehabilitation of the downtown area (Route 34) of Derby is a state-funded project, with construction scheduled to begin in 2019. As part of this program, the roof drains and sump pump systems at 37 buildings in the downtown area will be separated and re-connected to a new storm water drainage system that will be constructed as part of the roadway rehabilitation project.

2.3 DESCRIPTION OF EXISTING FACILITIES – DERBY WASTEWATER PUMPING STATIONS

The Derby wastewater collection system has four pumping stations. These are described in Section 6 of the 2014 Facilities Planning Study, and are:

1. South Division Street PS – The upgrade to this pump station has been completed.
2. Burtville Avenue PS – The upgrade to this pump station has been completed.
3. Roosevelt Drive PS – Replacement of this pump station is under construction, scheduled to be completed in May 2019, at a budgeted cost of $7.4M.
4. Patty Ann Terrace PS **–** This pump station, which was noted as deficient in the 2014 Facilities Planning Study, has been recently replaced by a new pump station.

The pumping stations are monitored through two inspections that occur each week. Each station has an alarm, which is transmitted by telemetry system to a pager. To date, these pump stations have not been on a SCADA system. The plan to add a new facility, the East Derby Pump Station, was recommended at the time of the 2014 Facilities Planning Study. However, Derby WPCA no longer considers this project, which was intended to eliminate a problematic siphon under the Naugatuck River, to be necessary. Therefore, following completion of the Roosevelt Drive Pump Station in 2019 there are no planned capital projects related to the wastewater pumping stations.

2.4 CAPITAL PROJECT NEEDS TO 2040 UNDER BASE CASE

This section summarizes the capital upgrades and improvements that would be needed for Derby to meet system needs throughout the planning period (to 2040), without regionalization.

The 2014 Facilities Planning Study developed a recommended plan for capital improvements over a 20-year planning period, summarized in Table 11-1 of that study. Derby WPCA officials updated items on that table related to projected collection system and WPCF capital improvements as part of the referendum passed in 2014.

2.4.1 Capital Projects to 2040 – Derby Water Pollution Control Facility

Based on Black & Veatch's review of the existing facilities at Derby, the following summarizes the improvements that we believe should be made at the WPCF. In view of the age and condition of the existing facilities, we believe that under the base case scenario (no regionalization for Derby), these improvements should be implemented in a single major plant upgrade. That upgrade should include the following components:

1. Replacement of the existing headworks, to provide a reliable medium- or fine-screening facility upstream of the influent pump station.
2. Replacement/ upgrade of the grit removal facility.
3. Complete mechanical and electrical upgrade of the influent pump station, replacing all pumps, motors, valves, piping, controls, etc. A major upgrade to the building housing the pump station also will be required.
4. Replacement of the existing primary clarifier mechanisms, which are beyond their useful life. The concrete tanks also need to be carefully reviewed in light of cracks in these structures, to assess the extent and cost of repairs required.
5. Complete mechanical upgrade of the sludge transfer pumping systems, including primary and secondary sludge pumping, thickened sludge pumping, and primary sludge grinders.

6. Simplify the sludge processing arrangement. Provide thickening for primary sludge and for waste activated sludge; and then store the thickened liquid sludges onsite, to be trucked offsite for dewatering and incineration. This approach would eliminate the need for anaerobic digestion, aerobic digestion, sludge dewatering and sludge cake transfer/ storage facilities onsite. This is a more cost-effective solution for a relatively small plant of this size, and would be simpler to operate and maintain.
7. Upgrade the site-wide electrical system, and provide a full plant SCADA upgrade. This would provide several operational advantages, such as allowing automatic or remote activation to switch to step-feed mode during wet weather events (as opposed to the current situation, which requires local manual switching).
8. An upgrade (as opposed to a total replacement) of the main operations building.
9. A full process upgrade of the secondary treatment system, to optimize performance of the BNR system and to improve energy efficiency. This would include adding additional high efficiency blowers and aeration distribution system, improving segregation and air supply to the blowers, replacing the RAS pumps, and hydraulic modifications to improve flow spit to the secondary clarifiers.
10. The secondary clarifier mechanisms and internal baffles need to be replaced. Surface loading rates are high at current and future peak day and peak hour hydraulic loading rates, and the relatively shallow depths of the clarifiers (10 ft SWD) do not provide a great deal of operating cushion to protect the sludge blanket from being scoured during peak flows. It may be possible to mitigate this without adding a third clarifier by implementing other modifications, for example by adding sludge blanket baffles within the clarifiers. This will need to be confirmed with additional study of the clarifiers.
11. The plant water system should be replaced.
12. Other plant systems including disinfection, dechlorination and odor control, should be upgraded.
13. We do not see a justification for implementing a membrane-based treatment system in the future, as was suggested for a future Phase 3 Upgrade package, in the Facilities Planning Study. For this size facility, with the effluent limitations anticipated for the future, we believe the best long-term plan will be to stay with an activated sludge BNR-type system with conventional clarifiers. This will also be easier to operate and will have lower O&M costs compared to a membrane-based treatment system.

2.4.2 Alternative Sludge Processing Approach

The strategy of eliminating sludge dewatering, as proposed above, could include modifying existing tankage or installing two new steel storage tanks: one for thickened primary sludge (TPS) and one for thickened waste activated sludge (TWAS). Plant personnel would pump the thickened sludges to the storage tanks daily; then the thickened sludges would be transferred to tanker trucks for hauling to the offsite merchant facility.

Based on rough estimates of sludge produced at the Derby plant, it appears that two 40,000-gallon steel tanks, one for TPS and TWAS storage, would suffice. The tanks should provide for several days' worth of thickened sludge storage in the event of an interruption in the hauling schedule.

If required, the temporary sludge storage tanks could be silo-type with conical bottoms to minimize concerns with sludge settling out. They should also be covered to minimize the release of any odors that are produced during storage. Any new tanks required would be anchored to new concrete pads, and could be located near the anaerobic digester tanks; however, other locations could be made to work as well.

Storage tanks for the thickened sludges (TPS and TWAS) could be fed through new connections to the existing buried sludge lines. Sludge loading pumps would be required to transfer one truck's worth of sludge (6,500 gallons). These truck loading pumps would withdraw sludge through a connection at the bottom of the storage tanks.

Due to the raw nature of the stored sludges, odors associated with hydrogen sulfide formation may be produced, particularly in the TPS storage tank. To minimize these odors, ferrous chloride could be metered into the two thickened sludge streams ahead of the storage tanks. Odorous off-gases in the air spaces above the sludge liquid in the storage tanks could be treated by an activated carbon odor control system. A similar activated carbon system would be used to treat off-gases that are produced as trucks are filled.

2.4.3 Capital Projects to 2040 – Derby Wastewater Collection System

The following projects are scheduled for construction in 2019:

1. Route 34 gravity sewer replacement;
2. Hawthorne Avenue sewer lining and replacement; and
3. Force main extension and replacement, associated with Roosevelt Drive Pumping Station improvements.

The following projects that were included in Table 11-1 of the Facilities Planning Study have been deleted from the capital improvements program:

1. McConney Grove sewer system extension; and
2. Various planned development projects, including: Commerce Street/ Business Park, Hitchcock/ Hines, Derby Business Revitalization, HALO Project, and Derby Sterling Opera House.

As noted in prior reports, collection system peak flows can reach up to 13 MGD. While some work has been undertaken in the collection system, additional work is required to provide a reliable system. Investigations and prioritization is needed to maximize reliability and benefit.

2.4.4 Capital Projects to 2040 – Derby Wastewater Pumping Stations

The following projects that were included in Table 11-1 of the Facilities Planning Study have been completed (as of October 1, 2018):

1. South Division Street Pumping Station improvements;

2. Burtville Avenue Pumping Station improvements; and
3. Patty Ann Terrace Pumping Station improvements.

The Roosevelt Drive Pumping Station improvements project, which was included in Table 11-1 of the Facilities Planning Study, is scheduled for construction in 2019. Therefore, the only pumping station project included in the Facilities Planning Study that is yet to be constructed is the proposed new Division Street Pump Station.

2.5 PROJECTED CAPITAL AND O&M EXPENDITURES – 2040 BASE CASE

Projected expenditures for the WPCF, the wastewater collection system, and the wastewater pumping stations have been addressed as part of this early planning study. Budgetary capital and operating costs associated with the base case scenario for Derby outlined in this section are provided in Appendix A of this report. Since no engineering design has been undertaken for these proposed upgrades, the costs provided in that appendix are for higher-level budgeting purposes only, and have been based on typical parametric considerations, i.e. dollars-per-gallon, taking into consideration the size and age of the facility as well as the overall constraints of the site. Operations and maintenance costs have been based on current operating cost information provided by the City.

3.0 ANSONIA WASTEWATER FACILITIES ASSESSMENT

3.1 DESCRIPTION OF EXISTING FACILITIES – ANSONIA WATER POLLUTION CONTROL FACILITY

The Ansonia Water Pollution Control Facility (WPCF) was constructed as a primary treatment plant in 1968, and upgraded to secondary treatment in 1970. An extensive upgrade to the WPCF was completed in 2011. The WPCF serves approximately 98% of the residents of the City of Ansonia, a small portion of Derby, and minor sections of Seymour and Woodbridge. The plant is a secondary treatment plant in a four-stage Bardenpho process configuration for nitrogen removal, with oxidation ditch (carousel) aeration, and UV disinfection. The plant process also provides for seasonal phosphorus removal, to meet effluent requirements for discharge to the Naugatuck River.

As part of the condition assessment of existing facilities, Black & Veatch reviewed the Preliminary Design Report (October 2006) and the design plans for the plant upgrade. Black & Veatch also visited the WPCF on July 12, 2018 accompanied by plant superintendent Brian Capozzi. An assessment of each major system of the plant follows, based on a review of existing reports, observation of the facilities and discussions with WPCA staff.

1. **Mechanical screening.** The plant has only one mechanical bar screen, which was installed as part of the 2011 plant upgrade, along with the associated screenings process equipment. This is upstream of the influent pump station. There is also a second (manual) bar screen located at the lower level, which is more difficult to access.

Figure 3-1 Ansonia Mechanical Bar Screen

2. **Influent Pump Station.** The plant's influent pumping station has two smaller and two larger centrifugal pumps in a dry pit. All four pumps are new from the 2011 plant upgrade.

