PUBLIC SEWER SYSTEM FOR HIGGANUM VILLAGE

EVALUATION OF FEASIBILITY FOR SEWER CONNECTION WITH MIDDLETOWN

FOR THE

TOWN OF HADDAM, CONNECTICUT

January 2010
(1st Revision-June 2010)
(2nd Revision-October 2012)

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Water
Wastewater
Infrastructure

October 8, 2012
W-P Project No. 10582C

Mr. Michael P. Fortuna, AIA
Principal
TLB Architecture, LLC
92 West Main Street
Chester, CT 06412

Subject: Higganum Village Sewer Connection to Middletown
Feasibility Evaluation – Revised Final Report (October 2012)

Dear Mike,

Please find attached for your use two hard copies and an electronic version of the revised report entitled: *Public Sewer System for Higganum Village - Evaluation of Feasibility for Sewer Connection with Middletown*. The report has been revised to incorporate a new force main route and connection point to Middletown's Pratt & Whitney sanitary sewer pump station.

This report summarizes the evaluation of the technical issues and costs related to construction of a sewer collection system for Higganum Village, including a pump station and two (2) alternative force main routes to connect to the Middletown sewer system. The intent of this evaluation is to provide the Economic Development Commission (EDC) with the costs and issues related to the construction of a sewer connection to Middletown for comparison with a separate wastewater treatment system for Higganum Village as was discussed in the 2006 report entitled: *Wastewater Collection and Treatment System for Higganum Village - Peer Review of Past Engineering Evaluations*.

Based on this current revised evaluation report, the two (2) alternative sewer connections to Middletown are technically feasible, would have reasonable annual user fees (not including debt retirement and potential costs related to lease agreements), and based on our understanding Middletown is agreeable to this concept. However, as previously indicated our June 2010 report, the estimated construction cost for Alternative 1 (force main route along Route 154) is substantially higher than originally envisioned due to a variety of factors identified during this evaluation; the current estimated total construction cost is $9.4 million. Issues that contribute to the high construction costs for Alternative 1 include the following: the length of the force main; a large elevation head pressure and long force main which require a multi-stage pumping system; stream and river crossings; DOT paving and traffic control requirements. We also inflated the costs for the following: an increased budget cost allowances for legal, financing and permitting services, and land acquisition; and a more conservative contingency allowance (20%) for additional unknown issues that could arise during the design and construction phases.

The estimated construction cost for Alternative 2 (collection system, centralized pump station and a force main route along existing railroad tracks with a discharge point to the Middletown's Pratt & Whitney Pump Station) is $5.9 million. Based on our initial analysis, the interconnection with the City of Middletown at the Pratt & Whitney Pump Station is technically feasible. This alternative force main route would be installed parallel to the existing railroad tracks that run north of Route 154 along the Connecticut River and connect to the existing sanitary Pratt & Whitney sanitary pump station. Construction of the force main along the existing railroad tracks would be also a major financial and permitting undertaking for the Town of Haddam. If this alternative is

169 Main Street, 700 Plaza Middlesex
Middletown, CT 06457 USA
Phone 860.343.8297 | Fax 860.343.9504

selected, additional "site specific" study or studies should be conducted to: confirm availability of land within the existing railroad ROW; confirm location of the force main in relation to the existing railroad and wetlands; confirm force main construction methods (open trench vs. directional drilling), evaluate existing environmental site conditions and impacts to existing wetlands and wild life, evaluate geotechnical subsurface soil conditions and ability to obtain lease agreements for construction and operation and maintenance of the force main. Depending on the findings of these additional studies and potential site and permitting restrains, the estimated construction cost for this alternative could be significantly higher than estimated in this report.

The wastewater treatment option has an estimated construction cost range of $4.5 million to $6.6 million depending on the sewer collection option. As previously indicated, if the Rossi property was developed into a 100 2-bedroom units with some mixed use retail space and the developer agreed to install a wastewater treatment system sized for a range of flows from 50,000 gallons per day to 75,000 gallons per day, the estimated construction cost related to the wastewater options would decrease to a range of $3.1 million to $4.8 million depending on the sewer collection option.

The construction costs for the pump station and force main (Alternative 1) could be reduced if the City of Middletown decided to promote development in the area near Exit 10 of Route 9 and along Route 154 (Saybrook Road in Middletown), and if Middletown would agree to share portion of the total construction costs related to the force main installation in Middletown (~ $3.0 million).

Similarly, the Town could discuss cost sharing of the construction cost related to the centralized pump station or force main along the railroad tracks (or both) with a prospective developer of the Rossi property. This would reduce the construction cost associated with the pump station and the force main that the Town of Haddam would have to pay for.

Both the sewer connections to Middletown and the wastewater treatment options are feasible but very expensive, especially when considering the relatively small number of properties to be served and the resulting low design flow rates. Based on our cost estimates, it would still be considerably less costly to construct a small package type wastewater treatment system to serve Higganum Village when compared to the sewer connection to Middletown options, but the per property unit costs will still be very high. If a larger sewer service area was identified (such as the proposed development of the Rossi property), the increased number of potential customers and the impacts on economic development could possibly help justify either alternative. Interconnection with Middletown would be a more financially feasible option if Middletown (force main Alternative 1) shared the cost related to the construction of the force main, but this would likely require commercial development along Route 154 in Middletown to take place.

At this time, it is recommended that the EDC consider the long-term economic development potential that could be achieved by providing sewer service (by either of option) in order to determine if there is justification to proceed to the next steps.

We appreciate this opportunity to work with you and the EDC on this project. Feel free to call me with any questions.

Very truly yours
WRIGHT-PIERCE

Mariusz D. Jedrychowski, P.E.
Project Manager

PUBLIC SEWER SYSTEM FOR

HIGGANUM VILLAGE

EVALUATION OF FEASIBILITY FOR SEWER CONNECTION WITH MIDDLETOWN

FOR THE

TOWN OF HADDAM, CONNECTICUT

JANUARY 2010
(1ST REVISION - JUNE 2010)
(2ND REVISION – OCTOBER 2012)

Prepared By:

Wright-Pierce
169 Main Street
700 Plaza Middlesex
Middletown, Connecticut 06457

PUBLIC SEWER SYSTEM FOR
HIGGANUM VILLAGE, CONNECTICUT
EVALUATION OF FEASIBILITY FOR SEWER
CONNECTION WITH MIDDLETOWN, CONNECTICUT
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A Wright-Pierce Peer Review of Past Engineering Evaluations Report, April 2006

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SECTION 1

EXECUTIVE SUMMARY

1.1 BACKGROUND

The Town of Haddam is a desirable community to live in, but has limited existing commercial business available, requiring residents to travel to surrounding communities for basic shopping needs, restaurants and other services. Limited commercial development does help maintain the rural character of the community, but also limits the property tax base which is a main source of revenue for the Town and reduces local employment opportunities for the Town residents. The Town of Haddam Economic Development Committee (EDC) would like to promote economic development by promoting more intensive commercial development in Higganum Village. One of the limiting factors to commercial development in this area is the wastewater treatment capacity that can be provided by on-site septic systems on the relatively small existing lots. The developable footprints of those lots are limited by the existing subsurface disposal systems.

The Town initiated several studies to evaluate the existing water supplies and wastewater disposal options that would allow for more intensive commercial development within the Higganum Village area of Haddam. Since 1999, there have been at least six engineering studies that have evaluated the water and wastewater issues. All of the previous studies have focused either on individual on-site disposal systems or on a more centralized community based wastewater collection and treatment systems for the Higganum Village. In 2005, Wright-Pierce was hired by the EDC to perform a review of these past studies and prepared the following report: "*Wastewater Collection and Treatment System for Higganum Village - Peer Review of Past Engineering Evaluations*", April 2006. This previous report concluded that the estimated cost for the complete system could range from approximately $3 million to $4.4 million in 2008 dollars, primarily depending on whether a low pressure sewer system, or gravity sewer system was provided. The operation and maintenance costs for a new wastewater system was estimated to range from $50,000 to $65,000 per year depending on the types of wastewater treatment and collection systems that would be provided.

Although technically feasible, a sewer connection to Middletown's sanitary system was given only a cursory review in past studies. Wright-Pierce included a rough budgetary capital cost estimate for connecting a Higganum collection system to Middletown's sanitary system collection in the 2005 letter report entitled "*Higganum Center Facility Plan for the Town of Haddam"*. The cost for a new collection system, pump station, and force main was initially estimated at $5,110,000 in 2008 dollars. The operation and maintenance cost was estimated at $6,000 per year. The report concluded that while the capital cost was significantly higher than the cost for construction of a treatment system within Higganum, it would have lower annual operating costs and user fees, making it more affordable for the potential users. This initial cost estimate for the Middletown sewer connection option was based on limited available information. It was recommended to perform a more detailed feasibility study if the EDC was still interested in pursuing this option.

In August of 2008, the Town of Haddam Economic Development Commission hired Wright-Pierce to further determine the feasibility of a sewer connection with the City of Middletown and to develop a better understanding of the costs and issues associated with the implementation of such system. The following is a summary of our findings.

1.2 SEWER SERVICE AREA

The limits of the sewer service area have varied with each of the past wastewater studies. Originally, the sewer service area was to include Higganum Village, including the Haddam Elementary School. However, the current intent is for the sewer service area to include 9 properties in the "North" Higganum Village area and 25 properties in Higganum Village, excluding the school. Based on a meeting between David Platt of the EDC and the Region 17 Superintendent, Gary Mala, Haddam Elementary School's subsurface septic disposal wastewater system is 1989 vintage with the capacity to meet the school's future needs. As a result, it appears that there is no reason for Region 17 to consider future alternative sewer options for the school at this time.

1.3 DESIGN FLOWS

The future flows within the defined sewer service area for Village Center and North Village will be dependent on the actual density of development and the type of businesses. Flow estimates from previous studies ranged from 65,000 to 112,000 gallons per day for full commercial development (full build-out) and from 14,000 to 25,000 for a "smart" growth development.

Our flow projection analysis presented herein exceeds the previously recommended average design flow rate of 25,000 gallons per day by 3,505 gallons per day. The additional flow rate can be attributed to the differences in Infiltration/Inflow allowance estimates and additional flow that could come from the largest parcel in the North Higganum Village sewer service area if this parcel was fully developed in the future. Our new recommended future average design flow rate is 28,500 gpd. Additionally, if the Rossi property is developed with one hundred 2 bedroom apartments in five building plus 4,000 to 5,000 square feet of retail space, that will add approximately 24,125 gallons per day of additional flow, for a total of 52,625 gallons per day.

1.4 COLLECTION SYSTEM DESIGN

Previous studies for the Higganum Village area considered various types of systems for collecting wastewater. Based on the 2005 Facilities Plan, two types of systems were recommended: gravity sewers and low-pressure sewers; either of which would work. A low-pressure sewer would include a small grinder pump at each of the 34 properties and a small diameter common force main discharging to a main pumping station. In a gravity sewer collection system, wastewater would be collected directly from the individual properties and transported by gravity through main collection pipes to a treatment facility or a pump station.

Both the low-pressure and gravity sewer options are feasible, but the installation of gravity sewers would be more costly to construct due to more expensive materials and the paving costs associated with the need to resurface Route 81 and 154 in Higganum Village and North Higganum. Portions of Route 81 in Higganum Village Center were recently resurfaced and the CTDOT indicates that construction of a gravity sewer collection system would need to include a complete resurfacing of the entire roadway width from shoulder to shoulder.

1.5 PUMPING STATION DESIGN

A gravity or low-pressure sewer collection system would drain to a main pump station that would be located in the relatively low lying area on the Town's Garage property. The actual pump station location on the property would need to be determined during a design phase and coordinated with the Department of Public Works. The Town Garage site has adequate access, security measures and is somewhat out of sight from the Village Center businesses. This is a preferred location due to the fact that the Town would not have to purchase or lease additional property for the pump station site.

For the force main route along Route 154 (Alternative 1) it would be necessary to either construct multiple pump stations along the force main route or to utilize multi-stage pumps at a main, single pump station in Higganum Village. For the single pump station option, pump station suppliers recommended two types of pump stations for this application: a dry-pit/wet-pit pump station with a below-grade wetwell, or a combination of a submersible style and dry-pit pump station. The dry-pit/wet-pit pump station would include a below-ground pump room with two sets of pumps in series, wetwell and an above-grade building to house electrical equipment and generator. The combination submersible style and dry-pit pump station would include a below-grade wetwell with submersible pumps and a pre-cast concrete below-grade vault with dry-pit pumps, piping and valves. An outdoor type generator with sound attenuation enclosure would be also installed to provide emergency power for the station.

For the force main constructed along the railroad tracks (Alternative 2), the pump station would be equipped with two pumps (one duty pump and one stand-by pump). Pumps in series would not be needed due to relatively low pumping head required to deliver the flow to the Pratt & Whitney sanitary sewer pump station.

The long length of the proposed force main would promote the formation of nuisance odors and it would require installation of an odor control system at the station to control odors at the station and at the selected connection point with Middletown. Odor production could be controlled by

chemical injection with sodium hypochlorite at the wetwell by utilizing chemical feed pumps and bulk storage chemical tanks.

Either type of pump station could provide adequate pumping and redundancy for the Higganum system. The combination of a submersible and dry-pit pump station would likely be somewhat less expensive to construct than a dry-pit/wet-pit pump station. This would be only utilized if force main Alternative 1 is selected.

1.6 PROPOSED FORCE MAIN ROUTE AND CONNECTION POINTS

Two options for force main route to convey flows generated from the Higganum Village to Middletown were reviewed and are discussed in sections below:

1.6.1 PROPOSED FORCE MAIN ROUTE ALONG ROUTE 154

As a part of this study, we reviewed the existing sewer maps and met with staff from the Middletown Water and Sewer Department to locate the most hydraulically feasible southern point of the existing sewer system in Middletown's sewer service area. During our review process, two potential interconnection points with Middletown's system were located, both located approximately 4 miles northwest from the Village Center sewer service area. The preferred interconnection point is located at the intersection of Brooks Road and Toll Gate Road. Under this alternative, the proposed force main would be installed along Saybrook Road (Route 154) and would continue onto Toll Gate Road where it would transition to a gravity line connecting to the existing sanitary sewer on Brooks Road. The Middletown Water and Sewer Department administrative staff indicated that this would be the preferred route as it would reduce the construction cost (Toll Gate Road is a Town road) and allow for new residential sanitary sewer connections along the Toll Gate Road in Middletown. It is our understanding that that Route 154 is a City Road from the Route 9 on ramp north in Middletown.

The proposed force main would be a 6-inch high pressure ductile pipe installed off the concrete base road as much as possible, within the roadway right-of-way and under the bituminous

shoulder. The CT DOT concurred that this would be acceptable location for the force main along Route 154.

1.6.2 PROPOSED FORCE MAIN ROUTE TO PRATT & WHITNEY PUMP STATION

This alternative force main route would be installed parallel to the existing railroad tracks that run north of Route 154 along the Connecticut River and connect to the existing sanitary Pratt & Whitney sanitary pump station. Based on our analysis, the interconnection with the City of Middletown at the Pratt & Whitney Pump Station is technically feasible. Construction of the force along the existing railroad tracks main would be also a major financial and permitting undertaking for the Town of Haddam. The Town would realize savings in force main construction due to shorter force main route and significantly reduced paving and roadway restoration required when compared to installation of force main along Route 154.

1.7 MIDDLETOWN SEWER CONNECTION FEE

As a new customer connecting to the Middletown's system, the Town of Haddam would be required to pay a one-time sewer connection fee. The sewer connection fee charge is based on water meter size and type and on the type of land use (residential vs. commercial) for each sanitary sewer service applicant. The total estimated one-time connection charge for the 34 properties would be $21,017. The cost related to connection of developed Rossi property is unknown at this time and it is not included in the above connection fee estimate.

1.8 MIDDLETOWN ANNUAL SEWER USER FEE

In addition to the connection charge, Haddam would be required to pay sewer user fees to Middletown on either annual or semi-annual basis. For Middletown residents on unmetered well water, the semi-annual flat sewer rate is $91.56. Based on our discussions with the staff from Middletown Water and Sewer Department, the sewer rates for Higganum users would be 25% to 30% higher than the rates for the Middletown residents. Since all of the 34 properties in Higganum are on unmetered well water, the total semi-annual sewer rate would be

approximately $120 dollars ($91.56 x 130%), or $240 annually per sewered property. The estimated $240 annual sewer user charge does not include any additional surcharges that could be assessed by the Town of Haddam to help to pay for the operation and maintenance of the sanitary sewer system and administrative cost related to the billing and collection system. One alternative would be to have Middletown take over the system after it is constructed and to bill each user directly.

1.9 MIDDLETOWN-HADDAM INTER-MUNICIPAL AGREEMENT

The Town of Haddam would be required to enter into an inter-municipal agreement with the City of Middletown for operation and maintenance of the proposed sewer utilities. The inter-municipal agreement would include the basis for the sewer assessment costs to the Town of Haddam. The sewer assessment would be based on average annual or semi-annual sanitary flows from Haddam to Middletown. It would be necessary for the Town of Haddam to enter into an inter-municipal agreement with the City of Middletown prior to moving forward with the design and construction of the proposed sewer system.

1.10 REGULATORY REQUIREMENTS

1.10.1 Connecticut DOT Road Opening Permit

It is anticipated that the majority of the collection system and the force main would be located in the existing roadways. The Connecticut Department of Transportation (CTDOT) would require a review of the proposed project to obtain the necessary road opening permits.

1.10.2 Outfall Pipe and Force Main Permits

- NPDES discharge Permit.
- DEP 401 Water Quality Certification.
- Review and approval by the Office of the Long Island Sound Program.
- DEP review and approval of the Stream Channel Encroachment Line.
- U.S. Army Corps of Engineers Permit.
- General Permit for the Discharge of Stormwater Associated with Construction Activities

1.10.3 Other State and Local Reviews and Permits

The following state and local permits would be required prior to start of construction of the proposed sanitary sewer system:

- Connecticut Department of Energy and Environmental Protection.
- Connecticut Department of Transportation (assumed railroad owner).
- Town of Haddam:
    - Planning and Zoning Commission Site Approval
    - Inland Wetland Commission Permit for construction activities in regulated
    - wetland areas
    - Building Department Permit
- City of Middletown:
    - Planning, Conservation and Development
    - Inland Wetland Commission Permit for construction activities in regulated wetland areas
    - Water & Sewer Department

1.10.4 Formation of Water Pollution Control Authority (WPCA)

Since the Town of Haddam currently does not operate a wastewater treatment system and has no Water Pollution Control Authority, the Town will need to designate a governing body to oversee the review and approval process as well as the construction and operation of the proposed sanitary sewer system. Currently the EDC is overseeing this process. However, an ordinance to designate the EDC or another body to oversee this process would be needed.

1.11 ESTIMATED COSTS FOR WASTEWATER TREATMENT FACILITY OPTION

The Wright-Pierce report dated April 2006 performed a review of the previous "study level cost estimates" as the basis in developing an updated construction cost estimate for a collection, treatment and outfall system for Higganum Village and North Higganum. The capital costs included in the 2006 report were modestly projected out to 2008 dollars but did not include cost

allowances for property acquisition, legal, financing and permitting. The original estimates also did not include the DOT required costs for repaving of roadways other than trench repair. We have reviewed the cost estimate included in the April 2006 and updated it to include increased budget cost allowances related to the project legal, financing and permitting services and repaving of roadways shoulder-to-shoulder in Higganum Village and North Higganum. We have also included budget cost allowances for property acquisition related to the treatment system effluent pump station. Based on our discussions with a packaged wastewater treatment unit vendor the cost for a unit to treat a flow ranging from 25,000 gallons per day to 75,000 gallons per day is approximately $600,000. The updated total project costs and present worth are included in Table 1-1 below.

