Building Bancroft
0T-09-185-00-MA

Watermain Hydraulic Modeling
(Copy of Original)
May 2010

Prepared for:
Greenview Environmental Management
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Project No. 0T-09-185-00-MA

GENIVAR

Project No. OT-09-185-00-MA

May 6, 2010

Tyler Peters
Greenview Environmental Management
69 Cleak Avenue,
Bancroft, ON Box 100
K0L 1C0

Re: Building Bancroft
Watermain Hydraulic Modeling - Rev 2

Dear Mr. Peters:

GENIVAR's Markham office is pleased to present the results of its hydraulic analysis of the Town of Bancroft Water Distribution System as part of the Building Bancroft development study. To conduct this study, an all pipe model of the Bancroft water distribution system has been created using WaterGEMS V8i modeling software with demands associated to the existing system condition. The model is contained on CD with this report.

The report has been updated to address the comments received and includes the updated Building Bancroft Master plan. This report describes the methodology used to develop the Bancroft Water Distribution Model and the system limitations identified. Based on modeling, system upgrades have been recommended to improve system security, water quality and increase available fire flow.

Yours truly,
GENIVAR Consultants LP

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Executive Summary

In support of the Building Bancroft servicing study, GENIVAR developed a hydraulic model of the Bancroft water distribution system. Steady state simulations of the average day, maximum day and peak hour demand conditions were carried out. Fire flow simulations were conducted throughout the system to determine the modeled available fire flows under the maximum day condition. Extended period simulations were developed to estimate water age. Distribution system upgrades were added to the model to determine the most advantageous upgrades based on hydraulics, water quality and system security.

ES-1 System Limitations and Recommended Solutions

System limitations and the associated recommended solutions are summarized below. The total estimated costs of the proposed water related works is $ **$2,743,000**

Low or no fire flow capacity at the following locations:

a. Valleyview Drive
b. Bridge Street W, Manor Line, Oak Street,Mill Street
c. Forest Hill Road, Forest Hill Drive, Ridge Road
d. Developments along Chemaushgon Road
e. Sherbourne Street

The modeled available fire flow under the maximum day condition range between 150 L/s in the downtown core and less than 30 L/s in the system peripheries. Fire flows are also low for the building types along Sherbourne Street. Fire flow requirements vary depending on building construction type, size, occupancy, sprinkler protection and proximity to adjacent buildings.

To provide improved fire flow within the Building Bancroft development area, the following recommendations are made:

- Replace existing Ductile Iron watermain along Bridge Street from Billa Street to Sherbourne Street with 250 mm PVC watermain.
- Replace existing Ductile Iron watermain along Sherbourne Street from Bridge to Monck Street with 250 mm PVC watermain.

Note that increased fire flow capacity have only been considered within the Building Bancroft study area although proposed system upgrades will improve fire flows throughout the system.

Water Age in vicinity of water tower

The modeled age of water during periods of low demand can cause a potential water quality problem and requires a significant amount of system flushing to keep chlorine residuals at acceptable rates.

To improve System water quality and reduce system flushing requirements, the following recommendation is made:

- Install SCADA controlled hydraulic valve system at base of 300 mm mains from Water Filtration Plant. Automatic controllers to force water usage from tank to improve water turnover rate and reduce flushing requirements.

Water Security due to single feed to Town

The existing 300 mm cast Iron watermain from the filtration plant to the Town is over 50 years old and has very limited access for over a kilometre. It is the only source of water for the town.

Preliminary model calibration results indicate that the C-factor is approximately 50 which would coincide with a cast iron pipe of severe attack for that age.

To improve system security the following recommendation are made:

- New 300 mm watermain along Snow Road from Water Filtration Plant to Hastings Street.
- Cleaning and lining of the existing 300 mm watermain from the Filtration Plant to Hastings Street. The lining can only occur after the installation of the new pipe but could be pushed forward in the Town's capital plan.

ES-2 Building Bancroft Water Site Servicing

All site servicing water laterals of the proposed Building Bancroft structures have been assigned as 50 mm service connections. Based on building size and occupancy, all building types that will likely requiring a standpipe system and/or sprinkler system should be provided a 150 mm fire service connection.

ES-3 Existing Water System

The Town of Bancroft water distribution system services an area of approximately 4,300 ha having an estimated population of approximately 1970. The system is comprised of a filtration plant with 627,350 L of associated clear well storage; a 1,070,000 L effective volume standpipe and over 33,500 m of watermains ranging in size between 150 mm and 300 mm. There are two (2) inline booster pumps to provide localized pressure increase at Forest Hill Drive and Bridge Street West. The pumps provide residential service pressures only with no fire protection capabilities. All system pressure is provided by the elevation difference between the town and the source at Clark Lake. This elevation difference results in service pressures that range between 250 kPa and 630 kPa. The Bancroft drinking water is treated at the Bancroft Water Treatment Plant (WTP) on Snow Road with rated capacity of 3,380 m^3/day.

Water Distribution System

There are approximately 33,500 m of watermains within the Bancroft water distribution system which range in size between 150 mm and 300 mm. The first watermain installations were cast iron installed in the 1950`s. The waterworks underwent extensive upgrades in the 1980's including the WTP, elevated standpipe, two booster pumping stations and approximately 3,300 m of watermains.

ES-4 Water Demands

System water demands were estimated based on a combination of water billing, SCADA data and Community Profile from the 2006 Census. Populations and the associated water demands were distributed based on land use designations. Individual heavy users such as institutional or industrial consumers were treated in isolation. From the available data, approximations for the average persons per unit (ppu), average water consumption per person and average commercial/industrial/institutional demands were determined. Geographic information system (GIS) mapping and database management was employed to allocate the populations and demands according to land parcels provided by the County of Hastings GIS and Mapping department.

The average daily demand was determined from billing information provided by the Town of Bancroft and metered flow data from the Bancroft Filtration Plant. The total 2009 billed water was given as 221,037 m^3 while water leaving the Bancroft Water filtration plant for the year 2009 was 354,385 m^3 representing 127,829 m^3 of unaccounted for water. The most common reasons for discrepancies between metered usage and the total water leaving the plant are leakage, errors in measurement, and unmetered usage. In the case of the Town of Bancroft water distribution system, flushing operations account for a significant amount of water usage which does not appear in the billing records. This unaccounted for water was added back to the system based on population distribution and locations of know flushing.

Growth in the Town of Bancroft

Consumer demands bases on the Building Bancroft development plan will result in an additional 122.8 m^3/day (1.42 L/s) of average day flow to the distribution system with an estimated Peak flow of 4.26 L/s. These are design numbers and represent a conservative estimation of the developments demands on the system. True development demands on the water distribution system may be less.

Fire Flow

The fire flow demands of the system exceed the consumer demands making fire flow govern the system design. Required fire flow for the Building Bancroft design area was calculated based the ISO Required Fire Flow as referenced by the Fire Underwriters Survey and the Office of the Ontario Fire Marshal Fire Protection Water Supply Guideline. The Fire underwriters flow requirement is the specified quantity for property loss prevention, while that specified by the Ontario Fire Marshal is the requirement to allow for life safety and evacuation. Consequently, the available flow requirements based on the Fire Underwriters is significantly higher than that specified by the Ontario Fire Marshal.

ES-5 System Model

An all pipe model of the water distribution system including pipes, hydrants, storage tanks and system source was created using WaterGEMS V8i hydraulic modeling software. The model was developed from GIS data of system components provided by the County of Hastings GIS and Mapping Department. Model calibration was performed by associating modeled pipe friction loss parameters with field data collected by GENIVAR staff. Calibration data was inputted into the model using WaterGEMS genetic calibrator. WaterGEMS Darwin® Calibrator finds a calibration solution that matches measured flows, pressures, and element status according to user defined parameters.

Within a hydraulic model, head loss through pipes is a function of the Hazen-Williams C-factor. The system calibration results are within the range of expected values and tend to be at the low end of the scale for older pipes indicating that they have a significantly reduced carrying capacity compared to new installations. Some of the low C-factors indicate potential severe attack on the ductile and cast Iron pipes.

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1. Introduction

In support of the Building Bancroft servicing study, GENIVAR developed a hydraulic model of the Bancroft water distribution system. Steady state simulations of the average day, maximum day and peak hour demand conditions were carried out. Fire flow simulations were conducted throughout the system to determine the modeled available fire flows under the maximum day condition. Extended period simulations were developed to estimate water age. This report contains detailed descriptions of the Bancroft water distribution system the modeling procedure and the simulation results. Distribution system upgrades were added to the model to determine the most advantageous upgrades based on hydraulics, water quality and system security.

2. Water System Background

The Town of Bancroft's water system services an area of approximately 43 km^2 (4,300 ha) representing an estimated population of approximately 1,970 people. The system is comprised of a Water Treatment Plant (WTP) with clearwell storage; a standpipe and over 33,500 m of watermains ranging in size between 150 mm and 300 mm. There are two (2) inline booster pumps to provide localised pressure increases at Forest Hill Drive and Bridge Street West. The pumps provide residential service pressures only and offer no fire protection capabilities. The Town's water distribution system is shown in Figure 2.1. A detailed drawing of the distribution system is found in Appendix A.

The Town's waterworks were upgraded in the 1980's including the WTP, elevated standpipe, two booster pumping stations and approximately 3,300 m of watermains. As part of these installations, a new 450 mm raw water intake main was installed 4 m deeper than the original in Clark Lake.

2.1 Water Source and Treatment

The Bancroft drinking water is sourced from Clark Lake and treated at the Bancroft Water Treatment Plant (WTP) located on Snow Road. The treatment plant was constructed in 1985 inline with an existing 300 mm watermain from Clark Lake to Hastings Street parallel to Snow Road through a ravine to the North. The plant is optimally located such that the raw water can flow through the treatment plant and into the Town without utilising pumps before or after the process. Prior to the plant installation, raw water was chlorinated at the base of the 300 mm transmission watermain before distribution to the Town.

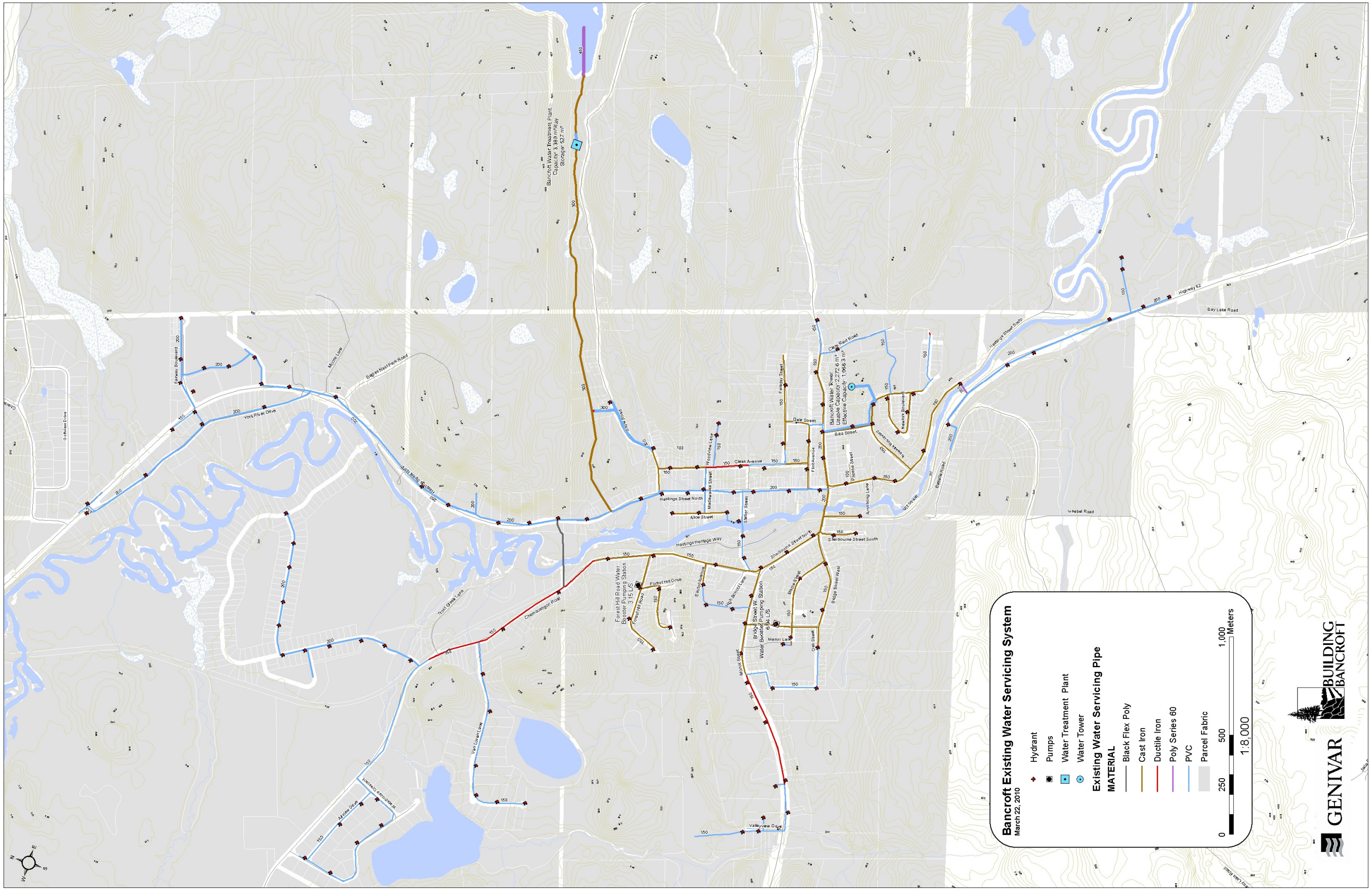
The Bancroft Water Filtration Plant houses two (2) packaged water treatment units consisting of rapid mix, flocculation, settling and filtration. Chemical disinfection occurs at the filtration plant with a re-chlorination system located at the outlet of the Town's water storage standpipe.

2.2 Water Storage

The distribution system energy is provided by the elevation difference between Clark Lake and the Town. Clark Lake has an average elevation of 396 m and drought level of 394.7 m. System pressure is governed by the WTP clearwell with 627,350 L of storage at elevations that range between 385.1 m and 386.1 m (1.5 m to 2.5 m tank depth). For water serviced areas within the Town, the ground elevations range between 321 m and 394 m, excluding the two zones with booster pumps. This elevation difference results in service pressures between 260 kPa to 630 kPa.

Bancroft's elevated standpipe is 12.2 m (40 ft) in diameter and 24.4 m (80 ft) in height. It is steel construction with an overall useable capacity of 2,272 m^3 (600,000 gal). The tank has an effective capacity to maintain service pressure for 1,068 m^3 (235,000 gal).

Figure 2.1 Existing Water Servicing Map



2.3 Water Distribution System

There are approximately 33,500 m of watermains within Bancroft's water distribution system that range in size between 150 mm and 300 mm. The Town's first watermains were made of cast iron and installed in the 1950s. A single main distribution line from the WTP to Hastings Street is part of this original installation. Many of the watermains within the downtown core have been replaced with PVC pipes.

Booster pumping stations were installed at Forest Hill Drive and Bridge Street West with rated capacities of 3.15 L/s and 6.94 L/s, respectively. These stations provide service pressures only and are not intended for fire protection. Both of these pumps have reached the end of their service life and are scheduled for replacement. At the time of this report, one of two pumps at the Bridge Street West booster station are to be replaced as well as the single booster pump at Forest Hill Road pending budgetary approval. A second pump at the Bridge Street booster station is scheduled for replacement under the 2011 capital budget.

Supervisory Control And Data Acquisition (SCADA) is in place at the WTP and the standpipe tank. The system is comprised of two flow monitors and tank level monitors. The flow monitors measure the raw water intake and treated water outflow at the WTP while level monitors provide readings on the clearwell and standpipe tank levels. A free chlorine residual analyzer intended for sampling treated water from the clearwell communicates with a 300 mm-diameter electrically actuated shut-off valve on the treated water outflow header to prevent treated water from entering the distribution system with high or low chlorine residuals. The shut-off valve will also close upon high turbidity, loss of power and low clearwell level.

2.4 Regulatory Framework

The Town of Bancroft Water Distribution System is regulated by the Ontario Ministry of the Environment (MOE) under the **Ontario Water Resources Act** R.S.O. 1990 c. O.40 and the **Safe Drinking Water Act**, 2002, S.O. 2002, c. 32.

A MOE issued permit to take water (PTTW) limits water taking from Clark Lake to 3,380 m^3/day. The water system, including the water treatment plant, instrumentation and controls, storage and distribution is regulated under a Certificate of Approval (C of A) issued March 16, 2009.

The water and wastewater systems are operated on behalf of the Town by the Ontario Clean Water Agency (OCWA), providing management, operation, administration, routine maintenance services, ensuring regulatory compliance and smooth day to day operations. All non-routine maintenance and capital costs for repair and installation of new works are the responsibilities of the Town of Bancroft.

The C of A-specified rated capacity of the treatment plan is 3,380 m^3/day, equal to the limit on the PTTW. The C of A allows for the system to be operated above this rated capacity for the purposes of fire fighting and maintenance of the drinking water system while the PTTW does not contain this *Increase to Rated Capacity* clause and may result in a conflict between regulations. It is recommended that an amendment to the PTTW be made to include this clause.

The MOE PTTW and C of A as well as the water and wastewater operating agreement are contained in Appendix B for reference.

3. Water Demands

The system's water demands were estimated based on a combination of water billing, SCADA data and Community Profiles from the 2006 Census. Populations and the associated water demands were distributed based on land use designations or specified by land parcel for individual heavy users such as institutional, commercial or industrial consumers. From the available data, approximations of the average persons per unit (ppu), average water consumption per person and average institutional, commercial and industrial demands were determined. Geographic Information System (GIS) mapping and database management was employed to allocate the populations and demands according to land parcels provided by the County of Hastings GIS and Mapping Department. Land use and population distribution mapping are contained in Appendix C while graphical analysis of SCADA data is contained in Appendix D.

3.1 Population Distribution

In order to determine the population distribution throughout the Town, 2006 Census Community Profiles were compared against land use designations as described in the Town of Bancroft Zoning By-Law Map (No. 27-2007). The County of Hastings *Official Plan Vacant Land Use Survey: Water & Sewer map* for the Bancroft Urban Area as well as Google Earth and Google Street View imaging were used to identify locations of existing users.

To determine the populations served within the water distribution servicing area, all GIS parcels within the Bancroft Urban Area were coded according to water and sanitary servicing and the Zoning By-Law Map. Census GIS mapping indicating the total populations from the 2001 census were available for four (4) distinct regions of Bancroft and is available in Appendix C as well as mapping showing the land parcels with existing water and sanitary servicing.

The 2006 Census Community Profile divides the occupied private dwellings by characteristics of single-detached, semi-detached, row house and apartment dwellings. According to the 2006 Census, the average Bancroft household is 2.2 ppu. It has been assumed that 100% of the semi-detached, row houses and apartments were contained within the Bancroft water-serviced area representing 490 individual units. The Census Community Profiles did not provide the average ppu for all dwelling types, as such an estimated 1.3 ppu were applied to all of theses units resulting in an estimated population of 637 residing in attached dwellings. This population was then distributed across land parcels with Multiple Residential land use designations based on plot size. Population distribution was manually adjusted to account for large parcels that may bias the population allocation.

Once the Multiple Residential population was allocated, the remaining populations within the Census distribution parcels were allocated to residential parcels with known existing dwellings. This allocation resulted in an average of 2.84 ppu for fully detached units. Based on this analysis, the total estimated population with municipal water servicing is 1971 people.

3.2 Water Consumption Distribution

Water consumption rates used in the hydraulic model were based on the average day demands derived from annual consumption for 2009. Peaking factors were applied to average day demands to account for seasonal and time-of-day variations as well as unaccounted-for water usage.

To facilitate the water demand allocation, the Town of Bancroft provided a summary of 2009 water billing data separated by residential and non-residential consumers. A selection of individual 2009 billing summaries for heavy users such as the hospital, schools and large commercial consumers was also provided.

The 12-month average water demands were added to the individual GIS parcels for heavy users. The sum of heavy user demands was then subtracted from the total commercial billing and the remaining commercial consumption was distributed across parcels with existing commercial, industrial or community facility land use designations based on parcel size. Manual adjustments were made for large parcels with small structures to avoid biasing the distribution.

