BIRDSALL SERVICES GROUP
ENGINEERS & CONSULTANTS

TOWN OF BROOKFIELD, CONNECTICUT
20 YEAR SANITARY SEWER FLOW PROJECTION

For the

BROOKFIELD WATER POLLUTION CONTROL AUTHORITY
TOWN OF BROOKFIELD, FAIRFIELD COUNTY, CONNECTICUT

June 2012

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Executive Summary

The purpose of this report is to present existing data and a technical basis for estimating future sanitary sewer flows in Brookfield, CT over the next 20 years and to establish, if necessary, an allocation of additional capacity, beyond the current 500,000 gallons per day (gpd) allocation. Brookfield only collects sanitary sewer flow for processing at the Danbury, CT, regional treatment plant. An understanding of the flows projected over the next 20 years is needed to determine how much treatment capacity Brookfield should request from the regional treatment plant in Danbury, a request that is sponsored with a capital investment contribution.

The current "InterLocal" agreement between the Town of Brookfield and the City of Danbury for the treatment of sanitary sewer flows generated in the Town of Brookfield expires in 2012 and must be renewed. To insure that the Town of Brookfield reserves adequate wastewater treatment capacity in the regional Danbury treatment plant to accommodate the future, Birdsall Services Group (BSG) has been retained to develop a 20 year sanitary sewer flow projection. This assignment included an analysis of historical flow data for the current service area; identifying areas where future expansion of the existing sewer service area is anticipated; and an evaluation of the economic growth potential as it might impact sewer flows from the Town of Brookfield.

The result of this analysis is a 20 year projection of anticipated sewage flows from the Town of Brookfield. These projected flows are estimated in five-year increments and at various ranges (low, medium and high) to account for potential variations in the assumptions on which the projected flows are based. This report is intended to serve as the basis for renewing the "InterLocal" agreement with the City of Danbury.

As indicated herein, the 10 year flow projection ranges from 80% to 95% of the current allocation of 500,000 gallons per day (gpd), depending on the specific range. Using the most conservative factors, the projection of flows in 20-years is approximately 20% to 30% of the current contractual limit. A more realistic estimate of flows projected out 20 years shows that the current treatment allocation of 500,000 gpd may not be exceeded.

Because the current economic market makes it difficult to predict the rate of economic growth, it is recommended that the WPCA maintain the current capacity commitment for the next 10 years, but re-evaluate the projection of sewer flows every 5 years. It is further recommended that the "InterLocal" agreement to allow the allocation of wastewater capacity at the treatment plant to be increased in ten-years if the updated flow projections dictate.

Background

The Town of Brookfield Water Pollution Control Authority (WPCA) is an independent utility governed by Connecticut State law. The WPCA is accountable to the CT Department of Energy and Environmental Protection (DEEP) for matters of health, safety and the environment, as it relates to sanitary sewer. This oversight includes the issue of competency and capacity.

The Board of Selectman appoints commissioners to a five-member board and three alternates to four-year terms. The WPCA is chartered to operate under Town Ordinance 71. When bonding is required, the Board of Finance, Town Treasurer and Office of the Town Controller are involved. The WPCA is responsible to its customers to handle the normal and peak sewage flows consistently, safely and cost effectively.

The State gives oversight to the regional operator to monitor the capability of the Regional Publically Owned Treatment Works (PTOW) at Danbury to handle flows from surrounding towns including Brookfield. Each town is obligated to contribute its proportional share of the capital cost and operational cost of the Danbury plant. As of the end of 2011, Brookfield contributed approximately 3% of the total flow treated at this regional plant. This equates to an average flow of just less than 300,000 gpd. The expiring 20 year "InterLocal" agreement signed in 1992 allows Brookfield to convey an average flow of 500,000 gpd.

Introduction

The Brookfield sewer system is comprised of a collection system that has over 18 miles of gravity and force main piping and ten (10) pumping stations. The collection system conveys all the sewage generated by the Town of Brookfield to a single sewage pump station, which pumps the flows to the City of Danbury for treatment and disposal. This primary pump station, known anachronistically as the "Caldor Pump Station," is located at the intersection of White Turkey Road and Federal Road.

In 2009 a major expansion of the sewer system was completed and during this same year the Brookfield WPCA transitioned from a Special Revenue Fund in the Town to an Enterprise Fund with finances separated from the Town. Consequently, the Brookfield WPCA is responsible and accountable to run the sewer operation as a stand-alone entity with a long-term view. The Brookfield WPCA has operated since 1975, and the analysis conducted as part of this report shows average daily flows over the past 30 years generally followed economic growth as measured by Grand List Value of Town properties. A history of the average daily flows recorded for the Town of Brookfield from 1981 to present can be found on the WPCA website at: http://www.brookfieldwpca.com/index.php?id=23.