TABLE 1-1

UPDATED PROJECT COST ESTIMATES FOR

WASTEWATER SYSTEM WITH UP TO 75,000 GPD CAPACITY*

	Collection System (millions)	Treatment System (millions) (4) (5)	Outfall System (millions)	Total Project Cost (millions)	Annual O&M Cost	Present Worth (millions) (6)	Present Worth (millions) (6) (7)
Gravity System w/ North Village (1) (2)	$3.6	$1.4 to $1.8	$1.2	$6.2 to $6.6	$61,000 to $78,000	$7.8	$6.2
Low-Pressure w/ North Village (3)	$1.9	$1.4 to $1.8	$1.2	$4.5 to $4.9	$61,000 to $78,000	$6.1	$4.5

Notes:

* Cost Table Qualifications:

- Costs include a 5% annual inflation factor for 2 years (2011 dollars) and 20% construction contingency.
- Costs include technical services (10%) and contractor's overhead and profit allowance (20%).
- Costs include allowances for property acquisition, legal, financing, major permitting effort and repaving of roadways shoulder-to-shoulder, including trench repair.

(1) Costs assume minimum ledge removal based on discussions with the Town of Haddam EDC and boring information from Replacement of Bridge 00625 over Candlewood Hill Brook provided by the Town of Haddam. The actual amount of ledge would be verified without by conducting a subsurface exploration program (borings or probes).

(2) Costs based on service laterals to property line and not to structures; property owners usually are responsible for service connections from the property line to structures.

(3) Costs include an estimated $12,000 for an individual grinder pump station at each property with a service connection to the street.

(4) Cost estimate range includes the options for treating flows if the Rossi property is developed with one hundred 2-bedroom apartments in five buildings.

(5) Equipment cost for packaged membrane filtration system is ~$600,000 to treat flows ranging from 25,000 to 75,000 gpd.

(6) Present worth analysis is based on mid figure of Total Project Cost and Annual O&M cost and a 20-year operating cycle with a 6% net escalating cost per year.

(7) Present worth excluding construction cost associated with a wastewater treatment system cost if the Rossi property is developed with 100 2-bedroom units and a retail mixed use development and the cost associated with the construction of a treatment unit is paid for the developer. The overall project cost could be further reduced if the Rossi property developer agreed to partially share the construction cost related to the outfall system.

1.12 FORCE MAIN AND PUMP STATION PROJECT COST ESTIMATES

In order to compare the total costs related to the sanitary sewer interconnection with the City of Middletown (force main route Alternative 1) or to the Middletown's Pratt & Whitney sanitary sewer pump station (force main route Alternative 2), updated estimated project costs (engineering and construction) to construct the force main and a centralized pumping station in Higganum Village is shown in Table 1-2 below. The length of the force main to Middletown or Pratt & Whitney is 17,500 and 16,200 linear feet respectively and includes a 6-inch diameter force main pipe. The proposed force main constructed along Route 154 within the road right-of-way and under the existing bituminous shoulder to minimize costs related to replacement of the existing concrete roadway base.

TABLE 1-2

FORCE MAIN AND PUMP STATION TOTAL PROJECT COST *

	Collection System (millions)	Force Main with a Pump Station on Town's Garage Property (millions)	Total Project Cost (millions)	Portion of Total Project Cost Associated with Construction of Force Main (millions)	Annual O&M Cost (2)	Present Worth (millions) (3)	Present Worth (millions) (4)
Gravity System w/ North Village (via Rt 154)	$3.6	$7.5 (1)	$11.1	$3.0	$13,860	$11.3	$8.3
Low-Pressure w/ North Village (via Rt 154)	$1.9	$7.5 (1)	$9.4	$3.0	$15,900	$9.7	$6.4
Gravity System w/ North Village (via railroad)	$3.6	$4.0 (5)	$7.6	N/A	$13,860	$7.9	N/A
Low-Pressure w/ North Village (via railroad)	$1.9	$4.0(5)	$5.9	N/A	$15,900	$6.2	N/A

Notes:

* Cost Table Qualifications:

- Costs include a 5% annual inflation factor for 2 years (2011 dollars) and 20% construction contingency.
- Costs include technical services (10%) and contractor's overhead and profit allowance (20%).
- Costs include allowances for legal, financing, permitting effort and repaving of the 5-foot wide shoulder along Route 154.

(1) Costs include an assumed minimum amount of ledge removal along the force main route. The actual amount of ledge would be verified by conducting a subsurface exploration program (borings or probes).

(2) The O&M Costs include electrical, operation and maintenance cost of the pump station, odor control system and annual user sewer charges based on $240 annually per connection.

(3) Present worth analysis is based on a 20-year operating cycle with a 6% net escalating cost per year and the Total Project Cost.

(4) Present worth analysis is based on a 20-year operating cycle with a 6% net escalating cost per year and the Total Project Cost assuming that the City of Middletown would agree to share the cost of construction of the force main.

(5) Costs does not include the following: treatment and/or disposal of contaminated soils (if any); directional drilling, any improvements to the railroad or bridges are required as part of the force main installation, lease agreements, improvements to the Middletown's Pratt & Whitney pump station and assumes minimum ledge quantities and that the force main would constructed using conventional open trench construction.

1.13 LIFE-CYCLE COST ANALYSIS

The present worth analysis of the alternatives listed in Tables 1-1 and 1-2 ranks the sanitary sewer interconnection with the City of Middletown as the most costly alternative. Even though the operation and maintenance costs are relatively low when compared to the other alternatives, the total initial total project costs related to the construction of the force main and the centralized pumping station exceeds or equals the total project costs of the other wastewater treatment alternatives. However, this alternative becomes very attractive under the assumption that Middletown would agree to share a portion of the construction cost related to the force main (force main Alternative 1).

Based on our analysis, it appears that a low pressure collection system with a treatment and outfall system would be the least costly alternative, followed by a gravity system with the same type of treatment system and low pressure system with the force main connection to the Middletown's Pratt & Whitney sanitary pump station. Furthermore, if the Rossi property was developed and a developer agreed to install a packaged wastewater treatment system sized for a range of flows from 50,000 gallons per day to 70,000 gallons per day, or agreed to pay for portion of pumps station and force main costs, both of these alternatives would be more attractive and feasible.

1.14 CONCLUSIONS AND RECOMMENDATIONS

1.14.1 Connection to Middletown via Route 154 force main

Based on our analysis, the interconnection with the City of Middletown is technically feasible and Middletown indicated that the Town of Haddam could connect to Middletown's existing sanitary system. Construction of the force main would be a major financial undertaking for the Town of Haddam. The total estimated present worth for a gravity sewer collection system with a pump station and force main is $11.1 million, and $9.4 million for a low pressure sewer based system.

1.14.2 Connection to Middletown at the Pratt & Whitney Pump Station

The interconnection with the City of Middletown at the Pratt & Whitney Pump Station is technically feasible. Construction of the force along the existing railroad tracks main would be also a major financial and permitting undertaking for the Town of Haddam. The total estimated present worth for a gravity sewer collection system with a pump station and force main is $7.9 million, and $6.2 million for a low pressure sewer based system. The Town would realize savings in force main construction due to shorter force main route and minimal paving and roadway restoration required when compared to installation of force main along Route 154.

Both the sewer connection to Middletown options and the wastewater treatment options are very expensive, especially when considering the relatively low number of properties served and low flow rates. Based on the updated cost estimates, it would be considerable less costly to construct a small package wastewater treatment system to serve Higganum Village when compared to the sewer connection to Middletown options without cost sharing; however, per property unit costs will still be very high.

One option would be to discuss with a prospective developer the provision of a treatment unit, which could be sized, not only for the flows that would result from the development of the Rossi property into one hundred 2-bedroom units in five buildings, but also for additional flows in the

future. The estimated design, construction and capital cost for a treatment unit sized with a range from 50,000 gallons per day (flows from the proposed development) to 75,000 gallons per day (includes flows from Higganum) is $1.4 to $1.8 million. Most of the packaged treatment systems are capable of treating a range of flows so that any additional flows in the future could be treated without the need to install a new unit.

Another option would be to discuss with a prospective developer of the Rossi property cost sharing of the construction cost related to the pump station or force main along the railroad tracks, or both. This would reduce the construction cost associated with the pump station and the force main that the Town of Haddam would have to pay for.

If a larger sewer service area was identified or the Rossi property was developed (as just recently proposed), the increased number of potential customers and impacts on economic development could possibly help justify either alternative. At this time, it is recommended that the EDC evaluate the long-term economic potential that could be obtained by providing either of these options in order to determine if there is justification to proceed to the next steps.

SECTION 2

INTRODUCTION

2.1 BACKGROUND

The Town of Haddam is a desirable community to live in, but has limited commercial businesses available, requiring residents to travel to surrounding communities for basic shopping needs, restaurants and other services. Limited commercial development does help maintain the rural character of the community, but also limits the property tax base which is the main source of revenue for the Town and reduces local employment opportunities for the Town residents.

In 2007, the Town Economic Development Commission (EDC) prepared an Economic Development Plan which promotes a vision for a more developed commercial center in the Higganum Village area of Haddam in order to encourage economic development. The EDC's vision was to develop a plan that would be supported by the existing Zoning Regulations, and at the same time promote smart growth within the community while maintaining the character of the Town.

Currently, the commercial properties in Higganum Village are somewhat underutilized, somewhat due to limitations with the existing subsurface wastewater disposal systems. Small lots, poor soils and high groundwater make it difficult to install subsurface disposal systems that would support expansion or more intensive uses of these properties. Problems with individual water supply wells, and separation distances between wells and septic systems have also been identified as limiting factors for more intensive development because of small lots and relatively large footprint of the subsurface wastewater disposal systems.

Based on the Economic Development Plan, the Town initiated several studies to evaluate the existing water supplies and wastewater disposal options that would allow for more intensive commercial development within the Higganum Village area of Haddam. Since 1999, there have been at least six engineering studies that have evaluated the water and wastewater issues. All of the previous studies have focused either on individual on-site disposal systems or on a more

centralized community based wastewater collection and treatment systems for the Higganum Village. In 2005, Wright-Pierce was hired by the EDC to perform a review of these studies and prepared the following report: "*Wastewater Collection and Treatment System for Higganum Village - Peer Review of Past Engineering Evaluations"*, April 2006. This report concluded that the estimated costs for the complete system could range from approximately $3 million to $4.4 million in 2008 dollars, primary depending on whether a low pressure sewer system, or gravity sewer system was provided. The operation and maintenance costs for a new wastewater system were estimated to range from $50,000 to $65,000 per year depending on the type of wastewater treatment and collection systems that would be provided.

Although technically feasible, a sewer connection to Middletown's sanitary system was given only a cursory review in past studies. Wright-Pierce included a rough budgetary capital cost estimate for connecting a Higganum collection system to Middletown's sanitary system collection in the 2005 letter report entitled "*Higganum Center Facility Plan for the Town of Haddam"*. The cost for a new collection system, pump station, and force main was inititally estimated at $5,110,000 in 2008 dollars. The operation and maintenance cost was estimated at $6,000 per year. While the capital cost is significantly higher than the cost for construction of a treatment system within Higganum, it would have lower operating costs and annual user fees, making it more affordable for the potential users.

2.2 PURPOSE OF THE STUDY

The Town of Haddam Economic Development Commission would like to further determine the feasibility of a sewer connection to Middletown and develop a better understanding of the costs and issues to implement such system. The Town of Haddam EDC has hired Wright-Pierce to develop a feasibility study report for connecting the Higganum collection system to Middletown's sanitary collection system and to address and investigate the following issues:

- Ultimate design flow capacity to use as the basis for sizing a centralized pump station and force main.
- CT DOT requirements to construct a force main along Route 154 including repaving, permitting and traffic control.

- Subsurface conditions along Route 154 including presence and depth of ledge and other possible buried utilities.
- Wetlands location and permitting requirements for the Higganum sewer system, pump station and force main route on Route 154.
- Elevation changes from Higganum Village to the Middletown sewer connection that will determine the pump station motor sizes and electrical requirements, force main configuration and need for surge, pressure and vacuum release provisions.
- Feasibility and cost related to installation a force main along existing railroad tracks and connection to the Middletown's Pratt & Whitney sanitary sewer pump station.
- Connection fees and user fees for sewer for sewer service by Middletown.
- Impacts of plan consistency with the Office of Policy and Management - *Plan of Conservation and Development*.
- Construction cost estimate and annual costs including operation and maintenance and user fees.

The intent of this report is to provide the EDC with an evaluation of the Middletown Sewer connection option compared to the alternative wastewater treatment options. Based on this evaluation, the EDC can decide whether to further pursue either wastewater management options as a means to promote commercial development and economic growth in Higganum Village.

SECTION 3

PROPOSED SEWER SERVICE AREAS

3.1 HIGGANUM VILLAGE SERVICE AREA

Retail Plaza near Route 81 and Route 154

Higganum Village is located within a one-half mile radius of the intersection of Route 154 (Saybrook Road), Route 81 (Killingworth Road), Depot Road, Candlewood Hill Road and Maple Avenue. Originally, the Study Area included Higganum Village, Haddam Elementary School and Tylerville; however, the area of interest for this feasibility report is limited to the 25 properties shown in Figure 3-1 including the Connecticut DOT garage, the former Rossi Manufacturing site and the Town Public Works garage. The 25 properties located in the Higganum Village study area were recently re-zoned from commercial property (C-1) to Higganum Village District (HVD). This re-zoning increases the maximum land coverage from 40% to 70% to allow denser development consistent with a Village Center concept.

Topography of Higganum Village slopes toward the main intersection of Saybrook Road (Route 154) and Killingworth Road (Route 81) in the center of the proposed sewer service area. Depot Road slopes away from the main intersection of Route 154 and Route 81 to the north/northeast. The southern and eastern portion of the proposed sewer area also slopes toward the intersection o Saybrook and Killingworth Road extending south to Ponset Brook and east to the intersection of Saybrook Road and Calliari Place.

3.2 NORTH HIGGANUM VILLAGE SERVICE AREA

North Higganum Village is located northwest from the Higganum Village service area. The proposed North Higganum Village service area includes 9 commercially zoned (C-1) properties located along Route 154 including Middletown Rug Cleaning, CITGO gas station and the Fisherman's Cove property. The North Higganum Village study area is also shown in Figure 3-1. Though the 25 properties in Higganum Village were re-zoned to Higganum Village District, the 9 properties located in the North Village area remain commercially zoned (Zone C-1) with maximum land coverage of 40%.

Topography of Route 154 along the North Higganum Village service area slopes easterly towards the Higganum Village service area. The properties located within the North Higganum Village Service Area are located at approximate ground elevation of 130 feet, whereas the Higganum Village Center is located at approximate ground elevation of 65 feet based on USGS Topographic Map of Haddam.

3.3 STATE OF CONNECTICUT OFFICE OF POLICY AND MANAGEMENT LAND USE CLASSIFICATION

Both the proposed Higganum Village and the North Village sewer areas are located in an area defined by the State of Connecticut Office of Policy and Management (OPM) Conservation and Development Policies Plan as "Rural Community Centers" (Figure 3-1, Color Code: yellow).

The OPM defines Connecticut's "Rural Community Centers" as "*existing mixed use areas or places that may be suitable for future clustering of the more intensive housing, shopping, employment, and public service needs of municipalities outside of urban development areas. Rural Community Centers are areas where small-scale community systems of water supply, waste disposal, and public services are appropriate but large-scale public service systems should be avoided*." Based on our discussions with the EDC and review of the Town adopted *Plan of Conservation and Development (2007)*, the existing and future land use within the two proposed sewer areas is consistent with the OPM's Conservation and Development Policies Plan for the Town of Haddam.

Source:

Parcel data obtained from the town of Haddam CT
Aerial Imagery obtained from NAIP.
Map developed by Wright-Pierce GIS Dept.

Higganum Village Study Area

North Higganum Village Study Area

Haddam

Saybrook Rd

Thayer Rd

154

9

N

Legend

Study Areas

Parcels

Zoning

Commercial

Rural Residential (R1)

Rural Community Center

0 125 250 375 500 Feet

Haddam, Connecticut
Higganum Village Study Area
Zoning Designation

PROJ NO: 10582B | DATE: Jan 2009 | FIGURE: 3-1

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SECTION 4

DESIGN FLOWS

The future flows within the defined sewer service area for Village Center and North Village will be dependent on the actual density of development and the type of businesses. Flow estimates from previous studies ranged from 65,000 to 112,000 gallons per day for full commercial development and from 14,000 to 25,000 for "smart" growth development that is being proposed by the Town's residents and Town of Haddam Economic Development Commission.

As part of this study, we reviewed the current zoning regulations and met with the Town Planner to discuss and review the existing and future land use in the Village Center and North Village in order to confirm these previously reported flow rates. The flow rate used as the design basis should ensure that the wastewater facilities are properly sized for the existing development and also for the foreseeable future with more intensive development. Too small of a design flow rate would result in an undersized wastewater facility that could not accommodate the development it was intended to promote. Accordingly, too large of a design flow rate would result in an over-sized wastewater facility that would be difficult to operate with unnecessarily high capital and operational costs.

In order to reconfirm the design flow rates, Wright-Pierce utilized Geographic Information System (GIS) and current zoning regulations and parcel data obtained from the Town of Haddam to develop wastewater generation rates for Higganum Village and North Higganum. Flow projections were based on the assumption that flow generation would be similar to that occurring at "typical" mixed retail/commercial development. Flow data obtained from exiting shopping centers in Massachusetts and Connecticut ranged from 0.03 gpd/ft^2 to 0.07 gpd/ft^2 of total building area. For the Higganum Village and North Higganum analysis, a flow rate of 0.05 gpd/ft^2 was used to reconfirm the future design flows.

The total land area within the proposed Higganum Village sewer service area is approximately 25 acres. From Section 4, Table 1 of Town of Haddam Zoning Regulations, the maximum allowable land coverage in Higganum Village District (HVD) is 70% of the total lot area, and the

maximum total floor area of a retail use cannot exceed 15,000 square feet as indicated in Section 7-8 of the Zoning Regulations. The total future building area was assumed to be approximately 30% of the total available land area, or approximately 328,978 square feet. At a flow rate of 0.05 gpd/ft^2, the estimated future flow is approximately 16,500 gpd. The proposed Higganum Village sewer service area is shown in Figure 4-1 and the estimated wastewater flows corresponding to parcels 1 through 25 in Higganum Village are summarized in Table 4-1 on the next page. If the Rossi property, including the three adjacent properties, were developed to accommodate a mixed-use development consisting of a one hundred 2-bedroom apartments, the total average sanitary flow would increase from 19,050 gpd to 43,175 gpd.