3.2.1 Average Daily Demand

The average daily demand was determined from billing information provided by the Town of Bancroft and recorded data of the Bancroft WTP outflow. The total volume of water leaving the Bancroft WTP in 2009 was 354,385 m^3, while billed water was 226,556 m^3 representing 127,829 m^3 of unaccounted for water.

3.2.1.1 Billed Water

The total annual daily demand based on Town billing data for residential and non-residential water usage for 2009 was given as 97,541 m^3 and 129,015 m^3 respectively. The residential water billing data was distributed by population while non-residential consumptions were distributed by parcel area as described in section 3.1 for all parcels with water service.

3.2.1.2 Unaccounted For Water

In a typical distribution system, the most common reasons for discrepancies between metered usage and the total water leaving the plant are leakage, errors in measurement, and unmetered usage. In the case of the Town of Bancroft, flushing operations account for a significant amount of water usage which does not appear in the billing records.

Leakage

Graphical analysis of the water measured from the plant shows that the period of lowest demand occurs in mid-March. During this period, the absolute lowest flow from the treatment plant is approximately 2 L/s which translate to 172.8 m^3/day. Note that this low flow occurs in early morning hours with the tank level stable and not contributing to flow. Because there were no significant night-time water demands identified on the system during the study, this flow was assumed to be leakage. This system loss accounts for approximately 18% of the total annual water usage and was distributed evenly throughout the system.

Flushing

Full system flushing occurs in May and October. As well, there are three automatic flushers at Mill Street, Williams Drive and Bridge St E. The spring and fall system flushing uses approximately 420 m^3 of unaccounted-for water. No other events of high demand such as watermain breaks or fires were identified to have significantly contributed to unaccounted-for water in 2009.

Graphical analysis of the tank level indicates that the nightly flushing at these three sites results in as much as 75 m^3 of water usage per day within a 2-hour period of flushing, or approximately 27375 m^3 annually. The nightly flushing accounts for approximately 8% of total water supplied annually from the treatment plant. The true loss due to flushing will vary depending on duration. The quantity reported by OCWA totals 30 m^3 per day for this flushing. At the time of this report, the existing triggering cycle of the flushers is unknown and warrants further investigation.

Billing Discrepancies

Removing the leakage and flushing, the remaining unaccounted-for water is 72.2 m^3 per day and was distributed evenly across the residential population.

3.2.2 Unit Rates

The demands associated with the Bancroft Water Distribution System are summarized in Table 3.1. Note that demands for the year 2009 are based on an estimate of the serviced population and do not constitute demand values for design purposes. The unit rates can fluctuate by year depending on climate conditions and the true serviced population. The recommended design demand for new developments is 270 L/person/day which is at the low end of the range recommended by the MOE *Design Guidelines for Drinking-Water Systems*. Demands associated with future employment and institutional land uses should be determined on a case by case basis according to the particulars of the development.

Table 3.1 Demand Factors

Population	
Type of Housing	**Persons / Unit**
Single Family Dwelling	2.84
Semi-detached, Row Houses, Apartments	1.3

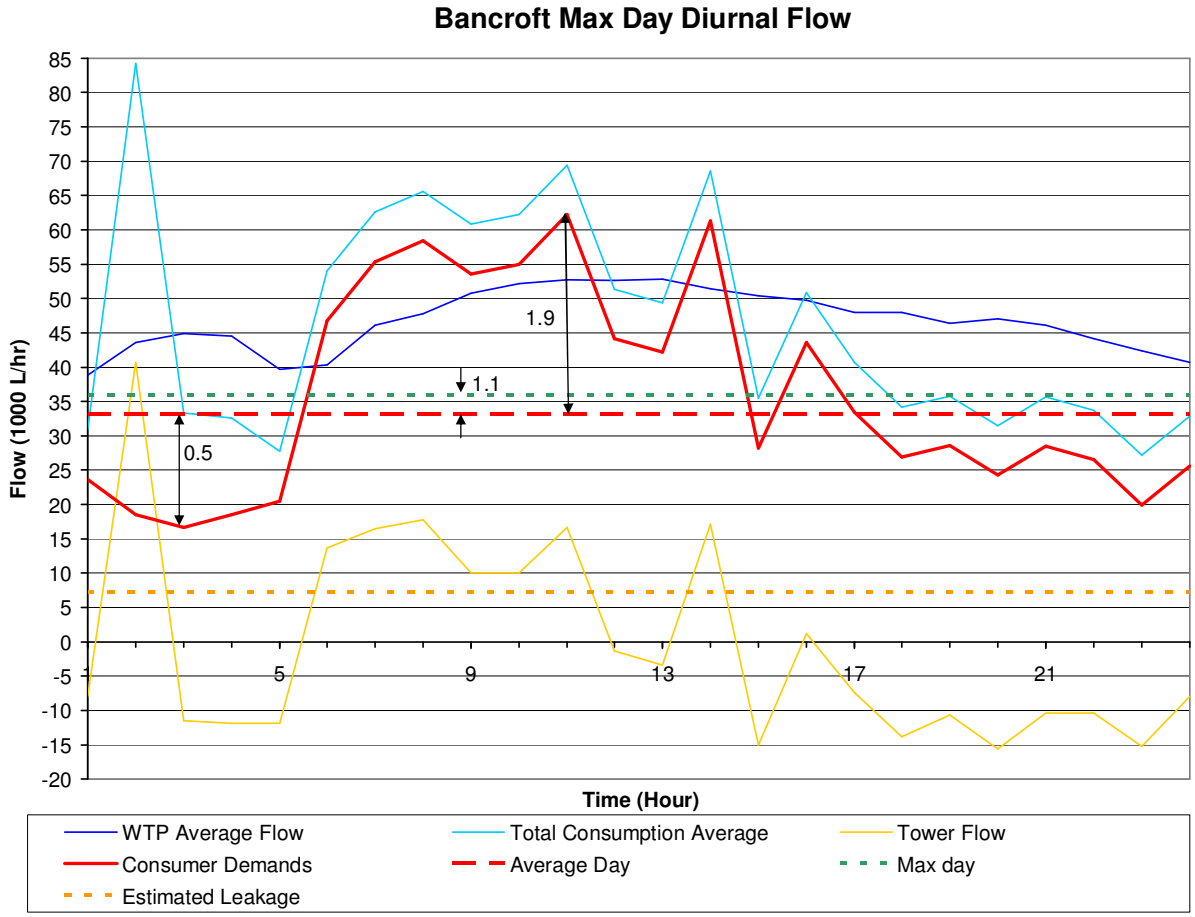
Demand		
Average Day	173	L/Person/day
Employment	2500	L/ha/day
Institutional	2500	L/ha/day

3.3 Diurnal Curve

The variations in water usage for municipal water systems follow a 24-hour cycle called a diurnal demand pattern. A system-wide diurnal curve was derived from SCADA data provided by OCWA for the flow leaving the treatment plant and the level changes in the standpipe tank. The period of maximum demand was found to be during the month of August. By averaging the results over a one week period, the diurnal curve with one (1) hour time steps was produced as shown in Figure 3.1.

The diurnal curve shows the significant impact of nightly system flushing activities. These flushing demands were added manually to the modeled system at the flushing locations. This flushing volume and the leakage as described in Section 3.2.1.2 was removed from the diurnal curve. The resulting demand pattern was applied to all system demands.

Figure 3.1 Diurnal Curve, System-Wide



3.4 Peaking Factors

The peaking factors are calculated as the ratio of Average Day demand to Maximum Day and Peak Hour demands. The peaking factor developed from the diurnal curves described in section 3.3 is shown in Table 3.2

Table 3.2 Demand Factors

Peaking Factors	
Max Day	1.1
Peak Hour	1.9

Design peaking factors applied to new developments should follow the MOE *Design Guideline for Drinking-Water Systems for populations between 2,000 and 3,000* of 2.25 and 3.38 for Maximum Day and Peak Hour, respectively.

3.5 Growth in the Town of Bancroft

Consumer demands based on the Building Bancroft Development Plan will result in an additional 122.8 m^3/day (1.42 L/s) of Average Day flow to the distribution system with an estimated Peak hour flow of 4.26 L/s. These design numbers represent a conservative estimate of the development demands on the system. True development demands on the water distribution system may be less.

Based on the Bancroft Zoning By-Law Map, a significant amount of potential developments may take place along Monck Street. At time of reporting, the development demands associated with this area have not been determined, but may represent a significant demand on the distribution system. Further analysis of the distribution system will be required prior to build-out of this area.

3.6 Fire Flow

Based on size and population serviced, fire flow requirements exceed consumer demands and governs the system design. Fire flow requirements vary depending on building construction type, size, occupancy, sprinkler protection and proximity to adjacent buildings. The minimum fire flow recognized by the Fire Underwriters survey is 2,000 L/min (33.3 L/s).

Required fire flow for the Building Bancroft design area was calculated based the ISO Required Fire Flow as referenced by the Fire Underwriters Survey and the Office of the Ontario Fire Marshal Fire Protection Water Supply Guideline. The Fire Underwriters' flow requirement is the specified quantity for property loss prevention, while that specified by the Ontario Fire Marshal is the requirement to allow for life safety and evacuation. Consequently, the flow requirements based on the Fire Underwriters is significantly higher than that specified by the Ontario Fire Marshal. The fire flow requirements are listed in Table 3.3. These fire flow requirements are comparable to those of existing surrounding buildings.

Table 3.3 Required Fire Flow

Building Code	Facility	Fire Underwriters Survey (L/min)	Office of Fire Marshall (L/min)
CS1	Community Facilities	4,000	2,700
CS2	Medical Clinic	6,000	2,700
CS3	Liquor Store	3,000	1,800
CS4	Post Office	5,000	1,800
GS1	Town Centre	4,000	2,700
HA1	Library	3,000	2,700
HA2	Heritage Attraction	10,000	3,600
HA3	North Hastings Museum	2,000	1,800
HA4	Train Station	2,000	1,800
M1	Motel	9,000	3,600
CR1	Commercial/Retail	2,000	1,800
CR2	Commercial/Retail	3,000	1,800
CR2A	Commercial Theatre	6,000	2,700
CR3	Commercial/Retail	2,000	1,800
CR4	Commercial/Café	3,000	1,800
CR5	Commercial/Retail	3,000	1,800
CR6	Commercial/Retail	2,000	1,800
CR7	Commercial/Retail	2,000	1,800
CR8	Commercial/Restaurant	3,000	1,800
CR9	Commercial/Retail	2,000	1,800
CR10	Commercial/Retail	2,000	1,800
CR11	Commercial/Retail	2,000	1,800
CR12	Commercial/Retail	2,000	1,800
CR13	Commercial/Retail	2,000	1,800
RE1	Condominiums	12,000	3,600

4. Water System Model

In support of land development activities taking place in the Town of Bancroft, a hydraulic water distribution model was created to simulate the Bancroft Water Distribution System. An all-pipe model of the system including pipes, hydrants, storage tanks and system source was created using Bentley Systems' WaterGEMS V8i hydraulic modeling software.

Simulations including steady-state analysis of the Average Day, Maximum Day and Peak Hour demand conditions were carried out using the model. Fire flow simulations were carried out throughout the system to determine the modeled available fire flows under the Maximum Day condition. Extended period simulations were developed to calibrate the model to observed SCADA tank and flow rates and to estimate water age throughout the system.

Water distribution upgrades were added to the model to determine the most advantageous upgrades based on hydraulics, water quality and system security.

4.1 Model Development

The model was developed from GIS data of system components provided by the County of Hastings GIS and Mapping Department. The watermains, hydrants and tanks were added to the model directly from the GIS shapefiles. WaterGEMS software was used to add demand junctions at all pipe connections and intersections. Automatic queries were employed to find duplicated junctions, pipe crossings and pipe split locations and manual adjustments were made to correct errors in the automatic junction creation. Most hydrants were added to the system offset from the watermains and were "orphaned" within the model. Hydrant laterals were added to connect the hydrants to the modeled system.

The tank and clearwell base elevations were taken from as-built drawings provided by the Town while triggering levels were provided by OCWA. All junction and hydrant elevations were associated to Ontario Base Mapping (OBM) elevation contours.

Demands were added to the system junctions by associating the demands contained within land parcels described in Section 3 with the closest junction.

4.2 Model Calibration

Model calibration was performed by adjusting modeled pipe friction loss parameters to coincide with field data collected by GENIVAR staff. Demand allocation and distribution was performed according to the descriptions given in Section 3.

System testing was limited by the risk of poor water quality issues during hydrant flowing activities. All hydrant testing within the Town Center needed to be performed during low usage periods between 11:00 pm and 6:00 am with advanced public notice advising of the possibility of discoloured or sediment-laden water.

On December 10, 2009, digital pressure sensors and data loggers were installed on water appurtenances at the Main Line Valve House, Hastings Street Sewage Pumping Station (SPS), Forest Hill SPS and at the Valleyview SPS. These sensors remained in place between December 10 and January 13, 2010. The pressure loggers were able to monitor system pressures through this period which included several hydrant flowing activities on December 10th and the night of January 11th.

Hydrant testing was performed using 1" and 2" Pitotless Nozzles^{tm} which allow for accurate measurement of flow by tapering from the 2½" port to a 1" or 2" opening. The pressure resulting from the constriction measured at a gage port along the nozzle shaft can be directly converted to a measurement of flow. This method can produce far more accurate flow measurements with less sources of error than the classic pitot measurement of flow from a hydrant.

Each hydrant test was used to create a calibration set which included one large flow, up to two pressure sight gauge readings and up to four e-log pressure recordings. Each test was performed with varying

flows and system valve conditions and the SCADA data was acquired for the same time period. System demands were adjusted to match the flow from the treatment plant during the same period.

Calibration sets were inputted into the model using WaterGEMS' genetic calibrator. WaterGEMS' Darwin® Calibrator finds a calibration solution that matches measured flows, pressures, and element status according to user defined parameters. The genetic process produces populations of potential solutions and the search evolves throughout generations, improving the features of potential solutions until a solution is achieved that falls within the defined parameters.

For accurate calibration, all test locations were surveyed for elevation by GENIVAR personnel to provide an accurate depiction of the Hydraulic Grade Line (HGL) at individual test locations. Detailed graphical analysis of pressure logs and hydrant test results are contained in Appendix E.

4.2.1 Calibration Results

Within a hydraulic model, head loss through pipes is a function of the Hazen-Williams C-factor. The Hazen-Williams formula is an expression of the pipe carrying capacity. High C-factors represent smoother pipes and lower C-factors represent rougher pipes. C-factors range depending on pipe material, age and diameter. Expected C-factor values are contained in Appendix-E.

The calibration C-factor results are within the range of expected values and tend to be at the low end of the scale indicating that the pipes may have a significantly reduced carrying capacity compared to new installations. Some of the low C-factors indicate potential severe corrosive attack on the ductile and cast iron pipes.

Of particular note, the modeled C-factor of the 300 mm mainline form the treatment plant to the town was found to be 50, which is consistent with a severe attack on the pipe by corrosion and sediment build-up.

Note that input data were obtained in winter conditions which limited field collection abilities. The calibration results are based on these data. At time of reporting, it is GENIVAR's intent to retest the system during the spring flushing activities to further fine tune the system model.

5. System Limitations

System limitations and the associated recommended solutions are summarized in this section. The total estimated costs of the proposed water related works is $ **$2,743,000**.

5.1 Fire Flow Capacity:

The modeled available fire flow of the system under the maximum day condition ranges between 150 L/s in the downtown core and less than 30 L/s in the system peripheries. The Detailed available fire flow maps of the existing system and of proposed upgrades are presented in Appendix E.

Low or no fire flow capacities have been identified at the following locations:

f. Bridge Street W, Manor Line, Oak Street, Mill Street
g. Forest Hill Road, Forest Hill Drive, Ridge Road
h. Developments along Chemaushgon Road
i. Sherbourne Street
j. Valleyview Drive

Low flows are defined as available fire flows that do not meet the requirements of proposed structures while no fire flow is defined as that being less than 2,000 L/min

To provide improved fire flow within the Building Bancroft Development Area, the following recommendations are made:

- Replace existing ductile iron watermain along Bridge Street from Billa Street to Sherbourne Street with 250 mm PVC watermain.

- Replace existing ductile iron watermain along Sherbourne Street from Bridge to Monck Street with 250 mm PVC watermain.

Note that increased fire flow capacity has only been considered within the Building Bancroft Study Area although proposed system upgrades will improve fire flows throughout the system.

5.2 Water Age

The modeled age of water during periods of low demand can cause a potential water quality problem and requires a significant amount of system flushing to keep chlorine residuals at acceptable level. Water Age Analysis is presented in Appendix E which shows the modeled water age under Average Demand conditions throughout the system. The locations of greatest age are found in the vicinity of the water tower and are symptomatic of a low turnover rate within the tank. Note that this age analysis is conducted with nightly system flushing built into the model.

To improve System water quality and reduce system flushing requirements, the following recommendation is made:

- Install a SCADA-controlled hydraulic valve systems at base of the existing and proposed 300 mm mains from the WTP. Implement automatic controllers to force water usage from the tank to improve water turnover rate and reduce flushing requirements.

5.3 Water Security

The existing 300 mm cast iron watermain from the WTP to the Town is over 50 years old and has very limited access for over a kilometre. It is the only source of water for the town.

Preliminary model calibration results indicate that the C-factor is approximately 50 which would coincide with a cast iron pipe of severe corrosive attack for that age.

To improve system security the following recommendations are made:

- Install new 300 mm watermain along Snow Road from WTP to Hastings Street.
- Cleaning and lining of the existing 300 mm watermain from the WTP to Hastings Street. The lining can only occur after the installation of the new pipe but could be pushed forward in the Town's capital plan.

The cleaning and lining of the existing 300 mm watermain will be challenging due to the length of this watermain (1,900 m), the layout of the land and limited access. There are two potential lining solutions that have been identified as part of this investigation, slip-lining a smaller diameter pipe or cleaning and lining with a Cured in Place Pipe (CIPP) liner. The method selected will depend on site conditions and will require further investigation. Depending on scheduling and funding sources, the Town may wish to twin the proposed new 300 mm along Snow Road and abandon the existing watermain. For budgetary purposes, the more expensive of the two methods has been assumed.

Option 1 – Slip-lining smaller diameter pipe:

> This will require a cleaning process, either through drag scraping or pressure jetting. By using this method, a contractor can line sections of up to 500 meters at a time, depending on access points and staging areas. Assuming that there would be approximately 4 staging/access areas along the path for, the estimated cost for this is $540,000

Option 2 - Cleaning and lining with a CIPP liner (300 mm)

> This process will require a pressure jetting operation. By using this method the contractor can line a maximum of 200 meters at a time, depending on access points and staging areas. Assuming that there would be approximately 10 staging/access areas along the path, the estimated cost is $785,000 for this method.

6. Building Bancroft Water Site Servicing

As part of the Building Bancroft site servicing analysis, all proposed Building Bancroft sites have been preliminarily assigned as 50 mm service connections. This is a conservative estimate and can likely be reduced once the detailed design of individual structures has been determined. Water service lines and meters should be sized according to AWWA Manual M22 according to the fixture method.

Buildings along the banks of the York River will not have water service connections immediately available and will require additional watermain installations within the Building Bancroft Site. These additional watermains include a 150 mm watermain loop between Hastings Street and Station Street and a 100 mm watermain between the main cluster of proposed buildings and Bridge Street. The Building Bancroft Site Servicing Plan is contained in Appendix F.

Buildings requiring a standpipe and/or sprinkler systems are outlined in the Ontario Building Code (OBC) Part 3 and depend on occupancy calcification, number of storeys and building area. All building types that will likely require a standpipe system and/or sprinkler system have been provided a 150 mm fire service connection within the model.