Table 1 is a tabular representation of the data shown in Figure 1 below.

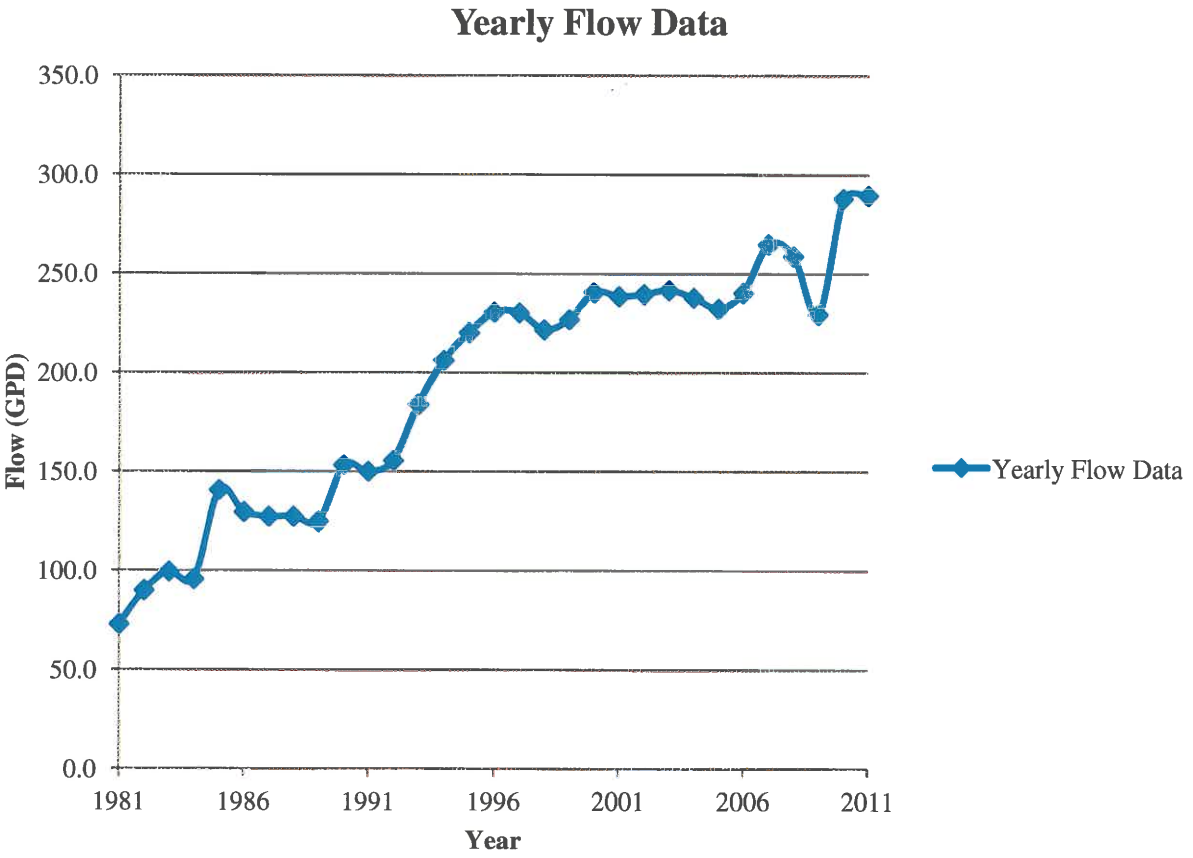

Figure 1

The Town of Brookfield is located in the northern portion of Fairfield County. It is bordered to the west by Candlewood Lake and the City of Danbury (hereinafter referred to as "Danbury"), to the north by the Town of New Milford, to the east by the Housatonic River and to the south by the Towns of Bethel and Newtown. The Town of Brookfield is comprised of approximately 20.4 square miles, of which 0.6 square miles are water bodies.

The population of Brookfield has grown from 12,870 people in 1980 to over 16,000 people in 2011. Based on this growth rate of an average of approximately 120 people per year over the previous three decades, the anticipated population in 2020 and 2030 will be 17,500 and 18,900, respectively. The average population growth rate over the past 30 years is summarized on Table 2 and shown graphically in Figure 2. For the 80's and 90s the population growth rate averaged 1% per year. For the decade of 2000, the average annual population growth was 0.5% per year.