TABLE 4-1
HIGGANUM VILLAGE ESTIMATED TOTAL WASTEWATER FLOWS

Higganum Village Parcel No.	Study Area	Zoning Designation	Acres	Lot Area (SF)	Maximum SF of Land Coverage [1]	Maximum SF of Total Floor Area [2]	Estimated Wastewater Flow [3] GPD	Estimated Wastewater Flow [5] GPD
1	Higganum Village	HVD	0.66	28,750	20,125	15,000	750	750
2	Higganum Village	HVD	3.45	150,282	105,197	15,000	750	750
3	Higganum Village	HVD	0.80	34,848	24,394	15,000	750	750
4	Higganum Village	HVD	1.17	50,965	35,676	15,000	750	750
5	Higganum Village	HVD	0.57	24,829	17,380	15,000	750	750
6	Higganum Village	HVD	0.52	22,651	15,856	15,000	750	750
7	Higganum Village	HVD	0.40	17,424	12,197	12,197	610	610
8	Higganum Village	HVD	0.47	20,473	14,331	14,331	717	717
9	Higganum Village	HVD	0.31	13,504	9,453	9,453	473	473
10	Higganum Village	HVD	0.49	21,344	14,941	14,941	747	747
11	Higganum Village	HVD	0.39	16,988	11,892	11,892	595	595
12	Higganum Village	HVD	0.52	22,651	15,856	15,000	750	750
13	Higganum Village	HVD	1.17	50,965	35,676	15,000	750	750
14	Higganum Village	HVD	1.11	48,352	33,846	15,000	750	750
15	Higganum Village	HVD	1.56	67,954	47,568	15,000	750	750
16	Higganum Village	HVD	0.68	29,621	20,735	15,000	750	24,125
17	Higganum Village	HVD	1.05	45,738	32,017	15,000	750	
18	Higganum Village	HVD	0.05	2,178	1,525	1,525	76	
19	Higganum Village	HVD	3.17	138,085	96,660	15,000	750	
20	Higganum Village	HVD	1.39	60,548	42,384	15,000	750	750
21	Higganum Village	HVD	4.42	192,535	134,775	15,000	750	750
22	Higganum Village	HVD	0.43	18,731	13,112	13,112	656	656
23	Higganum Village	HVD	0.42	18,295	12,807	12,807	640	640
24	Higganum Village	HVD	0.25	10,890	7,623	7,623	381	381
25	Higganum Village	HVD	0.20	8,712	6,098	6,098	305	305
		Totals:	25.65	1,117,314	782,120	328,978	16,449	38,249
						Total Estimated Flow (GPD)	**16,449**	**38,249**
						Infiltration and Inflow (GPD) [4]	**2,600**	**2,600**
						Total Wet Weather Flow (GPD)	**19,049**	**40,849**

Notes:

1 - The maximum percent of land converge in the Higganum Village District is 70% (Section 4 Table 1 of Town of Haddam Zoning Regulations).

2 - The maximum total floor area of a retail use shall not exceed 15,000 square feet in the Higganum Village District (Section 7 - 8 of the Zoning Regulations.

3 - Wastewater flow based on 0.05 Gallons per Day per Square Foot of total building area.

4 - Based on 500 GPD per inch diameter mile (IDM).

5 - Flows with development of Rossi property. Based on 120gal/bedroom*d + 4,000-5000 sf retail space.

The current land area available for development within the North Higganum Village sewer service area is approximately 8.3 acres. The potential total building area is estimated to be approximately 144,096 square feet. At a flow rate of 0.05 gpd/ft^2, the estimated future flow is approximately 7,205 gpd. The proposed North Higganum Village sewer service area is shown in Figure 4-1 and the estimated wastewater flows corresponding to parcels 1 through 9 in Higganum Village are summarized in Table 4-2 on the next page.

TABLE 4-2
NORTH HIGGANUM VILLAGE ESTIMATED TOTAL WASTEWATER FLOWS

North Higganum Parcel No.	Study Area	Zoning Designation	Total Acres	Total Area (SF)	Sewer Service Area (SF)	Maximum SF of Land Coverage [1]	Estimated Wastewater Flow [2] GPD
1	North Higganum	C-1	1.49	64,904	13,939	5,576	279
2	North Higganum	C-1	0.19	8,276	8,276	3,311	166
3	North Higganum	C-1	1.12	48,787	21,344	8,538	427
4	North Higganum	C-1	0.12	5,227	5,227	2,091	105
5	North Higganum	C-1	0.43	18,731	13,939	5,576	279
6	North Higganum	C-1	0.66	28,750	28,750	11,500	575
7	North Higganum	C-1	0.70	30,492	30,492	12,197	610
8	North Higganum	C-1	5.11	222,592	222,592	89,037	4,452
9	North Higganum	C-1	3.45	150,282	15,682	6,273	314
		TOTALS:	**13.27**	**578,041**	**360,241**	**144,096**	**7,205**
						Total Estimated Dry Weather Flow	**7,205**
						Infiltration and Inflow [3]	**2,200**
						Total Wet Weather Flow	**9,405**

Notes:
1 - The maximum percent of land coverage for buildings in the Commercial Zone is 40% (Section 4 Table 1 of Town of Haddam Zoning Regulations).
2 - Wastewater flow based on 0.05 Gallons per Day per Square Foot of total building area.
3 - Based on 500 GPD per inch diameter mile (IDM).

It is also prudent for the future design flow rate to include some allowance for inflow and infiltration (I/I). Inflow is the direct flow of stormwater into the collection system from direct connections to the sewer system such as roof leaders or sump pumps. Infiltration is groundwater leaking into the sewer through cracks or leaking joints in the sewers. These types of I/I sources are not allowed per current plumbing codes and new collection systems should have a minimal amount of I/I. However, over a long period of time, some I/I will likely occur but large amounts are undesirable for a public sewer.

Our flow projection analysis presented herein exceeds the previously recommended average design flow rate of 25,000 gallons per day by 3,505 gallons per day. The additional flow rate is due to the differences in Infiltration/Inflow estimates and potential additional flow from parcel No. 8 shown in Figure 4-1 in the North Higganum sewer service area, if this parcel is fully developed in the future in accordance with the Town of Haddam Zoning Regulations. Table 4-3 below summarizes the recommended future design flows. The total flow corresponds reasonably close with the *Higganum Village Sewer Feasibility Study (2003)* flow of 25,000 gpd. If the Rossi property was developed with 100 2-bedroom apartments the total recommended design flow rate would increase an average of 51,000 gallons per day (includes sanitary and I/I flows).

TABLE 4-3
RECOMMENDED FUTURE DESIGN FLOWS

Sanitary Sewer Service Area	Average Daily Flow (gpd)	Average Daily Flow [1] (gpd)
Higganum Village	16,500	38,249
North Higganum Village	7,205	7,205
Total Dry Weather Flow	**23,705**	45,454
Infiltration/Inflow	4,800	4,800
Total Wet Weather Flow	**28,505**	**50,254**

1 - Flows with development of Rossi property. Based on 120gal/bedroom*d + 4,000-5000 sf retail space.

Source:

Contour data developed from digital elevation model.
Parcel data obtained from the town of Haddam CT
Aerial imagery obtained from NAIP.
Map developed by Wright-Pierce GIS Dept.

Haddam

North Higganum Study Area

Higganum Village Study Area

Saybrook Rd

Saybrook Rd

154

Boulder Dell Rd

Dublin Hill Rd

Dublin Ln

Nosal Rd

Parsonage Rd

Depot Rd

Candlewood Hill Rd

Killingworth Rd

Olson Pl

Thayer Rd

Thayer Rd

Christian Hill Rd

Laurel Heights Rd

Maple Ave

Hull Ave

1 2 3 4 5 6 7 8 9

10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

N

0 120 240 360 480 Feet

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Haddam, Connecticut
Higganum Village Study Area
Proposed Sewer
Development Areas

PROJ NO:	DATE:	FIGURE:
10582B	Jan 2009	4-1

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SECTION 5

COLLECTION SYSTEM DESIGN

Previous studies for the Higganum Village area considered alternative types of wastewater collection systems. Based on the 2005 Facilities Plan, two types of systems were recommended: gravity sewers and low-pressure sewers, either of which are feasible.

5.1 LOW PRESSURE SEWERS

This type of system provides each property or set of adjoining properties with a small grinder pump station located to allow gravity flow from each property to the grinder station. The grinder station pumps the wastewater to a small diameter pressurized force main that discharges either to the treatment facility or a gravity sewer line located at a higher elevation.

Low-pressure sewers with grinder pumps are typically used in hilly areas where the properties are located lower than the main collection sewer pipe or in areas where high groundwater or ledge requires that the main sewer have a shallow burial depth. Each pump station requires its own power source, routine maintenance and alarm provisions. Administrative issues must also be considered, including whether the Town or property owner would be responsible for station purchase, unit maintenance and power costs.

Because there are only a few low lying properties within the Village Center, a gravity collection system would typically be considered more economical over the long-term. However, because much of the collection system would be located along state roads, a low-pressure collection system installed along the shoulder on both sides of these roads was also considered to minimize the costs associated with road repair.

5.2 GRAVITY SEWERS

In this type of system, wastewater is collected directly from the individual properties and transported by gravity through main collection pipes to a treatment facility or a pump station.

The collection mains are a minimum of 8-inches in diameter. Because the wastewater can contain solids that may settle in the pipe, gravity collection systems must be constructed to maintain a velocity that will minimize solids accumulation.

For planning purposes, it has been assumed that a centralized pump station would be located on the Town Garage property as shown in the proposed collection system schematic, Figure 5-1. The Town Garage property is located at the lowest elevation in the Higganum Village Center proposed sewer area, which would allow for gravity flow into the station. Our preliminary review indicates that installation of two (2) separate 8-inch sewer trunk lines would allow for gravity flow into the station without the need for low-pressure pump stations.

Candlewood Hill Creek Bridge

One sewer trunk line would collect flows from the North Higganum Village and Candlewood Hill Road and would run west and parallel to the Candlewood Hill Brook crossing the Depot Road north of Saybrook Road. Installation of this sewer trunk line would require a 20-foot wide sanitary easement on J.C.'s Products Inc. property, which would eliminate the need for a separate sewer pump station and bridge crossing. Based on the existing survey information obtained from the Town and our field site assessment, it appears there is insufficient change in elevation to cross the Candlewood Hill Creek Bridge without pumping.

J.C. Products, Inc. Property

The second trunk line would receive flows from gravity sewers on Killingworth Road, Maple Avenue and Saybrook Road (east of RT. 81) and would cross Candlewood Hill Brook immediately east of the Candlewood Hill Brook Bridge. This crossing would eliminate the need for a separate pump station, but would require a 20-foot sanitary easement on Sara, LLC property.

An alternative option would be to construct two low-pressure pump stations and utilize the Candlewood Hill Brook Bridge to cross the stream and connect to the centralized pump station located on the Town Garage property. Installation of low pressure pump stations would eliminate the need for sanitary easements, but would require the Town to provide emergency power and long-term maintenance which would increase the overall costs of the project.

Based on our initial review of the available survey mapping for Village Center and aerial photograph and GIS mapping for the North Higganum Village, installation of a gravity sewer is feasible and would consist of approximately 5,540 linear feet of 8-inch PVC sewer pipe below the roadways with manholes spaced at 300 feet and service laterals to each property. The approximate length of each gravity sewer line is shown in Table 5-1.

TABLE 5-1
8-INCH PVC GRAVITY SEWER

LOCATION	APPROXIMATE LENGTH (FEET)
Saybrook Road (West of RT.81)	2,400
Candlewood Hill Road	940
Maple Avenue	300
Killingworth Road	780
Saybrook Road (East of RT.81)	720
Depot Road	400
TOTAL	**5,540**

Portions of State Road 81 in Higganum Village were resurfaced in 2002 as part of the Streetscape Project. The DOT has indicated that construction of gravity sewers would require repaving of these roads from shoulder-to-shoulder which would add significant costs to the project.

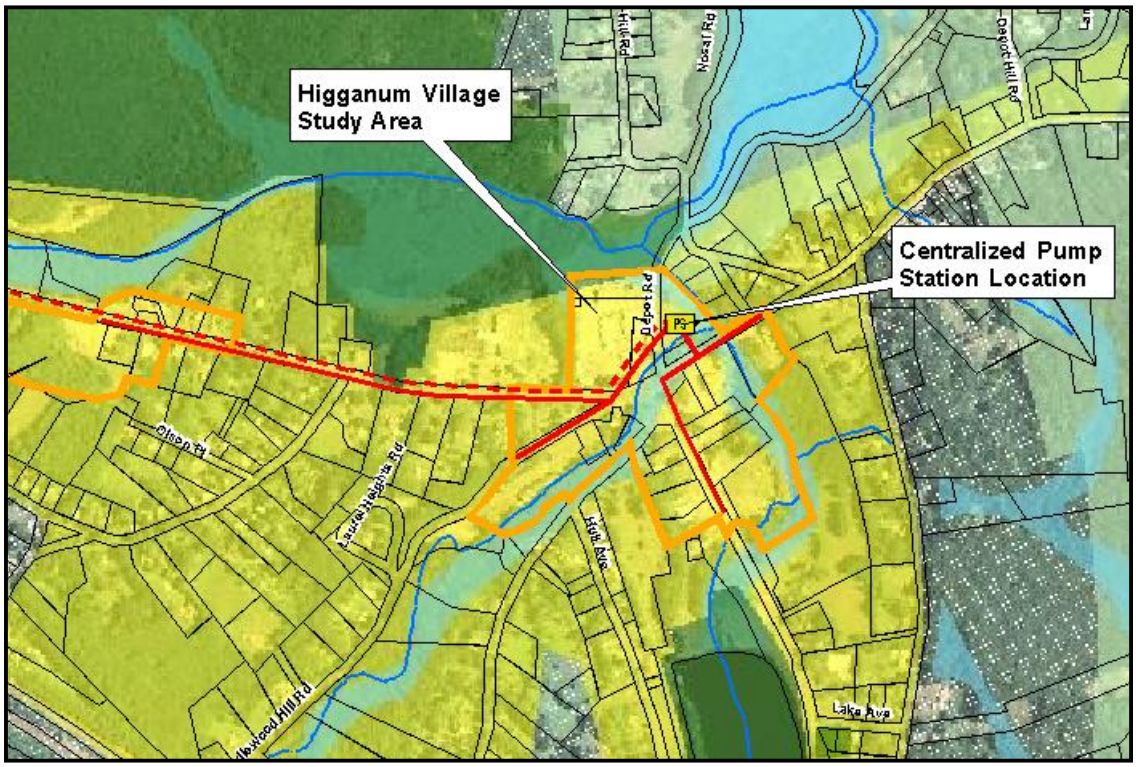
5.3 SERVICE CONNECTIONS

Installation of a municipal collection system typically includes installation of a 4-inch or 6-inch service lateral to each property line. Typically, the pipes would be installed at a minimum depth of 5 feet below ground level to be below the frost line. Typically a stub for laterals is provided and marked for the property owner's plumber to complete the connection to the structure. For properties where grinder pump stations are required, it is typically for the service connection stub and shut off valve to also be constructed by the Town to the property line. The property owner is typically responsible for constructing their own grinder pump station and force main connection to the service stub. However, there are some communities which provide and construct the grinder pups stations and service lateral force main on each private property and provide user fee credit for the power cost (Waterford, CT). Other communities purchase the grinder station and give it to the property owner to install on their own (Killingly, CT). Each of these alternatives has different capital cost, operating cost, and long-term operation and maintenance responsibility considerations.

Figure 5-1 below illustrates a conceptual layout of the proposed gravity collection system.

FIGURE 5-1

CONCEPTUAL GRAVITY SYSTEM LAYOUT



SECTION 6

PUMPING AND FORCE MAIN SYSTEM DESIGN

6.1 PROPOSED PUMP STATION LOCATION

Town Garage Property

The gravity or low-pressure sewer system described in Section 5 would drain to a main pump station located in the relatively low lying area on the Town's Garage property. The actual pump station location on the property would need to be determined during the design phase and coordinated with the Department of Public Works. The Town Garage site appears to have adequate access, security measures, and is relatively out of sight from the Village Center businesses. This is a preferred location also due to the fact that the Town would not have to purchase or lease additional property for the pump station site. Locating the pump station on the Town's property would also provide cost savings, lowering the overall costs of the project and cost to the end user.

6.2 FORCE MAIN ROUTES

Two force main options were analyzed in order to provide sanitary sewer connection from the Higganum Village to the City of Middletown sanitary system. Both alternatives are discussed in sections below.

6.2.1 Proposed Force Main Route along Rt. 154

This force main route is based on the location of the closest sanitary sewer connection in Middletown, and the available infrastructure between the proposed pump station in the Village Center and the interconnection point in Middletown. The closest interconnection point with Middletown's system is located approximately 4 miles northwest of the Village Center sewer service area along Route 154. The proposed force main would be installed along Saybrook Road

Rock Outcrops along Route 154

(Route 154) and would continue onto Toll Gate Road where it would transition to a gravity line connecting to the existing sanitary sewer on Brooks Road. Construction of the force main along Route 154 would have construction and hydraulic challenges. Saybrook Road was originally constructed as a reinforced concrete road with subsequent bituminous concrete overlays and shoulders. The CT DOT District 2 Office was contacted and it was determined that there is not any available subsurface geotechnical information for Saybrook Road to determine the presence of ledge, groundwater, or other characteristics that would impact the costs to construct the force main. Subsequent to our inquiries with the CT DOT, we conducted a visual drive-by inspection of the existing geological features along Saybrook Road to determine the likelihood of subsurface rock ledge. Based on our visual observations, it was determined that rock ledge is likely to be present during construction along sections of the proposed force main route. Presence of rock ledge will increase the overall construction duration and cost. Additional information regarding subsurface conditions along the force main route was obtained by the EDC. Based on such information, the current construction cost estimate assumes that rock ledge will be encountered along 10 % of the entire length of the proposed force main.

In order to minimize the construction costs associated with cutting the concrete roadway and need for a non-compressible fill over the pipe line, the proposed force main would be installed off the concrete road as much as possible, within the roadway right-of-way and under the bituminous shoulder. The CT DOT concurred that this would be acceptable location for the force main along Route 154. If Haddam decided to pursue this option, soil borings and probes would be performed during a preliminary design phase to determine the presence and profile of ledge, which would them be used to determine the optimal side of the road for the force main route in order to minimize ledge excavation costs. The proposed force main route would also include seven stream crossings at existing bridges on Route 154. There is also limited space for construction staging/storage area during construction activities along portions of Saybrook Road.

Uniform police traffic protection and flagmen would be required on Saybrook Road during construction. The proposed force main route is shown in Figure 6-1.

6.2.2 Proposed Force Main Route to Pratt & Whitney Pump Station

This alternative force main route would be installed parallel to the existing railroad tracks that run north of Route 154 along the Connecticut River and connect to the existing sanitary Pratt & Whitney sanitary pump station. The total length of this alternative force main route is approximately 3.0 miles. Figure 6-1 shows this alternate force main route.

As part of the inspection to identify the layout of the proposed force main route, a partial walkthrough along the length of the rail road was conducted by Wright-Pierce field personnel. Walkthrough along the entire length of this alternative route was attempted; however it was not completed due to limited access to portions of the railroad tracks. Construction of the force main will provide various construction challenges. The proposed force main route would require lease agreements from the railroad property owner and owners of other properties that are located adjacent to the railroad and granted ROWs to the railroad owner. Potential additional annual fees would be required for these lease agreements and are not included in the annual O&M costs.

Existing Railroad Tracks

The exact location of the force main would be determined during the preliminary design phase. Verification with the railroad owner would be required to determine if any areas next to the rail road should be avoided for additional future rail installation/expansion. A separation distance shall be also maintained between the railroad zone of influence and the force main to meet CT DOT standards from the railroad zone of influence. The force main route would also require a permanent access road for future maintenance and repairs. This permanent access road would have to be maintained by the Town. As part of the construction, the railroad owner may also

require an owner's fee to retain a railroad construction inspector to inspect and verify that construction activities are not causing damage to the railroad itself.

Prior to the installation of the force main along the railroad geotechnical explorations would have to be conducted to determine if the existing soils are suitable for the proposed pipe installation. Environmental soil and groundwater samples would also be collected to determine if the soils and the groundwater are contaminated and require special treatment and disposal. The geotechnical explorations and environmental testing can be conducted concurrently to minimize the number of boring required.

The railroad and the force main route runs adjacent to the Connecticut River and the railroad itself crosses two streams and runs parallel to large wetland areas which would require extensive permitting and could require use of special construction techniques and methods when installing the force main. Various Local, State and Federal permits and approvals will be required prior to the construction of this project.