7. Conclusions and Recommendations

Based on the modeling and water distribution analysis the following recommendations are made

- It is recommended that an amendment to the PTTW be made to include the same exceedance clause allowing for fire flow and system flushing that is contained in the WTP C of A.
- Determine the exact triggering cycle and flow of system flushers to improve model calibration and verify associated water usage.
- Retest the system during the spring flushing activities to further fine tune the system model.
- System upgrades including the following:
    - Replace existing ductile iron watermain along Bridge Street from Billa Street to Sherbourne Street with 250 mm PVC watermain.
    - Replace existing ductile iron watermain along Sherbourne Street from Bridge to Monck Street with 250 mm PVC watermain.
    - Install a SCADA-controlled hydraulic valve system at base of the existing and proposed 300 mm mains from the WTP. Implement automatic controllers to force water usage from the tank to improve water turnover rate and reduce flushing requirements.
    - Install new 300 mm watermain along Snow Road from WTP to Hastings Street.
    - Cleaning and lining of the existing 300 mm watermain from the WTP to Hastings Street.
- Prior to any commercial development along Monck Street, the development demands should be determined and further analysis of the distribution system will be required to evaluate system requirements to facilitate adequate site servicing in this commercial zoned area.

Appendix A

Bancroft Water Distribution System

List of Contents

Item	Description
Water Distribution System Map	24” × 36”

Appendix B

Permit, C of A, Agreements

List of Contents

Item	Description
Permit To Take Water No 8778-72SNQD	8 pages
Amended Certificate of Approval for the Bancroft Water Treatment Plant MOE No 5191-7LKR8H	14 pages
Water And Wastewater Operating Agreement	29 pages

Appendix C

Population Distribution and Water Demand Allocation

List of Contents

Item	Description
Bancroft Zoning by Land use	Drawing 11” × 17”
Bancroft Vacant Land	Drawing 11” × 17”
2006 Community Profiles	3 pages
Bancroft Census Population Zones	Drawing 11” × 17”
Bancroft Water and Sanitary System Key User	Drawing 11” × 17”
TOWN OF BANCROFT Water and Sanitary Servicing	Drawing 11” × 17”

Appendix D

SCADA Analysis

List of Contents

Appendix E

Model Calibration inputs and results

List of Contents

Item	Description
Model Calibration and Analysis	Text (1 page)
Calibration Test Locations	Drawing 11” × 17”
January 12 to January 13 system response	Graph (1 page)
Data from SCADA & E-log sensors corrections graph	Graph (1 page)
Flow tests 1 through 5	Graph (5 pages)
Model Outputs: Pipe C- Factors Fire Flow Existing Condition Fire Flow With Recommendations Water Age Existing Condition Water Age With Recommendations	Drawing 11” × 17” (5 pages)

Appendix F

Building Bancroft Site Servicing Plan

List of Contents

Item	Description
Build Bancroft Site Servicing Plan	Drawings 24” × 36”
Recommended Water System Upgrades	Drawings 24” × 36”
Cost Estimate	Table (2 pages)

Bancroft Existing Water Servicing System

March 22, 2010

- Hydrant
- Pumps
- Water Treatment Plant
- Water Tower

Existing Water Servicing Pipe

MATERIAL

- Black Flex Poly
- Cast Iron
- Ductile Iron
- Poly Series 60
- PVC
- Parcel Fabric

0 250 500 1,000 Meters

1:8,000

GENIVAR

BUILDING BANCROFT

Golfview Drive
Fairway Boulevard
York River Drive
Moore Lane
Eagles Nest Park Road
Hastings Street North
Airview Drive
Waterhouse Crescent
Trout Creek Lane
Van Luven Lane
Chemaushigon Road
Forest Hill Road Water Booster Pumping Station 3.15 L/S
Forest Hill Road
Forest Hill Drive
Hastings Heritage Way
Easton Avenue
High School Lane
Monck Street
Valleyview Drive
Bridge Street W. Water Booster Pumping Station 6.94 L/S
Manor Lane
Maple Street
Oak Street
Bridge Street West
Sherbourne Street North
Sherbourne Street South
Alice Street
Madawaska Street
Woodview Lane
Cleek Avenue
Station Street
Faraday Street
Dale Street
Flint Avenue
Bancroft Water Tower
Usable Capacity: 2,272.6 m³
Effective Capacity: 1,068.3 m³
Phoebe Street
Billa Street
Clare Reid Road
Armstrong Lane
Newkirk Boulevard
Mill Street
Battelle Road
Hastings Street South
Gaebel Road
Bay Lake Road
Highway 62
Snow Road
Bancroft Water Treatment Plant
Capacity: 3,380 m³/day
Storage: 527 m³

Ministry of the Environment
Safe Drinking Water Branch
Floor 19
2 St Clair Ave W
Toronto ON M4V 1L5
Fax: (416)314-1037
Telephone: (416) 314-4625

Ministère de l'Environnement
Direction du contrôle de la qualité de l'eau potable
Étage 19
2 av St Clair Ouest
Toronto ON M4V 1L5
Télécopieur: (416)314-1037
Téléphone : (416) 314-4625

Ontario

March 16, 2009

The Corporation of the Town of Bancroft
24 Flint Avenue, P.O. Box 790
Bancroft, Ontario
K0L 1C0

Dear Sir/Madam:

Re: Application for Approval of Municipal Drinking Water Systems
Amended Certificate of Approval for the Bancroft Water Treatment Plant
Bancroft Town, County of Hastings
MOE Reference Number 5191-7LKR8H

Enclosed please find an amended Certificate of Approval under Part V of the Safe Drinking Water Act for the above noted water works. This Certificate revokes and replaces the previously issued Certificate of Approval.

The Drinking-Water System Description portion of the Certificate of Approval has been amended to incorporate revisions requested by Ontario Clean Water Agency dated November 18, 2008.

If you have any questions regarding the above, please contact Girish Mehta, P.Eng. at 416-314-8217.

Yours truly,

A. Ahmed

Aziz Ahmed, P.Eng.
Director, Part V, SDWA

c: Drinking Water Supervisor, MOE Peterborough
Deborah Turner, Ontario Clean Water Agency

Ontario

Ministry of the Environment
Ministère de l'Environnement

AMENDED CERTIFICATE OF APPROVAL
MUNICIPAL DRINKING WATER SYSTEMS
NUMBER 7457-7N5KKK
Issue Date: March 30, 2009

The Corporation of the Town of Bancroft
24 Flint Ave
Post Office Box, No. 790
Bancroft, Ontario
K0L 1C0

Site Location: Bancroft Water Treatment Plant
785 Snow Rd
Bancroft Town, County of Hastings

Pursuant to the Safe Drinking Water Act, 2002, S.O. 2002, c. 32, and the regulations made thereunder and subject to the limitations thereof, this approval is issued under Part V of the Safe Drinking Water Act, 2002, S.O. 2002, c. 32 to:

The Corporation of the Town of Bancroft
24 Flint Avenue, P.O. Box 790
Bancroft, Ontario
K0L 1C0

PART 1 - DRINKING-WATER SYSTEM DESCRIPTION

1.1 for a drinking-water system, serving the Town of Bancroft, Located at NAD 83: UTM Zone 17: 4994960.00 m E, 276732.00 m N, rated as set out in Part 4 consisting of the following:

Intake

- An intake consisting of an intake crib 2.3m in diameter with screened openings and a 450mm diameter raw water intake line approximately 320m in length from the intake crib to the water treatment plant.

Raw Water Pipe

- a gravity flow intake pipe equipped with a 300 mm diameter electrically actuated shut-off valve configured to fail-closed on power failure to prevent raw water from entering the plant on power failure.
- splitter box for distributing water to the two package treatment units;
- a raw water flow meter;

Water Treatment Plant

Two (2) package water treatment units consisting of rapid mix, flocculation, settling and filtration within each packaged unit, consisting of the following:

Rapid Mix and Flocculation

- two (2) flocculation chambers, one per package plant, each with a volume of 17.7 m^3 and a 0.56 KW variable speed mixer with draft tube impeller;

Settling Chamber

- two (2) settling chambers, one per package plant, each 4.5 m long x 3.6 m wide x 2.5 m SWD each, with a surface loading rate of 4.3 m/hr;

Filters

- four (4) filter cells, two cells per filter equipped with 305mm anthracite and 305mm sand, with a surface area of 3.75 m^2 per filter and discharging to a common filter effluent pipe, each equipped with a continuous on-line turbidimeter;

- piping and valves to facilitate filter to waste;

Chemical Addition

coagulate feed system with available injection to the common raw water header consisting of:
- two chemical metering pumps (one duty, one spare) equipped with automatic switchover and alarms, each rated at 8 L/hr flow, paced to the raw water meter dosing coagulant,
- a 600 L day tank, and two (2) 900 L and two (2) 1900 L bulk storage tanks;

disinfection system using sodium hypochlorite, with available injection points on raw water, pre-filtered water, post-filtered water, and prior to entering the distribution system, consisting of:
- three diaphragm chemical metering pumps (two spare) each rated at 20 L/hr and flow paced to the raw water meter,
- one (1) 400 L capacity sodium hypochlorite solution tank complete with secondary containment and provisions for carboy storage;
- one (1) continuous chorine residual analyzer monitoring free chlorine residual in the treated water, one (1) 400 L day tank,

corrosion control system using sodium carbonate or equivalent, with available injection points on post-filter water, consisting of:

- one diaphragm chemical metering pumps rated at 130 L/hr flow paced to the raw water meter,
- a 900L solution tank and provisions for bulk bag storage;

Waste Residual Management

Backwash storage and treatment consisting of 65 m^3 sludge sedimentation tank, 170 m^3 backwash surge tank, and chemical feed pump dosing coagulant to the sedimentation tank;

Supernatant discharged to York River and settled sludge hauled off site for disposal;

Clearwell

two clearwells, installed in series with a respective maximum volumes of 261 m^3 and 366 m^3, and minimum operating water depth of 1.5m;
two (2) level sensors (one in Clearwell No.1, one in Clearwell No.2) connected to the plant SCADA system to ensure that a minimum clearwell level is maintained to meet the CT criteria for effective disinfection.
one (1) 300 mm diameter electrically actuated shut-off valve on the treated water header to prevent treated water from entering the distribution system on high/low chlorine residual, high turbidity alarm, loss of power and low clear well level.

Instrumentation and Controls

- SCADA System
- one (1) on-line free chlorine residual analyzer for sampling treated water from the clearwell equipped with a visual display and data transferred to SCADA for recording (Outpost5™)

Standby Power

one (1) 120 kW Diesel Engine Standby Power Generator Set located within a separate enclosure next to the water treatment plant and complete with fuel storage tank, exhaust silencer, stack, and transfer switch.

Water Storage Standpipe

one water storage standpipe, approximately 25 m high by 12m diameter located on Faraday Heights, complete with an access ladder, overflow pipe and access hatch;

standby re-chlorination system consisting of:

- one 100 L sodium hypochlorite storage tank, complete with containment;

- one chemical metering pump capable of delivering sodium hypochlorite solution at a rate of 3.6 L/h through a feed line discharging into the water tank common fill/draw pipe; and
- a free chlorine residual analyzer and related instrumentation of operation the pump.

1.2 all in accordance with the applications and plans and other supporting documents listed in Schedule "A", and all other Schedules, which are attached to, and form part of this approval, except as specified in the conditions contained herein.

PART 2 - DEFINITIONS AND INFORMATION

2.1 In this approval, unless the context otherwise requires, words and phrases shall be given the same meaning as those set out in the *Safe Drinking Water Act, 2002* , S.O. 2002, c. 32 and any regulations made in accordance with that act.

2.2 In this approval

"approval" means this entire approval document, issued in accordance with section 36 of the *SDWA*, and includes any schedules to it

"Director" means a director appointed pursuant to s. 6 of the *SDWA* for the purposes of Part V of the *SDWA*

"drinking-water system" includes the works set out in Part 1

"provincial officer" means a provincial officer appointed pursuant to s. 8 of the *SDWA*

"rated capacity" means the maximum flow rate and maximum daily volume of water which can be treated when operating the drinking-water system under design conditions

"SDWA" means the Safe Drinking Water Act, 2002, S.O. 2002, c. 32, as amended

2.3 The following information is applicable to this approval

"owner" is The Corporation of the Town of Bancroft, its successors and assignees

"operating authority" is Ontario Clean Water Agency, its successors and assignees.

PART 3 - GENERAL

Compliance

3.1 The owner and operating authority shall operate the drinking-water system in accordance with the *SDWA* , any applicable regulations made thereunder, and this approval.

3.2 Despite any condition of this approval to the contrary, the owner and operating authority set out in Part 2 are jointly and severally liable to comply with all conditions of this approval.

3.3 The owner and operating authority shall ensure that any person authorized to carry out work on or operate any aspect of the drinking-water system has been informed of the *SDWA* , all applicable regulations made in accordance with that act, and this approval and shall take all reasonable measures to ensure any such person complies with the same.

3.4 A copy of this approval shall be kept in a conspicuous place so that it is available for reference by all persons responsible for all or part of the operation of the drinking-water system.

Build, etc. in Accordance

3.5 Except as otherwise provided by this approval, the drinking-water system shall be designed, developed, built, operated and maintained in accordance with Part 1 above and the documentation listed in Schedule "A".

Interpretation

3.6 Where there is a conflict between the provisions of this approval and any other document, the following hierarchy shall be used to determine the provision that takes precedence:

i. The *SDWA* ;

ii. a condition imposed in this approval in accordance with s. 38 of the *SDWA* ;

iii. any regulation made under the *SDWA* ;

iv. this approval;

v. any application documents listed in Schedule "A" from most recent to earliest; and

vi. all other documents listed in Schedule "A" from most recent to earliest.

3.7 The requirements of this approval are severable. If any requirement of this approval, or the application of any requirement of this approval to any circumstance, is held invalid or unenforceable, the application of such requirement to other circumstances and the remainder of this approval shall not be affected thereby.

3.8 Nothing in this approval shall be read to provide relief from the need for strict compliance with the *Environmental Assessment Act,* R.S.O. 1990, c E.18.

Other Legal Obligations

3.9 The issuance of, and compliance with the conditions of, this approval does not:

i. relieve any person of any obligation to comply with any provision of any applicable statute, regulation or other legal requirement; or

ii. limit in any way the authority of the ministry to require certain steps be taken or to require the owner to furnish any further information related to compliance with this approval.

3.10 For greater clarity, nothing in this approval shall be read to provide relief from regulatory requirements in accordance with section 38 of the *SDWA* , except as provided in Part 9.

Adverse Effects

3.11 Nothing in this approval shall be read as to permit: i) the discharge of a contaminant into the natural environment that causes or is likely to cause an adverse effect; or ii) the discharge of any material of any kind into or in any waters or on any shore or bank thereof or into or in any place that may impair the quality of the water of any waters.

3.12 All reasonable steps shall be taken to minimize and ameliorate any adverse effect on the natural environment or impairment of the quality of water of any waters resulting from the operation of the drinking-water system including such accelerated or additional monitoring as may be necessary to determine the nature and extent of the effect or impairment.

3.13 Fulfillment of one or more conditions imposed by this approval does not eliminate the requirement to fulfill any other condition of this approval or the requirements of any applicable statute, regulation, or other legal requirement resulting from any act or omission that causes or is likely to cause an adverse effect on the natural environment or the impairment of water quality.

Change of Owner

3.14 The owner or the operating authority, as the case may be, shall notify the director, in writing, of any of the following changes within 30 days of the change occurring

i. change of owner or operating authority;

ii. change of address;

iii. change of partners where the owner is or at any time becomes a partnership, and a copy of the most recent declaration filed under the Business Names Act, R.S.O. 1990, c. B17; or

iv. change of name of the corporation where the owner or operating authority is or at any time becomes a corporation, and a copy of the most current information filed under the Corporations Information Act, R.S.O. 1990, c. C.39.

3.15 In the event of any change in ownership of the drinking-water system, other than change to a

successor municipality, the owner shall notify the successor of and provide the successor with a copy of this approval, and the owner shall provide a copy of the notification to the district manager of the local office of the ministry and the director.

Inspections

3.16 No person shall hinder or obstruct a provincial officer in the performance of their duties, including any and all inspections authorized by the *SDWA*.

Information

3.17 Any information requested, by the ministry, concerning the drinking-water system and its operation under this approval, including but not limited to any records required to be kept by this approval shall be provided to the Ministry, upon request.

3.18 Records required by or created in accordance with this approval, unless specifically referenced in s. 12 of O. Reg. 170/03, shall be retained for at least 5 years in a location where a provincial officer who is inspecting the treatment system can conveniently view them.

3.19 The receipt of any information by the ministry or the failure of the ministry to prosecute any person or to require any person to take any action, under this approval or under any statute, regulation or other legal requirement, in relation to the information, shall not be construed as:

i. an approval, waiver, or justification by the ministry of any act or omission of any person that contravenes any term or condition of this approval or any statute, regulation or other legal requirement; or

ii. acceptance by the ministry of the information's completeness or accuracy.

PART 4 - PERFORMANCE

Rated Capacity

4.1 The drinking-water system shall not be operated to exceed the rated capacity for maximum volume of 3,380 m^3/day on a daily basis conveyed from the treatment system to the distribution system as set out below:

Treatment System	Maximum Flow Rate (L/sec)	Maximum Daily Volume (m^3/day)
Bancroft Water Treatment Plant	Not applicable	3,380

Increase to Rated Capacity

4.2 Despite condition 4.1, the drinking water system may be operated at a rate above the rated

capacity set out in condition 4.1 where necessary for:

i. fighting a large fire; or

ii. the maintenance of the drinking-water system.

4.3 Condition 4.2 shall not be construed to allow drinking-water to be supplied that does not meet all other applicable standards and legal requirements.

Management of Residue

4.4 The average annual concentration of suspended solids in the effluent discharged from the backwash wastewater facilities shall not exceed 25 mg/L.

PART 5 - MONITORING AND RECORDING

Flow measuring devices

5.1 Install a sufficient number of flow-measuring devices within the drinking-water system to permit the measurement and recording of:

i. the daily maximum flow rate and maximum daily volume of water conveyed into the treatment system; and

ii. the daily maximum flow rate and maximum daily volume of water conveyed from the treatment system to the distribution system.

5.2 Records shall be maintained that set out the parameters recorded in accordance with condition 5.1, and where the parameters measured exceed the daily peak flow rate and daily maximum volume set out in Part 1, the amount, date, time and duration of the exceedence shall also be recorded.

Calibration of flow measuring devices

5.3 All flow measuring devices must be checked and calibrated in accordance with the manufacturer' s instructions.

5.4 If the manufacturer's instructions do not indicate how often to check and calibrate the flow measuring devices, the equipment must be checked and calibrated at least once every year during which the drinking-water system is in operation.

Additional Sampling - Management of Residue

5.5 In addition to any other sampling and analysis that may be required, sampling and analysis shall

be undertaken for the parameters listed in Table 1 at the listed frequencies and locations.

Table 1: Management of Residue Sampling

Item	Parameter	Frequency	Location
1.	Suspended Solids (composite)	Monthly	Point of discharge (Tributary of York River)

5.6 For the purposes of Table 1, composite means the mean of three samples taken during the discharge event, with at least one sample taken immediately following the commencement of the discharge, one sample taken approximately at the mid-point of the discharge event and one sample taken immediately before the discharge ceases.

PART 6 - OPERATIONS AND MAINTENANCE

Chemical standards

6.1 All chemicals and materials used in the operation of the drinking-water system that come into contact with water within the system shall meet all applicable standards set by both the American Water Works Association ("AWWA") and the American National Standards Institute ("ANSI") safety criteria standards NSF/60 and NSF/61.

6.2 The most current chemical and material product registration documentation from a testing institution accredited by either the Standards Council of Canada or by the American National Standards Institution shall be available at all times for each chemical and material used in the operation of the drinking-water system that comes into contact with water within the system.

6.3 Condition 6.2 does not apply in the context of any particular chemical or material where the Owner has written documentation signed by the director that indicates that the Ministry is satisfied that the chemical or material is acceptable for use within the drinking-water system and that chemical or material is only used as permitted by the documentation.

Operations manual

6.4 An up-to-date operations manual shall be maintained and available for reference by all persons responsible for all or part of the operation of the drinking-water system.

6.5 The operations manual shall include at a minimum:

i. the requirements of this approval and associated procedures;

ii. the operation and maintenance recommendations from the most recent engineers' report;

iii. procedures for the monitoring and recording of in-process parameters necessary for the control of the treatment system and assessing the performance of the drinking-water system;

iv. procedures for the operation and maintenance of monitoring equipment;

v. contingency plans and procedures for the provision of adequate equipment and material to deal with emergencies, upset and equipment breakdown;

vi. procedures for the dealing with complaints related to the drinking-water system, including the recording of the nature of the complaint and any investigation and corrective action taken that in respect of the complaint.