Figure 3-2 Ansonia Influent Pumps

3. **Vortex Grit Separation.** The plant has a new covered vortex grit chamber and grit system, also from the 2011 plant upgrade. There are provisions to bypass flow around the grit chamber when maintenance is required.
4. **Primary Clarifiers.** The chains and flights in the existing primary clarifiers were replaced during the 2011 upgrade. The clarifiers were full at the time of the visit, but appear to be in satisfactory condition based on staff input.

Figure 3-3 Ansonia Primary Clarifiers

5. **Primary Sludge Pumps.** The primary sludge pumps are air-driven diaphragm pumps, in a 4+1 arrangement. Pumps are FLSmidth slurry pumps, which are unusual in this type of application; those pumps are typically found in mineral slurry applications in the mining

and minerals industries, rather than for domestic wastewater sludge. It was reported that these are high-maintenance items, and that the ball checks need to be replaced relatively frequently. Without a high amount of maintenance for this system, these pumps would be unreliable. Ansonia is considering replacing these pumps with a pump more commonly used in primary sludge pumping applications.

Figure 3-4 Ansonia Sludge Pumps

6. **BNR Secondary Treatment.** The secondary treatment system features 2-stage anoxic zones, as well as first and second stage aeration. The old aeration basins were modified to become first stage anoxic zones. There appears to be some structural damage showing at these older tanks, including some cracks at the top of the walls.

   The first stage of aeration is accomplished by two oxidation ditch (carousel or racetrack type) aeration basins operated in parallel, which were installed during the 2011 upgrade. Orientation of one of the ditches appears to be backwards relative to what it should be, and as a result there may be some short-circuiting. Since the plant is operating below its design capacity, this does not appear to be a problem at this time. However, it could become an issue if plant flows increase to the point where they approach the plant's design capacity.

   Former rectangular secondary clarifiers were modified to become second stage aeration and second stage anoxic basins. New blowers and diffusers were installed for the second stage aeration system.

Figure 3-5 Ansonia Converted Anoxic Basins

Figure 3-6 Ansonia Oxidation Ditch Aeration Basin

7. **Secondary Clarifiers.** New circular secondary clarifiers were installed during the 2011 plant upgrade, along with new RAS and WAS pumping systems. Ansonia is adding alum ahead of the secondary clarifiers for phosphorus removal. Ansonia operations staff report that the phosphorus removal system is working well, and they have been meeting permit requirements for effluent phosphorus.

Figure 3-7 Ansonia Secondary Clarifier

Figure 3-8 Ansonia RAS and WAS Pumps

8. **UV Disinfection.** A new UV disinfection system was added to replace the chlorine contact tanks. Although the plant has only a single UV channel, some level of redundancy is provided since there is more than one bank of UV lamps in that channel.

9. **Effluent Pump Station.** The effluent pumping station, which is adjacent to the influent pump station, has two pumps in a duty/standby arrangement. The influent and effluent pumping stations are both designed for peak flows of up to approximately 12 MGD. However, according to plant staff the flow to the effluent pump station is limited to approximately 7 MGD. The cause of this limitation has not been fully investigated. However,

initial observations suggest there may be a hydraulic constriction in the conveyance system feeding into the effluent pump station wet well. As a result, the plant cannot handle peak flows greater than 7 MGD.

This is a problem that deserves immediate attention, and needs to be corrected as soon as possible, as historic peak flows to the plant as high as 10 MGD have been recorded. The current situation not only limits the plant's ability to handle peak flows from Ansonia, but also limits the facility's ability to receive wastewater flows from other communities as part of this regionalization study.

10. **Alkalinity Supplementation System.** The Merrick silo soda ash feed system was not being used at the time of the site visit, because the treatment process has not been requiring supplemental alkalinity. Plant operations staff noted that the layout of the pump system makes maintenance of this system very challenging.

11. **Thickened Sludge Storage.** WAS is thickened using rotary drum thickening. Thickened WAS is stored in one of two sludge holding tanks (two converted anaerobic digesters). Primary sludge from the primary clarifiers is pumped to the other storage tank. The sludge from these tanks is hauled away via tanker trucks to offsite incineration.

    The sludge storage tanks do not have decanting ports. The City reports that having the ability to decant from the storage tanks would reduce the amount of water hauled off by the tanker trucks, thereby extending storage capability and reducing hauling costs.

Figure 3-9 Ansonia Former Digesters Used for Sludge Storage

12. **Overall Observations.** In general, the plant infrastructure appeared to be in good condition, since most of the mechanical systems and some of the basins had been replaced or overhauled as part of the major upgrade to the plant in 2011. Also, MOR effluent data

indicate very good, consistent treatment plant performance. Record effluent BOD and TSS is consistently in single digits, and the WPCF is meeting nitrogen and seasonal phosphorus removal requirements.

3.2 DESCRIPTION OF EXISTING FACILITIES – ANSONIA WASTEWATER COLLECTION SYSTEM

This assessment of the condition and needs of the Ansonia wastewater collection system is based information contained in the 2004 Facilities Planning Study and discussion with WPCA staff.

The Ansonia collection system includes approximately 345,000 LF of sewers and includes three major interceptors: Two-Mile Brook interceptor, interceptors along the Naugatuck River, and an inverted siphon under the river. Much of the pipe is old, including vitrified clay (VC) pipe. Ansonia has undertaken several I/I reduction projects in recent years. However, while progress has been made, the collection system has I/I issues that contribute to high peak wet weather flows to the WPCF as noted in TM No. 1 – Flows and Loads.

As part of the 2004 Facilities Planning Study, televised inspections were performed for a significant number of pipes in the system. The videotapes of these inspections are still available, but summaries of the data were not developed, and some of the recommended improvements based on these videos were implemented. No further televised sewer inspections or other sewer system evaluation surveys (SSES) have been conducted since the 2004 study and associated construction activities.

Improvements recommended in the 2004 Facilities Planning Study were bundled into engineering and rehabilitation projects in May 2006. Two contracts were developed. The original design contract was $891,000 to cover identified improvements including inflow control, point repairs, manhole cover replacements, etc. Insituform was selected for the second contract, which focused on pipe lining and other rehabilitation efforts, with a contract cost of $2,934,000. The length of pipe and number of manholes rehabilitated in this project is not readily known. It was reported that because the pre-construction televised inspections required additional repairs, the lining project addressed approximately 60% of the recommended improvements identified in the 2004 Facilities Planning Study. No additional rehabilitation work has been performed on the collection system since the completion of these projects.

3.3 DESCRIPTION OF EXISTING FACILITIES – ANSONIA WASTEWATER PUMPING STATIONS

The City of Ansonia collection system has 14 wastewater pumping stations. Four of these are small “can” type stations that serve just a few homes; Ansonia hopes to eliminate up to three of these small stations by going with gravity systems instead. Of the remaining 10 larger stations:

- six have been upgraded within the past six years;
- the two largest two stations (Coe Pump Station, and Bartholomew or “Bart” Pump Station) were completely upgraded within the past ten years, including with new generators; and
- the other two stations were upgraded 6-10 years ago.

The WPCA staff is responsible for pumping station maintenance.

3.4 CAPITAL PROJECT NEEDS TO 2040 UNDER BASE CASE

This section summarizes the estimated capital improvements that would be needed for Ansonia to meet system needs throughout the planning period (to 2040), without regionalization

3.4.1 Capital Projects to 2040 – Ansonia Water Pollution Control Facility

Ansonia completed an extensive upgrade to the WPCF in 2011, and is consistently meeting permit requirements for all parameters, including nitrogen and seasonal phosphorus removal. The plant is overall in satisfactory operating condition. It is operating well under its design capacity, and is not projected to exceed that within the 20-year planning period. While the hydraulic restriction at the effluent pump station is a deficiency identified above that needs to be addressed immediately, at this point it has not yet been determined what the cause of that problem is, nor what capital expenditures would be necessary to correct it.

Otherwise, no additional major capital needs are foreseen in the near future as being required at the WPCF under the base case scenario (if no regionalization for Ansonia). Based on a 20 to 25-year average life for major mechanical systems that are well-maintained, and barring unforeseen changes in discharge requirements, the next major upgrade should be to replace recently-installed mechanical equipment when it comes to the end of its useful life. That would put the next significant mechanical upgrade cycle for the Ansonia WPCF in the 2031-2036 timeframe, near the end of the current planning period of this study.

3.4.2 Capital Projects to 2040 – Ansonia Wastewater Collection System

Increased investment in the collection system is needed to maintain appropriate service levels and meet regulatory requirements. A common industry approach in high-level analysis is to reference the estimated useful life of assets and estimate investment levels based on that useful life. For example, a 100-year useful life would require replacing an average of 1% of the system each year.

Initial activities would be focused on identified hot spots that have more frequent backups. The objective would be to focus on problematic areas and address them. The north end of downtown is believed to be the most problematic area at this time.

3.4.3 Capital Projects to 2040 – Ansonia Wastewater Pumping Stations

All ten of the larger pumping stations in the system have been upgraded within the past 10 years, and there are no plans to upgrade any of these stations in the near future nor to add new pumping stations. All of the pump stations in the system may be due for a major mechanical upgrade in 10-15 years. In the interim, it appears that the only capital expenditures foreseen related to the pumping stations would be for periodic upgrades and replacement of mechanical equipment and components that is typical for these types of facilities.

3.5 PROJECTED CAPITAL AND O&M EXPENDITURES – 2040 BASE CASE

Projected expenditures for the WPCF, the wastewater collection system, and the wastewater pumping stations have been addressed as part of this early preliminary study. Budgetary high-level capital and O&M costs associated with the work described in this section are provided in Appendix A of this report. In the absence of engineering estimates for specific capital projects, the cost information in that appendix represents high-level budgetary costs based on typical parametric values such as dollars-per-gallon of treatment. Operations and maintenance costs have been developed from current operating cost information provided by the City.

4.0 SEYMOUR WASTEWATER FACILITIES ASSESSMENT

4.1 DESCRIPTION OF EXISTING FACILITIES – SEYMOUR WATER POLLUTION CONTROL FACILITY

The Seymour WPCF was built in the 1970s, with a significant upgrade implemented in the early 1990s. It serves a sewered population of approximately 7,500 that includes the Town of Seymour plus a small portion of Oxford. The Seymour WPCF is a secondary treatment plant in a Modified Ludzak Ettinger (MLE) process configuration, followed by chlorination/dechlorination disinfection and cascade reaeration prior to discharge to the Naugatuck River. Recently the plant has begun to provide enhanced seasonal phosphorus removal, via chemical addition.