The projected population growth rate for the next 20 years is estimated at 0.6% annually for purposes of this report. This is slightly above the growth rate for the past decade.

Population growth is a factor for predicting increases in sewage flows and it is an indicator of continued economic growth in the Town of Brookfield. The following graph compares population growth to increase in sewage flows from 1980 through June 2011. As can be seen in Figure 2, although the direct correlation is somewhat distorted by the initial creation and expansion of the sewer service area, population growth does result in increases in sewage flows. This correlation is further distorted by the rate of which properties are connected to the sewer system.

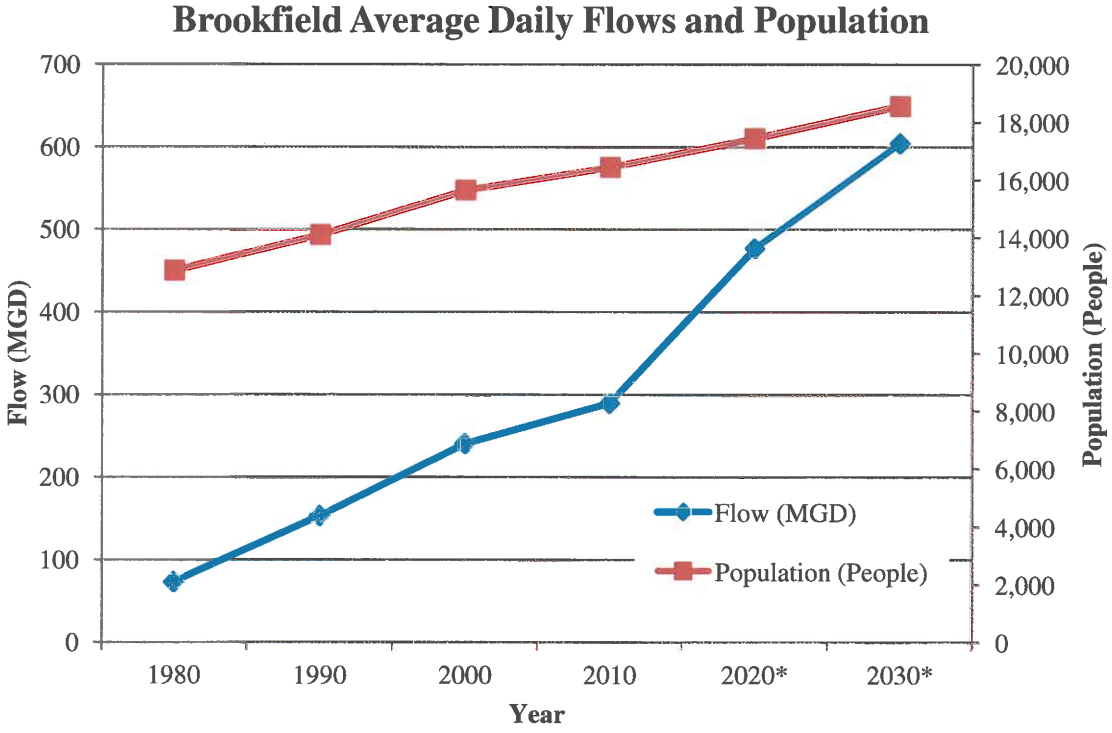

Figure 2

The Town of Brookfield contains a central industrial/commercial corridor located along Federal Road (Route 202) and Route 7 with residential and condominium complexes located along the perimeter of this central corridor. Beyond the central commercial corridor and the adjacent higher density residential developments, the remaining areas of Brookfield are mostly large acreage parcels zoned for residential use ranging in size from 1 to 2 acres and larger. These low-density residential properties are generally of adequate size and sufficient geological characteristics to accommodate on-site septic systems; and are therefore, not the focus of this analysis and have been excluded for purposes of estimating projected flows over the next 20

years. Future growth in the Town of Brookfield is anticipated to occur along the central corridor including Federal Road and Route 7 and only those outlying areas that either have or are prone to individual on-site septic system failures have been included in this analysis. Septic failures in these areas are typically due to but not limited to: soil conditions, environmental constraints and site area limitations.

InterLocal Agreement

The InterLocal agreement dated 1992 between the City of Danbury and the Town of Brookfield permits sewage discharges up to 500,000 gallons per day (GPD) to the City of Danbury sewage treatment plant. Further, the agreement allows a peak discharge of 3 times the average daily discharge during unusual flow conditions. Actual flow data collected by the WPCA is summarized in Table 1 and Table 2. The average discharge to the Danbury plant in 2011 was approximately 289,600 GPD.