The force main route also includes two bridge crossings as shown in the picture below. Construction of the force main would require special pipe supports connected to the bridge superstructure to allow for pipe crossing. It is assumed that the existing bridge is structurally sound to support the proposed force main and pipe supports. The cost of bridge repair (if required) is not included in the overall construction cost estimate for this option. There are other stream crossing options such directional drilling that could be employed during construction. Directional drilling would eliminate the need to support the pipe off the bridge; however it would require additional permitting since the pipe would be located under the stream bed. These options should be further evaluated during the design phase of the project.

Existing Bridge Crossing

Source:

Contour data developed from digital elevation model.
Parcel data obtained from the town of Haddam CT
Aerial imagery obtained from NAIP
Map developed by Wright-Pierce GIS Dept.

Pratt & Whitney

Proposed Force Main to
Pratt & Whitney Pump Station

Connect to Existing Sewer at Intersection
of Toll Gate Rd & Brooks Rd

East Hampton

CONNECTICUT RIVER

Middletown

Haddam

Saybrook Rd

154

9

Possible location for
intermediate pump station

Exit 10

Higganum Village
Study Area

Centralized Pump
Station Location

North Higganum Village
Study Area

Legend

- Proposed Sewer Area
- Proposed Force Main (Alt. 1)
- Proposed Force Main (Alt. 2)
- Proposed Gravity Main
- Proposed Pump Station

Development and Conservation Areas

- Rural Community Center
- Neighborhood Conservation
- Existing Preserved Open Space
- Conservation Area
- Preservation Area
- Rural Area

0 600 1,200 1,800 2,400
Feet

W:\GIS_Development\Projects\CT\Haddam\10582\CP\figures\Figure6-1.mxd

Town of Haddam Connecticut
Higganum Village Sewer 2
Feasibility Study
Proposed Force Main Routing

PROJ NO: 10582B | DATE: 10/04/2012 | FIGURE: 6-1

WRIGHT-PIERCE
Engineering a Better Environment

6.3 RECOMMENDED FORCE MAIN SIZE

To prevent solids deposition in the proposed force main, minimum velocities should not be below 3 feet per second (ft/s), and the maximum velocity should not exceed 6 feet per second to minimize force main frictional losses.

The force main route along Route 154 (Alternative 1) presents significant hydraulic challenges due to the relatively low projections of wastewater flows generated from the proposed sewer areas, significant increase in ground elevation along Route 154 to the Village Center and the proposed discharge location, and a very long force main. The increase in ground elevation along Route 154 of the evaluated force main routes is approximately between 360 feet. Depending on the force main size (6-inch or 4-inch), the pipe frictional losses would vary from 20 feet to 142 feet in a 6-inch or 4-inch force main respectively, at the design peak pumping flow rate of 120 gallons per minute (gpm). This would result in a total dynamic head of 387 feet to 510 feet for the 6-inch or 4-inch force mains respectively. If the Rossi property was developed, the peak pumping rate would increase to 210 gpm and the total dynamic head would increase to 771 feet for a 4-inch force main and 423 feet for a 6-inch force main.

For the railroad force main route (Alternative 2), the maximum ground elevation along the force main route is approximately 120 feet. Depending on the force main size (6-inch or 4-inch), the pipe frictional losses would vary from 120 feet to 250 feet in a 6-inch or 4-inch force main respectively, at the design peak pumping flow rate of 120 gallons per minute (gpm). If the Rossi property was developed, the peak pumping rate would increase to 210 gpm and the total dynamic head would increase to 461 feet for a 4-inch force main and 140 feet for a 6-inch force main.

If a 4-inch force was constructed (both alternatives), the velocity at the design peak pumping flow rates would be 3 ft/s and 5.4 ft/s (peak flow with flow from Rossi property). If a 6-inch force main was constructed, the velocity at the design peak pumping rate would be 1.4 ft/s and 2.4 ft/s (peak flow with flow from Rossi property), which is below the required minimum velocity of 3 ft/s. Based on the projected flow rates and the hydraulic constrains, we believe that a 6-inch force main would be the most appropriate size for both force main alternatives and flow scenarios to service the proposed Higganum Village and North Higganum service area.

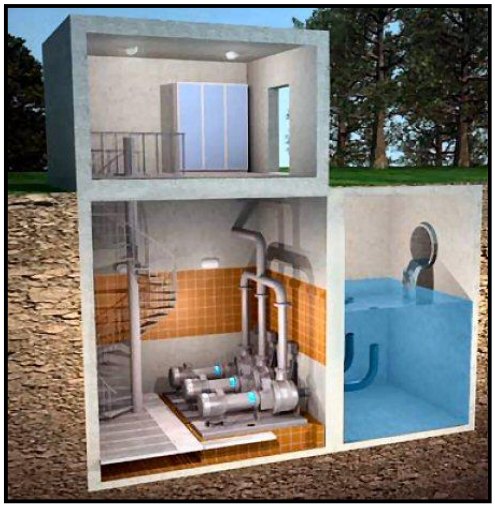
In order to minimize the headloss in the system and to maintain the force main velocity above 3 ft/s, the minimum flow in the 6-inch force main should not be below 250 gpm. At 250 gpm, the total frictional losses in the 6-inch force would be approximately 71 feet to 87 feet, or approximately 0.5 ft / 100 ft of force main, which is reasonable. The proposed pump station would be designed with adjustable speed pumps in order to maintain the desired flow rate while providing the minimum flushing velocity in the 6-inch force main.

6.4 PROPOSED PUMP STATION DESIGN

The type and design capacity of a pump station are usually based on the expected peak flow into the station and the required discharge head (pressure) for pumping. The peak flow includes the projected sanitary flows and any infiltration and inflow (I/I) flows resulting from the direct flow of stormwater into the collection system from direct connections to the sewer system and infiltration from groundwater leaking into the sewer through cracks or leaking joints. Based on the estimated average daily flow of 28,500 gallons per day and a peaking factor of 6 to account for diurnal flow variations, a pump station with a minimum design capacity of 120 gpm would be required to meet the peak flows from the proposed two (2) sewer areas. If Rossi property was developed, the estimated daily average flow would increase to 50,254 gallons per day. This would result in a peak flow of 210 gpm. However, as indicated above, the pumps should be sized to deliver 250 gpm in order to maintain the minimum force main velocity of 3 ft/s in the proposed 6-inch diameter force main. The preliminary design point for the pump station would be 250 gpm at 450 feet of TDH for the force main along Route 154 and 250 gpm at 160 feet of TDH for the force main along the railroad tracks.

As part of our analysis, we have contacted two wastewater pump station vendors to obtain information on the recommended pump station types and configuration for this flow and total dynamic head (TDH) conditions. Both vendors recommended similar pump station types and configurations.

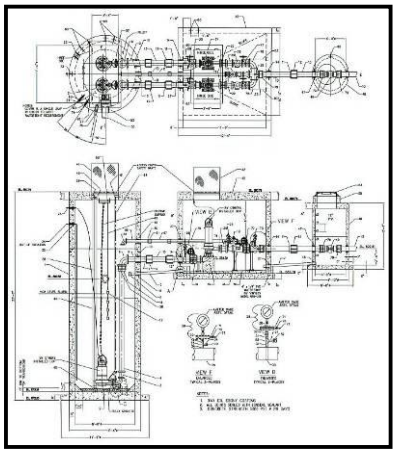
For the force main constructed along Route 154 (Alternative 1 in Figure 6-1), the pump station would be equipped with four pumps (two duty pumps in series and two stand-by pumps in series). This configuration would be necessary to provide the required discharge pressure to deliver the flow to Middletown's system and overcome the high point and hydraulic pipe losses in the force main.



Dry-Pit/Wet-Pit Pump Station

For the force main constructed along the railroad tracks (Alternative 2), the pump station would be equipped with two pumps (one duty pump and one stand-by pump). Pumps in series would not be needed due to relatively low pumping head required to deliver the flow to the Pratt & Whitney sanitary sewer pump station.

The two types of pump stations that were proposed by the vendors are a dry-pit/wet-pit pump station with a below-grade wetwell, and a combination of a submersible style and dry-pit pump station. The dry-pit/wet-pit pump station option would include a below ground pump room with two sets of pumps in series (or just duplex pumps), wetwell and an above-grade building to house electrical equipment and generator. The submersible style and a dry-pit pump station option would include a below-grade wetwell with submersible pumps and a pre-cast concrete below-grade vault with the following series dry-pit pumps (used for force main along Route 154), piping and valves. An outdoor type generator with sound attenuation enclosure would be also needed to provide emergency power for the station. The long length of the proposed force main would promote the formation of nuisance odors, necessitating installation of an odor control system at the station to control odors at the station and the connection point with Middletown or Pratt & Whitney sanitary pump station. Odor production would be controlled by chemical injection of



Combination of Submersible and Dry-Pit Pump Station

sodium hypochlorite at the wetwell by utilizing chemical feed pumps and bulk storage chemical tanks.

Either type of pump stations could provide adequate pumping and redundancy for the Higganum system. The combination of a submersible and a dry-pit pump station would likely be somewhat less expensive to install than a dry-pit/wet-pit pump station. This would be only utilized if force main Alternative 1 is selected.

Furthermore, if force main route along Route 154 is selected as an alternative to the proposed single, dual-stage pump station option, an intermediate pump station could be installed along the proposed force main in Middletown. The Middletown Water and Sewer Department indicated that they have considered construction of a pump station in the vicinity of Route 9 Exit 10 in Middletown to service local businesses that currently have septic tanks and to promote commercial development in that area. The intermediate pump station would reduce the discharge head from 450 feet to 360 feet required at the Higganum Center pump station, but it would not eliminate the need for pumping in series to overcome the required high discharge pressure. If the intermediate pump station was constructed, there may be a potential for some construction cost sharing related to the installation of the force main between the Town of Haddam and the City of Middletown.

SECTION 7

SEWER CONNECTION WITH MIDDLETOWN

7.1 PROPOSED SEWER CONNECTION LOCATIONS

For force main route along Route 154 (Alternative 1), we have reviewed the existing sewer maps and met with staff from the Middletown Water and Sewer Department to locate the most hydraulically feasible southern point of the existing sewer system in Middletown's sewer service area. During our review process, we have identified two potential interconnection points with Middletown's system, both located approximately 4 miles northwest of the Village Center sewer service area.

One option is to connect the existing sanitary sewer at the intersection of Saybrook Road (RT.154) and Brooks Road. Under this option, the force main would be installed along the entire length of Route 154 (Saybrook Road) from the Village Center to the intersection with Brooks Road in Middletown.

Route 154 at Brooks Rd.

Brooks Rd. at Toll Gate Rd.

As an alternative, the proposed force main could be connected to the existing sewer at the intersection of Brooks and Toll Gate Road. The proposed force main would be installed along Saybrook Road and would continue onto Toll Gate Road where it would transition to a gravity line connecting to the existing sanitary sewer on Brooks Road. The Middletown Water and Sewer Department administrative staff indicated that this would be the preferred route as it would reduce the construction cost of the force main (Toll Gate Road is a Town road) and allow for new residential sanitary sewer connections along the Toll Gate Road in Middletown.

For the force main route along the existing railroad tracks, the new force main would discharge into the Middletown's Pratt & Whitney sanitary sewer pump station. It is assumed that the Middletown Pratt & Whitney sanitary pump station has excess capacity to receive flow from the Higganum Center future sewer service area and no improvements would be required.

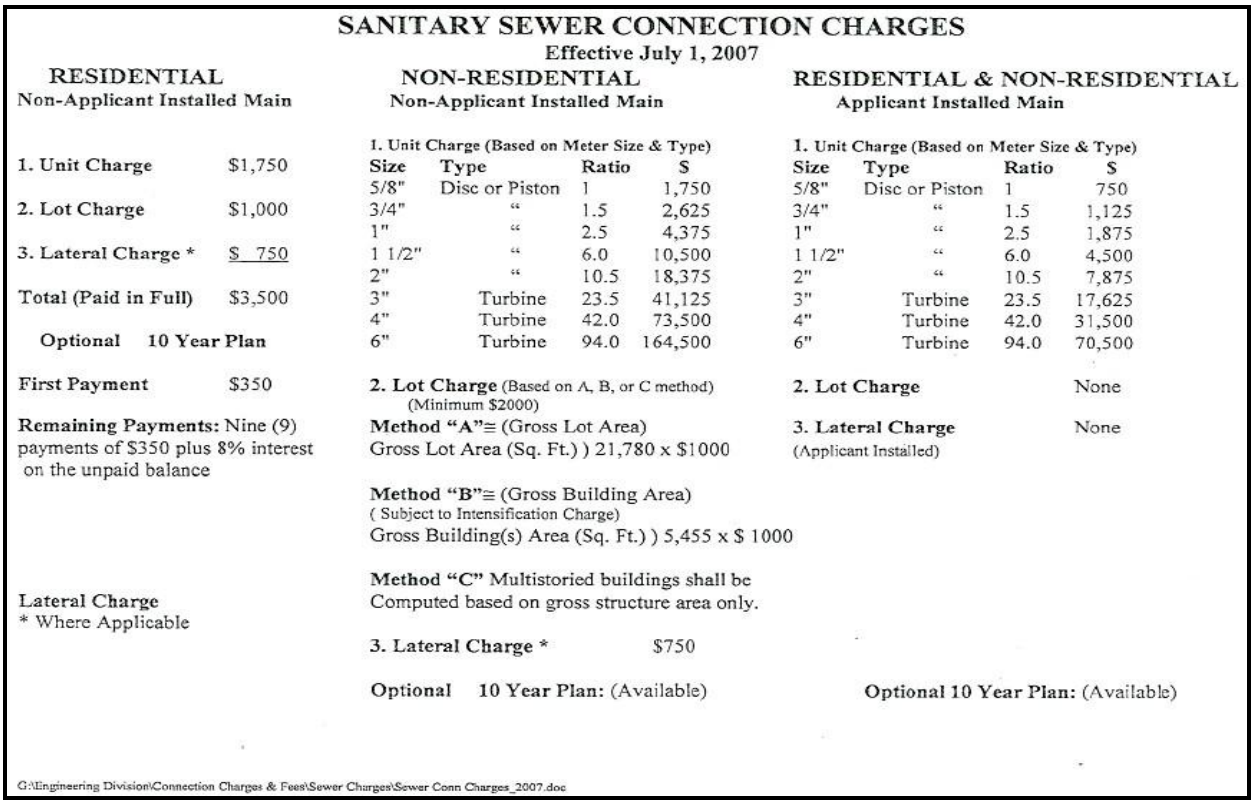
The Town of Haddam would be required to install a flow meter at the town line with Middletown (force main Alternative 1) or at the Pratt & Whitney sanitary pump station (force main Alternative 2) to record the total volume of flow entering Middletown's system for billing purposes.

7.2 MIDDLETOWN SEWER CONNECTION FEE

As a new customer connecting to the Middletown's system, the Town of Haddam may be required to pay a one-time sewer connection fee. The Middletown sewer connection fee charge is typically based on water meter size and on the type of land use (residential vs. commercial) for each sanitary sewer service applicant. We have contacted the Middletown Water and Sewer Department to obtain the current sanitary sewer connection charges schedule. Figure 7-1 below summarizes the current billing rates for a sanitary sewer connection within the Middletown corporate boundary.

FIGURE 7-1

SANITARY SEWER CONNECTION CHARGES



SANITARY SEWER CONNECTION CHARGES

Effective July 1, 2007

RESIDENTIAL
Non-Applicant Installed Main

1. Unit Charge	$1,750
2. Lot Charge	$1,000
3. Lateral Charge *	$ 750
Total (Paid in Full)	$3,500
Optional 10 Year Plan	
First Payment	$350
Remaining Payments: Nine (9) payments of $350 plus 8% interest on the unpaid balance	

Lateral Charge
* Where Applicable

NON-RESIDENTIAL
Non-Applicant Installed Main

1. Unit Charge (Based on Meter Size & Type)

Size	Type	Ratio	$
5/8"	Disc or Piston	1	1,750
3/4"	"	1.5	2,625
1"	"	2.5	4,375
1 1/2"	"	6.0	10,500
2"	"	10.5	18,375
3"	Turbine	23.5	41,125
4"	Turbine	42.0	73,500
6"	Turbine	94.0	164,500

2. Lot Charge (Based on A, B, or C method)
(Minimum $2000)

Method "A"≡ (Gross Lot Area)
Gross Lot Area (Sq. Ft.)) 21,780 x $1000

Method "B"≡ (Gross Building Area)
(Subject to Intensification Charge)
Gross Building(s) Area (Sq. Ft.)) 5,455 x $ 1000

Method "C" Multistoried buildings shall be Computed based on gross structure area only.

3. Lateral Charge * $750

Optional 10 Year Plan: (Available)

RESIDENTIAL & NON-RESIDENTIAL
Applicant Installed Main

1. Unit Charge (Based on Meter Size & Type)

Size	Type	Ratio	$
5/8"	Disc or Piston	1	750
3/4"	"	1.5	1,125
1"	"	2.5	1,875
1 1/2"	"	6.0	4,500
2"	"	10.5	7,875
3"	Turbine	23.5	17,625
4"	Turbine	42.0	31,500
6"	Turbine	94.0	70,500

2. Lot Charge None

3. Lateral Charge None
(Applicant Installed)

Optional 10 Year Plan: (Available)

G:\Engineering Division\Connection Charges & Fees\Sewer Charges\Sewer Conn Charges_2007.doc

The 25 properties in Village Center and 9 properties in North Village are commercial (non-residential) properties. Sewer services for individual properties could be constructed during construction phase of the gravity sewers and the costs associated with installation of the sewer connections could be included in the total cost of the project. As indicated above, sewer connection fee is typically based on the size of the water service meter servicing each property, with most residential water services having 5/8-inch meters with a 3/4-inch water service line. However, Higganum properties that are proposed to be sewered are commercial properties and are currently on well water and are not equipped with water meters. Based on our experience, the size of a water meter for a commercial property similar to those in Higganum could vary from ¾-inch to 1-inch. According to the *Sanitary Sewer Connection Charges for Residential & Non-residential Applicant Installed Main* shown in Figure 7-1, the total cost for one sewer connection could vary from $1,125 to $1,875 for a 3/4-inch to 1-inch sized water meter. For budgetary estimating purposes, we have assumed that 50% of the 34 properties would be

required to pay $1,125 per connection and the remaining 17 properties would be required to pay $1,875 per connection. The resulting total estimated connection charge for the 34 properties would be $21,017. The cost related to connection of developed Rossi property is unknown at this time and it is not included in the above connection fee estimate.

7.3 MIDDLETOWN ANNUAL SEWER USER FEES

In addition to the connection charge, Haddam would be required to pay sewer user fees to Middletown on either annual or semi-annual basis. The current (as of December 2008) sewer rates based on semi-annual billing cycle for Middletown residents include a minimum charge of $19.48 and additional $19.48 per thousand cubic feet of water used. For Middletown residents on well water, the semi-annual flat sewer rate is $91.56. These sewer rates only apply to the Middletown residents. Based on our discussions with the staff from Middletown Water and Sewer Department the sewer rates for Higganum users would be 25 to 30% higher than the rates for the Middletown residents.

Assuming that all of the future sewered properties in Higganum are on well water and the Middletown user fee rates for water well supply are used, the total semi-annual sewer rate would be approximately $120 dollars ($91.56 x 130%), or $240 annually per sewered property. The estimated $240 annual sewer user charge does not include any surcharges that could be assessed by the Town of Haddam to help to pay for the operation and maintenance of the sanitary sewer system and administrative cost related to the billing and collection system. However, as previously indicated, Middletown would require a flow meter on the force main to determine the actual flow from Higganum Village for billing purposes. Therefore, it may be possible to establish a user fee system with Middletown based on actual sewage flows.