The plant, which currently is operated by Veolia Water, is designed and permitted to treat 2.93 MGD on an average annual basis. However, in recent years (2015-2017) the average flow to the plant has been approximately 0.97 MGD.

As part of the condition assessment of existing facilities, Black & Veatch reviewed available documents, which included the May 2016 WPCF Phosphorus Planning draft engineering report, and some of the 1991 upgrade design drawings which were made available. Black & Veatch also visited the WPCF on August 22, 2018 accompanied by Veolia Water plant manager Walter Royals. An assessment of the major plant facilities follows based on a review of available documents, observation of the facilities and discussions with Veolia Water and WPCA staff.

1. **Influent Screening.** After Parshall flume flow measurement, the incoming wastewater flows through a coarse manual bar rake with 1.5-inch spacing. The flow then travels through a single mechanical bar screen located in a three feet wide channel. Bar spacing on the screen is 0.75 inches. A bypass channel allows for uninterrupted flow-through during times when the mechanical screen is down for maintenance. Captured screenings are lifted by a bucket elevator system to a dumpster at grade. The mechanical bar screen equipment and screenings handling system dates to the 1990s plant upgrade, and needs to be replaced with new equipment. This entire facility is located outdoors which makes operations and maintenance difficult, especially during the cold seasons.

Figure 4-1 Seymour Headworks Area

2. **Grit Removal.** A single rectangular aerated grit chamber receives the flow after screening. The tank is equipped with a submerged auger and bucket elevator for removal of grit. The grit is discharged into a classifier system prior to being conveyed into a dumpster. A bypass channel allows for flow to continue to pass through the plant during times when the grit chamber is down for service. The grit chamber facility and equipment was last upgraded in the early 1990s, and needs to be replaced with new equipment.

3. **Influent Pump Station.** The influent pump station is set up in a wetwell/drywell arrangement, and has three pumping units. The pumps are located at the lower level, with motors on the upper level connected by extended shafts. Each pump is rated at 2,700 gpm and the facility is reportedly rated at 5,000 gpm with two pumps operating and the third pump is a standby unit. All pumps are operated with variable frequency drives (VFDs). The pump station equipment was installed in the 1990s upgrade; however, some modifications have been made to the pumps since that time. Based on age of the equipment, this facility needs to undergo a major overhaul in the near future.

4. **Primary Settling Tanks**. The plant has four rectangular primary settling tanks. Two of the tanks date back to the original construction of the 1970s; the other two were constructed as part of the upgrade done in the early 1990s. The tanks include longitudinal sludge collectors with surface scum skimming. Effluent from the primary settling tanks flows to the secondary treatment influent box. Scum collected from the primary settling tanks is discharged to the primary scum reactor. The mechanisms on two of the four primary settling tanks require replacement. Metal within the tanks will require either replacement or sand blasting and recoating, depending on actual condition.

Figure 4-2 Seymour Primary Clarifiers

5. **Aeration Basins.** The biological treatment facilities include three rectangular extended aeration activated sludge basins. The basins are in an MLE configuration, to provide nitrification-denitrification. The middle basin, which serves as the anoxic zone, receives the primary effluent. Three submersible mixers keep this basin gently stirred. The outer basins are equipped with grid type fine bubble diffusers. The aerated basins are equipped with

effluent weirs which allow mixed liquor flow to the final clarifiers. Based on the age of the equipment, it is recommended that the aeration diffuser system in the aeration basins be programmed for replacement.

Figure 4-3 Seymour MLE Basin

6. **<u>Aeration Blowers</u>.** The aeration blowers include a newer magnetic bearing turbo blower unit which serves as the duty unit and two older style multistage centrifugal blowers. It is recommended that a new turbo blower be provided to match the operating conditions of the existing turbo blower. This will provide for more efficient operations and reliable back-up to the existing turbo blower. The older multi-stage blowers should be decommissioned. It is noted that the blowers are located within the same general space as sludge pumps. Turbo blowers have sensitive electronics that make them vulnerable to harsh environments, including sludge gasses that are prevalent at a wastewater treatment plant. The ventilation in the blower room space needs to be reviewed and modified accordingly such that the air supply to the blowers, including the space they occupy, is noncorrosive and conducive to their overall reliability. Relocating the blowers may be required if the ventilation system problem is not corrected.

Figure 4-4 Seymour Blower

7. **Final Clarifiers.** The two final clarifiers are 65-foot diameter, with 13-foot side water depth. The clarifiers are equipped with rotating suction type sludge collectors. The clarifiers were part of the early 1990s upgrade. Due to their age, the internal mechanisms in these tanks need to be replaced with new equipment. A detailed condition assessment of this equipment may show that sand blasting and recoating of all metal parts could be done as part of the upgrade.

Figure 4-5 Seymour Final Clarifier

8. **Phosphorous Removal System**. The Town recently installed and commissioned a chemical phosphorous removal system at the plant. The system utilizes alum, which is introduced into the process at the aeration basins effluent.

Figure 4-6 Seymour Alum Feed System for P Removal

9. **Disinfection**. Sodium hypochlorite is used for disinfection, with sodium bisulfite added post-disinfection, for dechlorination. From conversations with plant staff, it appears that the disinfection and dechlorination systems, including the chlorine contact tanks, are in satisfactory condition at this time.

10. **Sludge Processing and Treatment.** Sludge from the primary settling tanks is mixed with primary scum and pumped to a rotating drum thickener (RDT) for thickening. The waste activated sludge is co-thickened with the primary sludge at the RDT. The thickened combined sludge is discharged to a sludge holding tank located below grade. The thickened sludge is pumped to the belt filter press (BFP) for dewatering. The dewatered sludge cake discharges into a truck which hauls the material off-site to a merchant incineration facility for final treatment.

    The RDT has reached the end of it useful life and needs to be replaced. The BFP has also reached the end of its useful life. From experience gained from working at other small plants, we believe that sludge processing should end with thickening at Seymour. The thickened sludge would then be hauled off-site for additional treatment at the merchant incineration facility. The two sludges should also be handled separately, and not combined; this is to minimize release of odorous compounds and to minimize corrosion of steel and concrete. This should be investigated further in lieu of proceeding with new sludge dewatering equipment.

Figure 4-7 Seymour Rotary Drum Thickener

11. **Electrical System.** The majority of the electrical panels and motor control centers at the plant are approximately 25 years old, dating back to the early 1990s upgrade. Some units are even older, from the 1970s project. This equipment is either at its end of usefulness or fast approaching its life expectancy. We recommend that all MCCs and electrical panels from prior to the 1990s upgrade be replaced with new gear. The electrical power and lighting panels and MCCs from the 1990s upgrade should be carefully evaluated and replaced as needed. This gear can be expected to reach the end of its useful life by 25 or 30 years after being put in service; on that basis Seymour should program for its replacements soon.

12. **SCADA.** The WPCF is operated for the most part in manual mode. It is manned one shift per day, five days per week, with alarms during off-hours going to operator phones. The Town should implement a new SCADA system at the facility. A SCADA system will provide for effective monitoring and also for automatic control. The SCADA system can be programmed to operate the plant with various degrees of automation. A new SCADA system would

improve reliability in operations and maintenance, and also would enhance accountability in O&M and in overall treatment performance.

13. **Valves & Gates.** The WPCF has numerous slide gates, sluice gates and valves. The sludge processing systems in particular have numerous valves critical to the operation of these systems. A close inventory and condition assessment of all slide and sluice gates and valves throughout the plant should be undertaken and these critical components should be replaced as needed.
14. **Odor Control System.** The existing biofilter, which draws odorous air from the sludge thickening and dewatering areas, does not work and needs to be replaced.

4.2 DESCRIPTION OF EXISTING FACILITIES – SEYMOUR WASTEWATER COLLECTION SYSTEM

This assessment of the condition and needs of the Seymour wastewater collection system is based on limited information provided by Nafis & Young Engineers, including information contained in GIS files. According to the GIS, the collection system comprises approximately 63 miles of pipe, with the primary materials being PVC (39%), asbestos cement (34%), and vitrified clay (23%).

No prior plans, condition assessments, or I/I investigation data were available. Prior conversations with WPCA representatives and consultants indicate that the sewer collection system has received limited capital investment over the years. There are no known engineering reports nor investigations available on the condition of the collection system. No information about prior repair history or collection system investments were available.

However, earlier this year Seymour started an initial flow monitoring plan on a section of the collection system. The initial focus of the I/I monitoring program is taking place in an older area that has more problems. Clay pipe is a major problem in the older parts of the system, due to structural integrity and I/I issues. The outlying areas of the town that were developed more recently tend to have newer, PVC pipes.

The WPCA staff is responsible for maintaining the wastewater collection system. At this time, Seymour has no annual sewer replacement program.

As noted in TM No. 1 – Flows and Loads, the collection system has significant infiltration and inflow (I/I) issues that cause high peak wet weather flows to the WPCF. Seymour had the second highest peaking factor of the towns in the study, indicating that the wastewater collection system may be in poor and deteriorating condition, and may have direct inflow connections as well.

4.3 DESCRIPTION OF EXISTING FACILITIES – SEYMOUR WASTEWATER PUMPING STATIONS

The two largest pump stations in the collection system are both located on Derby Avenue: the South Derby Pump Station and the North Derby Pump Station. It appears these two pump stations received significant upgrades approximately 10 years ago. There are also eight smaller pump stations, at least six of which are new stations with submersible pumps. The Seymour WPCA staff is responsible for maintaining the pumping stations. No upgrade and maintenance records were provided on these smaller pump stations.

4.4 CAPITAL PROJECT NEEDS TO 2040 UNDER BASE CASE

This section summarizes the estimated capital facilities that would be required for Seymour to meet system needs throughout the planning period (to 2040), without regionalization. It addresses the WPCF, the wastewater collection system, and the wastewater pumping stations.