6.6 Procedures necessary to the operation of any physical alterations of the drinking-water system shall be incorporated into the operations manual prior to the alterations coming into operation.

Drawings

6.7 An up-to-date Process and Instrumentation Diagram for the treatment system shall be kept on site at the drinking water system.

6.8 All drawings and diagrams in the possession of the owner or operating authority that show the treatment system as constructed shall be retained.

6.9 An alteration to the treatment system shall be incorporated into Process and Instruction Diagrams and record drawings and diagrams within one year of the substantial completion of the alteration and shall be retained and shall be made readily available for inspection by Ministry staff.

PART 7 - FUTURE ALTERATIONS

Approved future alterations

7.1 *Not Applicable*

Certificate of compliance

7.2 *Not Applicable*

PART 8 - STUDIES AND UPGRADES REQUIRED

8.1 *Not Applicable*

PART 9 - RELIEF FROM REGULATORY REQUIREMENTS

Relief from regulatory requirements

9.1 *Not applicable*

Conditions in exchange for relief from regulatory requirements

9.2 *Not applicable*

SCHEDULE - A

The following supporting documents form part of this approval.

1. Correspondence dated November 18, 2008 and February 13, 2009 submitted by Ontario Clean Water Agency

2. Application dated September 30, 2003 submitted by KMK Consultants Ltd.
   - Correspondence from KMK dated;
     - October 1, 2003
     - November 21, 2003
     - December 18, 2003
   - CT Calculations

3. Application dated April 4, 2003.
   - Final Plans and Specifications dated
   - Design Brief
   - Design calculations

4. The original applications for approval, including design calculations, engineering drawings and reports, and other supporting documents prepared in support of any previous certificate(s) of approval issued for any works now approved and replaced by this approval, unless this approval states otherwise.

This Certificate of Approval revokes and replaces Certificate(s) of Approval No. 2693-5SSQTV issued on January 7, 2004

All or part of this decision may be reviewable in accordance with the provisions of Part X of the SDWA. In accordance with Section 129(1) of the Safe Drinking Water Act, Chapter 32 Statutes of Ontario, 2002, as amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this notice, require a hearing by the Tribunal. Section 129(2) sets out a procedure upon which the 15 days may be extended by the Tribunal. Section 129(3) of the Safe Drinking Water Act, Chapter 32 Statutes of Ontario, 2002, provides that the Notice requiring the hearing shall state:

1. The aspect of the decision, including the portion of the permit, licence, approval, order or notice of administrative penalty in respect of which the hearing is required; and
2. The grounds for review to be relied on by the person at the hearing

Except with leave of the Tribunal, a person requiring a hearing in relation to a reviewable decision is not entitled to,
(a) a review of an aspect of the decision other than that stated in the notice requiring the hearing or
(b) a review of the decision other than on the grounds stated in the notice

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the works are located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
655 Bay Street, 15th Floor
Toronto, Ontario
M5G 1E5

AND

The Director
Part V, *Safe Drinking Water Act, 2002*
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted water works are approved under Part V of the Safe Drinking Water Act.

DATED AT TORONTO this 30th day of March, 2009

A. Ahmed

THIS CERTIFICATE WAS MAILED
ON April 1, 2009
SC
(Signed)

Aziz Ahmed, P.Eng.
Director
Part V *of the Safe Drinking Water Act, 2002*

GM/

c: District Manager, MOE Peterborough
Deborah Turner, Ontario Clean Water Agency ✓

Ministry of the Environment
Eastern Region
Technical Support Section
Water Resources
1259 Gardiners Rd, PO Box 22032
Kingston, ON
K7P 3J6
Telephone: 613-549-4000

Ministère de l'Environnement
Direction régionale de l'Est
Bureau du district de Kingston
1259 Chemin Gardiners, CP 22032
Kingston, ON
K7P 3J6
Téléphone : 613-549-4000

Ontario

May 18, 2007

Mr. Barry Wannamaker
The Corporation of the Town of Bancroft
24 Flint Avenue, PO Box 790
Bancroft, Ontario
K0L 1C0
Canada

RE: Permit To Take Water No. 8778-72SNQD
Lot: 29, Concession: 14, Former Township of Dungannon
Bancroft, County of Hastings
Reference Number 5858-72BLRM

Dear Mr. Wannamaker:

Please find attached Permit to Take Water No. 8778-72SNQD issued to The Corporation of the Town of Bancroft which authorizes the withdrawal of water from Clark Lake in accordance with the application for this Permit to Take Water, dated April 5, 2007 and signed by Barry Wannamaker.

This Permit expires May 31, 2017 and shall be kept available at all times for inspection by Ontario Ministry of the Environment staff. This permit revokes and replaces Permit No. 86-P-4003.

Take notice that in issuing this Permit to Take Water, terms and conditions pertaining to the taking of water and to the results of the taking have been imposed. The terms and conditions have been designed to allow for the development of water resources, while providing reasonable protection to existing water uses and users.

The new Water Taking and Transfer Regulation, O. Reg. 387/04 came into effect on January 1, 2005. It requires that Permit Holders track the volume of water they take daily and report these volumes to the Ministry the following year. Please ensure that you inform yourself of the monitoring and reporting requirements related to your permit. You can find additional information on the MOE web site at www.ene.gov.on.ca or by calling the nearest MOE office.

Please note that it is the responsibility of the Permit Holder to ensure that all other approvals required by law are obtained for this project.

Yours truly,

Peter Taylor

Peter Taylor
Director, Section 34, Ontario Water Resources Act, R.S.O. 1990
Eastern Region

File Storage Number: P 8778 HAS

c: Deborah Turner, Ontario Clean Water Agency, 122 Patterson Crescent, Carleton Place, Ontario K7C 4P3

Ministry of the Environment

Ministère de l'Environnement

Ontario

PERMIT TO TAKE WATER
Surface Water
NUMBER 8778-72SNQD

Pursuant to Section 34 of the Ontario Water Resources Act, R.S.O. 1990 this Permit To Take Water is hereby issued to:

The Corporation of the Town of Bancroft
24 Flint Avenue, PO Box 790
Bancroft, Ontario
K0L 1C0
Canada

For the water taking from: Clark Lake

Located at: Lot 29, Concession 14, Former Twp. of Dungannon
Bancroft, County of Hastings

For the purposes of this Permit, and the terms and conditions specified below, the following definitions apply:

DEFINITIONS

(a) "Director" means any person appointed in writing as a Director pursuant to section 5 of the OWRA for the purposes of section 34, OWRA.

(b) "Provincial Officer" means any person designated in writing by the Minister as a Provincial Officer pursuant to section 5 of the OWRA.

(c) "Ministry" means Ontario Ministry of the Environment.

(d) "District Office" means the Belleville District Office.

(e) "Permit" means this Permit to Take Water No. 8778-72SNQD including its Schedules, if any, issued in accordance with Section 34 of the OWRA.

(f) "Permit Holder" means The Corporation of the Town of Bancroft.

(g) "OWRA " means the *Ontario Water Resources Act,* R.S.O. 1990, c. O. 40, as amended.

You are hereby notified that this Permit is issued subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. Compliance with Permit

1.1 Except where modified by this Permit, the water taking shall be in accordance with the application for this Permit To Take Water, dated April 5, 2007 and signed by Barry Wannamaker, and all Schedules included in this Permit.

1.2 The Permit Holder shall ensure that any person authorized by the Permit Holder to take water under this Permit is provided with a copy of this Permit and shall take all reasonable measures to ensure that any such person complies with the conditions of this Permit.

1.3 Any person authorized by the Permit Holder to take water under this Permit shall comply with the conditions of this Permit.

1.4 This Permit is not transferable to another person.

1.5 This Permit provides the Permit Holder with permission to take water in accordance with the conditions of this Permit, up to the date of the expiry of this Permit. This Permit does not constitute a legal right, vested or otherwise, to a water allocation, and the issuance of this Permit does not guarantee that, upon its expiry, it will be renewed.

1.6 The Permit Holder shall keep this Permit available at all times at or near the site of the taking, and shall produce this Permit immediately for inspection by a Provincial Officer upon his or her request.

1.7 The Permit Holder shall report any changes of address to the Director within thirty days of any such change. The Permit Holder shall report any change of ownership of the property for which this Permit is issued within thirty days of any such change. A change in ownership in the property shall cause this Permit to be cancelled.

2. General Conditions and Interpretation

2.1 Inspections

The Permit Holder must forthwith, upon presentation of credentials, permit a Provincial Officer to carry out any and all inspections authorized by the OWRA, the *Environmental Protection Act* , R.S.O. 1990, the *Pesticides Act* , R.S.O. 1990, or the *Safe Drinking Water Act,* S. O. 2002.

2.2 Other Approvals

The issuance of, and compliance with this Permit, does not:

(a) relieve the Permit Holder or any other person from any obligation to comply with any other applicable legal requirements, including the provisions of the *Ontario Water Resources Act* , and the *Environmental Protection Act* , and any regulations made thereunder; or

(b) limit in any way any authority of the Ministry, a Director, or a Provincial Officer, including the authority to require certain steps be taken or to require the Permit Holder to furnish any further information related to this Permit.

2.3 Information

The receipt of any information by the Ministry, the failure of the Ministry to take any action or require any person to take any action in relation to the information, or the failure of a Provincial Officer to prosecute any person in relation to the information, shall not be construed as:

(a) an approval, waiver or justification by the Ministry of any act or omission of any person that contravenes this Permit or other legal requirement; or

(b) acceptance by the Ministry of the information's completeness or accuracy.

2.4 Rights of Action

The issuance of, and compliance with this Permit shall not be construed as precluding or limiting any legal claims or rights of action that any person, including the Crown in right of Ontario or any agency thereof, has or may have against the Permit Holder, its officers, employees, agents, and contractors.

2.5 Severability

The requirements of this Permit are severable. If any requirements of this Permit, or the application of any requirements of this Permit to any circumstance, is held invalid or unenforceable, the application of such requirements to other circumstances and the remainder of this Permit shall not be affected thereby.

2.6 Conflicts

Where there is a conflict between a provision of any submitted document referred to in this Permit, including its Schedules, and the conditions of this Permit, the conditions in this Permit shall take precedence.

3. Water Takings Authorized by This Permit

3.1 **Expiry**

This Permit expires on **May 31, 2017**. No water shall be taken under authority of this Permit after the expiry date.

3.2 Amounts of Taking Permitted

The Permit Holder shall only take water from the source, during the periods and at the rates and amounts of taking specified in Table A. Water takings are authorized only for the purposes specified in Table A.

Table A

	Source Name / Description:	Source: Type:	Taking Specific Purpose:	Taking Major Category:	Max. Taken per Minute (litres):	Max. Num. of Hrs Taken per Day:	Max. Taken per Day (litres):	Max. Num. of Days Taken per Year:	Zone/ Easting/ Northing:
1	Clark Lake	Lake	Municipal	Water Supply	2,350	24	3,380,000	365	17 276732 4994960
						Total Taking:	3,380,000		

4. Monitoring

4.1 The Permit Holder shall maintain a record of all water takings. This record shall include the dates and times of water takings, and the total measured amounts of water pumped per day for each day that water is taken under the authorization of this Permit. A separate record shall be maintained for each source. The Permit Holder shall keep all required records up to date and available at or near the site of the taking and shall produce the records immediately for inspection by a Provincial Officer upon his or her request.

4.2 The total amounts of water pumped shall be measured using a properly calibrated flowmeter and totalizer.

5. Impacts of the Water Taking

5.1 Notification

The Permit Holder shall immediately notify the local District Office of any complaint arising from the taking of water authorized under this Permit and shall report any action which has been taken or is proposed with regard to such complaint. The Permit Holder shall immediately notify the local District Office if the taking of water is observed to have any significant impact on the surrounding waters. After hours, calls shall be directed to the Ministry's Spills Action Centre at 1-800-268-6060.

5.2 For Surface-Water Takings
The taking of water (including the taking of water into storage and the subsequent or simultaneous withdrawal from storage) shall be carried out in such a manner that streamflow is not stopped and is not reduced to a rate that will cause interference with downstream uses of water or with the natural functions of the stream.

5.3 The taking of water shall be carried out in such a manner as to prevent the disruption or removal of any fish, invertebrates, or sediment from Clark Lake.

6. Director May Amend Permit
The Director may amend this Permit by letter requiring the Permit Holder to suspend or reduce the taking to an amount or threshold specified by the Director in the letter. The suspension or reduction in taking shall be effective immediately and may be revoked at any time upon notification by the Director. This condition does not affect your right to appeal the suspension or reduction in taking to the Environmental Review Tribunal under the *Ontario Water Resources Act* , Section 100 (4).

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is included to ensure that the conditions in this Permit are complied with and can be enforced.

2. Condition 2 is included to clarify the legal interpretation of aspects of this Permit.

3. Conditions 3 through 6 are included to protect the quality of the natural environment so as to safeguard the ecosystem and human health and foster efficient use and conservation of waters. These conditions allow for the beneficial use of waters while ensuring the fair sharing, conservation and sustainable use of the waters of Ontario. The conditions also specify the water takings that are authorized by this Permit and the scope of this Permit.

*In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, you may by written notice served upon me, the Environmental Review Tribunal and the Environmental Commissioner, **Environmental Bill of Rights**, R.S.O. 1993, Chapter 28, within 15 days after receipt of this Notic require a hearing by the Tribunal. The Environmental Commissioner will place notice of your appeal on the Environmental Registry. Section 101 of the Ontario Water Resources Act, as amended provides that the Notice requiring a hearing shall state:*

1. The portions of the Permit or each term or condition in the Permit in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

In addition to these legal requirements, the Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Permit to Take Water number;
6. The date of the Permit to Take Water;
7. The name of the Director;
8. The municipality within which the works are located;

This notice must be served upon:

The Secretary
Environmental Review Tribunal
2300 Yonge Street, Suite 1700
Toronto, Ontario M4P 1E4

AND

The Environmental Commissioner
1075 Bay Street
6th Floor, Suite 605
Toronto, Ontario M5S 2W5

AND

The Director, Section 34
Ministry of the Environment
1259 Gardiners Rd, PO Box 22032
Kingston, ON
K7P 3J6

Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal:

by telephone at (416) 314-4600 ***by fax at (416) 314-4506*** ***by e-mail at www.ert.gov.on.ca***

*This instrument is subject to Section 38 of the **Environmental Bill of Rights** that allows residents of Ontario to seek leave to appeal the decision on this instrument. Residents of Ontario may seek to appeal for 15 days from the date this decision is placed on the Environmental Registry. By accessing the Environmental Registry, you can determine when the leave to appeal period ends.*

This Permit cancels and replaces Permit Number 86-P-4003, issued on 1986/02/12.

Dated at Kingston this 18th day of May, 2007.

Peter Taylor

Peter Taylor
Director, Section 34
Ontario Water Resources Act , R.S.O. 1990

Ontario Clean Water Agency
Agence Ontarienne Des Eaux

FILE COPY.

WATER AND WASTEWATER OPERATING AGREEMENT

APRIL 1ST 2001

THE CORPORATION OF THE TOWN OF BANCROFT

SERVICES AGREEMENT

THIS AGREEMENT effective as of the 1st day of April, 2001.

B E T W E E N

ONTARIO CLEAN WATER AGENCY/AGENCE ONTARIENNE DES EAUX, a corporation established under the Capital Investment Plan Act, 1993, c.23, Statutes of Ontario.

("OCWA")

A N D

THE CORPORATION OF THE TOWN OF BANCROFT

(the "Client")

RECITALS

(a) OCWA is in the business of providing operation and maintenance services ("Services") for water and wastewater facilities.

(b) The Client is the owner of the facilities more particularly described in Schedule A, (the "Facilities") pursuant to a transfer under the Municipal Water and Sewage Transfer Act, 1997.

(c) The Client wishes to retain the services of OCWA to operate and maintain the Water and Wastewater Facilities in accordance with the provisions of this agreement (the "Agreement").

(d) The Client and OCWA (collectively, the "Parties") are entering this Agreement to clarify and set out their respective rights and obligations with respect to the operation, maintenance, invoicing and payment arrangements for the Facilities.

(e) The Council of the Client on the ____ day of _____, 2001 __ passed By-Law No. _____ authorizing the Client to enter into this Agreement.

NOW THEREFORE the Client and OCWA agree as follows:

ARTICLE 1 - INDEX TO DEFINITIONS

Section 1.1 - Definitions

In this Agreement, definitions are set out in Schedule B, or within applicable provisions as indicated.

ARTICLE 2 - RESPONSIBILITIES OF OCWA

Section 2.1 - Retention of OCWA

The Client retains OCWA to provide management, operation, administration and maintenance services (as described in Schedule C to this Agreement) in respect of the water and wastewater facilities (the "Services").

Section 2.2 - Performance of Services

(a) OCWA shall deliver the Services in compliance with all Applicable Laws, except as described in Paragraphs 2.2(b) and (c) below and in any of the following circumstances:

(i) the Client not making the Capital Expenditures reasonably recommended by OCWA under Section 4.6 below;

(ii) mechanical failure of any equipment at the Facilities unless the mechanical failure is due to negligent maintenance by OCWA;

(iii) the water transmitted to the Facility for treatment contain contaminants or other substances which cannot be treated or removed by the Facility's processes;

(iv) the wastewater transmitted to the Facility for treatment does not meet the requirements of the Client's sewer use by-law or any Applicable Law;

(v) the wastewater transmitted to the Facility for treatment contains contaminants or other substances which cannot be treated or removed by the Facility's processes;

(vi) the quantity or quality of wastewater transmitted to the Facility exceeds the Facility's design or operating capacity.

(b) OCWA may temporarily cease to provide or reduce, the level of provision of Services hereunder in the event of an emergency, a breakdown or any Uncontrollable Circumstance; provided, however, that OCWA shall, when practicable, endeavour to give the Client reasonable advance notice of each such occurrence.

(c) Notwithstanding any other provision of this Agreement, delay in the performance of, or a failure to perform any term of this Agreement by OCWA, shall not constitute default under this Agreement or give rise to any claim for damages suffered by the Client if and to the extent caused by occurrences or circumstances beyond the reasonable control of OCWA, including but not limited to circumstances where water transmitted to the Facilities for treatment contains contaminants or other substances which cannot be treated or removed by the Facilities processing; the wastewater transmitted to the Facilities for treatment does not meet the requirements of the Client's sewer use by-law or any Applicable Law; the wastewater transmitted to the Facilities for treatment contains contaminants or other substances which cannot be treated or removed by the Facilities processes; the quantity or quality of wastewater transmitted to the Facilities exceeds the Facilities' design or operating capacity; decrees of government, acts of

God (including but not limited to hurricanes, tornadoes, floods and other weather disturbances), sabotage, strikes, lockouts and other industrial disturbances, insurrections, war, civil disturbances, riots, explosions, fire and acts of third parties (any such occurrence or circumstance is referred to as an "Uncontrollable Circumstance").

(d) OCWA, in its discretion, may take remedial measures that it determines are reasonably necessary to attempt to maintain compliance with Applicable Laws. Within the context of Section 2, such measures may be beyond the Services and as such would be subject to extra costs as described in Paragraph 4.5 (f). OCWA shall use its best efforts to contact the Client and obtain the Client's approval prior to undertaking such remedial measures.

(e) Notwithstanding Paragraph 2.2(d) above, the Client recognizes that such remedial measures taken by OCWA may be as a result of an emergency situation or an Uncontrollable Circumstance and that in such situations OCWA's primary concern will be making all reasonable efforts to maintain compliance with Applicable Laws.

Section 2.3 - Excluded Services

Any services not set out in the Services are excluded from this Agreement, (the "Excluded Services") and, without limiting the generality of the foregoing, those services set out in Schedule D to this Agreement are examples of Excluded Services. If the Client subsequently requires OCWA to provide the Excluded Services, the Excluded Services may be provided at additional cost to the Client.

Section 2.4 - Standard of Care

OCWA shall deliver the Services as would a reasonable operator with like skills in like circumstances.

Section 2.5 - OCWA as Independent Contractor

In performing the Services, OCWA shall be acting as an independent contractor and only to the extent and for the specific purposes expressly set forth herein. Neither OCWA nor its employees, agents or subcontractors shall be subject to the direction and control of the Client, except as expressly provided in this Agreement.