7.4 MIDDLETOWN-HADDAM INTER-MUNICIPAL AGREEMENT

An Intermunicipal Agreement is a written agreement between two municipalities that provides for sharing certain sewerage facilities. The shared components are usually treatment plants but may include all or parts of collection sewers, interceptor sewers including lift stations and force mains. Generally, Agreements are between two incorporated municipalities or one incorporated

municipality and a sewerage district, but may be between any two or more of the agencies that have jurisdiction over sewerage disposal.

The Town of Haddam may be required to enter into an inter-municipal agreement with the City of Middletown for operation and maintenance of the proposed sewer utilities. The inter-municipal agreement would include sewer generation assessment on the Town of Haddam. The sewer generation assessment would be based on average annual or semi-annual sanitary flows from Haddam to Middletown. This Inter-Municipal agreement would also address any other provisions, such as:

- **NPDES Ownership of the shared facilities.** Usually treatment works are owned by one municipality and the other is a user (customer), but the facilities may be also jointly owned. The Agreement should specify which municipality owns what facilities, or the ratio of ownership in case of jointly owned facilities. If Haddam decides to proceed with a sewer connection to Middletown, there may be advantages to determine if Middletown would consider taking over ownership of the system after it is constructed.
- **Distribution of costs.** The Agreement should specify how O&M costs will be divided between the participants. This can be done in several ways, some examples that are acceptable include:
    - If jointly owned, all O&M costs could be split according to the ratio of ownership.
    - Whether or not jointly owned, O&M costs could be split according to the percent of design capacity that each participant expects to use. If not jointly owned, the owning municipality could bill the other municipality or other users as regular customers in accordance with its user charge system.

  In the case of joint ownership, the Agreement should specify how capital costs would be distributed between the owners and how any debt owed on the facilities will be paid.

  Whenever O&M costs will be split according to a ratio of ownership or use, the Agreement should specify how the annual budget will be prepared and some mechanism

whereby both parties must agree to the budget amounts and a method for resolving any disagreements.

Whenever one municipality will be billed as a user, the Agreement should contain some provision for the user municipality to participate in and/or concur with any changes in rates, and a mechanism for resolving any disagreements.

- **Legal requirements.** The Agreement should specify which party is responsible for permit compliance and what the responsibilities of the other party are. If the party owning the facilities has a Sewer Use Ordinance, the user municipality should have its own ordinance or the Agreement should specifically allow the owning municipality to enforce its ordinance within the user's area of jurisdiction. The same requirement applies to any applicable Pretreatment Program.

- **Revision/Cancellation.** The Agreement should contain provisions for revisions agreed to by both parties and/or cancellation at the request of either party. The Agreement might be revised if the ratio of use changes over time, or for other reasons. The Agreement might be canceled if the shared facilities are no longer adequate to serve both parties and one party wishes to assume sole ownership and use, with the other party to construct replacement facilities of its own. The Agreement might also be canceled if the political climate between the parties deteriorates.

  If the Agreement is canceled, the disposition of any jointly owned assets should be specified. If one party owns the shared facilities but the other has contributed a percentage of the cost of acquisition of the facilities, and the Agreement is canceled, some method of recovering some of its cost might be needed.

If the Town of Haddam decides to move forward with a sewer connection with Middletown, we would recommend that Haddam start developing the concepts of an inter-municipal agreement with the City of Middletown prior to moving forward with the design and construction of the proposed sewer system.

SECTION 8

ESTIMATED CAPITAL CONSTRUCTION, ENGINEERING AND OPERATION & MAINTENANCE COSTS

8.1 COST ESTIMATES FROM PREVIOUS REPORTS

The April 2006 report prepared by Wright-Pierce performed a review of the previous "study level cost estimates" as the basis to develop an updated construction cost estimate for a collection, treatment and outfall system for Higganum Village and North Higganum. The April 2006 report and the estimated capital costs (Table No. 8, pg. 18) are included as Appendix A. The capital costs included in the 2006 report were projected out to 2008 dollars and did not include allowances for property acquisition, legal, financing, permitting or repaving of roadways other than trench repair. We have reviewed the cost estimate included in the April 2006 and updated it to include cost related to the project legal, financing and permitting services and repaving of roadways shoulder to shoulder in Higganum Village and North Higganum. We have also included costs for property acquisition related to the treatment system effluent pump station. The updated total project costs and present worth are included in Table 8-1 below.

TABLE 8-1

UPDATED PROJECT COST ESTIMATES FOR

WASTEWATER SYSTEM WITH UP TO 75,000 GPD CAPACITY*

	Collection System (millions)	Treatment System (millions) (4) (5)	Outfall System (millions)	Total Project Cost (millions)	Annual O&M Cost	Present Worth (millions) (6)	Present Worth (millions) (6) (7)
Gravity System w/ North Village (1) (2)	$3.6	$1.4 to $1.8	$1.2	$6.2 to $6.6	$61,000 to $78,000	$7.8	$6.2
Low-Pressure w/ North Village (3)	$1.9	$1.4 to $1.8	$1.2	$4.5 to $4.9	$61,000 to $78,000	$6.1	$4.5

Notes:

* Cost Table Qualifications:

- Costs include a 5% annual inflation factor for 2 years (2011 dollars) and 20% construction contingency.
- Costs include technical services (10%) and contractor's overhead and profit allowance (20%).
- Costs include allowances for property acquisition, legal, financing, major permitting effort and repaving of roadways shoulder-to-shoulder, including trench repair.

(1) Costs assume minimum ledge removal based on discussions with the Town of Haddam EDC and boring information from Replacement of Bridge 00625 over Candlewood Hill Brook provided by the Town of Haddam. The actual amount of ledge would be verified without by conducting a subsurface exploration program (borings or probes).

(2) Costs based on service laterals to property line and not to structures; property owners usually are responsible for service connections from the property line to structures.

(3) Costs include an estimated $12,000 for an individual grinder pump station at each property with a service connection to the street.

(4) Cost estimate range includes the options for treating flows if the Rossi property is developed with one hundred 2-bedroom apartments in five buildings.

(5) Equipment cost for packaged membrane filtration system is ~$600,000 to treat flows ranging from 50,000 to 75,000 gpd.

(6) Present worth analysis is based on mid figure of Total Project Cost and Annual O&M cost and a 20-year operating cycle with a 6% net escalating cost per year.

(7) Present worth excluding construction cost associated with a wastewater treatment system cost if the Rossi property is developed with 100 2-bedroom units and a retail mixed use development and the cost associated with the construction of a treatment unit is paid for the developer. The overall project cost could be further reduced if the Rossi property developer agreed to partially share the construction cost related to the outfall system.

8.2 FORCE MAIN AND PUMP STATION PROJECT COST ESTIMATES

In order to compare the total costs related to the sanitary sewer interconnection with the City of Middletown (force main route Alternative 1) or to the Middletown's Pratt & Whitney sanitary sewer pump station (force main route Alternative 2), updated estimated project costs (engineering and construction) to construct the force main and a centralized pumping station in Higganum Village is shown in Table 8-2 below. The length of the force main to Middletown or Pratt & Whitney is 17,500 and 16,200 linear feet respectively and includes a 6-inch diameter force main pipe. The proposed force main constructed along Route 154 within the road right-of-way and under the existing bituminous shoulder to minimize costs related to replacement of the existing concrete roadway base. For costs related to installation of the force main along the rail road route, costs incurred for installation of force main along the bridge is not included.

TABLE 8-2

FORCE MAIN AND PUMP STATION

TOTAL PROJECT COST *

	Collection System (millions)	Force Main with a Pump Station on Town's Garage Property (millions)	Total Project Cost (millions)	Portion of Total Project Cost Associated with Construction of Force Main (millions)	Annual O&M Cost (2)	Present Worth (millions) (3)	Present Worth (millions) (4)
Gravity System w/ North Village (via Rt 154)	$3.6	$7.5 (1)	$11.1	$3.0	$13,860	$11.3	$8.3
Low-Pressure w/ North Village (via Rt 154)	$1.9	$7.5 (1)	$9.4	$3.0	$15,900	$9.7	$6.4
Gravity System w/ North Village (via railroad)	$3.6	$4.0 (5)	$7.6	N/A	$13,860	$7.9	N/A
Low-Pressure w/ North Village (via railroad)	$1.9	$4.0(5)	$5.9	N/A	$15,900	$6.2	N/A

Notes:

* Cost Table Qualifications:

- Costs include a 5% annual inflation factor for 2 years (2011 dollars) and 20% construction contingency.
- Costs include technical services (10%) and contractor's overhead and profit allowance (20%).
- Costs include allowances for legal, financing, permitting effort and repaving of the 5-foot wide shoulder along Route 154.

(1) Costs include an assumed minimum amount of ledge removal along the force main route. The actual amount of ledge would be verified by conducting a subsurface exploration program (borings or probes).

(2) The O&M Costs include electrical, operation and maintenance cost of the pump station, odor control system and annual user sewer charges based on $240 annually per connection.

(3) Present worth analysis is based on a 20-year operating cycle with a 6% net escalating cost per year and the Total Project Cost.

(4) Present worth analysis is based on a 20-year operating cycle with a 6% net escalating cost per year and the Total Project Cost assuming that the City of Middletown would agree to share the cost of construction of the force main.

(5) Costs does not include the following: treatment and/or disposal of contaminated soils (if any); directional drilling, any improvements to the railroad or bridges are required as part of the force main installation, lease agreements, improvements to the Middletown's Pratt & Whitney pump station and assumes minimum ledge quantities and that the force main would constructed using conventional open trench construction.

8.3 LIFE CYCLE COST ANALYSIS

The present worth analysis of the alternatives listed in Tables 8-1 and 8-2 ranks the sanitary sewer interconnection with the City of Middletown as the most costly alternative. Even though the operation and maintenance costs are relatively low when compared to the other alternatives, the total initial total project costs related to the construction of the force main and the centralized pumping station exceeds or equals the total project costs of the other wastewater treatment alternatives. However, this alternative becomes very attractive under the assumption that Middletown would agree to share a portion of the construction cost related to the force main (force main Alternative 1).

Based on our analysis, it appears that a low pressure collection system with a treatment and outfall system would be the least costly alternative, followed by a gravity system with the same type of treatment system and low pressure system with the force main connection to the Middletown's Pratt & Whitney sanitary pump station. Furthermore, if the Rossi property was developed and a developer agreed to install a packaged wastewater treatment system sized for a range of flows from 50,000 gallons per day to 70,000 gallons per day, or agreed to pay for portion of pumps station and force main costs, both of these alternatives would be more attractive and feasible.

8.4 CONCLUSIONS AND RECOMMENDATIONS

8.4.1 Connection to Middletown via Route 154 Force Main

Based on our analysis, the interconnection with the City of Middletown is technically feasible and Middletown indicated that the Town of Haddam could connect to Middletown's existing sanitary system. Construction of the force main would be a major financial undertaking for the Town of Haddam. The total estimated present worth for a gravity sewer collection system with a pump station and force main is $11.1 million, and $9.4 million for a low pressure sewer based system.

The construction costs for the pump station and force main option could be reduced if the City of Middletown decided to promote development in the area near Exit 10 of Route 9 and along Route 154 (Saybrook Road in Middletown), and if Middletown would agree to share portion of the total construction costs related to the force main. Middletown would be able to increase their sanitary sewer and tax user base by allowing existing and future development to connect to the proposed sanitary sewer service. If Haddam still considers this sewer connection option, it could be beneficial to discuss cost sharing with Middletown as a means to decrease the total costs of the project, possibly making it financially feasible when compared to the other alternatives considered in previous studies. The total estimated construction cost could be reduced by approximately $3 million dollars if the City of Middletown agreed to contribute to the cost related to construction of the force main from Middletown/Haddam Town line to the discharge point on Toll Gate Road in Middletown.

8.4.2 Connection to Middletown at the Pratt & Whitney Pump Station

Based on our analysis, the interconnection with the City of Middletown at the Pratt & Whitney Pump Station is technically feasible. Construction of the force along the existing railroad tracks main would be also a major financial and permitting undertaking for the Town of Haddam. The total estimated present worth for a gravity sewer collection system with a pump station and force main is $7.9 million, and $6.2 million for a low pressure sewer based system. The Town would

realize savings in force main construction due to shorter force main route and minimal paving and roadway restoration required when compared to installation of force main along Route 154.

The costs associated with construction of a gravity collection system within the roadways would require coordination with repaving of the State owned roads. Portions of Route 81 were recently repaved as part of the streetscape project and will not need to be repaved for another 10 to 15 years. A low pressure collection system could be installed more easily in the roadway shoulders without the need to repave the roadways. However, a low pressure sewer would require maintenance of up to 34 grinder pump stations. The present worth of a wastewater treatment system with a gravity or low pressure sewer collection ranges from $6.1 million to $7.8 million based on "study level estimates".

Both the sewer connection to Middletown options and the wastewater treatment options are very expensive, especially when considering the relatively low number of properties served and low flow rates. Based on the updated cost estimates, it would be considerable less costly to construct a small package wastewater treatment system to serve Higganum Village when compared to the sewer connection to Middletown options without cost sharing; however, per property unit costs will still be very high.

One option would be to discuss with a prospective developer the provision of a treatment unit, which could be sized, not only for the flows that would result from the development of the Rossi property into one hundred 2-bedroom units in five buildings, but also for additional flows in the future. The estimated design, construction and capital cost for a treatment unit sized with a range from 50,000 gallons per day (flows from the proposed development) to 75,000 gallons per day (includes flows from Higganum) is $1.4 to $1.8 million. Most of the packaged treatment systems are capable of treating a range of flows so that any additional flows in the future could be treated without the need to install a new unit.

Another option would be to discuss with a prospective developer of the Rossi property cost sharing of the construction cost related to the pump station or force main along the railroad

tracks, or both. This would reduce the construction cost associated with the pump station and the force main that the Town of Haddam would have to pay for.

If a larger sewer service area was identified or the Rossi property was developed (as just recently proposed), the increased number of potential customers and impacts on economic development could possibly help justify either alternative. At this time, it is recommended that the EDC evaluate the long-term economic potential that could be obtained by providing either of these options in order to determine if there is justification to proceed to the next steps.

SECTION 9

REGULATORY REQUIREMENTS AND PERMITTING

9.1 CONSISTENCY WITH THE STATE OF CONNECTICUT PLAN OF CONSERVATION AND DEVELOPMENT POLICY FOR HADDAM, CONNECTICUT

The Village of Higganum and North Higganum Village is classified by the Connecticut Office of Policy and Management (OPM) a "Rural Community Center". According to the *Conservation and Development: Policies Plan for Connecticut 2005-2010*, this means that such communities are encouraged to "vigorously pursue sewer avoidance programs and limit development to those uses and densities that ensure indefinite functioning of on-lot or small community water supply and waste disposal systems." It recommends that they "support application of advanced on-site wastewater treatment technologies only when their long term functioning is assured and only where the development they support meshes with and complements existing rural patterns and avoids scattered development; in particular, they may be necessary to support higher intensity uses and economic development within Rural Community Centers."

A discussion with the OPM office clarified the intent behind these guidelines. Septic tanks are usually the preferred option for waste treatment in a Rural Community Center area; however, sewered development is not necessarily excluded by the OPM area classification (i.e. the area does not need to be re-classified to sewer the area). Any waste treatment system must be appropriately sized to service the community such that growth and development of the area is consistent with the established character of the community (i.e. sewered areas are only permitted in areas of existing development, not undeveloped areas).

The past studies concluded that it is not practical to provide upgraded individual subsurface disposal systems. A community septic/subsurface disposal system raised concerns about the available suitable land and the long-term viability of a subsurface disposal system. Also, because the desired goal of providing sewer improvements in Higganum Village is to provide for more intensive commercial development, the use of land within Higganum Village and North

Higganum Village for subsurface disposal would appear to provide no advantage over the current disposal methods. Because the Town EDC and the Planning and Zoning Commission intends to promote growth within the Village Center and the North Village in such a way that maintains the character of the village, it is believed that plans for a sewer system would not conflict with the State of Connecticut Plan of Conservation and Development Policy.

9.2 CONNECTICUT DOT ROAD OPENING PERMIT

It is anticipated that part of the collection system and the force main would be located in the existing roadways. At a minimum, some laterals would need to cross state roads and the main collection lines would need to cross the intersection of Route 81 and 154. The force main itself would likely be located in the shoulder of Route 154.

The Connecticut Department of Transportation (CTDOT) would require review of the proposed project to obtain the necessary road opening permits. Additionally, the CTDOT limits construction in state roads for several years following resurfacing projects. In such situations, the CTDOT requires any excavation be conducted by saw cutting the pavement where the excavation is to occur. The road must then undergo repaving in the area according to their specifications and based on the road's Pavement Serviceability Rating (P.S.R.).

Portions of Route 81 and Route 154 in Higganum Village Center were recently resurfaced and the CDOT indicates that construction of a gravity sewer collection system would need to include a complete resurfacing of the entire roadway width.

The construction of the proposed force main would be likely in the bituminous shoulder along Route 154. We have contacted CT DOT and determined that there are no resurfacing projects planned for Route 154 for the next two years, and the road currently has a P.S.R. of about 7.5. The CT DOT does not schedule projects beyond a two-year time frame, as resurfacing is determined by how well the road conditions hold up over time. The CT DOT has also classified Route 154 as a Scenic Highway, a designation meant to encourage sightseeing along the road

and to preserve the road from modifications such as rerouting or widening, which might detract from its appearance.

9.3 OUTFALL PIPE AND FORCE MAIN PERMITS

- NPDES discharge Permit.
- DEP 401 Water Quality Certification.
- Review and approval by the Office of the Long Island Sound Program.
- DEP review and approval of the Stream Channel Encroachment Line.
- U.S. Army Corps of Engineers Permit.
- General Permit for the Discharge of Stormwater Associated with Construction Activities.

9.4 OTHER STATE AND LOCAL REVIEWS AND PERMITS

We have reviewed the construction requirements and have determined that the following state and local permits would be required prior to start of construction of the proposed sanitary sewer system:

- Connecticut Department of Energy and Environmental Protection
- Connecticut Department of Transportation (assumed railroad owner)
- Town of Haddam:
    - Planning and Zoning Commission Site Approval
    - Inland Wetland Commission Permit for construction activities in regulated wetland areas
    - Building Department Permit
- City of Middletown:
    - Planning, Conservation and Development
    - Inland Wetland Commission Permit for construction activities in regulated wetland areas
    - Water & Sewer Department

9.5 WATER POLLUTION CONTROL AUTHORITY (WPCA)

Chapter 103 of the State Code authorizes municipalities to designate its legislative body or any existing board or commission to oversee the operation of the water pollution control facilities (WPCF). As the Town of Haddam currently does not operate a WPCF and has no WPCA, the Town will need to designate a body to oversee the review and approval process as well as the construction and operation of the proposed sanitary sewer system. Currently the EDC is overseeing this process. However, an ordinance to designate the EDC or another body to oversee this process would be needed.

SECTION 10

POTENTIAL FUNDING SOURCES

There could be several funding sources available to the Town of Haddam for this project. The project could be funded locally through bonding (if approved by community) and a combination of state and federal programs. The following are some potential state and federal funding sources that the Town of Haddam could consider to help finance the proposed project:

- State of Connecticut Department of Economic Development Loan through the Economic and Manufacturing Assistance Act (MAA)
- USDA Business Programs: Rural Economic Development Loans and Grants through the Rural Business-Cooperative Service Program
- Low Interest Loan Program through the DEP Clean Water (CWF)
- State and Tribal Assistance Grants (STAG)
- Economic Development Administration (EDA)
- Small Town Economic Assistance Program (STEAP)

We are familiar with these programs and could assist the Town of Haddam in filing necessary applications and/or determine project's eligibility to participate in these state and federal sponsored programs. There may be other funding sources that we are not aware of that may be available for this type of project.