4.4.1 Capital Projects to 2040 – Seymour Water Pollution Control Facility

Based on Black & Veatch's review of the existing facilities at Seymour, the following summarizes the improvements that we believe should be made at the WPCF. In view of the age and condition of the existing facilities, we believe that under the base case scenario (no regionalization for Seymour), these improvements should be implemented in a single major plant upgrade. That upgrade should include the following components:

1. Replacement of the existing screenings facility at the headworks, to provide a reliable medium- or fine-screening facility. This would include new mechanical screening equipment as well as associated screenings processing and conveyance systems. These systems should be enclosed.
2. Replacement of the grit removal facility.
3. Complete mechanical and electrical upgrade of the influent pump station, which would include replacing all pumps, motors, valves, piping, drives, controls, etc.
4. Replacement of the mechanisms in two of the four primary clarifiers. The concrete tanks also need to be carefully reviewed in light of their age to assess the extent and cost of repairs required.
5. Replacement of the aeration diffusers in the aeration basins, and other related modifications as needed to optimize BNR system performance and to improve energy efficiency. This would include replacing the older multi-stage blowers with a new turbo blower suitable to operate in concert with the existing turbo blower. Either fix the HVAC issues in the blower area, or consider relocating the blowers into another existing or new building as necessary to maintain an appropriate operating environment.
6. Replacement of the mechanisms on both circular secondary clarifiers.
7. Replacement of the rotary drum thickener (RDT), with similar equipment or other appropriate waste active sludge thickening systems.
8. Decommission the belt filter press (BFP). Instead of dewatering sludge onsite, provide thickened liquid storage onsite, with decanting capability, for trucking liquid sludge offsite for further processing and incineration. For a plant this size, this will be more cost-effective in the long term than dewatering onsite.
9. Upgrade of the site-wide electrical system, which would include replacing all MCC's as well as all of the older electrical panels, including power and lighting panels. Power cables should also be considered for replacement.
10. Provide a full plant SCADA system upgrade.

11. Review the condition of gates and valves throughout the plant, and replace those that are not functioning or which are at the end of their useful life.

4.4.2 Capital Projects to 2040 – Seymour Wastewater Collection System

No capital planning information was provided relating to planned investment in the collection system. It is assumed that increased investment in the collection system is needed to maintain appropriate service levels and meet regulatory requirements. A common industry approach in high-level analysis is to reference the estimated useful life of assets and estimate investment levels based on that useful life.

Because of the high I/I rate and the lack of prior investigation, it is assumed that 1.5% of the system will require replacement or rehabilitation per year to maintain the system. This corresponds to approximately 5,000 ft of pipe per year. This level of investment may not have a significant impact on reducing I/I in the system. It also appears that capital improvements for an initial period of time is also necessary to increase overall system reliability.

Some initial activities would be focused on identified hot spots that have more frequent backups. The objective would be to focus on problematic areas and address them.

4.4.3 Capital Projects to 2040 – Seymour Pumping Stations

There are two larger and eight small pump stations in the collection system. Based on age and condition, we would anticipate a major mechanical upgrade for the larger stations in 10-15 years. The smaller pump stations need to be investigated to determine investment requirements and timing. Lacking this information, it is assumed that these smaller pump stations require upgrade in the next 5 to 10 years.

4.5 PROJECTED CAPITAL AND O&M EXPENDITURES – 2040 BASE CASE

Projected expenditures for the WPCF, the wastewater collection system, and the wastewater pumping stations have been addressed as part of this early planning study. Budgetary capital and operating costs associated with the base case scenario for Seymour outlined in this section are provided in Appendix A of this report. Since no engineering design nor assessment work has been undertaken for the Town's wastewater treatment, collection and pump station infrastructure, the costs provided in that appendix are for higher-level budgeting purposes only, and have been based on typical parametric considerations such as dollars-per-gallon, taking into consideration the size and age of the facility as well as the other factors, such as plant site constraints.

5.0 BEACON FALLS WASTEWATER FACILITIES ASSESSMENT

5.1 DESCRIPTION OF EXISTING FACILITIES – BEACON FALLS WATER POLLUTION CONTROL FACILITY

The Beacon Falls WPCF is a small facility, with a permitted design flow of 0.71 MGD and recent annual average flow (2015-2017) of approximately 0.31 MGD. The 2015 Wastewater Facilities Plan estimated an average annual flow of 0.36 MGD and a peak day flow of 1.01 MGD. The plant solely serves residents of the Town of Beacon Falls, while other residents in town are served by septic systems and some wastewater flow is sent to the Naugatuck WPCF. The Beacon Falls WPCF was built in 1971 as a secondary treatment plant with primary clarifiers, activated sludge, secondary clarifiers and anaerobic sludge digestion (now used as a sludge holding tank).

The plant, which is subject to nitrogen limits, has been a net payer into the Long Island Sound nitrogen credits exchange program. The plant currently discharges approximately 50 pounds/day of nitrogen; the Town paid approximately $16,000 into the nitrogen credits exchange program in 2017.

The most recent major upgrade to the WPCF was done in 1994, and included: new aeration blowers and diffusers, septage receiving station, sludge pumps, a new (12-foot side water depth) final settling tank, and modifications to the existing (8-foot side water depth) final settling tank. A UV disinfection system was added at the WPCF in 2006. Since much of the mechanical equipment is approaching 25 years in service and clearly nearing the end of its useful life, the plant is due for a major mechanical upgrade.

Since the plant is not at the southernmost (downstream) end of the collection system service area, most of the wastewater flow must be pumped to the plant.

Following a study by an engineering consulting firm which recommended an extensive upgrade to the WPCF, Beacon Falls retained DPC Engineering to develop a more streamlined plan for upgrading the facility. The projected capital cost for upgrading the Beacon Falls WPCF, included in the appendix to this report, is based on information provided by DPC Engineering.

Black & Veatch met with Beacon Falls WPCA members and operations staff at the Beacon Falls WPCF on August 22, 2018, and were given a tour of the facility at that time. The following summarizes observations made regarding condition of the existing facilities.

1. **Influent Pump Station.** The plant influent pump station features three constant speed centrifugal pumps in a wet pit/dry pit configuration. Based on the age and condition of the equipment, it appears that this pump station is structurally sound overall, but is due for a mechanical upgrade.

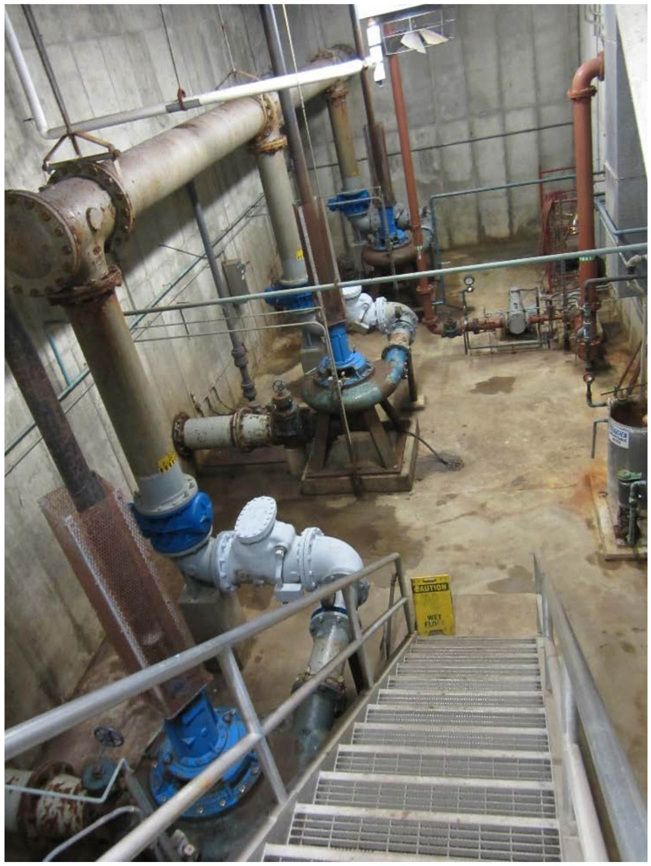


Figure 5-1 Beacon Falls Influent Pump Station

2. **Headworks.** The headworks, which is located downstream of the influent pump station, features a comminutor in parallel with a manually cleaned bar screen in the bypass channel. The equipment is at the end of its useful life and should be replaced.

Figure 5-2 Beacon Falls Comminutor and Bar Screen

3. **Primary Settling Tank.** There is only one primary settling tank at the plant, a rectangular basin mostly below grade, which dates back to the early 1970's. With the tank in service and most of it out of view, it was not possible to assess its condition. A condition assessment needs to be undertaken to determine whether structural repairs are needed. It was not clear whether this tank can be bypassed.

Figure 5-3 Beacon Falls Rectangular Primary Clarifier

4. **Aeration Basins and Blowers.** The secondary treatment system is activated sludge basins, with a grid of diffusers. These were installed during the 1994 upgrade, along with the three small conventional aeration blowers which are located in the basement of the Operations Building. Based on the age of these units, they should be replaced with more energy-efficient modern blowers. The aeration basins need to be modified as well, to improve nitrification and denitrification capability.

Figure 5-4 Beacon Falls Aeration Basin

Figure 5-5 Beacon Falls Aeration Blowers

5. **<u>Secondary Clarifiers</u>.** The Seymour plant has two rectangular concrete secondary settling tanks. The older, original clarifier is relatively shallow (8-foot depth); the second clarifier, added during the 1994 upgrade, is 12 feet deep. It was reported that a retrofit at the inlet to these tanks is required to optimize flow split and overall treatment performance.

Figure 5-6 Beacon Falls Secondary Clarifier Effluent Weirs

6. **Ultraviolet Disinfection.** A new two-bank outdoor ultraviolet disinfection system, installed in 2006, is reported to be in good working condition.

Figure 5-7 Beacon Falls UV Disinfection System

7. **Alkalinity Addition.** Soda ash is added at the headworks for alkalinity supplementation, to facilitate nitrogen removal.
8. **Sludge Processing.** The existing sludge pumps, which include plunger pumps for primary sludge and RAS/WAS pumps for secondary sludge, were installed in the 1994 upgrade and are due to be replaced. The solids processing system blends primary and secondary sludge, which is periodically decanted to a final concentration of approximately 2% solids. The sludge is trucked off-site to a regional sludge treatment merchant plant. The existing

anaerobic digester no longer functions as a digester, and is used for sludge storage. There is an abandoned sludge centrifuge onsite. Mechanical thickening should be provided to decrease sludge disposal costs.