The current agreement between the Town of Brookfield and the City of Danbury expires in April 2012 and must be renewed. To insure that the Town of Brookfield reserves adequate capacity in the Danbury treatment plant to accommodate future growth in the Town, Birdsall Services Group (BSG) has been retained to analyze the existing flow data for the current service area, identify areas where future expansion of the existing sewer service area is anticipated, evaluate the economic growth potential as it might impact sewer flows from the Town of Brookfield and to collate this information for the purposes of establishing a 20 year sewage flow projection.

The result of this detailed analysis is a 20 year flow projection of anticipated sewage flows from the Town of Brookfield. These projected flows, which are categorized in five-year increments and are intended to serve as the basis for renewing the agreement with the City of Danbury.

Existing Sewer Service Area

The existing sewer service area, for purposes of this report, is defined as all properties currently connected or approved to be connected to the Town of Brookfield sewer system. According to WPCA records, the sewer service areas as shown on Map No. 2, included with this report, currently services 2,887 *equivalent* units at the end of FY 2011. The term *equivalent unit* is further defined below.

Determination of Flow per *Equivalent Unit*

The WPCA's Rules and Regulations adopted on March 2, 2001 and last revised January 11, 2012 regulate fees that can be assessed to individual property owners to cover the cost of the day-to-day operation of the WPCA. The fee for a property is based on the type and size of a proposed Use which is then converted to an *equivalent unit* count. An excerpt from the WPCA's Rules and Regulations defining the number of *equivalent units* based on the type and size of use is included as Appendix 1. This conversion to *equivalent units* is the method used by the WPCA to assess fees on an equitable basis and has been the method used since the early formation of the WPCA.

For planning and design purposes the State assigns a projected flow rate for the proposed uses in accordance with Connecticut Public Health Code (CPHC) for Sewage Flows. These flow projections are utilized in the design of all infrastructure expansions or improvements. However, as detailed below, the flow projections based on the CPHC are far higher than actual flows. So the CPHC projections are extremely conservative as compared to actual flow data. To ensure the greatest level of accuracy possible in predicting the future needs of the Town of Brookfield actual flow data is used to benchmark the estimated sewage flows for an equivalent unit. This careful comparison of State suggested projected flows versus actual flow data must be made to insure the appropriate allocation of plant capacity is requested. If the 20 year projections of flow and related reservation of plant capacity is too great, the portion of the Brookfield contribution to the overall capacity of the regional POTW will be in excess of what can be beneficially used. The WPCA, using their Supervisory Control and Data Acquisition System (SCADA) can determine the actual flow characteristics across their system. Table 3 provides a summary of this data as a comparison of the average daily flow on an annual basis for recent years versus the total number of *equivalent units* connected to the system.

The average daily flow per *equivalent unit* ranges from 87 gpd to 109 gpd for the years 2007 through 2011. For purposes of estimating the annualized 20 year flow projection, BSG suggests that the actual flow data translates into an average daily flow of 100 gpd per *equivalent unit* which is a reasonable standard for use to projecting sewage flows for the next 20 years.

Design Flow versus Actual Flow

For infrastructure design purposes, the WPCA utilizes the Connecticut Public Health Code (CPHC) for Sewage Flows. The CPHC design flows are utilized in the design process to ensure that all infrastructure improvements are built to account for inflow/infiltration and peak flow conditions which are factored into the CPHC flow estimates. However, using these design flows to estimate the overall discharge to the Danbury treatment plant would result in a substantial

overstatement of the actual flows being discharged from the Town of Brookfield into the Treatment plant.

For example, per Appendix 2, Section 7.1.1 of the CPHC, a single-family dwelling with two bedrooms is considered one (1) equivalent unit (EU). Using CPHC design estimates, this would result in the following design flow: 1 EU x 300 gpd/unit = 300 gpd as compared to the average typical flow for one (1) EU of 100 gpd, based on historical data for the Town of Brookfield.

Because the agreement between the Town of Brookfield and the City of Danbury includes an allowable peaking factor of 3 times the average daily flow under unusual flow conditions, it is unnecessary to include a peaking factor in determining the appropriate flow rate per EU.

For purposes of establishing the projected 20-year flows from the Town of Brookfield and renewing the InterLocal Agreement with the City of Danbury, BSG recommends an average daily flow of 100 gpd per EU as supported by historical data. This flow rate per EU can reasonably be used to calculate the 20 year projection of flows which will then determine the appropriate allocation of plant capacity to the Town of Brookfield.