WRIGHT-PIERCE PEER REVIEW OF PAST ENGINEERING EVALUATIONS REPORT

April 2006

WRIGHT-PIERCE
Engineering a Better Environment

WASTEWATER COLLECTION AND TREATMENT SYSTEM FOR HIGGANUM VILLAGE

PEER REVIEW OF PAST ENGINEERING EVALUATIONS

Prepared for the

TOWN OF HADDAM ECONOMIC DEVELOPMENT COMMISSION

FINAL REPORT
APRIL 2006

Wright-Pierce
Civil and Environmental Engineering Services

Wright-Pierce

March 31, 2006
W-P Project No. 10582A

Mr. Anthony Bondi
Town of Haddam
30 Field Park Drive
Haddam, CT 06438

Subject: Wastewater Collection and Treatment System for Higganum Village
Peer Review of Past Engineering Evaluations

Dear Tony,

Find attached, for the Town of Haddam Economic Development Commission (EDC) review and comment, twelve (12) copies of the final report summarizing our review of the previous engineering evaluations. Our review includes: confirmation of the basic design criteria and regulatory requirements that would be used as the basis for new wastewater facilities; review of the alternatives for the collection, treatment and effluent disposal systems; development of updated estimated project costs; our assessment of the permitting issues that will need to be considered; and, a discussion of potential funding sources.

We agree that the future wastewater flow design basis of 25,000 gpd appears reasonable for the proposed sewer service area at the current zoning, and assuming a "typical" commercial mix of future development. Each of the wastewater collection and treatment systems discussed in the previous reports could provide the necessary service, each with their own advantages, disadvantages and cost considerations. If this project were to move forward, we recommend that proven, commonly used technologies be provided which will better ensure satisfactory long-term performance.

Based on our review, it appears that a low pressure collection system would be the less costly alternative, since it could avoid the need to construct a costly influent pump station directly ahead of the proposed wastewater treatment facility. A gravity sewer system may be able to work, but sewer profiles would need to be developed to determine if the gravity sewers could cross the Candlewood Hill Brook bridge crossings at the Rt. 154, Rt. 81 and Depot Road intersection. A gravity sewer system may also be more difficult to construct without major disruption to the recent streetscape improvements.

We developed updated cost estimates of different scenarios for the collection and treatment system. Our cost estimates are considerably higher than the past estimates, and includes components that may not have been included in the past estimates. For example, we have included assumed allowances for ledge excavation for the collection system and treatment system. The actual presence and quantity of ledge and the associated cost would be determined with subsequent geotechnical investigations.

169 Main Street· 700 Plaza Middlesex · Middletown, Connecticut USA 06457 · (860) 343-8297 · Fax (860) 343-9504
Offices in Maine, New Hampshire, Massachusetts, Connecticut and Vermont
E-mail: info@wright-pierce.com
Website: www.wright-pierce.com

Our updated cost estimates for the complete system range from approximately $3 million to $4.4 million, depending on the type of collection system, if the North Higganum Village area is sewered, and the type of treatment system. These estimates include a 5% per year inflation factor, assuming that the project would be constructed in 2008. It should be noted that the previous evaluations cost estimates and the updated cost estimates in the attached report, should be considered "study level cost estimates". These estimates can be used to screen alternatives, and determine the approximate magnitude of the proposed project costs to allow the EDC to determine if it will be financially viable. In order to develop more accurate costs, additional investigations and preliminary drawings would be needed.

We also reviewed the previous estimates of the operation and maintenance costs, and believe that the annual costs would range from $50,000 to $65,000 depending on which wastewater treatment system were provided, and how much of Higganum was provided with sewers.

Funding for this type of project is becoming more difficult to obtain. We have listed out potential funding sources but believe that the most viable sources of funding may be the Office of Policy and Management - Small Town Economic Assistance Program, the Connecticut Department of Economic Development Community Development Block Grant, and the U.S. Department of Agriculture (USDA) - Rural Development (RD).

Obviously, this wastewater project would be a major and costly undertaking for the community. It appears that the past reports did provide a cursory consideration to provide a sewer connection to the Middletown system, but that option was not pursued further because it was thought to be too costly. Though not included in our scope of work, given the magnitude of our updated cost estimates, the EDC may want to take a closer look at this option. It would likely have a capital cost of similar magnitude to our updated cost estimates, but could have a considerably lower annual user fee.

Hopefully, the attached report will provide the EDC with sufficient information to determine the future course of action for a wastewater system for Higganum Village. We appreciate the opportunity to work with the EDC and Town of Haddam. Please feel free to call with any questions or comments.

Very truly yours
WRIGHT-PIERCE

John W. Braccio

John W. Braccio, P.E.
Vice President

WASTEWATER COLLECTION AND TREATMENT SYSTEM FOR HIGGANUM VILLAGE

PEER REVIEW OF PAST ENGINEERING EVALUATIONS

PREPARED FOR THE

TOWN OF HADDAM ECONOMIC DEVELOPMENT COMMISSION

FINAL REPORT
APRIL 2006

Prepared By:

Wright-Pierce
169 Main Street
Middletown, Connecticut 06457

WASTEWATER COLLECTION AND TREATMENT SYSTEM FOR HIGGANUM VILLAGE, CONNECTICUT

PEER REVIEW OF PAST ENGINEERING EVALUATIONS

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WASTEWATER COLLECTION AND TREATMENT SYSTEM FOR HIGGANUM VILLAGE, CONNECTICUT

PEER REVIEW OF PAST ENGINEERING EVALUATIONS

APRIL 2006

1. BACKGROUND

The Town of Haddam has somewhat limited commercial facilities available, causing residents to travel to surrounding communities for basic shopping needs, restaurants and other services. Limited commercial development helps maintain the rural character of the community, but limits the property tax base, which was reduced with the closing of the Connecticut Yankee power plant. In order to encourage economic development and increase the property tax base, while maintaining the character of the Town, the Economic Development Commission (EDC) prepared an *Economic Development Plan* which promotes a vision for a more developed commercial center in the Higganum Village area of Haddam.

Currently, the commercial properties in Higganum Village are somewhat underutilized, in-part due to limitations of the existing subsurface wastewater disposal systems. Small lots, poor soils and high groundwater make it difficult to install subsurface disposal systems that would support expansion or more intensive use of these properties. Problems with individual water supply wells, and separation distances between the wells and septic systems have also been identified as limiting factors for more intensive development.

Based on the *Economic Development Plan*, the Town initiated several evaluations of water supply and wastewater disposal options that would allow for more intensive commercial development within Haddam and Higganum Village. Since 1999, there have been six engineering studies that have evaluated the water and wastewater issues, as shown on Table 1.

TABLE NO. 1
PREVIOUS WASTEWATER STUDIES

Study	Performed By	Date
Report on Infrastructure Needs, Tylerville Commercial Area and Higganum Village Center	Weston and Sampson	February 1999
Higganum Village Assessment of Water and Sewer Service	The Water Planet Company	October 2001
Higganum Village Sewer Feasibility Study	Weston and Sampson	February 2003
On-Site Sewage Disposal Evaluation for Higganum Village	ECS Marin	August 2003
Alternate Wastewater Management Engineering Plan	Lombardo Associates, Inc.	August 2003
Higganum Center Sewer and Water Supply Conflicts	ECS Marin	September 2003

The past studies concluded that it is not practical to provide upgraded individual subsurface disposal systems. A community septic/subsurface disposal system raised concerns about the available suitable land and the long-term viability of a subsurface disposal system. Also, because the desired goal of providing sewer improvements in Higganum Village is to provide for more intensive commercial development, the use of land within Higganum Village for subsurface disposal would appear to provide no advantage over current disposal methods. The conclusion is that a centralized wastewater collection and treatment system with surface water discharge to the Connecticut River would be the desired option. There was also a brief consideration of pumping the wastewater to the Middletown wastewater system, but that option was not considered feasible due to cost concerns.

The past studies established the design flow and loadings for the desired sewer service area, and evaluated a variety of centralized treatment and disposal options. The studies conclude that a wastewater system with a capacity of 25,000 gpd would meet current wastewater treatment needs and provide excess capacity available for more intensive commercial development.

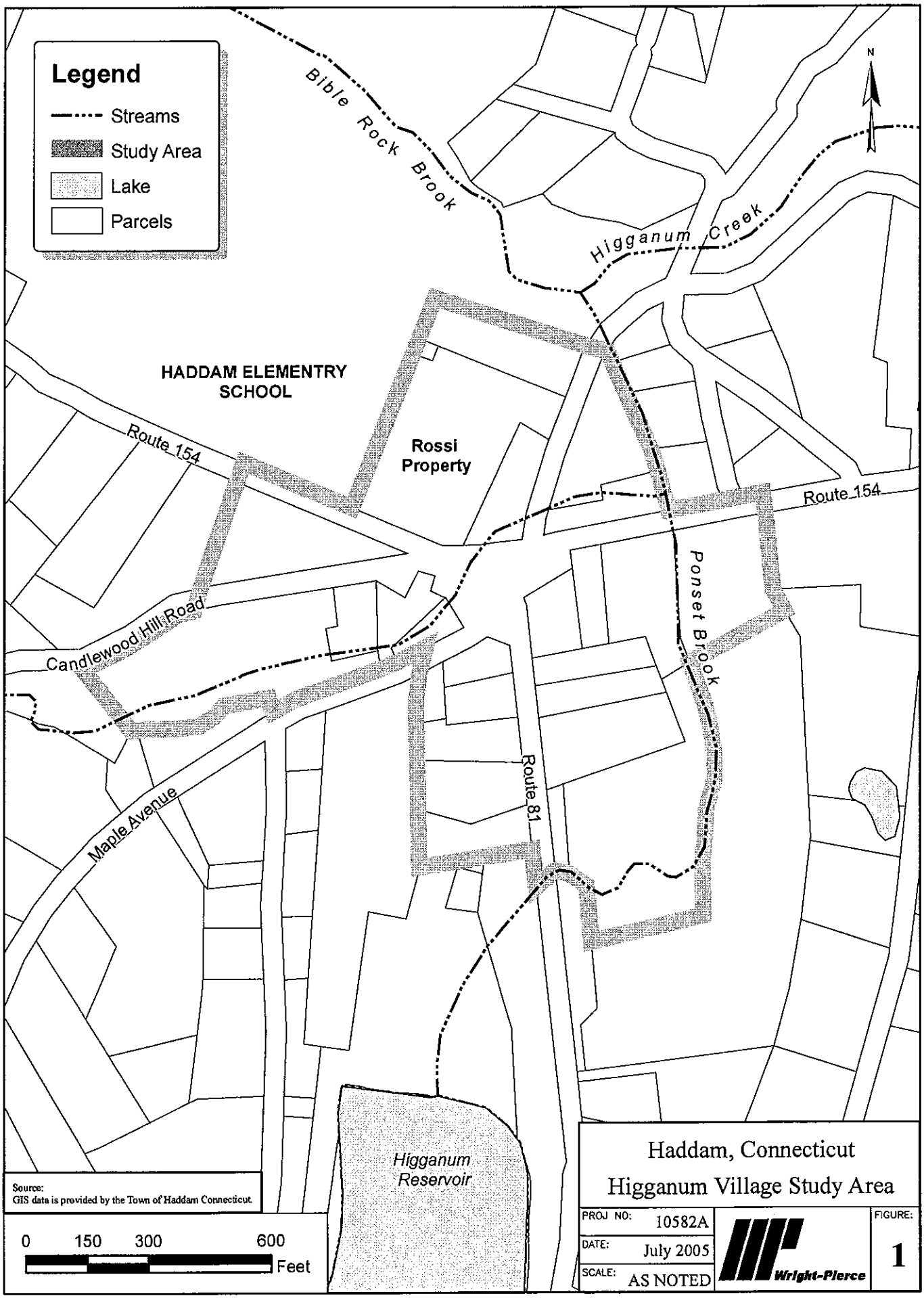
The past studies also included estimates of the capital costs to construct the wastewater collection, treatment and disposal system, and annual operation and maintenance costs. The most recent studies completed in 2003 indicated that the capital costs for the recommended collection/treatment/disposal options range from $1.3 to $1.6 million, with annual operation and maintenance costs ranging from as low as $32,000/year to as high as $95,000/year. These costs did not appear to include architectural improvements, land acquisition, financing, debt retirement or any extensive permitting effort.

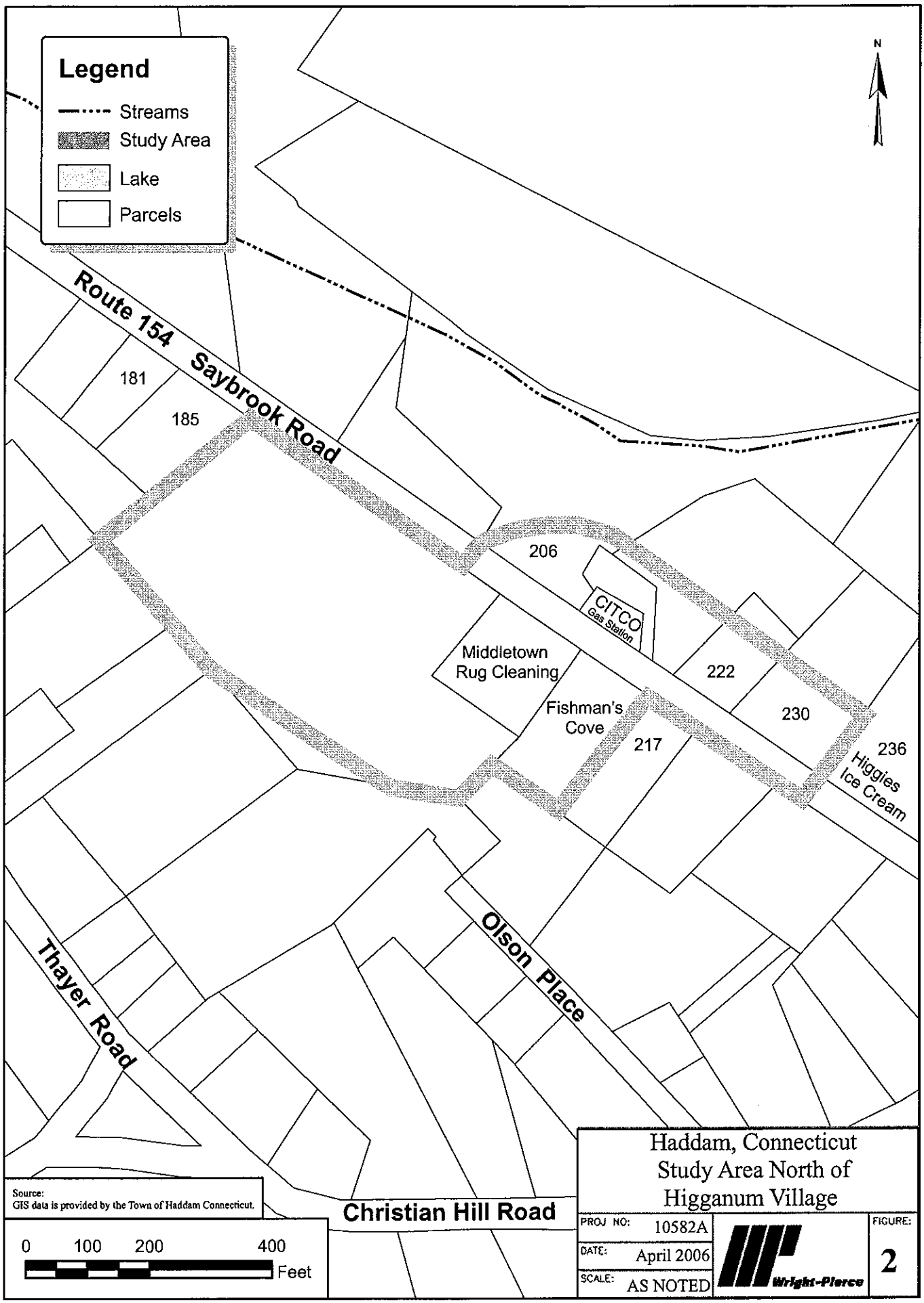
Wright-Pierce was hired to perform a peer review of these previous engineering reports in order to identify the wastewater treatment options that best meet the needs of Higganum Center, and to verify the estimated capital, operation and maintenance costs. Wright-Pierce was also to compile the past report information into a wastewater facilities plan that could be submitted to the Connecticut Department of Environmental Protection (DEP) in order to determine if the project could qualify for grants/loans from the Connecticut Clean Water Fund.

2. SEWER SERVICE AREA

The limits of the sewer service area have varied with each of the past wastewater studies. Originally, the sewer service area was to include Higganum Village, including the Haddam Elementary School, and Tylerville. However, the current intent is for the sewer service area to include 25 properties in Higganum Village, excluding the school, and 9 properties in the "North" Higganum Village area as shown on Figure No. 1 and 2. Note that including the North Village area doubles the length of the wastewater collection system, with corresponding increases in project costs.

The 25 properties in the Higganum Village area as shown on Figure No. 1 were recently rezoned from *Commercial Property* (C-1) to *Higganum Village District* (HVD). This rezoning increases the maximum land coverage from 40% to 70%, to allow for denser development consistent with the Village Center concept. The North Village area properties are still zoned as C-1.


Legend
Streams
Study Area
Lake
Parcels
Bible Rock Brook
Higganum Creek
N
HADDAM ELEMENTRY SCHOOL
Rossi Property
Route_154
Route_154
Candlewood Hill Road
Ponset Brook
Route_81
Maple Avenue
Higganum Reservoir
Source:
GIS data is provided by the Town of Haddam Connecticut.
0 150 300 600
Feet
Haddam, Connecticut
Higganum Village Study Area
PROJ NO: 10582A
DATE: July 2005
SCALE: AS NOTED
Wright-Pierce
FIGURE: 1


Legend
Streams
Study Area
Lake
Parcels
N
Route 154 Saybrook Road
181
185
206
CITCO
Gas Station
Middletown
Rug Cleaning
Fishman's
Cove
217
222
230
236
Higgies
Ice Cream
Olson Place
Thayer Road
Christian Hill Road
Source:
GIS data is provided by the Town of Haddam Connecticut.
0 100 200 400
Feet
Haddam, Connecticut
Study Area North of
Higganum Village
PROJ NO: 10582A
DATE: April 2006
SCALE: AS NOTED
Wright-Pierce
FIGURE:
2

3. DESIGN FLOWS

Current Flows

The *Higganum Village Sewer Feasibility Study (2003)* included estimates of the current wastewater flow from Higganum Village using door-to-door surveys to gather information such as the number of meals served at restaurants, number of chairs in a salon, and number of employees at a business. Using these data, wastewater flows were estimated utilizing the Connecticut Department of Public Health (DPH) septic system guidelines, which are intended to provide an estimate of maximum daily water usage. The *Alternate Wastewater Management Engineering Plan* (2003) assumed that actual water usage would be approximately 65 to 75% of the flows estimated using the DPH guidelines. In order to confirm this assumption, Wright-Pierce reviewed water-meter readings available from the Haddam Elementary School to compare to DPH design criteria for schools. The water meter readings indicate an average water usage of about 3,000 gallons per day (gpd) for 400 students, which is only 50% of the 6,000 gpd as calculated using the DPH design criteria for schools. It therefore appears reasonable to assume that the actual wastewater flows are in the range of 65% to 75% of the flows calculated using DPH guidelines. The estimates of the current flows from the previous studies are summarized in Table No. 2.