Figure 5-8 Beacon Falls Plunger Pumps for Sludge

9. **Other Items.** The Beacon Falls WPCF Upgrade Summary memorandum provided by DPC Engineering, dated October 18, 2018 identified additional upgrades required at this facility. This includes: operations building roof replacement, site-wide electrical system upgrades, a new emergency standby generator, and miscellaneous safety-related improvements.

5.2 DESCRIPTION OF EXISTING FACILITIES – BEACON FALLS WASTEWATER COLLECTION SYSTEM

Most of the collection system (perhaps two-thirds) consists of pipe installed within the past 20 years, mostly PVC. The remaining one-third of the collection system is older than that. It is reported that the system has approximately 33 miles of sewer pipes overall. The Beacon Falls WPCA has recently taken over responsibility for maintaining the collection system. Most of the maintenance work is related to occasional blockages and root intrusion type problems. There is no annual program for pipe replacement in the system.

An I/I study was reported to have been conducted as part of the 2015 Wastewater Facilities Plan. It recommended further I/I investigation in the future, as well as limited I/I remediation work. At this time, I/I reduction is not a high priority for the Beacon Falls WPCF, and all future plans related to plant upgrades have assumed current levels of I/I wastewater flows.

5.3 DESCRIPTION OF EXISTING FACILITIES – BEACON FALLS WASTEWATER PUMPING STATIONS

All flow to the WPCF is pumped to the plant (none flows to the plant by gravity). There are three municipal pump stations in the collection system, plus one private pump station operated by a condominium developer. The three municipal pump stations typically require minimal maintenance work; it is anticipated that they will require their next major renewal/rehabilitation in approximately 10 years. The three pump stations are:

1. Railroad Avenue Pump Station – Located across from the WPCF, last upgraded 10 years ago; this station takes about 85% of the system flow. Consists of two pumps, each 1,000 gpm.
2. Pines Bridge Pump Station – Utilizes Tsurimi cutter pumps.
3. West Road Pump Station – A very small station, with a 3-inch force main.

5.4 CAPITAL PROJECT NEEDS TO 2040 UNDER BASE CASE

This section summarizes the estimated capital facilities that would be needed for Beacon Falls to meet system requirements throughout the planning period (to 2040), without regionalization. It addresses expenditures for the WPCF, the wastewater collection system, and the wastewater pumping stations.

5.4.1 Capital Projects to 2040 – Beacon Falls Water Pollution Control Facility

Proposed capital facility needs for the Beacon Falls WPCF are based on recommended upgrade items in a projected capital improvements program provided by DPC Engineering in the Beacon Falls WPCF Upgrades Summary memorandum dated October 17, 2018. The list of new or upgraded facilities programmed at the plant is identified below:

1. Influent Pumping System Upgrade
2. Headworks (Screen Building at Existing Pump Station)
3. Primary Clarifier (Convert to Anoxic)
4. Aeration System Upgrades and Instrumentation
5. Secondary Clarifier Upgrade/Expansion
6. Secondary Clarifier Anoxic Conversion
7. RAS/WAS Systems Upgrades
8. Gravity Thickener – Anoxic Recycle Conversion
9. Rotary Drum Thickener – Dewatering (In Existing Building/Finance)
10. Electric/Main Switchgear/Generator
11. Digester Cleaning, Replacement Roof and Mixer
12. Operations Building Replacement Roof
13. Safety Improvements

5.4.2 Capital Projects to 2040 – Beacon Falls Wastewater Collection System

There is no program for sewer replacement in Beacon Falls at this time. While no major new sewer projects have been identified, over time the system will need replacement of aging sewers on a long-term cycle. We have assumed the collection system improvements to be started and underway within the short-term (approximately 5 years).

5.4.3 Capital Projects to 2040 – Beacon Falls Pumping Stations

Beacon Falls has three relatively small municipal pumping stations in its collection system. The largest one, Railroad Avenue Pumping Station, will likely be due for a major upgrade in approximately 10 years. The other two stations will require periodic replacement of mechanical equipment and other repairs. With no additional information provided for these pump stations, it is assumed they will require upgrade in approximately 10 years.

5.5 PROJECTED CAPITAL AND O&M EXPENDITURES – 2040 BASE CASE

Projected expenditures for the WPCF, the wastewater collection system, and the wastewater pumping stations have been addressed as part of this early planning study. Budgetary capital and O&M costs associated with the base case scenario for Beacon Falls outlined in this section are provided in Appendix A of this report. Capital costs associated with upgrading the WPCF have been based on engineering cost information provided by DPC Engineering.

6.0 NAUGATUCK WASTEWATER FACILITIES ASSESSMENT

6.1 DESCRIPTION OF EXISTING FACILITIES – NAUGATUCK WATER POLLUTION CONTROL FACILITY

The Naugatuck Water Pollution Control Facility (WPCF) serves the Borough of Naugatuck and portions of adjacent communities: Middlebury, Oxford, Beacon Falls and Prospect. Recent average flows to the plant (2015-2017) have been approximately 4.6 MGD, which is significantly below the permitted design average flow for the plant of 10.3 MGD.

The original plant was upgraded to secondary treatment in the 1970's. The treatment process lineup includes influent pumping followed by primary sedimentation, 4-stage Bardenpho BNR for nitrogen removal, secondary clarification, and disinfection prior to discharge to the Naugatuck River. Disinfection consists of sodium hypochlorite addition at the head of a chlorine contact tank, with bisulfite addition at the end for dechlorination.

The lack of a headworks at the plant to remove grit and screenings presents an operational challenge at the primary settling tanks and downstream facilities.

The Naugatuck WWTF is also the site of a regional solids processing facility that includes bulk sludge delivery, liquid sludge storage, dewatering via centrifuge or belt filter press, and incineration. High strength sidestream flows from the regional solids processing facility to the WWTP contribute significantly to plant loading.

The Naugatuck WWTF Facilities Plan (December 2017) included a recent, detailed condition assessment of the existing facilities, and developed a capital improvements plan for projects that should be undertaken within the next 10 years to address the needs of the plant over a 20-year planning period. The Facilities Plan addressed the aging infrastructure that needs to be repaired or replaced, and included process changes to meet the new phosphorus limitations. The regional sludge incinerator was not included in the scope of the Facilities Plan.

The condition of the existing facilities at the Naugatuck WWTF is discussed in detail in Section 4 and Appendix D of the 2017 Facilities Plan.

Black & Veatch visited the Naugatuck WWTF on July 27, 2018 to observe major plant systems. The facilities include the following:

1. **Influent Pump Station.** The plant influent pump station consists of four pumps in a dry pit/ wet pit arrangement. There is no headworks upstream of the influent pump station; consequently, the influent pumps are subject to maintenance challenges related to both grit and screenings. Three of the four influent pumps were recently replaced with new Sulzer centrifugal pumps.

Figure 6-1 Naugatuck New Sulzer Influent Pump

2. **<u>Primary Settling Tanks</u>**. The plant has two operable rectangular primary settling tanks, each 120 ft x 30 ft x 12 ft SWD. Each tank has two parallel sections, with chain and flight sludge collectors and cross-collectors. The tanks are covered with fabric covers, for odor control. The scum collection system has not worked for several years.

Figure 6-2 Naugatuck Primary Settling Tanks, Covered for Odor Control

3. **<u>BNR Biological Treatment</u>.** Biological treatment is accomplished in two parallel trains, by a 4-stage Bardenpho process for nitrogen removal. The basins have internal curtain walls to segregate the zones, along with internal mixed liquor recycle to enhance denitrification. Air for the diffuser grids is provided by two Piller turbo blowers installed in 2013, with backup provided by positive displacement blowers installed in 1986. A number of deficiencies in the biological treatment system, and opportunities to improve performance, were noted in Section 4.6 of the 2017 Facilities Plan.

   Naugatuck and Veolia are working to meet 0.4 mg/L effluent phosphorus while keeping chemical costs low. The high sidestream phosphorus loading from onsite sludge processing activities makes this more of a challenge than at more typical domestic wastewater treatment plants. To achieve phosphorus reduction in anticipation of more stringent permit limits scheduled to take effect late summer/early fall of 2019, Naugatuck has started to implement low capital cost measures and chemical addition (PAC). These initial measures have resulted in effluent phosphorus reduction; however, additional capital cost improvements are planned in the upcoming months to reduce phosphorus levels and to meet the permit requirements.

Figure 6-3 Naugatuck Anoxic Basins, in Modified 4-Stage Bardenpho Process

Figure 6-4 Naugatuck Activated Sludge Aeration Basin

Figure 6-5 Naugatuck Piller Turbo Blower, for Aeration System

4. **Secondary Clarifiers**. The Naugatuck WPCF has three rectangular secondary clarifiers, each 150 ft x 40 ft x 12 ft SWD. Much of the mechanical equipment, including the collector drives, RAS pumps and WAS pumps, is from the 1970's and needs to be replaced. Flow from these three clarifiers is sent to a fourth polishing clarifier downstream of the other three.

Figure 6-6 Naugatuck Secondary Clarifiers

5. **Disinfection System.** Disinfection, which is provided by hypochlorite addition, is followed by bisulfite dechlorination. Since a significant portion of the plant's secondary effluent is used by the sludge incinerators, only a portion of the secondary effluent is disinfected and discharged to the Naugatuck River. The condition of the chlorine contact tanks is considered fair.

Figure 6-7 Naugatuck Chlorine Contact Basins

6. **Sludge Thickening and Dewatering.** Primary sludge and WAS are co-thickened in a gravity thickener. There are four covered gravity thickeners at the WPCF. Thickened sludge is stored in multiple sludge storage tanks onsite. Sludge dewatering is accomplished with two centrifuges (installed 2002) and two belt filter presses (installed in the 1970's). Due to the large amount of sludge being processed from other plants at the incineration facility, sludge dewatering generally takes place on a 24/7 basis.

Figure 6-8 Naugatuck Belt Filter Press

6.2 DESCRIPTION OF EXISTING FACILITIES – NAUGATUCK WASTEWATER COLLECTION SYSTEM

The existing sewer system is comprised of 156 miles of gravity sewer ranging from 6 inches to 24 inches in diameter and 0.8 mile of force main and is divided into 20 subsystems. In October 2017 Naugatuck received a Consent Order (No. CWA-AO-R01-FY17-07) relating to the collection system. The Order contains specific requirements for reporting and operations and maintenance of the collection system, as well as an I/I Control Plan and a Capacity, Management, Operation and Maintenance (CMOM) program.