Future Sewer Limit Areas

For planning purposes, it is the intention of the WPCA to plan to include in the 20-year plan certain areas with suspected changes to the health, safety or the environment with existing on-site systems. But as part of the strategy, the plan is to create a sewer avoidance area by establishing a future Sewer Limit Area that defines the area in which public sewer service will and will not be made available in the next 20-years. Sewer service will not be provided to properties outside of the sewer limit area without declaration of a public health emergency or a finding of some other significant rationale for extending sewer service to other areas.

The goal of creating this plan for future sewer limit areas is to insure that there is adequate infrastructure and reserved plant capacity to support the desired land use patterns rather than have the availability or unavailability of sewage capacity dictate land use and future growth in the Town. Utilizing this approach, the WPCA can provide sanitary sewer service in a manner that will foster commercial and industrial development consistent with the Brookfield Plan of Conservation and Development. The goal is to support economic growth for the benefit of the Town of Brookfield in a manner consistent with the overall planning objectives set forth by other Boards and Commissions in the Town.

In establishing the future sewer limit areas several factors were reviewed. These factors included the knowledge of the Town and the current growth patterns within the Town, current zoning regulations and environmentally sensitive areas. It should be noted that the sewer limit area is

based on the information presented within this report. A description of how these factors influenced the determination of the future sewer limit areas is outlined in the sections following.

Current Growth Patterns

Based on the current growth patterns which were discussed with the Town's Planning Staff, there are four (4) categories of properties that are expected to connect to the Brookfield sewer system were identified:

- Properties that are within the existing sewer service area and are eligible to connect but are not currently connected;
- Future projects to be developed in accordance with the Brookfield Plan of Conservation and Development and current zoning requirements;
- Properties that might be developed to accommodate apartment housing; and
- Properties that are deemed to have challenges with current septic installations.

These properties were specifically identified by the WPCA and Town staff and have been summarized from the information contained within Tables 4, 5 and 6 included in the Exhibits section of this report. Table 4 includes a list of all properties that have been approved to connect by the WPCA, but have not yet been physically connected. Table 4 also includes a comparison of approved number of EUs (column 1), to the estimated number of EUs that will ultimately connect (column 2) to the actual number of EUs connected as of September 11, 2011 (column 3). The differential between columns 1 and 2 is based on past experiences of the WPCA, were the final number of EUs is in many cases less than the original planned and approved number of EUs. Column 3 also represents the number of units that each property is being assessed for the "Danbury Plant Charge." This charge is based on the number of acres of the property and is used to pay for a 1993 bond covering a major treatment plant upgrade.

Table 4, column 1 totaling to 805 EUs, represents properties that have historically been in an area eligible for sewers and on the books for capacity planning purposes. Column 2 in Table 4 is an estimate of EUs per property based on the historical connection rates Column 3 of Table 4 provides a total number of EUs actually connected to the sewer system as of September 11, 2011. These estimates of EUs base on various factors will are used to project a range of possible flows for the next 20 years. The maximum number of EUs (805) will be used to ensure that the twenty-year flow projection is inclusive of all possible build-out scenarios.

Table 5 includes planned future projects that have yet to receive the appropriate approvals from the WPCA. The numbers of EUs for each of these potential projects have been estimated based on the best available information and the underlying zoning regulations.

Table 6 includes a list of miscellaneous projects in preliminary stages of design, that have not yet received any approvals or that may be under construction. This table also includes approximately 200 EUs relating to potential future apartment units.

This analysis represents an exhaustive accounting of areas within the municipal boundary of Brookfield. The table below summarizes the total number of additional units to be included within the sewer service area. Based on input from the WPCA and Town officials the total potential is to add an additional 3159 equivalent units.

Summary of Tables 4, 5, AND 6		NUMBER of EUs		
Table	**Subject**	LOW	MED	HIGH
4	SEWER ELIGIBLE PROPERTIES NOT CURRENTLY CONNECTED	403	644	805
5	PLANNED FUTURE CONNECTION PROJECTS	978	1565	1,956
6	MISCELLANEOUS PROPERTIES WITH POTENTIAL TO BUILD	99	158	198
6	FUTURE APARTMENT UNITS	100	160	200
	SUM OF EQUIVALENT UNITS	1580	2527	3159

Current Zoning Regulations

It is the intention of the WPCA and the Town of Brookfield to provide sanitary sewer service to all properties within the municipal boundaries that cannot adequately support properly configured on-site sub-surface wastewater disposal. The future Sewer Limit Areas are represented on Map No. 3, includes all such properties, except those residential properties zoned R80 and above. These properties are generally adequate in size to support an on-site sub-surface wastewater disposal (septic) system. The lot size in the R80 and above zoning districts range in size from 80,000 square feet (1.8 acres) to 100,000 square feet (2.3 acres) and greater. Refer to Map No. 1 depicting the sewer limit areas in relationship to the Town's current zoning boundaries.