TABLE NO. 2
ESTIMATES OF CURRENT FLOW FROM PREVIOUS WASTEWATER STUDIES

Location	*Sewer Feasibility Study (2003)* Flow Estimate (gpd)	*Alternate Wastewater Management Engineering Plan (2003)* Flow Estimate (gpd)
Higganum Village Properties	9,800	6,500 to 7,000
Haddam Elementary School	6,050	3,800 to 4,500
Total	15,850	10,300 to 11,500

As indicated above, the current intent is not to include the Haddam Elementary School as part of the sewer service area. Based on a meeting between David Platt of the EDC and the Region 17 Superintendent, Gary Mala, Haddam Elementary School's septic system is a 1989 vintage that has the capacity to meet the school's future needs. The current population of 400 students is projected to decrease to 300 students, as the school will become Kindergarten through 4th Grade only. As a result, it appears that there is no reason for Region 17 to consider future alternative sewer options for the school at this time.

However, the proposed sewer service area now includes the North Higganum Village area, which was not included as part of the flow estimates in the previous studies. The North Higganum Village area has 9 properties which include several commercial businesses, some apartments and a few homes. Assuming that each property currently generates the wastewater equivalent of a 3 or 4 bedroom home, this area likely has a total wastewater flow of 2,000 gpd to 3,000 gpd. Therefore, the total current wastewater flow from the Higganum Village Center and North Higganum Village is estimated at approximately 8,500 to 10,000 gpd.

Projections of Future Flows

The previous studies also included projections of future wastewater flows from the Higganum Village area. Future flows were developed in the *Infrastructure Needs Report (1999)* using two different scenarios as indicated in Table No. 3. One scenario considered full development to the limits of the zoning regulations and one considered development consistent with the EDC's development estimate.

TABLE NO. 3
FUTURE FLOW ESTIMATES FROM *INFRASTRUCTURE NEEDS REPORT (1999)*

Parameter	Full Commercial Development (gpd)	EDC Development Estimate (gpd)
Average Wastewater Production	65,000 to 112,000	14,000 to 25,000
Peak Wastewater Production	161,000	36,000

The *Higganum Village Sewer Feasibility Study (2003)* included a future wastewater flow based on the premise that the increase in flows would be gradual as commercial development occurs. This evaluation projected incremental flow increases from 10,000 gpd to 40,000 gpd, but recommended a design future flow of 25,000 gpd based primarily on limiting the operating costs for the new wastewater treatment system.

Recommended Design Flow

The future flows within the sewer service area will be dependent on the actual density of development and the type of businesses. Because it is uncertain what the actual density and nature of future development will be, it is somewhat difficult to accurately predict what future flow should be used as the design basis for the new wastewater facilities. The future flow rate used as the design basis should ensure that the wastewater facilities are properly sized for the foreseeable future. Too small of a design flow rate would result in an undersized wastewater facility that could not accommodate the development it was intended to promote. Accordingly, too large of a design flow rate would result in an over-sized wastewater facility that would be difficult to operate with unnecessarily high capital and operational costs.

In order to confirm the design flow rates, Wright-Pierce developed an independent analysis of future flows based on the assumption that flow generation would be similar to that occurring at "typical" mixed retail/commercial development. Flow data obtained from exiting shopping centers in Massachusetts and Connecticut ranged from 0.03 gpd/ft^2 to 0.07 gpd/ft^2 of total building area. For the Higganum Village analysis, a flow rate of 0.05 gpd/ft^2 was used to confirm the future design flows.

The current area available for development within the Higganum Village sewer service area is approximately 25 acres. From the EDC's *Economic Development Plan*, total building area is estimated to be approximately 30% of the total available land area, or approximately 326,700 square feet. At a flow rate of 0.05 gpd/ft^2, the estimated future flow is approximately 16,500 gpd.

The current land area available for development within the North Higganum Village sewer service area is approximately 6.3 acres. The potential total building area is estimated to be approximately 52,300 square feet. At a flow rate of 0.05 gpd/ft^2, the estimated future flow is approximately 2,600 gpd.

It is also prudent for the future design flow rate to include some allowance for inflow and infiltration (I/I). Inflow is the direct flow of stormwater into the collection system from direct connections to the sewer system such as roof leaders or sump pumps. Infiltration is groundwater leaking into the sewer through cracks or leaking joints in the sewers. These types of I/I sources are not allowed per current plumbing codes and new collection systems should have a minimal amount of I/I. However, over a long period of time, some I/I will likely occur and large amounts are undesirable for a public sewer.

The independent analysis of the design flow rates is summarized in Table No. 4. The total flow corresponds reasonably with the *Higganum Village Sewer Feasibility Study (2003)* flow of 25,000 gpd.

TABLE NO. 4
RECOMMENDED FUTURE DESIGN FLOWS

Area	Flow (gpd)
Higganum Village	16,500
North Higganum Village	2,600
Total Dry Weather Flow	19,000
Infiltration/Inflow	3,000
Total Wet Weather Flow	22,000

4. REGULATORY REQUIREMENTS

Discharge Permit Requirements

The proposed wastewater treatment system will require a NPDES discharge permit issued by the Connecticut Department of Environmental Protection (DEP). The discharge permit will include discharge limitations that will determine the design criteria for the new treatment facilities. A discharge permit for Higganum Village would be based on the Class B Water Quality Classification of the Connecticut River. Based on discussions with the DEP, the discharge permit would include the discharge limits indicated on Table No. 5.

TABLE NO. 5
ANTICIPATED NPDES EFFLUENT DISCHARGE LIMITS

Effluent Parameter	Average Monthly Concentration	Maximum Daily Concentration	Sample Type / Frequency of Collection
BOD_5	20 mg/L	50 mg/L	Composite / 1 per week
TSS	20 mg/L	50 mg/L	Composite / 1 per week
Total Nitrogen	4 to 5 mg/L	N.A.	12-month rolling average/1 per week
Fecal Coliform (30-day geometric mean) [1]	200/100 mL	N.A.	Grab / 3 per week
Fecal Coliform (7-day geometric mean) [1]	400/100 mL	N.A.	Grab / 3 per week

[1]For the period May 1 through September 30.

These are typical design parameters for treated wastewater discharge into the Connecticut River based on current regulations. However, it should be noted that the total nitrogen discharge limit of 4 to 5 mg/L on an annual average basis is approaching the limit of available treatment technology, and could result in increased capital and operational costs. Prior to initiating funding for the design of a wastewater treatment system, the Town of Haddam should meet with the DEP to determine if less stringent nitrogen discharge limits could be permitted which would allow for a less costly wastewater treatment facility.

Operator Requirements

Based on the size and complexity of the proposed wastewater treatment facility, it is anticipated that the facility would be considered as a Class II facility per DEP criteria. The DEP regulations require that a Class II facility be staffed with a licensed operator for a minimum of 2 hours per day, 5 days per week. The previous studies also concluded that a minimum of 2 hours per day, 5 days per week would be the minimum time requirement for the facility to be staffed with a licensed operator.

For facilities with a design flow of less than 25,000 gpd, the DEP may allow the licensed operator to be present for fewer hours if it is demonstrated that the facility can be properly operated to meet discharge requirements.

5. WASTEWATER COLLECTION ALTERNATIVES

The previous studies considered various types of collection systems including:

- Septic Tank Effluent with Gravity Sewers (STEG);
- Septic Tank Effluent with Pressure Sewers (STEP);
- Vacuum collection system;
- Conventional gravity sewers; and

- Low pressure sewers with individual grinder pump stations.

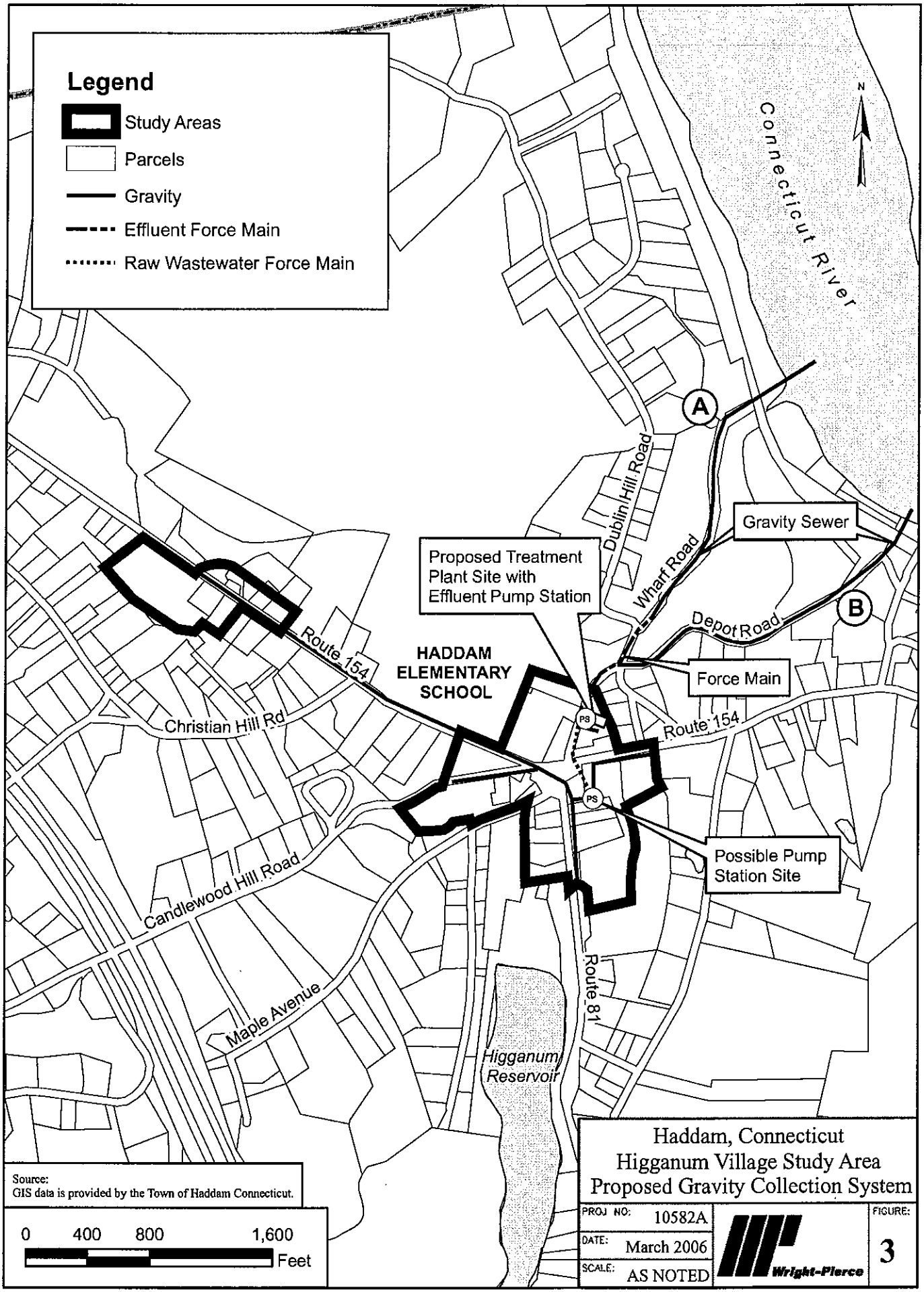
The STEG, STEP and vacuum collection system are considered somewhat innovative, and are used in specific situations where more common sewer alternatives are not possible. The STEG and STEP systems utilize on-site septic tanks to remove solids before the wastewater is conveyed to the treatment facility for further treatment and discharge. The vacuum collection system utilizes a vacuum to suck the wastewater from each property to a central pump station which pumps the wastewater to the treatment facility. To the best of our knowledge, these systems are currently not used for any public sewer system in Connecticut.

Gravity Sewer

Conventional gravity sewers are the most commonly used collection method for communities throughout the world. Based on current engineering standards, a gravity sewer system for Higganum Center would consist of an 8-inch diameter PVC pipe with a manhole every 300 feet. A 4-inch or 6-inch service lateral would be provided to each property. Typically, the pipes would be installed at a minimum depth of 5 feet to be below the frost line. Depending on the actual topography, elevation of building served and pipe slopes, the actual depth could be considerably deeper. The goal is to minimize the depth to minimize the cost of the sewer construction. The presence and depth of ledge and groundwater will also significantly impact the cost to construct sewers.

For purposes of this analysis, it is assumed that the proposed wastewater treatment facility would be located on the Town Garage property. Based on initial site visits and review of topographical data, it appears that a gravity sewer may be too deep to attach to the Candlewood Hill Creek bridge at Depot Road. Constructing the sewer below the creek would require even deeper sewers. Therefore, it appears that a pump station would be needed to pump to the wastewater treatment facility. The previous reports did not consider that a pump station may be required prior to the treatment facility, which would substantially increase the project costs. Additional survey information and preliminary design profiles would be needed to confirm whether a gravity sewer could go across the bridge at a relatively shallow depth in order to avoid the need for a pump station.

Proposed conceptual layouts for a gravity sewer system, along with two potential routes (A and B) for the outfall sewer to the Connecticut River, are shown on Figure No. 3.


Legend
Study Areas
Parcels
Gravity
Effluent Force Main
Raw Wastewater Force Main
N
Connecticut River
A
B
Dublin Hill Road
Wharf Road
Gravity Sewer
Proposed Treatment Plant Site with Effluent Pump Station
Depot Road
Force Main
HADDAM ELEMENTARY SCHOOL
Route 154
Christian Hill Rd
PS
PS
Possible Pump Station Site
Candlewood Hill Road
Maple Avenue
Higganum Reservoir
Route 81
Source:
GIS data is provided by the Town of Haddam Connecticut.
0 400 800 1,600
Feet
Haddam, Connecticut
Higganum Village Study Area
Proposed Gravity Collection System
PROJ NO: 10582A
DATE: March 2006
SCALE: AS NOTED
Wright-Pierce
FIGURE: 3

Low Pressure Sewer

A low pressure sewer system utilizes individual grinder style pump stations at each property or groups of up to 4 properties. Wastewater is then pumped through a small diameter force main to a gravity sewer or directly to the treatment facility. This type of system can at times be less costly than a gravity sewer because the force main can be constructed at shallower depth than a gravity sewer, especially in areas with varying topography, ledge or high groundwater. There are many of these types of sewer system throughout Connecticut. For example, the East Haddam wastewater system utilizes low pressure sewers.

There can be a variety of arrangements that are used to pay for the installation and operation of the low pressure sewer components. The cost tables provided later in this report include an estimated cost of $12,000 for each individual pump station and service connection. This cost estimate would be refined during a final design process and based on issues that would need to be address on each individual lot. The different arrangements to construct, operate, and maintain each individual pump stations are summarized as follows:

- The Town can be responsible to pay for the construction costs for the force main and each individual pump station. This tends to be the most costly option and requires construction easements on each property.

- The Town can be responsible to only pay for the construction costs for the force main in the street, and each property owner constructs and pays for their pump station and service connection when they decide to make the actual connections. This will initially be less costly to the Town, but can ultimately result in fewer users to share the wastewater system operation and maintenance costs.

- The Town can be responsible to operate and maintain each individual pump station. The actual monthly operating costs per individual pump station are actually quite low. However, this arrangement can get somewhat complicated and undesirable over time, especially as these pump stations age and have increased maintenance needs, along with a variety of other issues. We are aware of communities that have this arrangement and are trying to get out of it. The more desirable alternative is to have each property owner responsible for the operation and maintenance of their own system.

Sewer System Considerations

It should be noted that the Connecticut Department of Transportation (CDOT) indicates that resurfacing of portions of Routes 81 and 154 are tentatively scheduled for 2007. If the sewer system were to be constructed after the repaving, the CDOT indicates that the sewer project would need to include a complete resurfacing of the entire roadway width. This could add approximately $300,000 to $500,000 to the sewer construction cost. It may or may not be possible to request that the CDOT postpone repaving until 2008 or 2009 to allow sufficient time to construct the sewer.

It should also be noted that the recommended collection system options in the previous studies were based on a gravity collection system to the treatment facility. As previously discussed, there is concern that it may be necessary to provide a pump station ahead of the treatment plant because of the gravity sewer depth that would be needed to cross the Candlewood Hill Creek Bridge on Depot Road. This needs to be confirmed with additional survey data and preliminary sewer profiles. This pump station adds a significant cost (approximately $500,000) to the total project cost.

Theoretically, a siphon system could be provided under the stream, avoiding the need for another pump station. However, due to the relatively low flows, a siphoned may not actually be practical. Again, this idea could be explored continued during an actual design process.

An alternative approach to avoid the need for an influent pump station, and to possibly avoid costly roadway construction provisions imposed by the CDOT, would be to consider a low pressure sewer system. Such system would consist of low pressure force mains that could be constructed on the edge or shoulder of the roadway, minimizing work and associated costs for construction of a sewer in the center of the roadway. Each property or group of properties would have its own grinder style pump station, and an influent pump station would not be needed.

6. WASTEWATER TREATMENT ALTERNATIVES

Treatment System Location

The previous studies concluded that either the Rossi property or the Town Garage property are viable locations for the treatment facility. Both of these properties are located at the "low" end of the Village area, theoretically allowing for gravity sewers to work. The actual amount of land required will vary from approximately 0.25 to 0.6 acres depending on the type of treatment system utilized. If the Town Garage property were utilized, it would likely be necessary to reconfigure or relocate the Town Garage operation in order to provide sufficient room for the treatment facility. Only a portion of the Rossi property would need to be acquired, but may require some demolition of the existing buildings.

Treatment System Alternatives

The previous studies initially were based on evaluating wastewater treatment facilities with a subsurface wastewater disposal system. As discussed above, because of the limited availability of suitable land for a subsurface system, and concerns with the long-term viability of a subsurface disposal system, the current concept is for a surface-water discharge to the Connecticut River. The DEP has indicated that they would prefer a surface water discharge due to concerns with the long-term reliability of a subsurface disposal system.

The previous studies included an evaluation of a variety of "package type" treatment systems based on the following system categories:

- Fixed Media (non-submerged)
- Fixed Media (submerged)

- Sequencing Batch Reactor (SBR)
- Extended Aeration
- Membrane Filtration
- Artificial Wetlands

Each of these type systems utilizes a combination of physical and biological treatment processes to achieve the desired level of treatment. The treatment technologies are based on similar basic treatment processes, but in different configurations with different equipment. There are numerous manufacturers of these package systems, each with their own proprietary process and equipment arrangements.

Of these systems, artificial wetlands are still considered an emerging technology for this type of application, and it is unlikely that such a system would be acceptable to the DEP, and was therefore not considered.