The Naugatuck WPCA has engaged in an active sewer system evaluation survey (SSES) and rehabilitation program, with recent engagements including the 2015 I/I analysis, which recommended two phases of SSES, the first of which was completed and documented in the SSES Plan Report in 2017. The 2017 SSES plan documented the investigation of priority I/I subbasins, and its recommendations included further SSES activities as well as cost-effective rehabilitation and I/I removal efforts. These recommendations were incorporated into the 2017 Facilities Plan. I/I reduction resulting from the proposed activities was estimated to be 0.3 MGD on average.

6.3 DESCRIPTION OF EXISTING FACILITIES – NAUGATUCK WASTEWATER PUMPING STATIONS

The Naugatuck collection system has five wastewater pumping stations. All were constructed in the 1970's or 1980's, and are relatively small facilities with submersible pumps. The condition of these facilities is discussed in Section 6 and Appendix J of the 2017 Facilities Plan. In all cases, it is reported that the pumps were recently replaced or rebuilt. All stations are generally reported to be in good condition, however the Inwood Pump Station has corrosion on some of the metal piping and valves, which may be due to hydrogen sulfide.

6.4 CAPITAL PROJECT NEEDS TO 2040 UNDER BASE CASE

This section summarizes the estimated capital facilities that would be required for Naugatuck to meet system needs throughout the planning period (to 2040), without regionalization. It addresses the WPCF, the wastewater collection system, and the wastewater pumping stations.

6.4.1 Capital Projects to 2040 – Naugatuck Water Pollution Control Facility

The recommended capital improvements for the Naugatuck WPCF are indicated on Table 8-2 of the 2017 Naugatuck Wastewater Treatment Facilities Plan, with the associated costs (in 2016 dollars) provided on Table 8-4 of that Plan. The capital costs for the WPCF presented in Appendix E have been developed based on that information.

The Facilities Plan accounted for capital costs that would need to be expended during the first ten years of the planning period, through FY 2026. During the later years of this regionalization planning period, which extends to 2040, replacement of mechanical equipment expected to wear out after 2026 also need to be included.

6.4.2 Capital Projects to 2040 – Naugatuck Wastewater Collection System

In the 2017 Facilities Plan, a program of collection system studies and improvements was identified, including a budget for emergency repairs, for the period of FY18 to FY26. This information has been used as a basis for the projected costs in Appendix E of this report.

6.4.3 Capital Projects to 2040 – Naugatuck Pumping Stations

Several relatively small recommended capital or repair type projects for the wastewater pumping stations are listed in Table 8-3 of the 2017 Facilities Plan. This includes generator replacement and miscellaneous repairs in the near term, and regular, scheduled equipment replacement in 11-20 years. Estimated costs for those projects are included in Table 8-4 of the 2017 Facilities Plan. Those costs have been used as the basis for the projected pumping station capital costs that are included in Appendix E of this report.

6.5 PROJECTED CAPITAL AND O&M EXPENDITURES – 2040 BASE CASE

Projected expenditures for the WPCF, the wastewater collection system, and the wastewater pumping stations have been addressed as part of this early planning study. Budgetary capital and operating costs associated with the base case scenario for Naugatuck outlined in this section are provided in Appendix A of this report. Capital costs associated with upgrading the WPCF have been based on engineering cost information provided in the 2017 Facilities Plan.

APPENDIX A

Projected Capital and O&M Expenditures to 2040 Under Base Case

APPENDIX A Projected Capital and O&M Expenditures to 2040 Under Base Case

This appendix provides planning-level capital and O&M costs for wastewater infrastructure for the five communities in this study (Derby, Ansonia, Seymour, Beacon Falls, and Naugatuck), under the base case scenario of no regionalization, through 2040. The costs presented in this appendix correspond to what will be required to address the existing conditions identified in the main body of this report, for each community.

In developing these costs, we have reviewed existing planning and engineering reports on wastewater infrastructure needs for the communities. However, for some of the communities there was little information available to properly capture the 20-year capital needs. As a result, very high-level estimates have been made based on experience with other comparable-sized facilities, on-site reviews, and parametric considerations (such as $/gallon for treatment or $/LF for collection system replacement).

The capital cost tables are broken down by the three main categories for wastewater infrastructure: treatment facilities, collection systems and large pumping stations in the collection system. The basis for the costs developed in for each community is provided in the discussion that follows.

A.1 Derby Capital Expenditures to 2040 – Summary

Projected wastewater infrastructure capital costs for Derby, under the base case scenario of no regionalization, through 2040, are summarized in Table A-1 below. The costs presented are based on 2019 dollars. Project costs shown include allowances for construction contingency as well as engineering, legal and administration.

Table A-1 Derby Wastewater Facilities Base Case Condition Capital Budgetary Needs

Derby Wastewater Capital Projects to 2040	Project Cost (2019 $)
Water Pollution Control Facility (**WPCF**, Major Upgrade)	$ 70,000,000
Collection System (CS)	
Subtotal for Years 1-5 (System Renewal @ 2.50%/yr. = $654,000/yr.)	$ 3,300,000
Subtotal for Years 6-20 (System Renewal @ 1.20%/yr. = $314,000/yr.)	$ 4,700,000
Large Pumping Stations (PS)	
Division Street New Pumping Station	$ 2,200,000
Allowance for Other Pumping Station Upgrades through 2040	$ 2,000,000
TOTAL: WPCF + CS + PS	$ 82,200,000

Derby Base Case Capital Costs – Basis and Assumptions

The basis for the costs presented in Table A-1 is summarized below.

- Based on Black & Veatch's observations of the facilities and supported by input of plant staff, the Derby WPCF is due for a major overhaul, approaching full replacement. We believe that the extent of the work that will required to upgrade this facility to meet requirements through 2040 was not fully captured in the 2014 Draft Facilities Plan. This estimate for WPCF upgrade needs was calculated based on a $20/gal assumption considering the maximum month flow capacity of 3.5 MGD.

- Based on age and condition of the collection system (very old, approximately 70% VC pipe, high infiltration and inflow) system renewal costs were based on replacing 2.5% of the collection system per year during the first five years of a "catch up" period, followed by a sustained investment thereafter of replacing 1.2% of the system annually. Based on an overall collection system length of 41.2 miles of sewers, at an average 2019 replacement cost of $120/LF, this would require approximately $654,000/year for the first five years, and $314,000/year thereafter, as shown on Figure A-1.

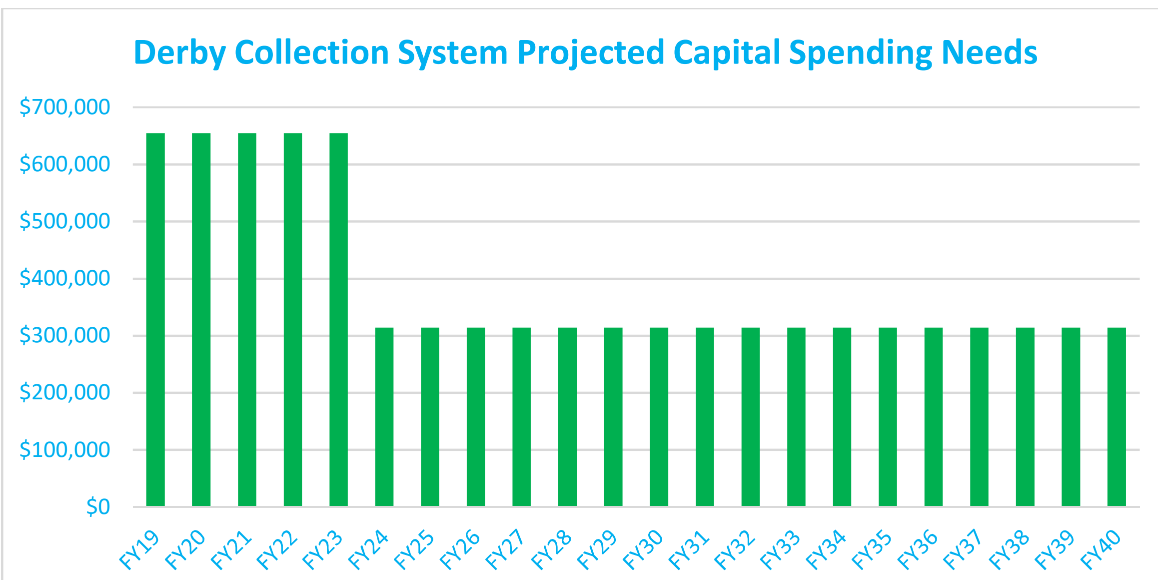


Figure A-1 Derby Collection System Projected Capital Spending Needs (2019 $)

- Estimated project costs for new Division Street Pump Station were based on Table 11-1 of the Facilities Plan, escalated to 2019 and includes allowances for contingency as well as for engineering, legal and administration.

A.2 Capital Expenditures to 2040 – Ansonia Summary

Projected wastewater infrastructure capital costs for Ansonia, under the base case scenario of no regionalization, through 2040, are summarized in Table A-2 below. The costs presented are based on 2019 dollars. Project costs shown include allowances for construction contingency as well as engineering, legal and administration.

Table A-2 Ansonia Wastewater Facilities Base Case Condition Capital Budgetary Needs

Ansonia Wastewater Capital Projects	Project Cost (2019 $)
Water Pollution Control Facility (WPCF)	$ 15,000,000
Collection System (CS)	
Subtotal for Years 1-5 (System Renewal @ 2.0%/yr. = $828,000/yr.)	$ 4,100,000
Subtotal for Years 6-20 (System Renewal @ 1.0%/yr. = $414,000/yr.)	$ 6,200,000
Large Pumping Stations (PS)	
Allowance for Pumping Station Upgrades through 2040	$ 3,000,000
TOTAL: WPCF + CS + PS	$ 28,300,000

Ansonia Base Case Capital Costs – Basis and Assumptions

The basis for the costs presented in Table A-2 is summarized below.