All properties that are below the R80 zone, with the exception of those areas along the central corridor that are already included in the sewer limit, have been accounted for in Tables 4, 5 and 6 for this analysis. It is intended to be an exhaustive list assembled by the WPCA and the Town. While a few properties might be misclassified, alterations to the list would not be expected to be material to the analysis. Properties not on the list are lots are considered excluded in the overall sewer limit area based on zoning.

Environmentally Sensitive Areas

Utilizing GIS information provided by the CT DEEP and the Town, a review of environmentally sensitive areas was performed. These areas include wetlands; areas that might support threatened and endangered species; floodplains; certain lake front communities; and areas with extreme

slopes. Any properties found to contain environmentally sensitive features were located outside of the sewer limit areas since there is no development potential on these lots.

All properties, regardless of their environmentally sensitive nature, that are below the R80 zoning district have already been accounted for by the WPCA; therefore, no additional lots were included based on environmentally sensitive areas.

Economic Trends

Economic trends versus sewer flows have been analyzed utilizing historical information provided by the WPCA. The purpose is to establish a correlation that might help reasonably predict future sewage flows over the next 20-years. As demonstrated in the below chart, sewer flows increase as the total Grand List Value increase. This chart compares the Grand List Value within the Town and the actual annual sewer flows. There seems to be a perturbation in Grand List Values for the period of 2005 to 2010. The October 2011 Re-evaluation process puts the GLV back on an expected track consistent with prior years. Thus for this analysis, it is useful to smooth the historical GLV numbers, and then project forward. In any event, it seems clear the increasing Grand List Value follows a similar track as the sewer flows. The Grand List Value as a measure of economic activity appears to be a good predictor of sewer flow.