Section 2.6 - Authorized Representatives

Each of OCWA and the Client shall be entitled to designate in writing to the other one or more individuals who shall be authorized to represent it in connection with the day-to-day administration of the provisions of this Agreement (the "Authorized Representatives"). Each of the parties shall be entitled to rely on the acts and approvals given by the other party's Authorized Representative until such time as it receives a written notification of change of the other party's Authorized Representative.

Section 2.7 - Reporting

OCWA will provide the Client with reporting as required under the Ontario Drinking Water Protection Regulations. In addition, OCWA will also supply the Client with quarterly

operations report on the Facilities and will be available in both written and electronic versions as requested by the Client.

Section 2.8 - Indemnification of the Client

OCWA shall exonerate, indemnify and hold harmless the Client, its directors, officers, employees and agents from and against any and all Claims which may be suffered or incurred by, accrue against or be charged to or recoverable from the Client that are caused by OCWA's negligence or wilful misconduct when performing the Services. The Client shall be deemed to hold the provisions of this Section 2.8 that are for the benefit of the Client's directors, officers, employees and agents in trust for such directors, officers, employees and agents as third party beneficiaries under this Agreement.

Section 2.9 - Insurance

(a) OCWA shall arrange for insurance coverage of the Facilities as described in Schedule E to this Agreement (the "Insurance") and, with the exception of automobile insurance, the Client shall be an additional insured under the Insurance. If there is a significant change in the Insurance, the Client will be notified of such changes.

(b) The Client may, at its cost, maintain additional insurance in respect of the Facilities if it wishes and OCWA shall be an additional insured under such insurance.

(c) The Client shall be responsible for securing its own insurance for any operations with which it is involved or which are Excluded Services that are not the subject of this Agreement. The Client acknowledges that it will have no recourse under OCWA's policies of insurance for any such operations.

(d) In the event of a claim under the Insurance, the payment of deductibles is as specified in Schedule E.

Section 2.10 - Representations and Warranties of OCWA

OCWA represents and warrants to the Client that the following are true and correct:

(a) that it has full power and authority and has taken all necessary steps to enter into and perform its obligations under this Agreement; and

(b) OCWA's staff are trained and capable of carrying out the terms of this Agreement.

ARTICLE 3 - RESPONSIBILITIES OF THE CLIENT

Section 3.1 - Representations and Warranties of the Client

The Client represents and warrants to OCWA that the following are true and correct:

(a) The Client has the full power and authority to enter into and perform its obligations under this Agreement.

(b) The Client has passed all necessary by-laws and has obtained all necessary Authorizations to enable it to enter into and perform its obligations under this Agreement and to operate the Facilities, including without limitation, any Authorizations required from the Ontario Municipal Board and the Ministry of the Environment, and the Authorizations are in good standing.

(c) The Client will provide OCWA with a true copy of each of the Authorizations referred to in Paragraph 3.1(b) above prior to the date of this Agreement, including a certified copy of each municipal by-law required to authorize the Client to enter into and perform its obligations under this Agreement.

(d) As owner of the Facilities the Client is fully aware of its responsibilities and obligations and, as part of its due diligence in operating the Facilities, has selected OCWA as operator to provide the Services.

Section 3.2 - Covenants of the Client

The Client hereby covenants for the benefit of OCWA:

(a) The Client agrees to promptly provide OCWA with any information relating to the Facilities which could have a bearing on the provision of Services by OCWA.

(b) The Client shall repair, maintain and keep in a good working state, in accordance with good engineering practices and the standards reasonably applicable to an owner of a like facility, all wastewater works that belong to or are under the control of the Client and that collect and transmit wastewater to the Facility and all water works that belong to or are under the control of the Client and that distribute water from the Facility.

(c) The Client shall take reasonable steps to ensure that wastewater transmitted to the Facility complies with the Client's sewer use by-law and any Applicable Laws.

Section 3.3 - Exoneration and Indemnification of OCWA

(a) Subject to Paragraph 3.3(c) below, the Client shall exonerate, indemnify and hold harmless OCWA, its directors, officers, employees and agents and Her Majesty the Queen in Right of Ontario, as represented by the Minister of the Environment and all officers, employees and agents of the Ministry of the Environment (collectively referred to as the "Indemnified Parties") from and against any and all Claims which may be suffered or incurred by, accrue against, or be charged to or recoverable from any one or more of the Indemnified Parties that, in any way, either arise from or are connected with the operation of this Agreement.

(b) OCWA shall be deemed to hold the provision of this Section 3 that are for the benefit of OCWA's directors, officers, employees and agents and the other Indemnified Parties as defined above, in trust for all such Indemnified Parties as third party beneficiaries under this Agreement.

(c) Notwithstanding the other provisions of this Section 3, the Client shall not be liable in respect of the damages arising out of any Claim:

(i) to the extent that such damages arise out of any Claim covered by the Insurance or a policy of insurance put in place by OCWA and/or the Ministry of the Environment, the premiums of which were paid for by the Client; or

(ii) where the Claim is caused by OCWA's negligence or wilful misconduct in providing the Services.

ARTICLE 4 - TERM, PAYMENT FOR SERVICES AND OTHER CHARGES

Section 4.1 - Initial Term of Agreement

(a) This Agreement shall start on **April 1, 2001** and, subject to Paragraph 4.1(b) and (c) below, shall continue in effect for an initial term of **ten years** (the "Initial Term") and then shall be renewed for successive **one** year terms unless terminated under Section 6.1 of this Agreement. The annual price for each renewal term shall be determined in accordance with Section 4.3 of this Agreement.

(b) In order to accommodate the wishes of the Client to have the option to terminate this Agreement prior to the end of the Initial Term of ten years, and at the same time compensate OCWA for its investment in this Agreement, the parties agree that, in addition to the termination rights set out in Section 6.2 of this Agreement, the Client will also have the right to terminate this Agreement at the end of the fifth year of the Initial Term, provided that the following conditions are satisfied:

(i) Prior to March 31, 2004 the Client shall provides written notice of intention to OCWA of its decision to terminate this Agreement at the end of the fifth year of the Initial Term, i.e., March 31, 2005; and

(ii) The Client shall pay OCWA **$105,000.00** within 30 days of such notice to terminate this Agreement, in addition to any other amounts owed to OCWA pursuant to this Agreement.

If the conditions of Paragraph 4.1(b) are not met, the Initial Term shall continue for the remaining five years and the Client shall be entitled to terminate this Agreement as set forth in Section 6.1.

Section 4.2 - Annual Price for Initial Term

(a) Subject to any adjustments made pursuant to other provisions of this Agreement, the Client shall pay OCWA for OCWA's provision of the Services, a price for each year of the Initial Term in the following amounts (the "Annual Price"):

(i) For Year One from **April 1, 2001** through to **March 31, 2001** inclusive: the combined Annual Price for water and wastewater services shall be $181,336.75 and $188,738.25 respectively.

(ii) For Year Two and subsequent Years: **$370,075.00** plus an adjustment for inflation calculated as described below in Paragraph 4.2(b).

(b) Statistics Canada Consumer Price Index, All Items (Ontario) ("CPI") shall be used to calculate the inflation adjustment referred to in Paragraph 4.2(a) above. The percentage difference between the CPI during the last month of the previous year as compared to the CPI of the last month of the current year shall be the inflation adjustment for the next year. For example, the inflation adjustment for year 2000 is the CPI of December 1999 divided by the CPI of December 1998. The adjustment will be calculated as soon as necessary information is available from Statistics Canada and the Annual Price will be retroactively adjusted to January 1. In year two of the Agreement and subsequent years, the inflation adjustment shall be added to the Annual Price for year one of the Agreement on a cumulative basis.

(c) The Annual Price includes all additional charges prescribed by Regulation 157/93 under the Ontario Water Resources Act.

Section 4.3 - The Annual Price in Renewal Terms

The Annual Price for any renewal term will be as agreed between the Client and OCWA. If the Parties cannot agree on the Annual Price for any renewal term within six months of the beginning of the last year of the Initial Term or within six months of the beginning of a renewal term (the "Current Term"), this Agreement will be terminated six months from the last day of the Current Term. During this six month period, the Client shall pay the Annual Price paid for the last year of the Current Term, as indicated above, pro-rated over the six month period.

Section 4.4 - Payment of the Annual Price

The Client shall pay OCWA the Annual Price for each year of the Initial Term or any Current Term, in twelve monthly payments, in advance, on the first day of each month. In Year One of the Initial Term, the monthly payment of the Annual Price shall be **$ 30,839.58**. The first payment shall be due and payable on **April 1, 2001** and available in its designated bank account on that date. Payment shall be made by the Client by pre-authorized bank debit from a bank account designated by the Client.

Section 4.5 - Items not included in the Annual Price

The Annual Price, for each year of the Initial Term and any subsequent term, covers all charges for the Services, but does not cover items or matters that are outside the scope of the Services, and without restricting the generality of the foregoing, does not include the following:

(a) any Capital Expenditures as agreed to by the Client over the amount set forth in Paragraph 4.6(d) or resulting from any failure of the Client to implement reasonably recommended Capital Expenditures;

(b) any charges resulting from any changes in Services required by changes to Applicable Laws;

(c) Unexpected Expenses (as defined in Paragraph 4.7(a) below);

(d) the payment of municipal taxes or municipal grants in lieu of taxes;

(e) any charges resulting from adverse tax changes in respect of the Services or the Facilities, excluding income taxes payable by OCWA on its own revenues;

(f) any charges resulting from OCWA having to address an Uncontrollable Circumstance and, without limiting the generality of the foregoing, such charges resulting from those situations addressed in Section 2.2 of this Agreement;

(g) any charges to the Client or credits to the Client arising from a significant change in flows, as set out in Part 1 of Schedule F to this Agreement.

(h) any charges to the Client or credits to the Client resulting from a significant change in sludge production, as set out in Part 1 of Schedule G to this Agreement.

Section 4.6 - Capital Expenditures

(a) "Capital Expenditures" means the charges for all capital items in relation to the Facilities, including new or replacement equipment, any overhaul or rebuild of equipment, any non-routine repair; maintenance, (and excluding routine maintenance); any alterations and any associated installations, commissioning, including labour and preselection charges, together with OCWA's service fee.

(b) No later than October 30th of each year this Agreement is in force, or on a date as the parties may agree in writing, OCWA will provide the Client with an estimate of the Capital Expenditures reasonably required for the operation of the Facilities for the following year. The Client's written approval of any estimate authorizes OCWA to incur the Capital Expenditures included in the estimate (the "Approved Capital Expenditures").

(c) OCWA will invoice the Client for the Approved Capital Expenditures together with any additional supporting documentation and the Client shall pay the invoice within 30 days of receipt.

(d) OCWA will pay the first $2,000.00 of Capital Expenditure for each year of the Initial Term or Current Term on a non-cumulative basis. OCWA will not be required to obtain the prior approval of the Client before incurring such Capital Expenditures.

Section 4.7 - Unexpected Expenses

(a) "Unexpected Expenses" means unanticipated expenditures that OCWA reasonably incurs in order to address equipment failure, acts of third parties, or other circumstances beyond OCWA's reasonable control, including but not limited to unregulated septic dumping, illegal industrial waste discharges or overflows, an emergency situation or any situation resulting from an Uncontrollable Circumstance

(b) In the event that OCWA is required to incur Unexpected Expenses, the prior approval of the Client with respect to those Unexpected Expenses will be required only if time

permits. Within ten days of incurring the Unexpected Expenses, OCWA will provide the Client with a report detailing the reasons the Unexpected Expenses were incurred and the Client shall pay OCWA for the Unexpected Expenses within thirty (30) days of receipt of an invoice from OCWA.

Section 4.8 - Interest on Late Payments

If the Client's monthly payment of the Annual Price is not available in its designated bank account on the agreed to date of payment, or if a certified cheque payable to the Ontario Clean Water Agency, has not been received, OCWA will notify the Client that the funds were not available. On the next Business Day, OCWA will again attempt to withdraw the monthly payment. If funds are not available when the second attempt to withdraw funds is made, OCWA will notify the Client that the payment is late, and in addition to paying the monthly payment owing to OCWA, the Client shall pay OCWA interest at that rate determined by the Minister of Finance, from time to time, as payable on overdue accounts, in accordance with the Financial Administration Act plus any banking and administrative charges.

Section 4.9 - Partial Payment of Disputed Invoices

If the Client disputes any portion of an invoice, the Client shall nonetheless pay to OCWA the undisputed portion of the invoice by the due date. If any additional amount is finally determined to be payable to OCWA, the Client shall pay OCWA the additional amount, plus interest as provided in Section 4.8 above, within ten days from the date of final determination.

Section 4.10 - Adjustments for Significant Changes in Flows and Sludge Production

(a) If there is a significant change in flow at the Facilities, where significant change is defined in Part 1 of Schedule F, an invoice or credit memo as the case may be will be issued by OCWA to the Client calculated according to the formula set out in Part 2 of Schedule F.

(b) If there is a significant change in sludge production, as measured by sludge production and described in Part 1 of Schedule G, a credit memo or invoice as the case may be will be issued by OCWA to the Client calculated according to the formula set out in Part 2 of Schedule G.

(c) There shall be no credit to the Client where the decrease in flow and/or sludge production at the Facilities results from any changes made to the Facilities or to the operation of the Facilities, that was paid for by OCWA.

Section 4.11 - Hydro Costs

(a) OCWA's Annual Price is calculated based upon hydroelectricity rates prevailing during October 2000 (the "Base Year") however, due to the uncertainty of hydroelectricity rates under the proposed market deregulation of electricity commencing in 2001, unexpected adjustments may have to be made for Hydro Cost increases as follows:

(i) If there is an increase of greater than one hundred dollars ($100.00) in total annual Hydro Costs over the Base Year in any year of the Agreement then the Client shall pay OCWA the entire amount of the increase over and above the Annual Price.

(ii) If there is a decrease of greater than one hundred dollars ($100.00) in total annual Hydro Costs over the Base Year in any year of the Agreement then the Client shall be compensated by OCWA for the entire amount of the decrease.

(b) The calculations for the purpose of this section will take place as soon as it is reasonably possible after OCWA knows the annual Hydro Costs for that year. At the end of each year of the Agreement, OCWA shall deliver an account to the Client. If the Client owes monies to OCWA under this section then an invoice for that amount will be sent to the Client. If OCWA owes monies to the Client then a credit will be applied to the Client's account.

(c) Should the decrease in total annual Hydro Costs be a direct result of an investment by OCWA then there shall be no credit under (b) above until such time as OCWA's investment is fully recovered.

(d) Given that deregulation of the electricity market is still in process and that the rules governing deregulation continue to evolve, OCWA and the Client agree to revisit this Section 4.10 at the end of 2001 and/or at the end of 2002, to mutually develop an amendment that maximizes the benefit of deregulation to both parties.

ARTICLE 5 - DISPUTE RESOLUTION

Section 5.1 - Mediation

(a) If a dispute arises between the Client and OCWA which cannot be resolved within a reasonable time, the issue shall be referred to a mediator.

(b) The fees and expenses of the mediator will be divided equally between the Parties.

(c) Involvement in mediation is on a without prejudice basis and does not preclude and is not a bar to either Party pursuing whatever legal remedies may be available, including litigation.

ARTICLE 6 - TERMINATION

Section 6.1 - Termination of Agreement

(a) At least twelve calendar months before the expiry of the Initial Term or any Renewal Term, either party may notify the other in writing whether it wishes to renew or terminate this Agreement at the end of the Initial Term or any Renewal Term. If no notice is given

as required by this section or the parties do not otherwise agree in writing then the Agreement shall automatically renew for further one year periods ("Renewal Term") in accordance with Paragraph 4.1(a). If notice of termination is to be given in the final year of the Initial Term or in any Renewal Term, a minimum of twelve months written notice shall be given before any such date of termination.

(b) During the Initial Term or any Renewal Term, this Agreement may be terminated by either the Client or OCWA ("Termination for Cause") if:

(i) there has been a material breach of the Agreement;
(ii) the party complaining of the breach has given written notice of the breach to the other party; and
(iii) the other party does not correct the breach within thirty days of receiving the notice.

(c) Where there is a material breach and: (i) such material breach has not been corrected within the time set out in Paragraph 6.1(b) above; (ii) the material breach has not been referred to mediation pursuant to Section 5.1 of this Agreement; or (iii) the Parties have not otherwise agreed in writing, then the complaining party may terminate this Agreement by giving at least six months notice in writing to the other Party.

(d) If either Party disputes the existence of a breach or that the breach is material, the dispute may be referred to mediation under Section 5.1 of this Agreement.

(e) After the Initial Term, either the Client or OCWA may terminate this Agreement only as follows:

(i) in accordance with Section 6.2;
(ii) for any reason, upon twelve months prior written notice; or
(iii) if there has been a material breach of the Agreement, in accordance with the procedures described in Paragraph 6.1(b) above.

Section 6.2 - Early Termination

If there has been Termination for Cause, then the terminating party shall be paid its actual costs up to the date of termination. Such costs may include, on the part of the Client, the costs of retendering or hiring a replacement and temporary operator until a permanent operator can be retained, and in the case of OCWA, the costs of demobilization.

Section 6.3 - Inventory Count of Consumables/Supplies

OCWA and the Client will conduct an inventory count of consumables/supplies at the Facilities on the first day or as soon as the parties may agree of the Initial Term. If, on termination of this Agreement, OCWA shall either:

(a) ensure that there is the same amount of consumables/supplies at the Facilities on the date of termination as there was on the first day of the Initial Term; or

(b) reimburse the Client for any shortfall.

If the amount of consumables/supplies at the Facilities on the date of termination exceeds the amount on the first day of the Initial Term, the Client will either reimburse OCWA for any excess or OCWA may take possession of any excess, as OCWA may determine.

Section 6.4 - Final Settlement

If OCWA ceases to operate and maintain the Facilities, there shall be a final settlement of all accounts with respect to the Annual Price and any other expenses incurred by OCWA and amounts owing by or to the Client under this Agreement no later than ninety days after OCWA ceases to provide the Services.

ARTICLE 7 - INNOVATIONS

Section 7.1 - Innovations

Either Party may bring forward innovative ideas for the operation of the Facilities and both parties agree to reasonably consider such innovative ideas

ARTICLE 8 - GENERAL

Section 8.1 - Year 2000 Compliance

(a) The parties represent and warrant that all proprietary and non-proprietary computer hardware, software and firmware (including without limitation all telecommunications, imbedded systems and premise technology), individually and in combination that are used by each and that may impact the delivery or the quality of each party's respective obligations under this Agreement or the ability each to provide accurate invoicing and payment in respect of the Services (collectively the Parties' Systems), shall be "Year 2000 Compliant", meaning that the Parties' Systems:

(i) are designed to be capable of operating prior to, during and after the calendar year 2000 AD, without error or reduction in performance relating to date data, specifically including any error relating to date data which represents or references different centuries or more than one century;

(ii) are able to accurately manage, manipulate and process date and date-related data (including but not limited to calculating, comparing, sequencing and sorting) from, into and between the calendar years 1999 and 2000 AD. and from, into and between the twentieth and twenty-first centuries (including leap year calculations); and

(iii) shall not abnormally terminate or provide invalid or incorrect results due to date or date-related data, specifically including date data which represents or references different centuries or more than one century.

(b) At either Party's request, the other shall, at no charge to the requester, demonstrate the compliance techniques and test procedures to be followed by such party to confirm that the its systems are Year 2000 Compliant in accordance with paragraph (a).

(c) Either Party shall cause all subcontractors to comply with paragraph (a) with respect to any component of its Systems to be provided by such subcontractors.

(d) Each Party represents and warrants that the meeting of its obligations under this Agreement shall not be interrupted due to the failure of those systems which support the operation of its business to be Year 2000 Compliant.

Section 8.2 - Ownership of Technology

The Client acknowledges and agrees that in providing the Services, OCWA may utilize certain technology developed by or for OCWA, whether existing now or in the future, including but not limited to technology such as WMMS, Outpost 5 and PDC (the "Technology"). The Client further agrees that the use of the Technology at the Facilities does not in any way give the Client any ownership rights in or Intellectual Property Rights to, the Technology.

Section 8.3 - Agreement to Govern

If there is any inconsistency between this Agreement and any Schedule to this Agreement, this Agreement shall govern.

Section 8.4 - Headings

The division of this Agreement into Articles, Sections and Paragraphs and the insertion of headings are for convenience of reference only and will not affect the construction or interpretation of this Agreement.