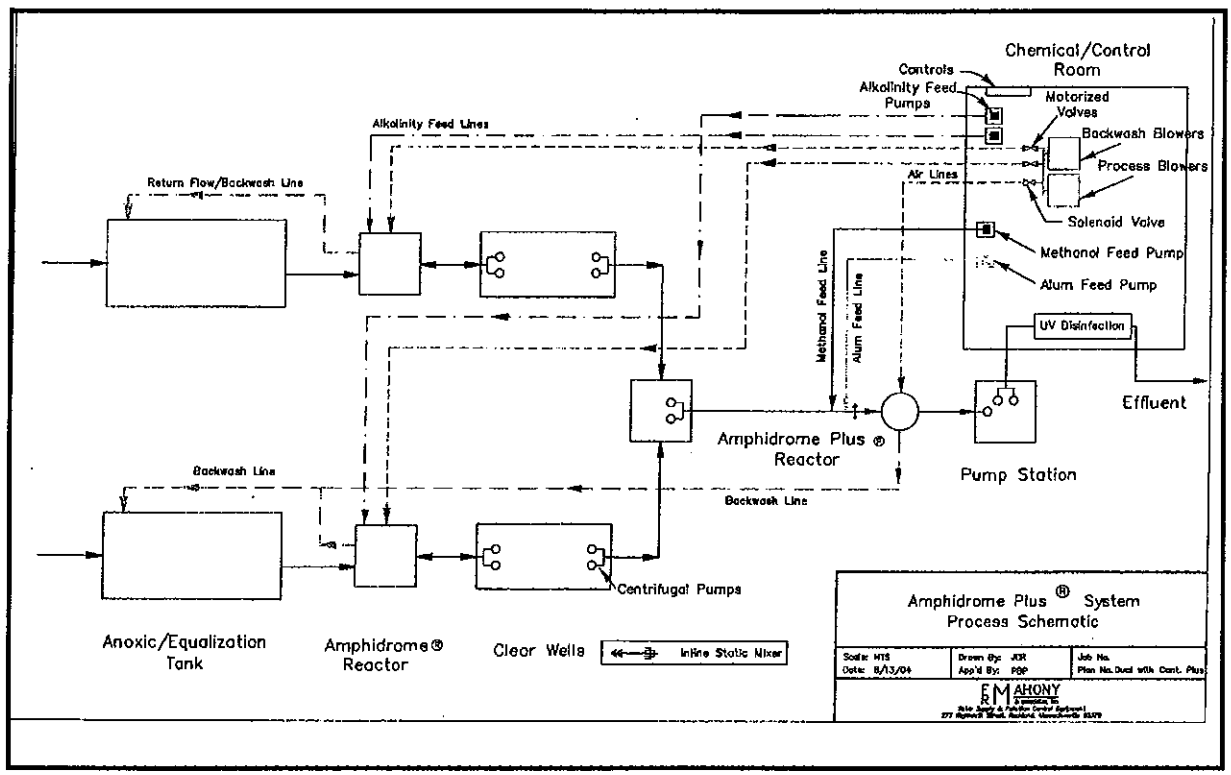
Extended aeration systems have been the most commonly used system for small package type installations, and have been in longer use than any of the other technologies. However, over the past 10 to 20 years, there have been advances in the fixed media and SBR technologies which have resulted in more reliable, simpler and less costly operations. As a result, over the recent years these technologies are becoming more commonplace in small installations compared to the extended aeration systems.

The membrane filtration systems can provide the highest level of treatment, but historically have been the most costly of the alternatives with the highest operational costs due to their complexity. These types of system are often used when there is a desire to recycle treated effluent for purposes that do not require drinking water quality. However, they are becoming more cost competitive and can provide a greater assurance of achieving effluent permit requirements.

The systems recommended by the previous studies were the SBR and fixed media systems. These types of systems are widely used in applications of similar size as proposed for Higganum Village, and can be provided by multiple manufacturers. Each of these package systems would be provided with an ultraviolet (UV) disinfection system. These treatment systems can be provided in modular format to allow for expansion as flows increase over time. However, depending on the specific system and manufacturer, the standard unit capacities may somewhat limit the modular flexibility.

One type of common package submerged fixed media system is the Amphidrome System. The manufacturer has provided the process schematic of the system configuration they would recommend for Higganum Village as shown in Figure No. 4.

FIGURE NO. 4
FIXED FILM AMPHIDROME SYSTEM PROCESS SCHEMATIC [1]



[1]Figure prepared for Higganum Village District by F.R. Mahony & Associates, Inc.

The *Alternative Wastewater Management Engineering Plan (2003)*, proposed a fixed film system that utilizes a combination of anaerobic up-flow filter, recirculating sand filter, proprietary Nitrex® filter for nitrogen removal, and post filtration with UV disinfection prior to discharge. This system would utilize individual on-site septic tanks for the initial removal of solids, with a small diameter gravity sewer to the treatment facility. This type of system reportedly can be provided in a very modular format to allow a wide range of flexibility to increase capacity as flows increase. However, these types of systems are not in common use, and there are currently no such systems operating in Connecticut in a similar application. Two technology testing centers were contacted to confirm the viability of this type of system. They reported that the system can produce a high effluent quality, but that there is a considerably long start-up time, and that the nitrogen removal filter requires periodic proprietary media replacement. A private installation reference was also contacted, who report good performance, but that a post treatment system had to be provided due to a high effluent BOD from the nitrogen removal filter. Because of the limited demonstrated use of this system in similar applications compared to other proven technologies, and the fact that contract operators in Connecticut are not familiar with its operation, it is not recommended that this type of system be provided for Higganum Village.

7. EFFLUENT DISPOSAL

The previous studies were primarily focused on evaluating sites for a subsurface disposal system. As discussed above, the current concept is for a surface water discharge to the Connecticut River. This type of system would consist of an effluent pump station at the new treatment facility and an outfall force main pipe to the Connecticut River and as shown on Figure No. 3.

The *Higganum Village Sewer Feasibility Study (2003)* determined that an effluent pipe could be located along the Nosal Road right-of way, which is a "paper road" that currently is a foot path to the Connecticut River that passes by an abandoned industrial site. Directly adjacent to the Connecticut River the path crosses privately owned property. There are some concerns with this route regarding the potential for contaminated soils from the industrial site, some ownership questions, and proximity to residential properties, all which would need to be further investigated as part of a final design process. An alternative route would be along Depot Road, which would require property acquisition to gain access to the Connecticut River.

With either route, the effluent line would need to cross the Valley Railroad track, and an outfall structure would be required in the Connecticut River. The specific requirements for performing the railroad track crossing are not known at this time and would need to be confirmed during the final design process.

It can also be a difficult and costly permitting and construction effort to provide a new wastewater treatment discharge into surface waters. Because the proposed discharge flow would be a small volume compared to the volume of the Connecticut River, the DEP indicates that they would envision a relatively simple effort to permit this discharge. The DEP has also indicated that a simple outfall structure below the low tide elevation would suffice, similar to the outfall structures provided for the East Haddam and Deep River treatment facilities. However, there will likely still be specific requirements from the U.S. Army Corps of Engineers that will need to be addressed in order to ensure the outfall structure does not interfere with the maintained navigation channel. Our preliminary review of the permitting effort identified the potential need for a considerable number of permit approvals. This potentially extensive permitting effort does not appear to have accounted for in the previous studies or previous cost estimates.

8. ESTIMATED COSTS

Two of the previous studies include estimated capital and operating costs for the entire proposed wastewater system including the collection system, treatment facility and discharge outfall system. A summary of these previous costs, for a system with a design capacity of 25,000 gpd, are provided in Table No. 6. This table includes an update of the costs based on an average construction cost inflation factor of 5% from the original estimates in 2003 up to 2005. It also includes projected project cost inflation to an assumed construction date of 2008, again assuming a future inflation factor of 5%. It should be noted that the construction industry has experienced an extraordinary increase in materials costs beyond all projections over the past several years, which has resulted in higher than expected bid costs for heavy construction projects. Construction labor shortages are also a factor that is impacting recent construction bid costs.

TABLE NO. 6
PROJECT COST ESTIMATES FROM PREVIOUS STUDIES

Estimate Source and Date	Collection System[3]	Treatment Facility	Effluent Piping	Project Total
Higganum Village Sewage Feasibility Study(2003)				
2003	$287,000	$482,000	$538,000	$1,307,000
2005 (Adjusted)[1]	$316,000	$531,000	$593,000	$1,668,000
2008 (Adjusted)[2]	$366,000	$615,000	$687,000	$1,668,000
Alternate Wastewater Management Engineering Plan (2003)				
2003	$386,000	$976,000	$263,000	$1,625,000
2005 (Adjusted)[1]	$425,000	1,076,000	$289,000	$1,790,000
2008 (Adjusted)[2]	$492,000	$1,246,000	$335,000	$2,073,000

[1]Converted from 2003 dollars to 2005 dollars at an average inflation rate of 5% (F/P = 1.1025)
[2]Converted from 2003 dollars to 2008 dollars at an average inflation rate of 5% (F/P = 1.2763)
[3]Collection system costs based on sewers only in Higganum Village and does not include the North Village area.

It should be noted that the previous reports were based on providing sewers only in Higganum Village but did not include the North Higganum Village area along Route 154. This would increase the sewer length by approximately 2,600 feet, which essentially doubles the length of the collection system, and the collection system cost. Assuming that the collection system costs were doubled, the adjusted equivalent project costs from the previous studies are summarized in Table No. 7.

TABLE NO. 7
PROJECT COST ESTIMATES FROM PREVIOUS STUDIES ADJUSTED TO INCLUDE SEWER LENGTH INCREASE FOR NORTH HIGGANUM VILLAGE AREA

Estimate Source and Date	Collection System[3]	Treatment Facility	Effluent Piping	Project Total
Higganum Village Sewage Feasibility Study(2003)				
2003	$574,000	$482,000	$538,000	$1,594,000
2005 (Adjusted)[1]	$632,000	$531,000	$593,000	$1,756,000
2008 (Adjusted)[2]	$732,000	$615,000	$687,000	$2,034,000
Alternate Wastewater Management Engineering Plan (2003)				
2003	$772,000	$976,000	$263,000	$2,011,000
2005 (Adjusted)[1]	$850,000	1,076,000	$289,000	$2,215,000
2008 (Adjusted)[2]	$984,000	$1,246,000	$335,000	$2,565,000

[1]Converted from 2003 dollars to 2005 dollars at an average inflation rate of 5% (F/P = 1.1025)
[2]Converted from 2003 dollars to 2008 dollars at an average inflation rate of 5% (F/P = 1.2763)
[3]Collection system costs based on sewers in Higganum Village and the North Village area.

Wright-Pierce performed a review of the previous cost estimates as a basis to develop an updated cost estimate. From our review, it appeared that the previous cost estimates may not have accounted for various cost line items that we believe will ultimately be needed for a complete system. It is our understanding that the cost estimates are not to include costs for land acquisition, legal, financing or extensive permitting efforts. It was also requested that we provide an updated estimate of the incremental costs for the project at different possible flow rates, under the premise that the initial system would be provided for the immediate needs, with modular expansion as the flows increased. It was also requested that the cost estimates be provided with and without providing sewers for the North Higganum Village area.

Wright-Pierce also performed a review of the previous cost estimates for the annual operation and maintenance (O&M) costs, which ranged from $32,000 up to $95,000. Based on our experience at other facilities, discussions with DEP to confirm the actual minimum number of licensed operator hours that would be required for this facility, and discussions with contract operators at similar facilities, we estimate that the annual O&M costs would likely range from between $55,000 to $70,000, depending on the type of wastewater facility ultimately provided. These estimated costs also include an allowance for the O&M of an influent pump station.

A summary of our updated cost estimates for each incremental system are provided in Table No. 8 and Table No. 9.

TABLE NO. 8
UPDATED COST ESTIMATES FOR
WASTEWATER SYSTEM WITH 25,000 GPD CAPACITY*

	Collection System (millions)	Treatment System (millions)	Outfall System (millions)	Total Capital (millions)	Annual O&M Cost
Gravity System w/ North Village (1) (2)	$2.3	$1.1 to $1.5	$1.0	$4.4 to $4.9	$55,000 to $70,000
Gravity Sewer w/o North Village (1) (2)	$1.6	$1.1 to $1.5	$1.0	$3.7 to $4.1	$55,000 to $70,000
Low-Pressure w/ North Village (3)	$1.6	$1.1 to $1.5	$1.0	$3.7 to $4.1	$55,000 to $70,000
Low-Pressure w/o North Village (3)	$0.95	$1.1 to $1.5	$1.0	$3.05 to $3.45	$55,000 to $70,000

* Cost Table Qualifications:
- Costs include a 5% annual inflation factor for 3 years (2008 dollars).
- Costs include technical services and contractors overhead and profit allowance.
- Costs do not include allowances for property acquisition, legal, financing, major permitting effort, or repaving of roadways other than trench repair.

(1) Costs include an assumed amount of ledge removal. The estimated coast is based on an assumed 2-foot deep ledge the entire length of the sewer construction at an estimated ledge removal cost of $75/CY.

(2) Costs based on service laterals to property line and not to structures; property owners usually are responsible for service connections from the property line to structures.

(3) Costs include an estimated $12,000 for an individual grinder pump station at each property with a service connection to the street.

TABLE NO. 9
UPDATED COST ESTIMATES FOR
WASTEWATER SYSTEM WITH 10,000 GPD CAPACITY*

	Collection System (millions)	Treatment System (millions)	Outfall System (millions)	Total Capital (millions)	Annual O&M Cost
Gravity System w/ North Village (1) (2)	$2.3	$1.1	$1.0	$4.4	$50,000 to $65,000
Gravity Sewer w/o North Village (1) (2)	$1.6	$1.1	$1.0	$3.7	$50,000 to $65,000
Low-Pressure w/ North Village (3)	$1.6	$1.1	$1.0	$3.7	$50,000 to $65,000
Low-Pressure w/o North Village (3)	$0.95	$1.1	$1.0	$3.05	$50,000 to $65,000

* Cost Table Qualifications:
- Costs include a 5% annual inflation factor for 3 years (2008 dollars).
- Costs include technical services and contractors overhead and profit allowance.
- Costs do not include allowances for property acquisition, legal, financing, major permitting effort, or repaving of roadways other than trench repair.

(1) Costs include an assumed amount of ledge removal. The estimated coast is based on an assumed 2-foot deep ledge the entire length of the sewer construction at an estimated ledge removal cost of $75/CY.

(2) Costs based on service laterals to property line and not to structures; property owners usually are responsible for service connections from the property line to structures.

(3) Costs include an estimated $12,000 for an individual grinder pump station at each property with a service connection to the street.

Obviously, there is a significant discrepancy between the original studies cost estimates and our updated cost estimates, even accounting for inflation. We believe some of the discrepancy is that the original estimates did not include adequate allowances to cover items such as:

Sewer Cost Estimate - Possible Discrepancies

- Main lift pump station.
- Ledge removal.
- Traffic control for sewer construction.
- Sewer bridge crossings.
- Service laterals.
- Manholes.
- Contractor's overhead and profit.
- Contractor's mobilization, demobilization, bonding and insurance costs
- Materials testing.
- Repaving of the state roadways was not included in previous or current costs estimates.

Treatment Facility Cost Estimate - Possible Discrepancies

- Demolition of existing facilities.
- Sufficient site improvements.
- Equipment and office building.
- Ledge removal.
- Select fill materials
- Sufficient tankage and concrete slab requirements.
- Sufficient process piping requirements.
- Influent and effluent samplers.
- Electrical service and distribution requirements.
- Contractor's overhead and profit.
- Contractor's mobilization, demobilization, bonding and insurance costs
- Materials testing.

Effluent Pipeline Cost Estimate - Possible Discrepancies

- Sewer bridge crossings.
- Contractor's overhead and profit.
- Contractor's mobilization, demobilization, bonding and insurance costs
- Materials testing.

Another discrepancy may be somewhat accounted for by the assumed design standards, and how the project would be bid for construction. Our updated estimates are based on our experience with wastewater facilities designed and constructed for municipal ownership and service. Municipally owned facilities are somewhat more conservatively designed than facilities commissioned for private residential, commercial or industrial development. Also, municipal facilities are typically publicly bid, with fairly strict bonding, insurance and contractual provisions such as liquidated damages, compared to how a private project can be bid. Also, municipal projects often require that state prevailing wage rates be utilized, especially if there is

state or federal funding. Contractors have told us that the requirement for state prevailing wage rates can increase a project cost by 20% or more.

It should also be noted that the cost estimates in the previous studies and the updated cost estimates are approximate costs based on generalized concepts. This level of cost is typically used for alternative screening, and to determine the overall magnitude of project costs to ensure that adequate funding can be obtained to move the project forward. More accurate cost estimates would be developed during a preliminary and final design process, with additional geotechnical and survey data, and with the preparation of design drawings to allow for materials quantity take-offs.

9. PERMITTING ISSUES

It does not appear that the regulatory and permitting requirements for a new wastewater treatment facility with discharge to the Connecticut River, was fully addressed in the previous studies, which focused on subsurface disposal systems. Such regulatory and permitting requirements could have a significant impact on the total project costs. Wright-Pierce conducted a preliminary review of the permits and approvals that may be needed for this project, and which are listed as follows:

- DEP wastewater facilities design document review and approval.
- NPDES discharge Permit.
- DEP 401 Water Quality Certification.
- Flood Management Certification.
- Review and approval by the Office of the Long Island Sound Program.
- Connecticut Department of Transportation Road Opening Permits and Bridge Crossing approval.
- DEP review and approval of the Stream Channel Encroachment Line.
- DEP review and approval of Natural Diversity Database.
- U.S. Army Corps of Engineers Permit.
- General Permit for the Discharge of Stormwater Associated with Construction Activities.
- Inland Wetland Commission review and approval.
- Planning and Zoning Board review and approval.
- Right-of-way approval and acquisition from the DEP Bureau of Land Acquisition which is the current owner of the Valley Railroad line.

Wright-Pierce also reviewed the available FEMA flood map elevation information to determine if there would be flood zone issues with the project. Based on our initial review, it appears that both of the proposed treatment facility sites are not within the 100-year flood zone. However, it appears that the Town Garage property is within the regulated wetlands setback distances from the Candlewood Hill Brook and Higganum Creek, and Inland Wetland variances would likely be required for this property to be used for a treatment plant site. Major portions of the proposed outfall line would be within the 100 year flood zone, and within regulated distances for wetland setbacks, and Inland Wetland variances would also be required.

It should also be noted that the DEP will require that the Town of Haddam will ultimately be responsible for compliance with the wastewater facility discharge permit, and for proper operation and maintenance of the facilities, even if a contract operator is hired. One approach would be for the Town to establish a Water Pollution Control Authority (WPCA) to oversee the facility. This is the most common approach by towns with public sewer systems.

10. POTENTIAL FUNDING SOURCES

There are a variety of potential funding sources that could be considered for the design and construction of the facilities including:

- **DEP Clean Water Fund (CWF)** - This fund can provide a 20% grant/80% loan with a 2% interest rate over 20-years. We believe that this project would only qualify for funding if the DEP was convinced that it was necessary to solve existing pollution problems. However, this program was recently significantly under-funded by the state legislature, and at this time, we believe that it is unlikely that this project would seriously be considered for funding within the foreseeable future.
- **Department of Economic Community Development (DECD)** - This agency provides Community Development Block Grants to municipalities typically up to $500,000 on an annual basis. It is at times possible to qualify for several successive block grants over several years.
- **State and Tribal Assistance Grants (STAG)** - This is a direct appropriation of funds to a particular project by the U.S. Congress Representative. Rob Simmons' office would need to be contacted to determine the eligibility of this type of project.
- **Economic Development Administration (EDA)** - This federal agency can provide grants for wastewater infrastructure that preserves or provides for commercial or industrial jobs, but not for retail jobs. There is a fairly involved application process, which can be influenced by the Haddam's congressional representatives.
- **U.S. Department of Agriculture (USDA), Rural Development (RD)** - RD provides grants and loans for wastewater infrastructure. Grants can be up to 55% for areas with median household incomes below the State median, and up to 75% grant for areas with poverty level median household incomes. Based on discussions with RD, it is our understanding that Higganum Village falls under the State medium for household incomes, even though Haddam does not. However, due to program funding limitations, RD does not envision this level of grant funding even for communities that qualify. They also provide loans currently at 4.375% interest rates for up to 40 years, with no penalties for prepayment.
- **Small Town Economic Assistance Program (STEAP)** - This program can provide up to $500,000 per year in grant money for infrastructure projects to support "economic development, community conservations, and quality of life projects."

There may be other funding sources that we are not aware of that may be available for this type of project. Obviously, the Town can also obtain its own bonding if approved by the community.

WRIGHT-PIERCE
Engineering a Better Environment