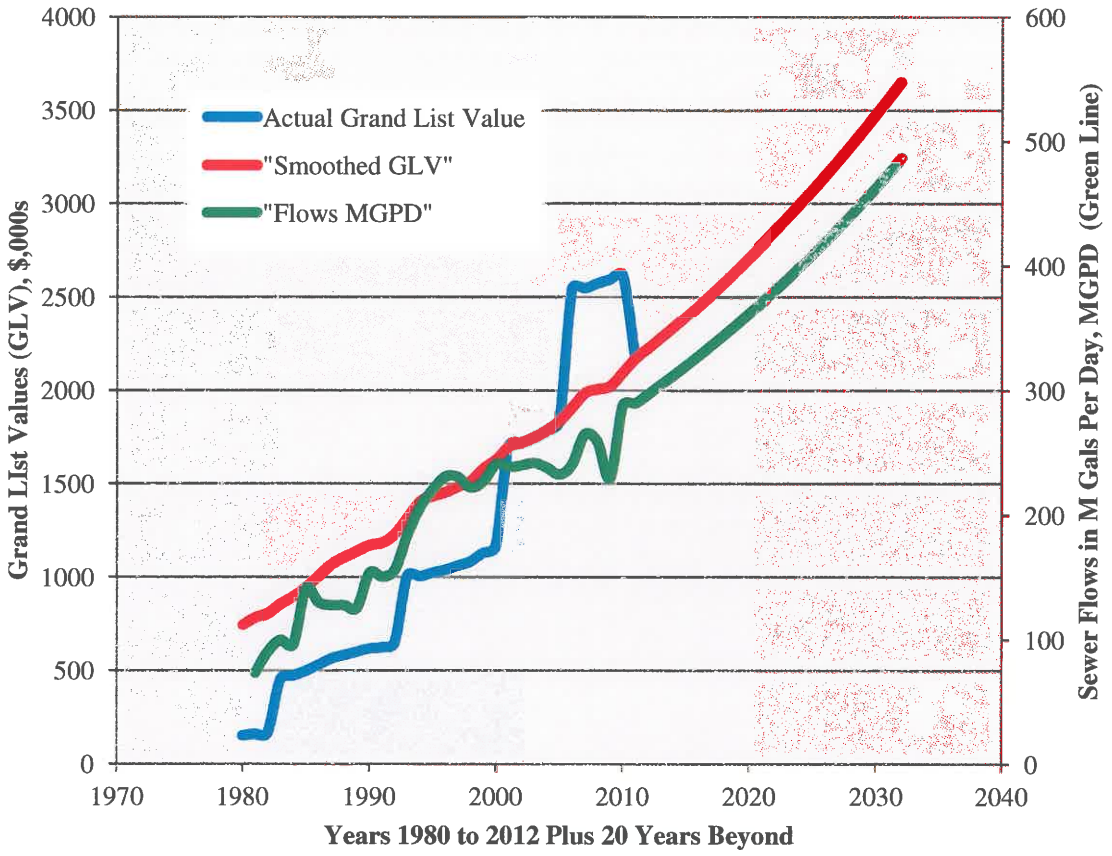

Figure 3

Future Sewer Service Area

Map No. 3 included with this report represents all properties that are currently within the existing sewer service areas that are eligible to connect but are not currently connected, future projects and miscellaneous properties within future Sewer Limit Areas. These are also represented on Tables 4, 5 and 6. All properties within the Sewer Limit Area are considered to be a part of the future plan.

Other properties have been included in the Sewer Service Area for the following reasons:

- The property is zoned less than R-80;
- The properties contain poor soil conditions or environmentally sensitive features that limit the amount of buildable area; and
- The properties have suspected on-site wastewater treatment system challenges.

Future Sewer Service Area Flow Projections

Based on the information outlined above, the future sewer service area was determined based on this area and the properties included within, and the future anticipated sewage flows were calculated. Based on the number of units included in the existing and future sewer service areas, the anticipated development potential of these parcels based on the Brookfield Plan of Conservation and Development, current zoning requirements, and accounting for environmentally sensitive areas and other development trends in the Town, the projected sewage flows generated by the Town of Brookfield over the next twenty years is shown in Table 7, included in the Exhibits section of this report.

To assist in determining when the current contract should be amended to allocate additional plant capacity, it is useful to estimate flows at 5-year increments for the next twenty years. The calculations for these projections detailed below have been summarized on the following page.

Based on this flow projection the Town of Brookfield could generate approximately 605,000 GPD of sewage in twenty years. This exceeds the currently allocated 500,000 GPD. However, it is not necessary to allocate this much capacity immediately. If the most aggressive assumptions are made as to development, that is all projects are completed and all future sewer areas are placed on-line, the average daily flow will ramp up about 600,000 GPD over time. This represents more than doubling of the current flow rate. This does not seem likely. More conservative estimates in the low range show the flows will not come to this level. A conservative flow rate estimate will project the total flow will be about 60% of the maximum possible should all properties come on-line. This rate has the total flow in 20 years rising to 485 M GPD, just under the current contracted rate. A mid-range rate at 85% of the maximum projects the 20-year rate at 550 M GPD, about 10% over the contracted rate.

Both the high and mid-range rates do not anticipate the rates will exceed the 500 M GPD for 10 years. The calculations are summarized in the Table 7 included in the Exhibits section of this report.