Section 8.5 - Entire Agreement

This Agreement constitutes the entire agreement between the Client and OCWA with respect to the subject matter hereof and cancels and supersedes any prior understandings, undertakings, representations, warranties, terms, conditions and agreements, whether collateral, express, implied or statutory, between the Client and OCWA with respect thereto.

Section 8.6 - Proposal not Part of Agreement

OCWA's proposal to the Client to operate the Facilities dated July 6, 2000 shall not form part of this Agreement.

Section 8.7 - Amendments and Waivers

No amendment to this Agreement will be valid or binding unless it is in writing and duly executed by both of the parties hereto. All amendments shall be attached to this Agreement as a Schedule. No waiver of any breach of any provision of this Agreement will be effective or binding unless it is in writing and signed by the party purporting to give such waiver and, unless otherwise provided, will be limited to the specific breach waived.

Section 8.8 - Successors and Assigns

This Agreement shall operate to the benefit of and be binding upon, the parties hereto and their successors and assigns. This Agreement may be assigned in the discretion of either party.

Section 8.9 - Survival

All representations, warranties and indemnities given by each of the parties, shall survive indefinitely the termination of this Agreement.

Section 8.10 - Severability

If any covenant, obligation or provision hereof or the application thereof to any person or circumstance shall, to any extent, be invalid or unenforceable, the remaining provisions or the application of each provision to persons or circumstances other than those as to which it is invalid or unenforceable, shall not be affected thereby and shall continue to be valid and enforceable.

Section 8.11 - Notices

(a) Any notice, or other communication required or permitted to be given hereunder by either party to this Agreement shall be in writing and shall be delivered in person, transmitted by fax or sent by registered mail, addressed as follows:

(i) if to the Client:

Town of Bancroft
24 Flint Street, Box 790
Bancroft, ON K0L 1C0
Telephone: (613) 332-3331
Fax: (613) 332-0384
Attention: Barry Wannamaker, CAO

(ii) if to OCWA:

Ontario Clean Water Agency
593 Norris Court
Kingston, ON K7P 2R9
Telephone: (905) 342-2263
Fax: (905) 342-2279
Attention: Derek French, Client Services Representative

(b) If delivered in person or transmitted by fax, any such notice or other communication shall be deemed to have been given and received on the day on which it was delivered or transmitted (or, if such day is not a Business Day, on the next following Business Day).

(c) If mailed, any such notice or other communication shall be deemed to have been given and received on the third Business Day following the date of mailing; provided, however, that if at the time of mailing or within three Business Days afterwards a labour dispute or other event occurs, which might reasonably be expected to disrupt the delivery of documents by mail, any notice or other communication hereunder shall be delivered or transmitted by fax as provided in this Section 8.11.

(d) A party to this Agreement may change its address for the purpose of this Section by giving the other party notice of such change of address in the manner provided in this Section.

Section 8.12 - Counterparts

This Agreement may be executed in counterparts, each of which shall constitute an original and all of which taken together shall constitute one and the same instrument.
IN WITNESS WHEREOF the parties have duly executed this Agreement.

ONTARIO CLEAN WATER AGENCY

Apr 6, 2001
Date of Signing

By: _____
(Authorized Signing Officer)

Apr 23/01.
Date of Signing

By: _____
(Authorized Signing Officer)

THE CORPORATION OF THE TOWN OF BANCROFT

MARCH 30 . 01
Date of Signing

By: _____
(Authorized Signing Officer)

MARCH 30 . 01
Date of Signing

By: _____
(Authorized Signing Officer)

SCHEDULE A

17

The Facilities

Part 1. Description of the Facilities

For the purposes of this Agreement, the Facilities are comprised of the following:

Water Treatment Plant: Class II - Full treatment plant with flocculation, clarification, filters and chemical addition.

Stand-pipe (Faraday Heights)

Booster Stations: Two in-ground booster stations to boost pressure to higher residential areas above tower level.

Wastewater Treatment Plant: A Class II extended aeration/contact stabilization wastewater treatment plant utilizing grit removal, screening, aeration clarification, chlorine contact tank and sludge holding tank.

Seven Sewage Pumping Stations

Part 2. Street Addresses of the Facilities

The street addresses of the Facilities are as follows:

Bancroft Water Pollution Control Plant
58 Anderson Lane
Bancroft Water Treatment Plant
Snow Road, Bancroft, ON (West side of Clark Lake)

Part 3. Diagram of Facilities

N/A

SCHEDULE B

Definitions

In this Agreement, the following terms are defined below or in the section in which they first appear:

"Agreement" means this agreement together with Schedules A, B, C, D, E, F and G attached hereto and all amendments made hereto by written agreement between OCWA and the Client.

"Annual Price" is defined in Paragraph 4.2(a) of this Agreement.

"Applicable Laws" is to be broadly interpreted and means, with respect to any person, property, transaction, event or other matter dealt with in this Agreement, any and all statutes, by-laws, regulations, enactments, ordinances, rules, permits, consents, approvals, certificates of approval, licences, judgments, orders, judicial decisions, common-law rules, decrees, injunctions, agreements, authorizations, regulations, policies, guidelines, directives, objectives, whether federal, provincial or municipal including, but not limited to all laws relating to occupational health and safety matters, fire prevention and protection, heath protection and promotion, land use planning, environment, Building Code, or workers' compensation matters.

"Approved Capital Expenditures" is defined in Paragraph 4.6(b) of this Agreement.

"Authorizations" means each of the sewer use and water by-laws, licences, certificates of approval, permits, consents and other authorizations or approvals required under any Applicable Law from time to time in order to operate the Facility.

"Authorized Representatives" is defined in Section 2.5 of this Agreement.

"Business Day" means a day other than a Saturday, Sunday or statutory holiday in Ontario.

"Capital Expenditures" is defined in Paragraph 4.6(a) of this Agreement.

"Claim" means any claim, fine, penalty, liability, damages, loss and judgements (including but not limited to, costs and expenses incidental thereto) of any kind and nature whatsoever.

"Current Term" is defined in Section 4.3 of this Agreement.

"Excluded Services" is defined in Section 2.3 of this Agreement.

"Facility" is defined in the "Background to this Agreement" and further described in Schedule A.

"Indemnified Parties" is defined in Section 3.3 of this Agreement.

"Initial Term" is defined in Paragraph 4.1(a) of this Agreement.

"Insurance" is defined in Paragraph 2.9(a) and further described in Schedule E.

"Intellectual Property Rights" means any copyright, trademark, patent, registered design, design right, topography right, service mark, application to register any of the aforementioned rights, trade secret, rights in unpatented know-how, right of confidence and any other intellectual or industrial property rights of any nature whatsoever in any part of the world.

"Outpost 5" means a remote monitoring and control system designed and constructed by OCWA and its consultants for the purpose of monitoring and controlling processes at water and wastewater treatment facilities and their related parts.

"Parties" is defined in Paragraph (c) of the Recitals to the Agreement..

"Parties System" is defined in Paragraph 8.1(a) of this Agreement.

"PDC" or "Process Data Collection" means technology that allows process data to be entered into a format that can be viewed, manipulated and retrieved in the form of customized reports.

"Renewal Term" is defined in Paragraph 6.1(a) of this Agreement.

"Services" is defined in Section 2.1 and further described in Schedule C to this Agreement.

"Technology" is defined in Section 8.2 of this Agreement.

"Termination for Cause" is defined in Paragraph 6.1(b) of this Agreement.

"Uncontrollable Circumstance" is defined in Paragraph 2.2(c) of this Agreement.

"Unexpected Expenses" is defined in Paragraph 4.7(a) of this Agreement.

"WMMS" or "Work Management Maintenance System" means a computer program used to determine a program of preventive maintenance activities for equipment in a facility based on a risk analysis that considers factors such as equipment life expectancy, present value and replacement cost.

"Year 2000 Compliant" is defined in Paragraph 8.1(a) of this Agreement.

SCHEDULE C

The Services

1. Operating Duties

Subject to the provisions of this Agreement the Services are those services specifically set out in this Schedule. Specifically, OCWA will, during normal working hours, provide the following:

A. Wastewater Treatment Facility

- inspect process control equipment to ensure proper operation of secondary wastewater treatment clarifiers, pumps, blower and aeration systems, chlorine and other chemical feeders;
- check pumping stations to ensure that everything is in order (also take routine readings);
- sound clarifier for sludge depth to ensure proper return rates;
- operate pump controls and valve controls for pumping of all process streams;
- clean grit channels;
- skim chlorine contact chambers and settling tanks;
- rake bar screens and check barminutor and/or comminutor;
- hose down weirs, walls and channels in aeration and secondary clarifier;
- mix and monitor chlorine in feed tanks and other process chemicals;
- remove and dispose of sludge as required; and
- perform regularly schedule maintenance on all equipment and pumping stations.

B. Wastewater Collection

- yearly, remove maintenancehole covers and inspect maintenanceholes for flow through, debris accumulation, structural stability of walls, and rungs, infiltration and proper benching;
- flush maintenanceholes and sewers as required and remove sand and debris; and
- routinely monitor wastewater collection system for infiltration, illegal connections and illegal discharge of contaminants to system.
- provide supervision/management of all repairs or capital work to the collection system
- the Town of Bancroft will have right of refusal to utilize Town Works staff for capital works, repairs, upgrades.
- inspection of new water and sewer services

C. Water Treatment Plant

- inspect process control equipment to ensure proper operation of chlorinators, mixing, coagulation, flocculation systems, clarifier, pumps, filters, chemical feeders;
- operate pump controls and valve controls for pumping of all process streams;
- hose down weirs, walls and channels in flocculation and sedimentation tanks and clarifier;
- supply, mix and add routine process chemicals as required;

- check filters and backwashing filters as required on a routine basis;
- add sodium hypochlorite to feed tanks and check chlorine residual;
- visually inspect the water tower; and
- collect samples and monitor chlorine residual in the distribution system.

D. Water Distribution

- open, exercise and flush water hydrants annually and as required, make repairs and paint where necessary and winterize each fall;
- inspect water tower, stand-pipe and ground water reservoir yearly through visual inspection, draining, checking controls and valves, or by monitoring pressure and water levels; and
- inspect distribution system, visually for major leaks, exercise main distribution shut-off valves and hydrants once per year
- collect samples and monitor chlorine residual.
- provide supervision/management of all repairs or capital works to the distribution system
- the Town of Bancroft will have right of refusal to utilize Town Works staff for capital works, repairs, upgrades.
- inspection of new water and sewer services
- thawing of water services
- inspecting/maintaining curbstops

2. Routine Maintenance

OCWA will provide routine maintenance of the Facilities as would a reasonable operator. Specifically, OCWA will:

- carry out a routine lubrication program including greasing and oiling consistent with best industry practices ;
- perform routine annual maintenance duties to equipment by following the preventive maintenance procedures; by checking machinery and electrical equipment when required and overhauling of equipment when necessary;
- maintain an inventory on all equipment and tools;
- ensure the security of the project by locking doors and gates;
- snow removal at plants and pumping stations; and
- grass cutting at plants and pumping stations.

3. Capital Improvements

OCWA, acting as a reasonable operator, will record information on the frequency of equipment breakdown and repair costs to determine replacement needs. Where reasonable, parts of the Facilities requiring upgrading or improvement will be identified and brought to the attention of the Client in accordance with Paragraph 4.6(b) of this Agreement.

4. Optimization and Compliance of Operation

OCWA will routinely analyze, investigate and, where appropriate, implement measures to improve the effectiveness and efficiency of the Facilities.

OCWA, acting reasonably, is responsible for ensuring an efficient operation of the process and keeping records on a daily basis.

A. Wastewater Collection and Treatment

- recording and analyzing wastewater flow, chemicals used, process water and wastewater flow calculations;
- checking chemical feed pumps and return sludge rates, comparing to routine calculations and determining operational adjustment requirements;
- calculating, recording, and analyzing the amount of wastewater treated, the daily flows and monthly flows, pumping station running hours, diesel running hours, amount of chemicals used, and the sludge hauled;
- performing routine wastewater tests such as suspended solids, BOD, total solids, chlorine residual, dissolved oxygen, temperature, 30 minute settling and recording results, calculating plant process control parameters and making operational adjustments as required such as increasing chemical feed or wasting return sludge;
- on a routine basis, completing the daily operating forms for statistics for computer input and output forms to ensure a proper monitoring of plant flows and process for wastewater treatment;
- collecting samples for heavy metals and trace organics, conducting routine analysis for coliform bacteria and chemicals and ensuring that they are shipped to the proper labs (analysis to ensure a representative analysis.); and
- ensuring that the daily operations comply with and fulfill the requirements of the Certificate of Approval and other legal documents.

B. Water Treatment and Distribution

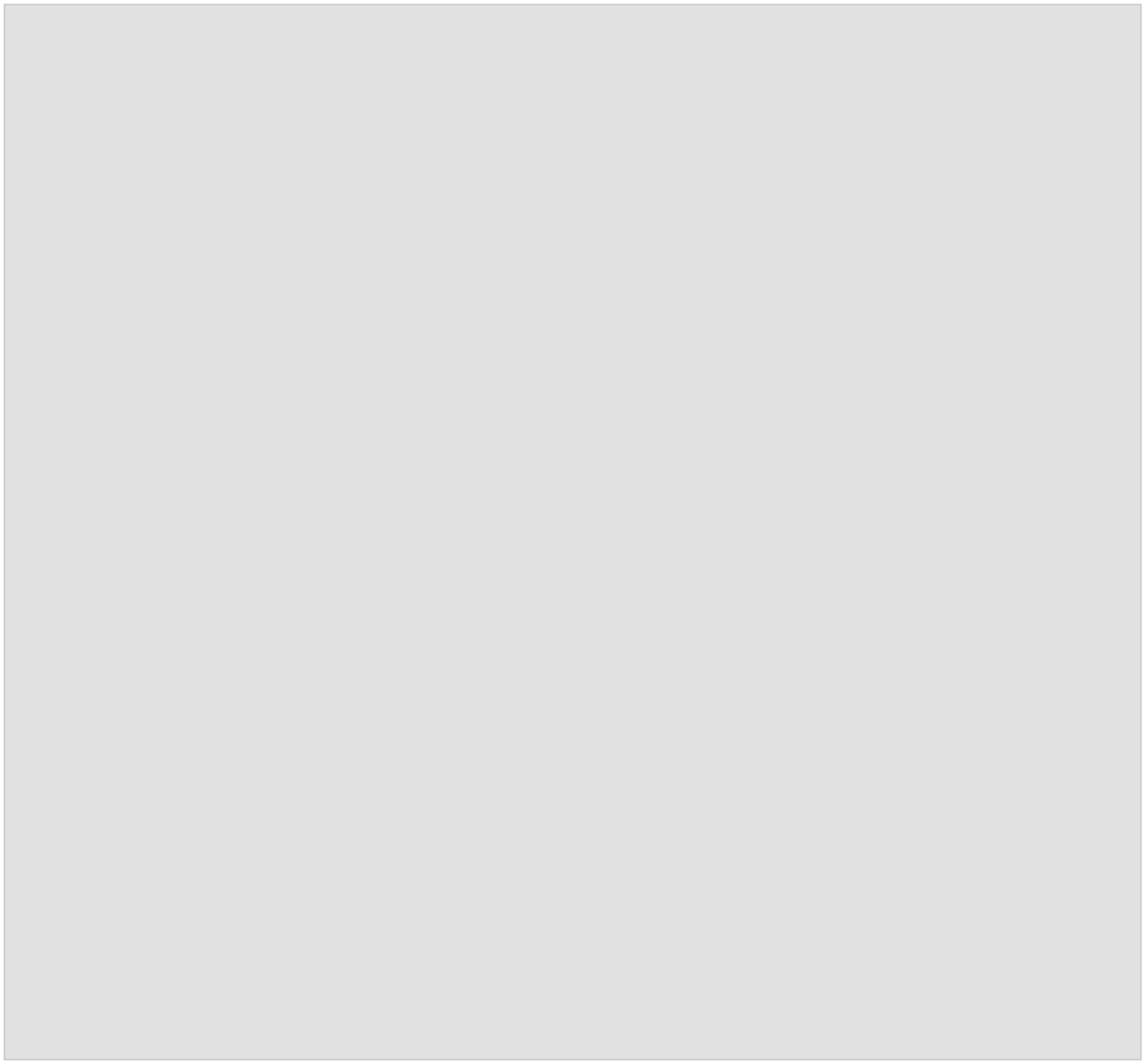
- recording and analyzing water flow, chemicals used, chlorine residuals, turbidity;
- checking chemical feed pumps, and performing routine calculations and evaluations and determining operational adjustment requirements;
- calculating, recording and analyzing daily and monthly water flows, pump running hours, the amount of chlorine, and alum used;
- routinely conducting the following water tests: chlorine residual, water temperature, colour, pH, turbidity; recording the results and making operational adjustments such as increased chemical dosages;
- completing the daily operating forms for statistics for computer input and output forms to ensure a proper monitoring of plant flows and process;
- collecting samples in accordance with the Ontario Drinking Water Standards and Regulation 459 , conducting routine analysis for bacti and ensuring that they are shipped to the proper labs for analysis; and

ensuring that the daily operations comply with and fulfill the requirements of the Certificate of Approval and other legal documents.

5. Regulatory Matters

OCWA will handle day-to-day regulatory requirements and contacts with regulatory authorities in respect of operating issues concerning the Facilities. OCWA will review any inspection reports prepared by regulatory authorities that are provided to OCWA. Subject to any approvals of the Client required by Paragraph 4.6(b) of this Agreement, OCWA will either correct deficiencies identified in such inspection reports or negotiate changes to the reports with the regulatory authorities.

6. Staffing



7. **Emergency Situations and Safety**

- OCWA will ensure that the Facilities have a contingency plan in place to deal with non-routine operational situations and emergency situations such as spills, by-passes, overflows, hydro interruptions and equipment failure.

8. **Sludge**

OCWA acknowledges and agrees that it is responsible for arranging for all aspects of sludge removal, storage and spreading and is required to comply with all relevant Applicable Laws, including, but not limited to, any relevant regulatory guidelines on biosolids management and disposal issued by the Ministry of the Environment and any relevant certificates of approval.

SCHEDULE D

Excluded Services

Services that will not be provided by OCWA include but are not limited to, the following ("Excluded Services"):

- installation of new water and sewer services;
- snow removal around hydrants;
- foam swabbing and pigging watermains;
- cost for non-routine sampling and lab analysis;
- reading residential water meters;
- cleaning of sludge storage tank beyond routine cleaning associated with sludge removal for disposal;
- the cost of any capital costs for repairs or maintenance to the collection and distribution systems.

If the Client subsequently requires OCWA to provide any of the Excluded Services, such Excluded Services may be provided at additional cost to the Client.

SCHEDULE E

Insurance

A summary of the insurance coverage that OCWA will arrange for in respect of the Facility is described below:

Property Insurance

Perils: "All Risks" including earthquake and flood. Subject to policy exclusions.

Limits:
- Replacement Value (Subject to Annual Reports)
- Extra expenses
- Expediting expenses

Deductibles: For the year 2001, subject to change on annual basis.

All Perils - $2,500 except earthquake and flood
Earthquake - $50,000 (minimum)
Flood - $25,000

Where the Client's property is repaired or replaced the Client will pay the deductible. Where OCWA's property is repaired or replaced, OCWA will pay the deductible. In cases where both the Client's and OCWA's property is repaired or replaced, the deductible will be paid by both the Client and OCWA pro rata in accordance with the total loss.

Property Insured: All reported properties including buildings and equipment situated within 1,000 feet of the premises. Includes pumping stations, excludes underground sewer and water system.

Boiler and Machinery Insurance

Coverage: Insures against loss or damage arising from an accident to scheduled object in use or connected ready for use.

Objects: Boilers, Pressure Vessels (Excess of 15PSI) Piping.

Accident: Sudden and accidental breakdown of an object which causes it physical damage, requiring its repair or replacement.
Subject to policy exclusions.

Limit: $60,000,000 per loss.

Deductibles: $2,500 for the year 2001; subject to change on annual basis.

Where the Client's property is repaired or replaced the Client will pay the deductible. Where OCWA's property is repaired or replaced, OCWA will pay the deductible. In cases where both the Client's and OCWA's property is repaired or replaced, the deductible will be paid by both the Client and OCWA pro rata in accordance with the total loss.