- The Ansonia WPCF had an extensive upgrade completed in 2011, and the overall condition of the plant is good. While no major plant upgrades involving new tanks and structures are anticipated before 2040 under the base case scenario, it is likely that mechanical equipment upgrades would be required by approximately 2030, which is within the planning period of this study. Based on major mechanical equipment upgrades at approximately 20% of the cost of the prior upgrade, the planning level budget for capital expenditures is approximately $15M in 2019 dollars.

- The Ansonia collection system is old and much of it is VC pipe. While there has been some I/I work done in the past, significant investment is still required. A higher system-wide renewal rate is recommended for the first five years for catch-up. Therefore, system renewal costs were based on replacing 2.0% of the collection system per year during the first five years of a “catch up” period, followed by a sustained investment thereafter of replacing 1.0% of the system annually. Based on an overall collection system length of 65.3 miles of sewers, at an average (2019) unit cost of $120/LF (to cover average lining or replacement costs, manhole rehabilitation, related inspection and SSES activities), this would require an investment of approximately $828,000/year for the first five years, and $414,000/year thereafter, as shown on Figure A-2.

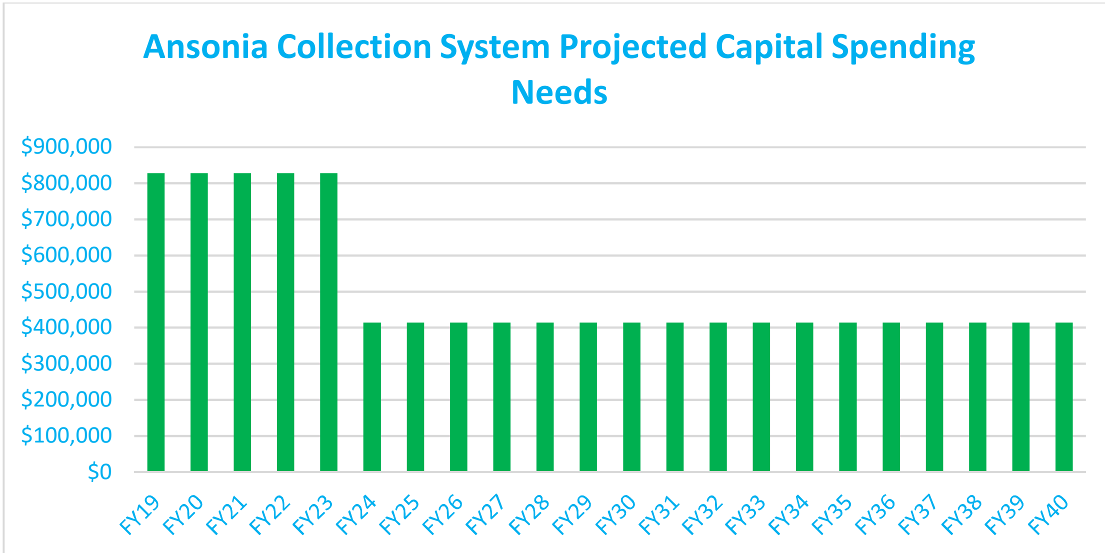


Figure A-2 Ansonia Collection System Projected Capital Spending Needs (2019 $)

- All of the ten larger pump stations in Ansonia have been upgraded within the past 10 years, including the two largest stations (Coe and Bartholomew) which completely upgraded recently. Therefore, an allowance of $2M has been provided for mechanical upgrades to each of the two larger pumping stations, which would be expected within the 20-year planning period.

A.3 Capital Expenditures to 2040 – Seymour Summary

Projected wastewater infrastructure capital costs for Seymour, under the base case scenario of no regionalization, through 2040, are summarized in Table A-3 below. The costs represent project are based on 2019 dollars. Project costs shown include allowances for construction contingency as well as engineering, legal and administration.

Table A-3 Seymour Wastewater Facilities Base Case Condition Capital Budgetary Needs

Seymour Wastewater Capital Projects	Project Cost (2019 $)
Water Pollution Control Facility (WPCF)	$ 40,000,000
Collection System (CS)	
Subtotal for Years 1-5 (System Renewal @ 2.0%/yr. = $798,000/yr.)	$ 4,000,000
Subtotal for Years 6-20 (System Renewal @ 0.75%/yr. = $299,000/yr.)	$ 4,500,000
Large Pumping Stations (PS)	
Allowance for South Derby and North Derby PS Upgrades through 2040	$ 2,000,000
TOTAL: WPCF + CS + PS	$ 50,500,000

Seymour Base Case Capital Costs – Basis and Assumptions

The basis for the costs presented in Table A-3 is summarized below.

- The Seymour WPCF is due for a major upgrade and overhaul of existing systems. However, no Facilities Plan has been commissioned to identify the facility needs in depth. Therefore, a high-level budgetary estimate for plant upgrade needs was based on a unit cost of $14/gal and a maximum month design flow of 2.93 MGD, resulting in a project cost of approximately $40M for the WPCF upgrade (based on 2019 dollars).

- Significant investment will be required for sewer replacement and repairs, based on age and anticipated poor condition of the system. Projected system renewal costs were based on replacing 2.0% of the collection system per year during the first five years of a “catch up” period, followed by a sustained investment thereafter of replacing 0.75% of the system annually. Based on an overall collection system length of 63 miles of sewers, at an average (2019) unit cost of $120/LF (to cover average lining or replacement costs as well related inspection and SSES activities), this would require an investment of approximately $798,000/year for the first five years, and $299,000/year thereafter, as shown on Figure A-3.

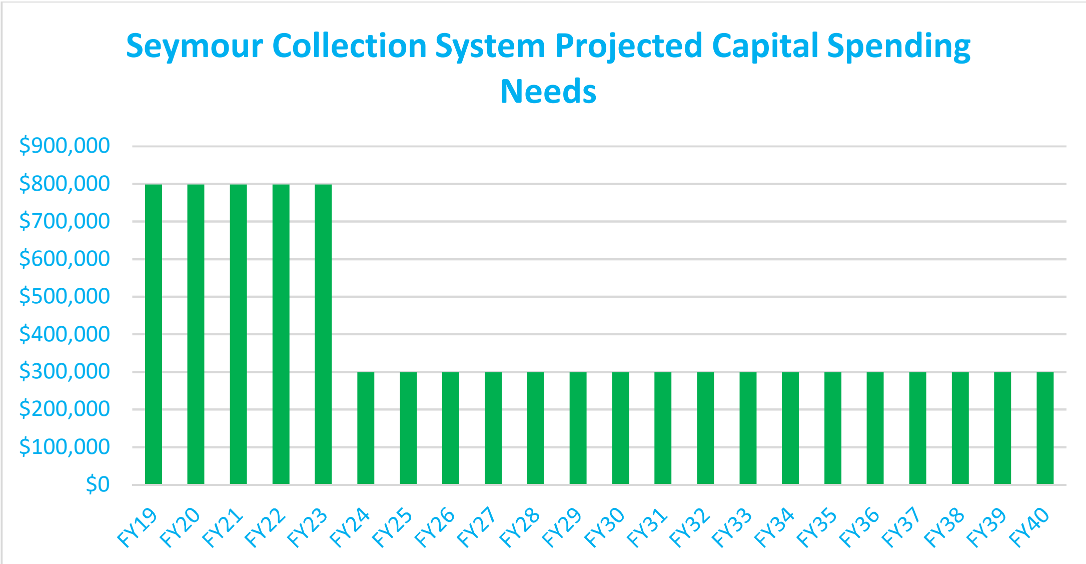


Figure A-3 Seymour Collection System Projected Capital Spending Needs (2019 $)

- The two largest pumping stations in the system are on Derby Avenue: the South Derby Pumping Station and the North Derby Pumping Station. While these pumping stations are in good condition at this time, is anticipated that they will require major mechanical upgrades within the planning period (before 2040). Therefore, a high level budgetary cost allowance for that work has been included in Table A-3 above, for renewal of these two pump stations.

A.4 Capital Expenditures to 2040 – Beacon Falls Summary

Projected wastewater infrastructure capital costs for Beacon Falls, under the base case scenario of no regionalization, through 2040, are summarized in Table A-4 below. The costs presented are based on 2019 dollars. Project costs shown include allowances for construction contingency as well as engineering, legal and administration.

Table A-4 Beacon Falls Wastewater Facilities Base Case Condition Capital Budgetary Needs

Beacon Falls Wastewater Capital Projects	Project Cost (2019 $)
Water Pollution Control Facility (WPCF)	$ 14,000,000
Collection System (CS)	
Total for Years 1-20 (System Renewal @ 0.75%/yr. = $157,000/yr.)	$ 3,100,000
Large Pumping Stations (PS)	
Allowance for PS Upgrades through 2040	$ 500,000
TOTAL: WPCF + CS + PS	$ 17,600,000

Beacon Falls Base Case Capital Costs – Basis and Assumptions

The basis for the costs presented in Table A-4 is summarized below.

- The Beacon Falls WPCF is due for a major upgrade and overhaul of existing systems. DPC Engineering is underway in preparing construction plans and specifications to upgrade the WPCF. DPC also prepared a construction cost opinion based on the design level of completion, which was summarized in a memorandum from Dave Prickett to Beacon Falls dated October 17, 2018. That memorandum outlined a program of proposed improvements through 2024, at a project cost of $9.77M in 2018 dollars. For the current study we have escalated that cost to 2019 dollars and added an allowance for future upgrades through the end of the 20-year planning period.

- Approximately two-thirds of the Beacon Falls collection system sewer piping was installed within the past 20 years. However, no detailed engineering investigations have been done on the collection system in the recent past. Based on this being a relatively new sewer system, it is presumed that the system as a whole is good condition. Therefore, a relatively low annual investment should be required compared to other the communities in this study. Projected system renewal costs were based on replacing 0.75% of the collection system per year, throughout the 20-year planning period. Based on an overall collection system length of 33 miles of sewers, at an average (2019) unit cost of $120/LF (to cover average lining or replacement costs as well related inspection and SSES activities), this would require an investment of approximately $157,000/year throughout the planning period, as shown on Figure A-4.