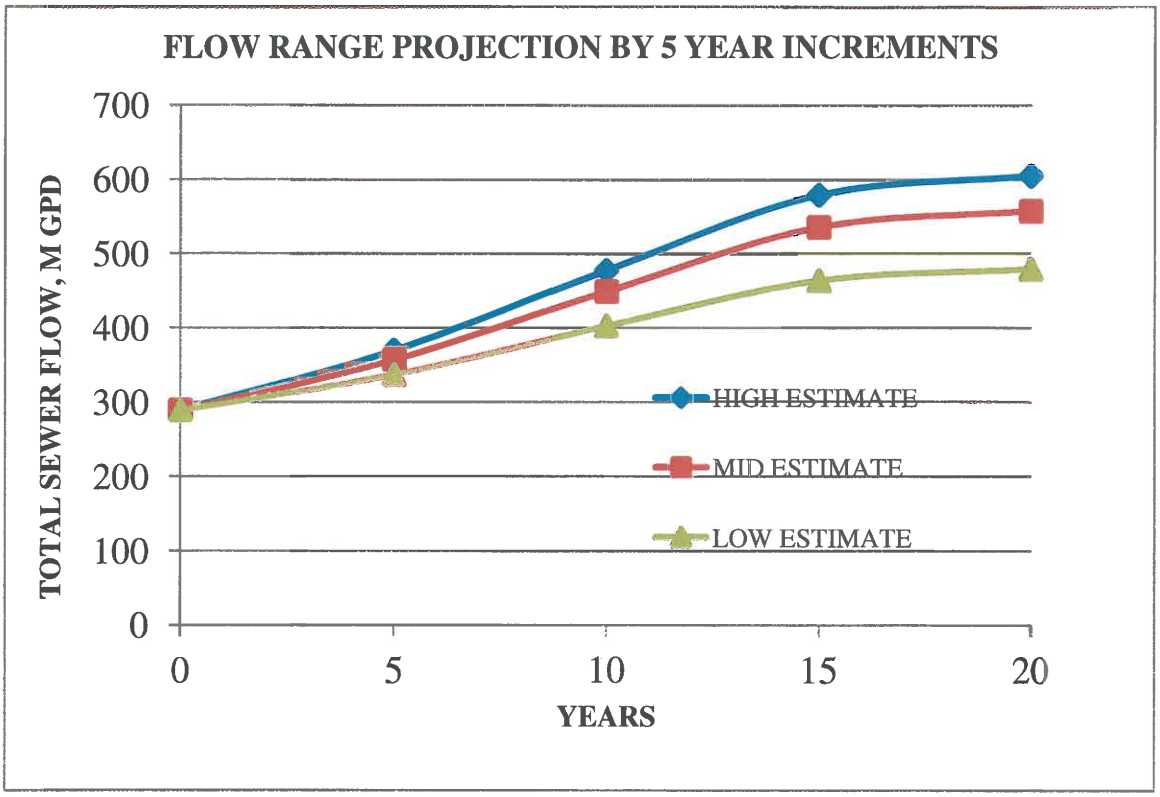

Figure 4

Five (5) Year Flow Projection

To predict the future flow rates, the WPCA conducted an exhaustive accounting of eligible properties in the town as outlined in the foregoing analysis. For purposes of this analysis it is assumed that these properties will connect within the next five-years. Taking this into account the five 5-year flow projection is as detailed in Table 7. The High flow rate assumes all of these properties will connect. The Medium rate assumes 80% will connect and the Low rate assumes 50% will connect. This ratio of 100:80:50 is used to estimate the Medium and Low rates off the Maximum predicted rates for the 10, 15 and 20 year marks.

Based on the data included in Table 7, the five-year flow projection is approximately 370,000 gpd at the high end of the estimated rates. Therefore, it is predicted that the current 500,000 gpd allocation will be sufficient for the next five years.

Ten (10) Year Flow Projection

The 10 year flow projection will assume that all of the properties that are eligible to connect but have not yet connected and approximately 50% of the properties that are planned for construction but do not currently have the appropriate approvals (future properties) will connect.

The 10 year flow projection is detailed in Table 7 included in the Exhibits section of this report. Based on this calculation the ten-year flow projection will result in a flow of approximately 477,000 gpd at the High rate. This is judged to be a fairly conservative estimation of the 10 year flow level and does approach the current capacity allocation of 500,000 gpd. It is recommended that the renewal of the InterLocal agreement include a provision that would allow Brookfield to increase their allocation of capacity in 2022.

Fifteen (15) Year Flow Projection

The fifteen-year flow projection will assume that all of the future properties that are eligible to connect but have not yet connected and the remainder of the properties that are planned for construction, but do not currently have the appropriate approvals, will connect. The fifteen-year flow projection is as detailed in Table 7, included in the Exhibits section of this report. Based on this calculation the fifteen-year flow projection will result in a flow of approximately 579,000 gpd. This projection suggests that the flows within fifteen years could exceed the current 500,000 gpd allocation. Any terms of agreement with Danbury should allow for a higher allocation in 2027.

Twenty (20) Year Flow Projection

The analysis considers most properties within Sewer Limit Area will be connected within the next 15-years. Thus an increase in flow from the 15 to the 20-year mark will be slight as remaining properties come on or there is a natural increase in economic activity. The graphical representation of this shows the sewer flow approaches an asymptotic level approaching 600,000 GPD at the upper projection.

Conclusions and Recommendations

Based on the detailed analysis presented in this report, it appears the sewage flows for the Town of Brookfield projected at 10 years will equal the current allocation of 500,000 gpd. Because the current economic market makes it difficult to predict the rate of economic growth, it is recommended that the WPCA re-evaluate the sewer service area in five years and recalculate the projected sewage flows. This would ensure that the flow projections determined in this report are within reasonable margins. Should the results indicate significant changes, based on increased development or other factors, the allocation should be increased at that time, or, if development has slowed, the allocation should remain the same.