Automobile Insurance

Coverage: Automobile Liability.

Limit: $2,000,000
Accident Benefits per Ontario Statutes.

Coverage: Collision

Coverage: Comprehensive

Deductible: The deductible will be paid by OCWA.

Comprehensive General Liability Insurance

Coverage: Third party liability including legal fees, for property damage and/or bodily injury as caused by negligence arising out of all operations of the insured.

Limit: $20,000,000 per occurrence.

Deductible: $10,000 for the year 2001; subject to change on annual basis.

Where OCWA is negligent the deductible will be paid by OCWA. Where the Client is negligent, the deductible will be paid by the Client. In cases where both OCWA and the Client are negligent the deductible will be divided equally.

Pollution Liability Insurance

Coverage: Pollution legal liability covering third party property damage and bodily injury and clean up costs for pollution conditions emanating from the Facilities, with a coverage limit of $10,000,000.00 per claim or occurrence and aggregate. Coverage provides for on-site clean up of the Facilities.

Limit: $10,000,000 per loss on a Claims Made basis with automatic, extended reporting periods. $10,000,000 aggregate.

Deductible: $50,000 for the year 2001; subject to change on annual basis

Where OCWA is negligent the deductible will be paid by OCWA. Where the Client is negligent, the deductible will be paid by the Client. In cases where both OCWA and the Client are negligent the deductible will be divided equally.

Where neither the Client nor OCWA is negligent the deductible will be paid as follows:

Where the Client's property is repaired or replaced the Client will pay the deductible. Where OCWA's property is repaired or replaced, OCWA will pay the deductible. In cases where the Client's and OCWA's and/or a third party's property is repaired or replaced, the deductible will be paid by both the Client and OCWA pro rata in accordance with the total loss.

SCHEDULE F

Part 1: Changes in Flows

(a) A significant change in flow means a flow that is at least 6% greater or 6% less than the flow of the Base Year.

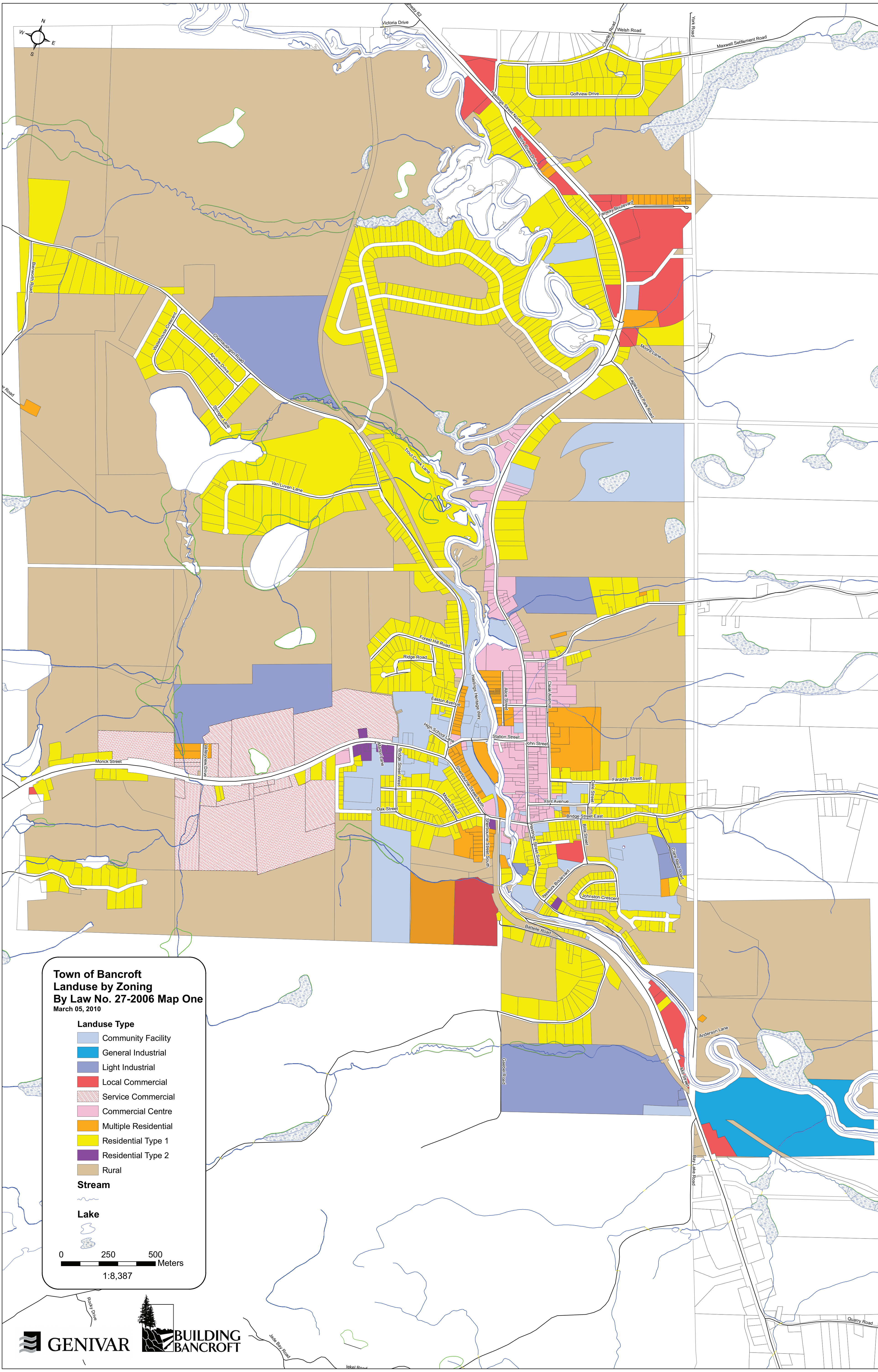
"Base Year Flow" means, the annual average flow volume of the three years immediately preceding the Initial Term or any renewal term, as may be applicable.

The Base Year Flow for the water treatment facility for the Initial Term is 451,505 m3 per year. The Base Year Flow for the wastewater treatment facility for the Initial Term is 626,461 m3 per year.

Part 2: Calculation of Flow Invoice Debit/Credit

(a) A debit/credit amount equal to $0.09 cents per m^3 of water which is greater than/less than the applicable Base Year Flow for water treatment will be levied based on a significant change in flow (as per Part 1 of Schedule F).

(b) A debit/credit amount equal to $0.06 cents per m^3 of wastewater which is greater than/less than the applicable Base Year Flow for wastewater treatment will be levied based on a significant change in flow (as per Part 1 of Schedule F).


Town of Bancroft
Landuse by Zoning
By Law No. 27-2006 Map One
March 05, 2010
Landuse Type
Community Facility
General Industrial
Light Industrial
Local Commercial
Service Commercial
Commercial Centre
Multiple Residential
Residential Type 1
Residential Type 2
Rural
Stream
Lake
0
250
500
Meters
1:8,387
N
W
E
S
Victoria Drive
Charles Road
Welsh Road
York Road
Maxwell Settlement Road
Golfview Drive
Hastings Street North
York River Drive
Fairway Boulevard
Moore Lane
Eagles Nest Park Road
Bierworth Road
Waterhouse Crescent
Chemaushgon Road
Airview Drive
Stringer Lane
Trout Creek Lane
Van Luven Lane
Forest Hill Road
Ridge Road
Easton Avenue
High School Lane
Hastings Heritage Way
Alice Street
Cleak Avenue
Station Street
John Street
Monck Street
Valleyview Drive
Manor Lane
Bridge Street West
Sherbourne Street North
Maple Street
Oak Street
Faraday Street
Dale Street
Flint Avenue
Bridge Street East
Billa Street
Hastings Street South
Sherbourne Street South
Clare Reid Road
Newkirk Boulevard
Johnston Crescent
Battelle Road
Anderson Lane
Mill Street
Gaebel Road
Bay Lake Road
Quarry Road
Rocky Drive
Jade Bay Road
GENIVAR
BUILDING BANCROFT

Bancroft Urban Area Vacant Land

March 05, 2010

Identified Serviced Vacant Land

Parcel Fabric

0 250 500 1,000 Meters

1:8,400

GENIVAR constructive people

BUILDING BANCROFT

Statistics Canada Statistique Canada

Canada

Population and dwelling counts	Bancroft, Town			Ontario		
	Total	Male	Female	Total	Male	Female
Population in 2006[1]	3,838			12,160,282[†]		
Population in 2001[1]	4,089			11,410,046[†]		
2001 to 2006 population change (%)	-6.1			6.6		
Total private dwellings[2]	1,849			4,972,869		
Private dwellings occupied by usual residents[3]	1,656			4,554,251		
Population density per square kilometre	16.8			13.4		
Land area (square km)	227.84			907,573.82		

Figure Age characteristics	Bancroft, Town			Ontario		
	Total	Male	Female	Total	Male	Female
Total population[4]	3,835	1,785	2,050	12,160,285	5,930,700	6,229,580
0 to 4 years	175	95	75	670,770	343,475	327,290
5 to 9 years	175	85	90	721,590	369,670	351,920
10 to 14 years	245	130	110	818,445	420,705	397,740
15 to 19 years	250	120	130	833,115	427,185	405,925
20 to 24 years	185	85	100	797,255	400,445	396,815
25 to 29 years	155	65	85	743,695	360,525	383,170
30 to 34 years	165	65	95	791,955	382,030	409,925
35 to 39 years	170	95	75	883,990	430,220	453,770
40 to 44 years	280	120	160	1,032,415	507,130	525,280
45 to 49 years	300	150	150	991,970	486,390	505,585
50 to 54 years	310	145	155	869,400	423,345	446,060
55 to 59 years	310	150	155	774,530	378,530	395,995
60 to 64 years	240	115	125	581,985	283,545	298,440
65 to 69 years	210	85	125	466,240	222,640	243,600
70 to 74 years	195	85	110	401,950	187,510	214,445
75 to 79 years	200	90	115	338,910	149,585	189,325
80 to 84 years	160	60	100	250,270	97,240	153,035
85 years and over	130	40	90	191,810	60,555	131,260
Median age of the population[5]	47.0	45.9	48.2	39.0	38.1	39.9
% of the population aged 15 and over	84.6	82.4	86.4	81.8	80.9	82.7

Figure Common-law status characteristics	Bancroft, Town			Ontario		
	Total	Male	Female	Total	Male	Female
Total population 15 years and over[6]	3,250	1,475	1,770	9,949,485	4,796,850	5,152,630
Not in a common-law relationship	2,975	1,335	1,635	9,257,730	4,448,935	4,808,790
In a common-law relationship	270	140	140	691,755	347,915	343,840

Figure Legal marital status characteristics	Bancroft, Town			Ontario		
	Total	Male	Female	Total	Male	Female
Total population 15 years and over[7]	3,245	1,475	1,775	9,949,480	4,796,850	5,152,635
Never legally married (single)[8]	830	410	420	3,143,960	1,662,930	1,481,025
Legally married (and not separated)[9]	1,625	810	810	5,168,660	2,585,115	2,583,545
Separated, but still legally married[10]	150	70	80	345,075	150,090	194,980
Divorced[11]	250	115	135	679,990	283,150	396,840
Widowed[12]	400	70	330	611,805	115,565	496,235

Source: Statistics Canada, 2006 Census of Population.

How to cite: Statistics Canada. 2007. *Bancroft, Ontario* (table). *2006 Community Profiles*. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Released March 13, 2007. http://www12.statcan.ca/census-recensement/2006/dp-pd/prof/92-591/index.cfm?Lang=E (accessed March 21, 2010).

Print definitions and symbols included in this table

Date Modified: 2010-02-05

Statistics Canada Statistique Canada

Canada

Figure Occupied private dwelling characteristics	Bancroft, Town			Ontario		
	Total	Male	Female	Total	Male	Female
Total private dwellings occupied by usual residents[13]	1,655			4,555,025		
Single-detached houses - as a % of total occupied private dwellings	70.7			56.1		
Semi-detached houses - as a % of total occupied private dwellings	0.6			5.7		
Row houses - as a % of total occupied private dwellings	3.9			7.9		
Apartments, duplex - as a % of total occupied private dwellings[14]	1.8			3.4		
Apartments in buildings with fewer than five storeys - as a % of total occupied private dwellings[14]	21.8			10.8		
Apartments in buildings with five or more storeys - as a % of total occupied private dwellings	0.0			15.6		
Other dwellings - as a % of total occupied private dwellings[15]	1.5			0.5		
Number of owned dwellings[16]	1,120			3,235,495		
Number of rented dwellings[17]	535			1,312,290		
Number of dwellings constructed before 1986	1,225			3,124,010		
Number of dwellings constructed between 1986 and 2006[18]	430			1,431,020		
Dwellings requiring major repair - as a % of total occupied private dwellings	8.8			6.6		
Average number of rooms per dwelling[19]	6.2			6.6		
Dwellings with more than one person per room - as a % of total occupied private dwellings[19]	0.0			1.9		
Average value of owned dwelling ($)[20]	161,706			297,479		

Figure Selected family characteristics	Bancroft, Town			Ontario		
	Total	Male	Female	Total	Male	Female
Total number of census families[21]	1,075			3,422,315		
Number of married-couple families[22]	795			2,530,560		
Number of common-law-couple families[23]	140			351,045		
Number of lone-parent families	140			540,715		
Number of female lone-parent families	115			441,105		
Number of male lone-parent families	25			99,605		
Average number of persons in all census families	2.8			3.0		
Average number of persons in married-couple families[22]	2.9			3.1		
Average number of persons in common-law-couple families[23]	2.8			2.7		
Average number of persons in lone-parent families	2.5			2.5		
Average number of persons in female lone-parent families	2.5			2.6		
Average number of persons in male lone-parent families	2.8			2.4		
Median income in 2005 - All census families ($)[24]	49,681			69,156		
Median income in 2005 - Married-couple families ($)[22]	56,842			77,243		
Median income in 2005 - Common-law-couple families ($)[23]	38,619			66,525		
Median income in 2005 - Lone-parent families ($)	26,626			38,448		
Median income in 2005 -						

Female lone-parent families ($)	21,295	36,496
Median income in 2005 - Male lone-parent families ($)	44,998	50,339
Median after-tax income in 2005 - All census families ($) [24]	44,801	59,377
Median after-tax income in 2005 - Married-couple families ($) [22]	49,532	65,534
Median after-tax income in 2005 - Common-law-couple families ($)	38,571	57,013
Median after-tax income in 2005 - Lone-parent families ($)	25,730	35,677
Median after-tax income in 2005 - Female lone-parent families ($)	21,295	34,206
Median after-tax income in 2005 - Male lone-parent families ($)	39,110	43,972

Figure

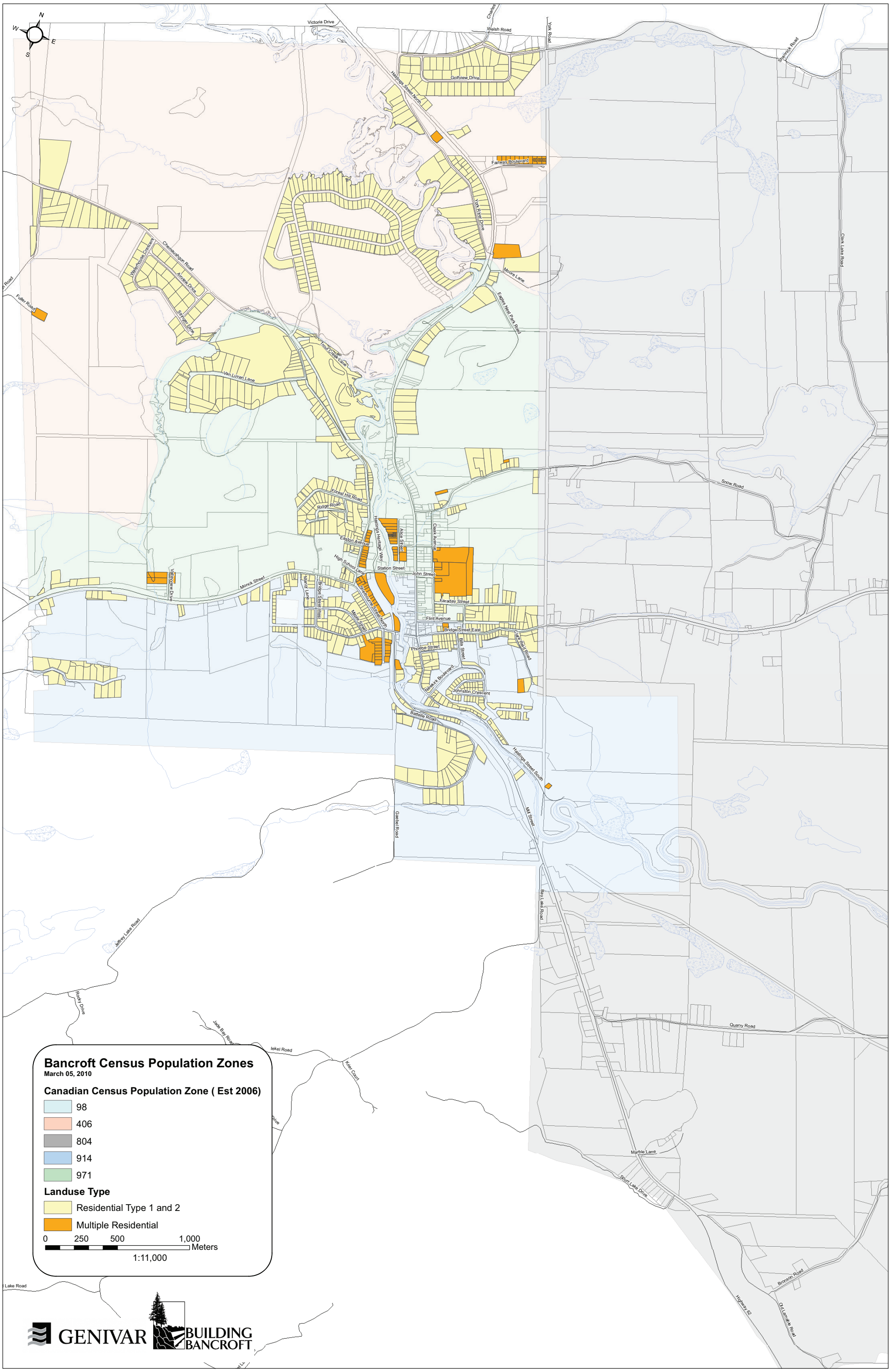
Selected household characteristics	Bancroft, Town			Ontario		
	Total	Male	Female	Total	Male	Female
Total private households [25]	1,655			4,555,025		
Households containing a couple (married or common-law) with children [26]	400			1,420,515		
Households containing a couple (married or common-law) without children [27]	525			1,288,140		
One-person households	555			1,104,865		
Other household types [28]	180			741,505		
Average household size	2.2			2.6		
Median income in 2005 - All private households ($) [29]	38,480			60,455		
Median income in 2005 - Couple households with children ($) [26]	59,739			87,960		
Median income in 2005 - Couple households without children ($) [27]	43,750			68,764		
Median income in 2005 - One-person households ($)	18,313			30,025		
Median income in 2005 - Other household types ($) [28]	36,442			51,560		
Median after-tax income in 2005 - All private households ($) [29]	34,664			52,117		
Median after-tax income in 2005 - Couple households with children ($) [26]	53,339			74,095		
Median after-tax income in 2005 - Couple households without children ($) [27]	40,367			58,755		
Median after-tax income in 2005 - One-person households ($)	17,864			26,473		
Median after-tax income in 2005 - Other household types ($) [28]	33,114			46,194		
Median monthly payments for rented dwellings ($) [30]	601			801		
Median monthly payments for owner-occupied dwellings ($) [31]	666			1,046		

Source: Statistics Canada, 2006 Census of Population.

How to cite: Statistics Canada. 2007. *Bancroft, Ontario* (table). *2006 Community Profiles*. 2006 Census. Statistics Canada Catalogue no. 92-591-XWE. Ottawa. Released March 13, 2007. http://www12.statcan.ca/census-recensement/2006/dp-pd/prof/92-591/index.cfm?Lang=E (accessed March 21, 2010).