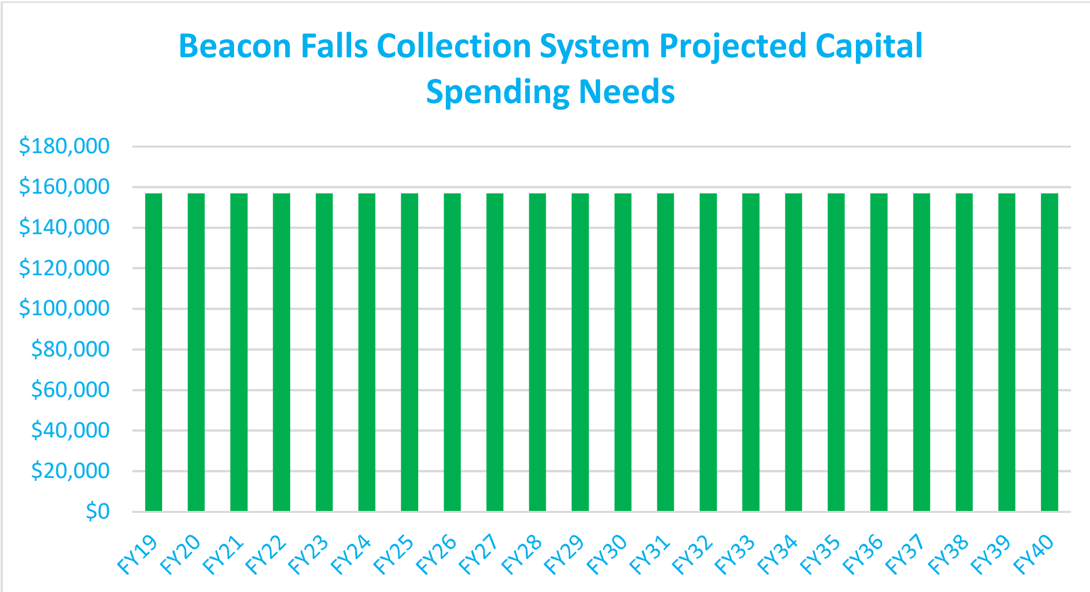


Figure A-4 Beacon Falls Collection System Projected Capital Spending Needs (2019 $)

- There are three wastewater pumping stations owned by Beacon Falls that serve the collection system. The Railroad Avenue PS (upgraded about 10 years ago, which handles approximately 85% of the system's flow) is the largest; the two smaller stations are West Road PS and Pines Bridge PS. While all three stations are reported to be in good condition, it is anticipated that mechanical upgrades will be required in another 10 years. Therefore, an allowance for pump station upgrades has been included in Table A-4.

A.5 Capital Expenditures to 2040 – Naugatuck Summary

Projected wastewater infrastructure capital costs for Naugatuck, under the base case scenario of no regionalization, through 2040, are summarized in Table A-5 below. The costs represent project are based on 2019 dollars. Project costs shown include allowances for construction contingency as well as engineering, legal and administration.

Table A-5 Naugatuck Wastewater Facilities Base Case Condition Capital Budgetary Needs

Naugatuck Wastewater Capital Projects	Project Cost (2019 $)
Water Pollution Control Facility (WPCF)	$ 55,000,000
Collection System (CS)	
Subtotal for Years 1-5 (System Renewal @ 1.5%/yr. = $1,480,000/yr.)	$ 7,400,000
Subtotal for Years 6-20 (System Renewal @ 0.75%/yr. = $741,000/yr.)	$ 11,100,000
Large Pumping Stations (PS)	
Allowance for PS Upgrades through 2040	$ 1,000,000
TOTAL: WPCF + CS + PS	$ 74,500,000

Naugatuck Base Case Capital Costs – Basis and Assumptions

The basis for the costs presented in Table A-5 is summarized below.

- The Naugatuck WPCF is due for a major upgrade at a number of its significant treatment systems. The December 2017 Facilities Plan identified necessary upgrades with capital costs through 2026. In view of the age of the facility, additional capital expenditures have been programmed to address future upgrades and equipment replacement that will be needed during the 2027-2040 period. The capital costs shown include approximately $46M for upgrades through 2026, and $9M for replacements and upgrades for the period 2027-2040.

- The Naugatuck collection system is old and much of it is VC pipe. Significant investment will be required for sewer replacement and repairs, based on age and anticipated poor condition of the system. Projected system renewal costs were based on replacing 1.5% of the collection system per year during the first five years of a "catch up" period, followed by a sustained investment thereafter of replacing 0.75% of the system annually. Based on an overall collection system length of 156 miles of sewers, at an average (2019) unit cost of $120/LF (to cover average lining or replacement costs as well related inspection and SSES activities), this would require an investment of approximately $1,480,000/year for the first five years, and $741,000/year thereafter, as shown on Figure A-5.

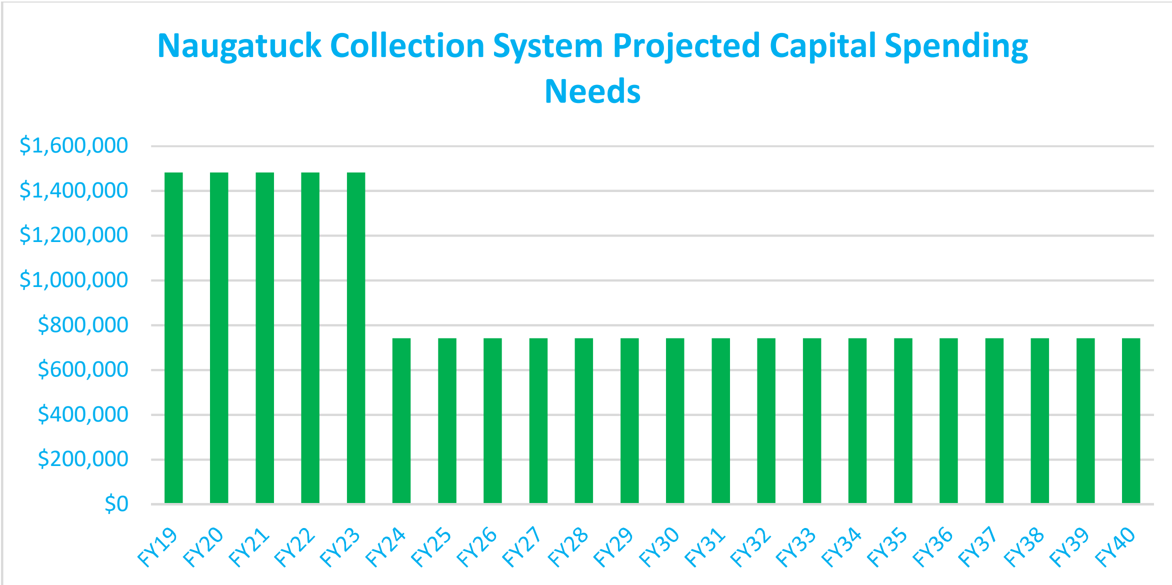


Figure A-5 Naugatuck Collection System Projected Capital Spending Needs (2019 $)

- The Naugatuck collection system has five small to medium-sized pumping stations, each equipped with submersible pumps. These stations were built in the 1970's and 1980's, and are reported to be in fair condition. All will need equipment replacement (pumps, lighting, electrical, controls, generators, etc.) within the 20-year planning period. An allowance of $1M has been provided for equipment replacement and upgrades through 2040.

A.6 Annual O&M Expenditures – Summary

Table A-6 below represents expected annual O&M costs for each of the five communities under the base case scenario, with no regionalization. Note that these costs represent the current O&M costs provided by the communities. O&M costs are not expected to change significantly with the upgrades of the WPCFs.

Table A-6 O&M Cost Summary

Estimated O&M Needs	Annual O&M Costs for Wastewater Systems ($M/year, 2019 dollars)
Derby[1]	$ 2.56
Ansonia[2]	$ 2.70
Seymour	$ 1.55
Beacon Falls	$ 0.68
Naugatuck[3]	$ 7.62

NOTES:

1. Derby includes $0.634M/yr. debt service
2. Ansonia includes $0.9M/yr. loan repayment to DEEP
3. Naugatuck costs have been increased by $0.5M/year to account for chemicals associated with the phosphorus removal upgrade.

NAUGATUCK VALLEY
COUNCIL of GOVERNMENTS
49 Leavenworth Street, 3rd Floor, Waterbury, CT 06702 · 203-757-0535 · 203-735-8688 · nvcogct.org

REGIONAL WASTEWATER TREATMENT CONSOLIDATION STUDY
Phase 1 Report Community Outreach Addendum

In May 2019, NVCOG conducted outreach presentations to the legislative bodies in the five municipalities where the wastewater treatment plants being studied are located:

May 7: Naugatuck Board of Mayor and Burgesses
May 9: Derby Board of Aldermen
May 13: Beacon Falls Board of Selectmen
May 14: Ansonia Board of Aldermen
May 21: Seymour Board of Selectmen

Prior to each meeting, members of each board were provided the Phase 1 Executive Summary and online link to the complete Phase 1 Report. A hardcopy of the Executive Summary complete Phase 1 Report was provided to each member at the meetings.

The presentations consisted of an introduction by NVCOG Municipal Shared Services Director John DiCarlo, study overview by NVCOG Executive Director Rick Dunne and details of what was studied in that municipality, reviews/analysis of local collection system and plant by Black & Veatch Senior Project Manager Mario Francucci. The team also answered questions during the presentations. During the presentations, board members were informed of:

- The study's funding source
- The intention to identify savings for taxpayers and users, both for capital outlays and operations
- Potential study outcomes may include recommendations to combine facilities, combine administrative functions
- The towns could opt out of the study at any point, other than when the EIE is being conducted, and are under no obligation to participate in any regional recommendation(s)
- The division of Phase 1 and Phase 2 tasks, including -
  Phase 1 assessed existing conditions and the cost of a upgrades that would be required in a 'go it alone' base case and long list of alternatives;
- Phase 2 will involve a partnership with DEEP, NVCOG and Black & Veatch in an environmental impact evaluation culminating in a record of decision reflecting a preferred alternative(s); tighter cost analyses, projection of cost savings & a governance model and model regulations.

Feedback from board members was fully supportive of the study. Questions primarily focused on the needs of their municipality's plant and collection systems and potential regionalization of services with neighboring towns. No board members expressed opposition or skepticism of the study process.

(Continued)

NVCOG Regional Wastewater Treatment Consolidation Study Phase 1
Municipal Outreach Presentations

Naugatuck 05/07/2019

Beacon Falls 05/13/2019

Seymour 05/21/2019

Derby 05/09/2019

Ansonia 05/14/2019