Print definitions and symbols included in this table

Date Modified: 2010-02-05


N
W
E
S
Victoria Drive
Charles
Welsh Road
York Road
Stanmott Road
Golfview Drive
Hastings Street North
Fairway Boulevard
York River Drive
Clark Lake Road
Moore Lane
Eagles Nest Park Road
Fuller Road
Waterbutlers Crescent
Chemaushgon Road
Airview Drive
Stringers Lane
Trout Creek Lane
Van Luven Lane
Snow Road
Forest Hill Road
Ridge Road
Easton Avenue
Hastings Heritage Way
Alice Street
Clark Avenue
High School Lane
Station Street
John Street
Valleyview Drive
Monck Street
Manor Lane
Ridge Street (West)
Shanbourne Street North
Marie Street
Faraday Street
Flint Avenue
Bridge Street East
Clare Road Road
Bell Street
Phoebe Street
Newkirk Boulevard
Johnston Crescent
Bancroft Road
Hastings Street South
Mill Street
Gerber Road
Bay Lake Road
Jeffrey Lake Road
Rocky Drive
Jade Bay Road
Iekel Road
Krier Court
Quarry Road
Marble Lane
Spurr Lake Drive
Bronson Road
Old Lamarche Road
Highway 62
Bancroft Census Population Zones
March 05, 2010
Canadian Census Population Zone (Est 2006)
98
406
804
914
971
Landuse Type
Residential Type 1 and 2
Multiple Residential
0 250 500 1,000
Meters
1:11,000
GENIVAR
BUILDING BANCROFT

Bancroft Water and Sanitary System Key User

March 05, 2010

Key User

Town of Bancroft

0 125 250 500 Meters

1:4,500

GENIVAR constructive people

BUILDING BANCROFT

N

W E

S

Fairway Boulevard

Bancroft Motor Inn

Moore Lane

Eagles Nest Park Road

Trout Creek Lane

Tim Hortons

Laundromat

Cement Plant

Snow Road

Forest Hill Road

Ridge Road

Forest Hill Drive

Best Western

McDonalds

Alice Street

Hastings Heritage Way

Easton Avenue

Clark Avenue

Madawaska Street

Woodview Lane

Cheminahton Road

High School Lane

RT Brooks Apartment

Station Street

Chateau Apartment

John Street

Monck Street

New Manor

Manor Lane

Bridge Street West

Maple Street

Queen Street North

Mill Street

Faraday Street

Clare Street

Bancroft Public School

Flint Avenue

Highway 28

Bridge Street East

North Hastings Medical BLDG

Elliot Street

Phoebe Street

Curling Club

Arena

Clare Reid Road

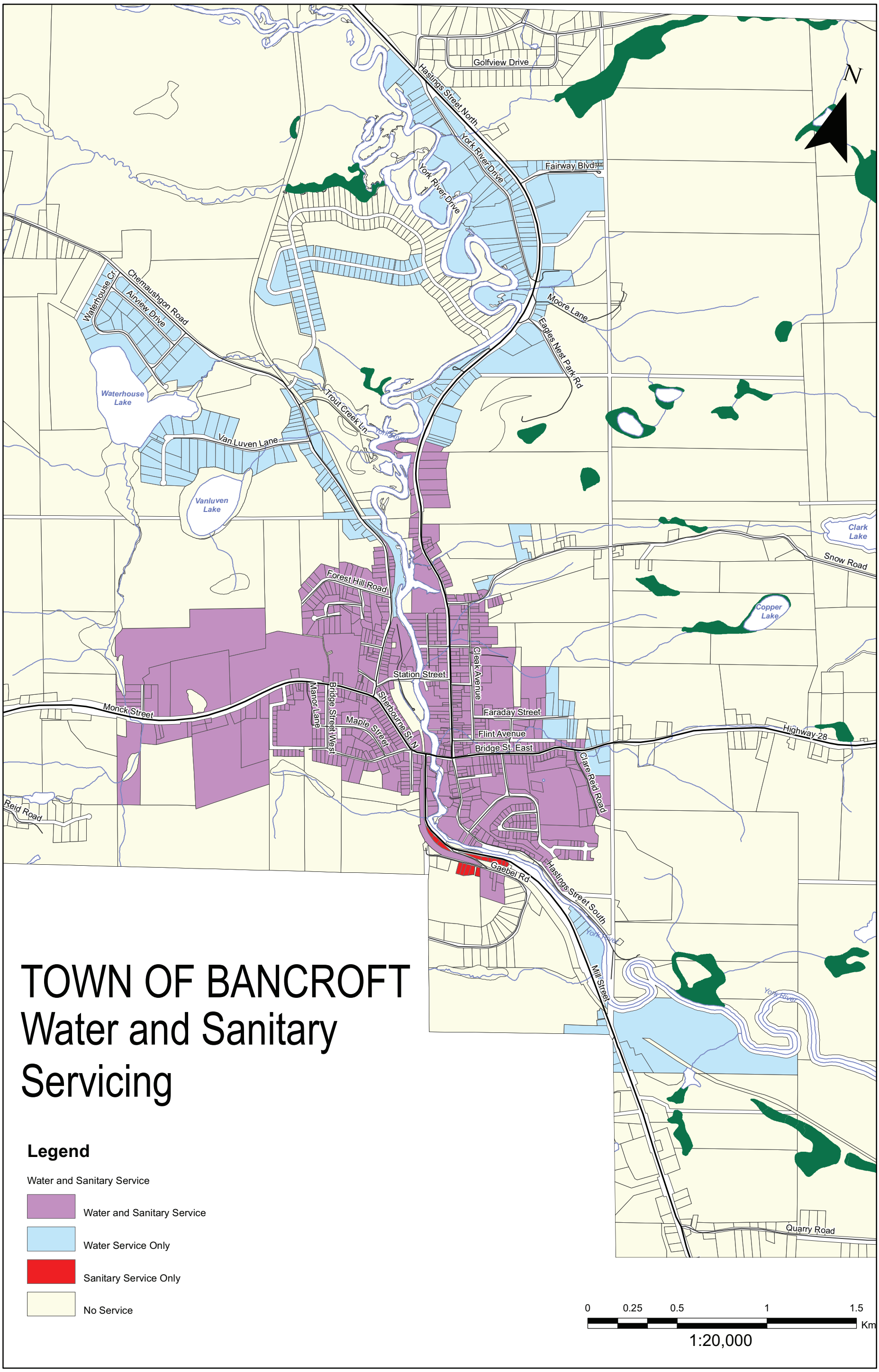
Armstrong Lane

Newkirk Boulevard

North Hastings High School

Johnston Crescent

TOWN OF BANCROFT
Water and Sanitary Servicing



Legend

Water and Sanitary Service

- Water and Sanitary Service
- Water Service Only
- Sanitary Service Only
- No Service

D. SCADA Data Graphical Analysis

GENIVAR received the following SCADA data from the Ontario Clean Water Association (OCWA) staff in Bancroft for the year 2009:

- Raw water intake, given in L/s at differing intervals
- Treated water flow out of the water treatment plant (WTP), given in L/s at differing intervals
- Water tower liquid level elevations, given in m at differing intervals

The Bancroft Daily Average Water Flow for 2009 graph was produced by calculating the average daily flows. Since the data was recorded at varying intervals, it was assumed that flow measurements remained constant until the following flow measurement. Using this assumption, timesteps were calculated for each measurement and a time-weighted flow average (flow x timestep) was calculated. Daily average flow for each day was calculated by dividing the sum of the time-weighted flow averages by the total timesteps in that day. The daily average flow was plotted for the year for both the raw water intake and the treated water flow out of the WTP.

Of note are the two spikes in treated and raw water flows from May 1 to 7 and from October 15 to 21. These are due to system flushing which takes place in the spring and the fall. Note as well, the raw water intake limit is significantly higher than the raw water intakes recorded throughout the year. Consequently, there is a great deal of capacity available for future water demands.

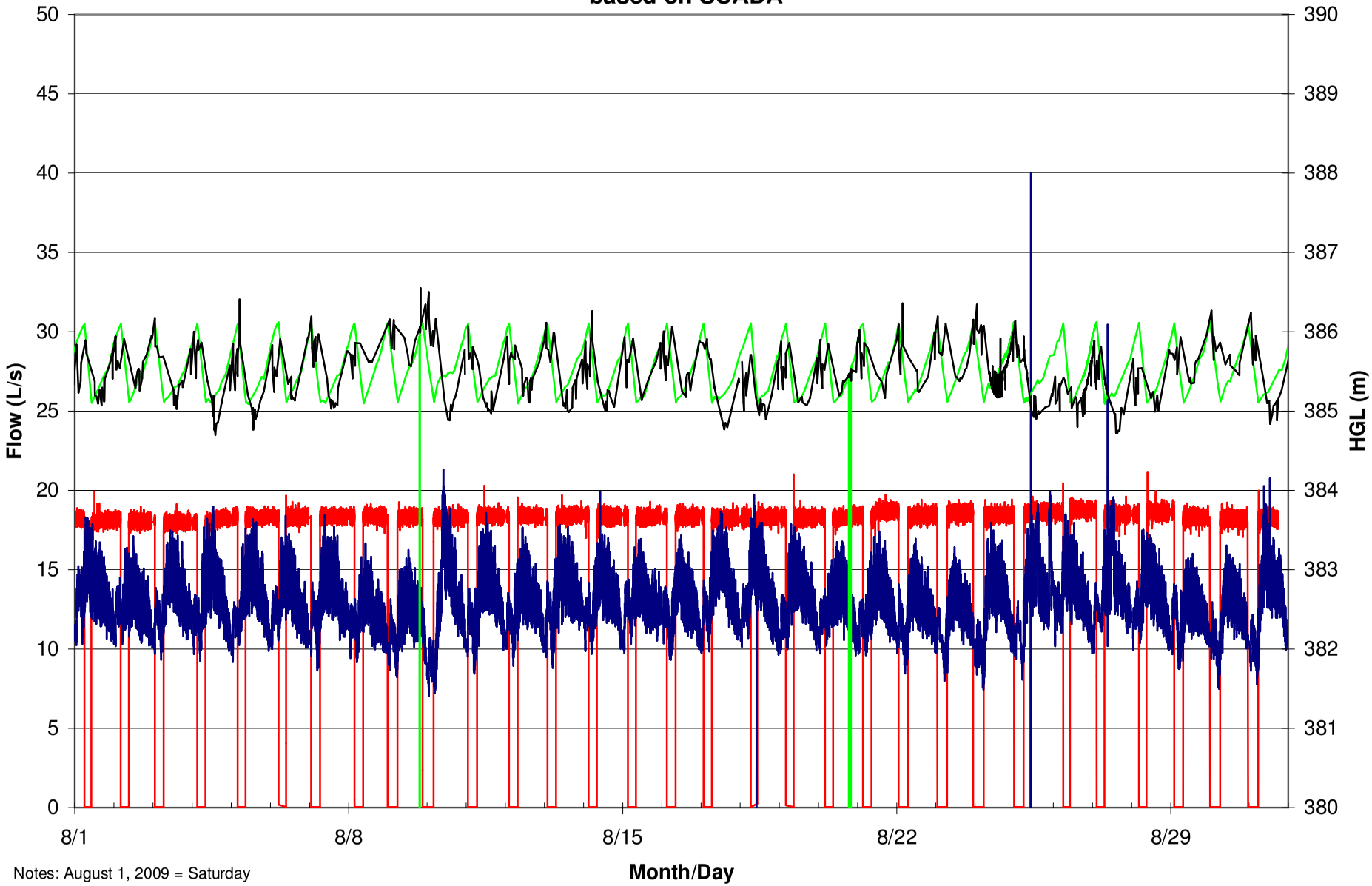
From the annual graph, it was determined that August was the month of highest demand. The Bancroft Flows and HGLs during August 2009 graph plots the raw data of raw water flow, treated water flow and clearwell and tower HGLs.

From the graph of August, it was estimated that the week of August 11 through 18 was a representative week of that month, with few irregularities. The graph titled Bancroft Flows and HGLs from August 11 to 18, 2009 shows a close-up of that week.

Each day of that week was then grouped into hours to determine the average diurnal curve for that week. Using a time-weighted flow average much like in the annual graph, the hourly averages for flow leaving the WTP were calculated. The circumference of the tank was measured to be 12.2, and its area consequently calculated as 117.6 m2. It was assumed that the liquid level varied linearly between level measurements. With this assumption and the area of the tank, an average net flow rate was calculated. For some hours during the week of August 11 to 18, there were no liquid level measurements and so it was assumed that the average flow rate calculated from the previous hour would carry through to the hour with no measurement as this constant flow rate would continue until the next reading.

The calculated hourly average net flows at the WTP and tower for the week were then plotted on the graph titled Bancroft Maximum Day Diurnal Flow. They were also summed together to show a total diurnal consumption of the town.

Bancroft Flows and HGLs during August 2009 based on SCADA

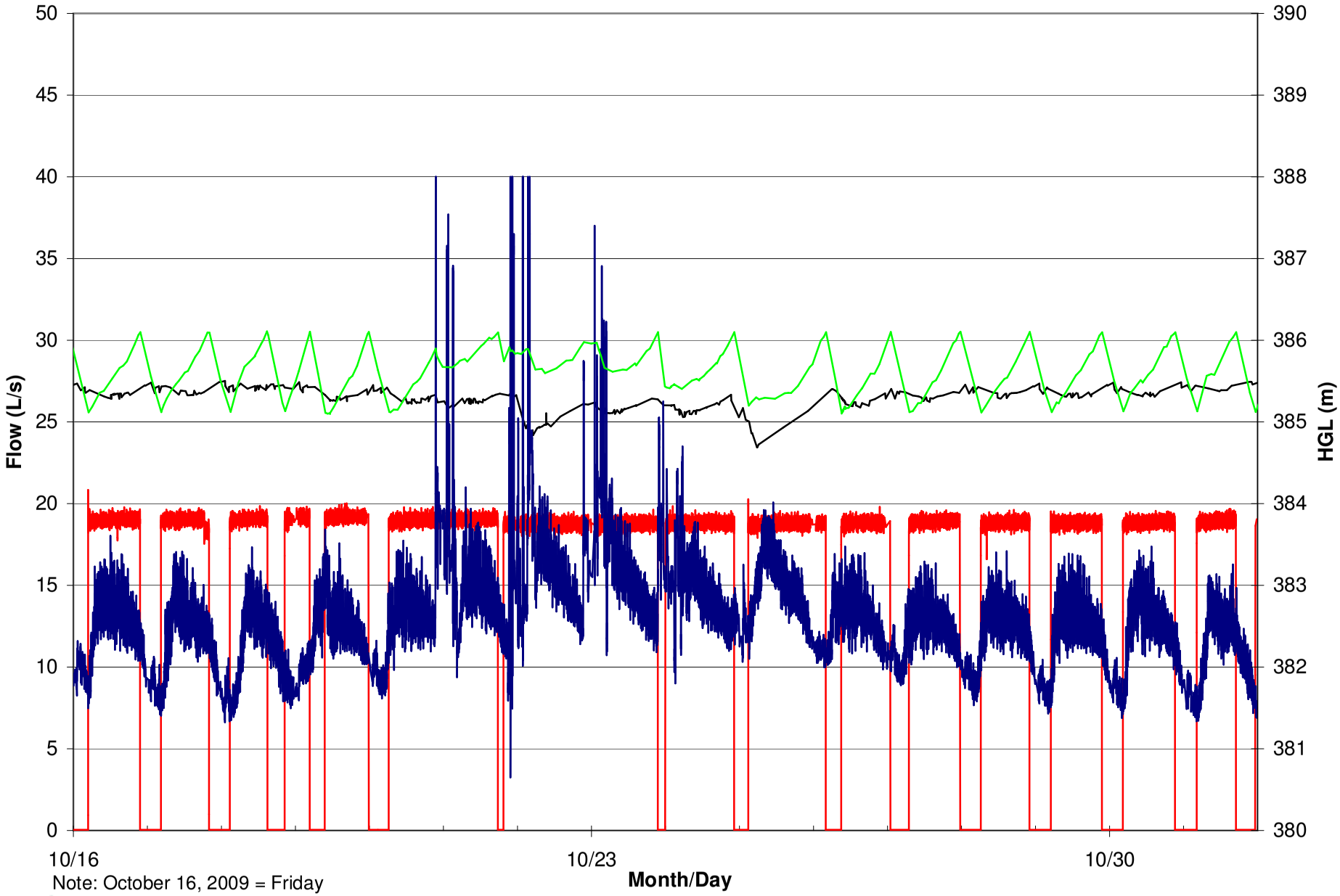


Notes: August 1, 2009 = Saturday
Tower average elevation set according to model results

Bancroft

GENIVAR

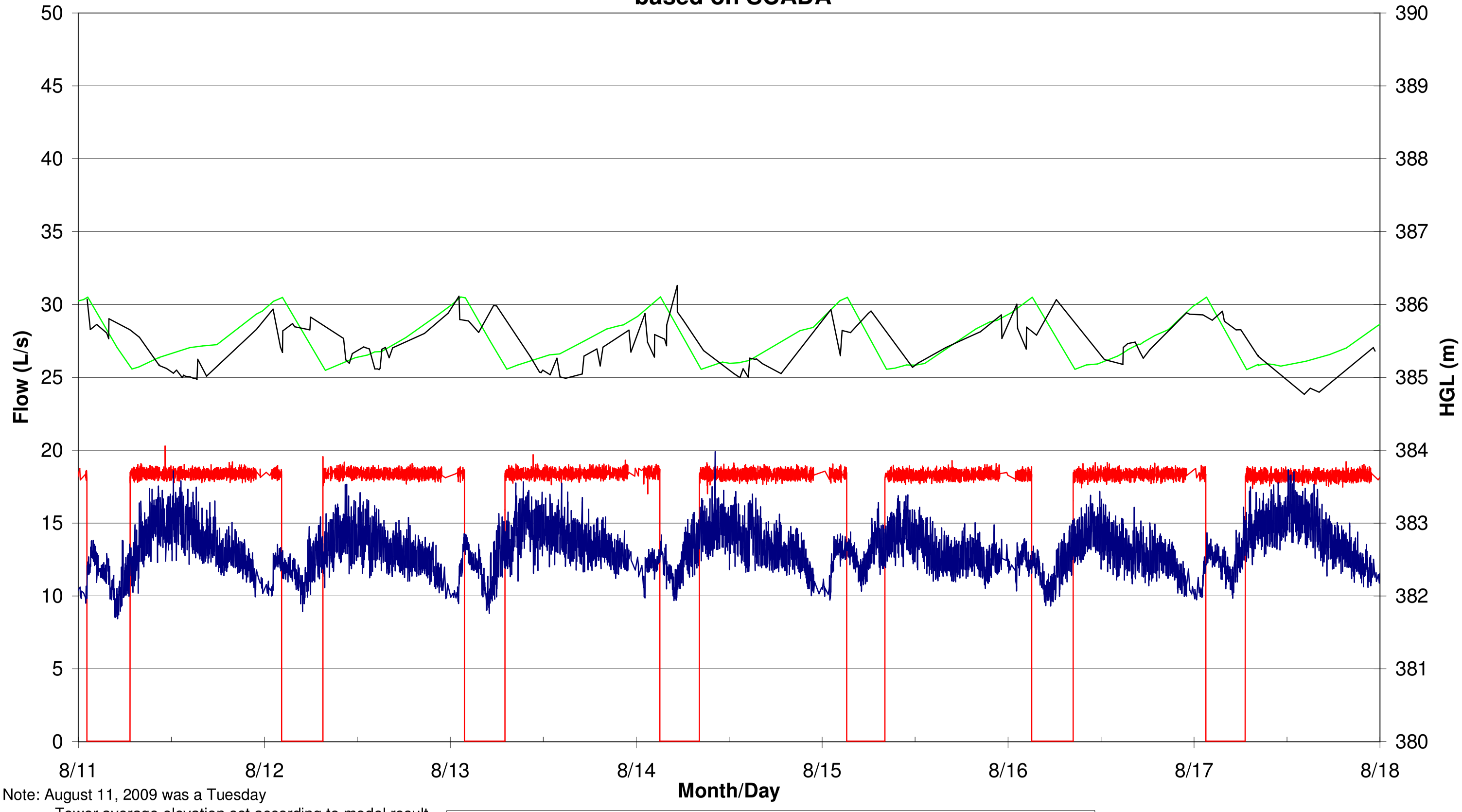
Bancroft Flows and HGLs during October 2009 Water System Flushing



Bancroft

GENIVAR

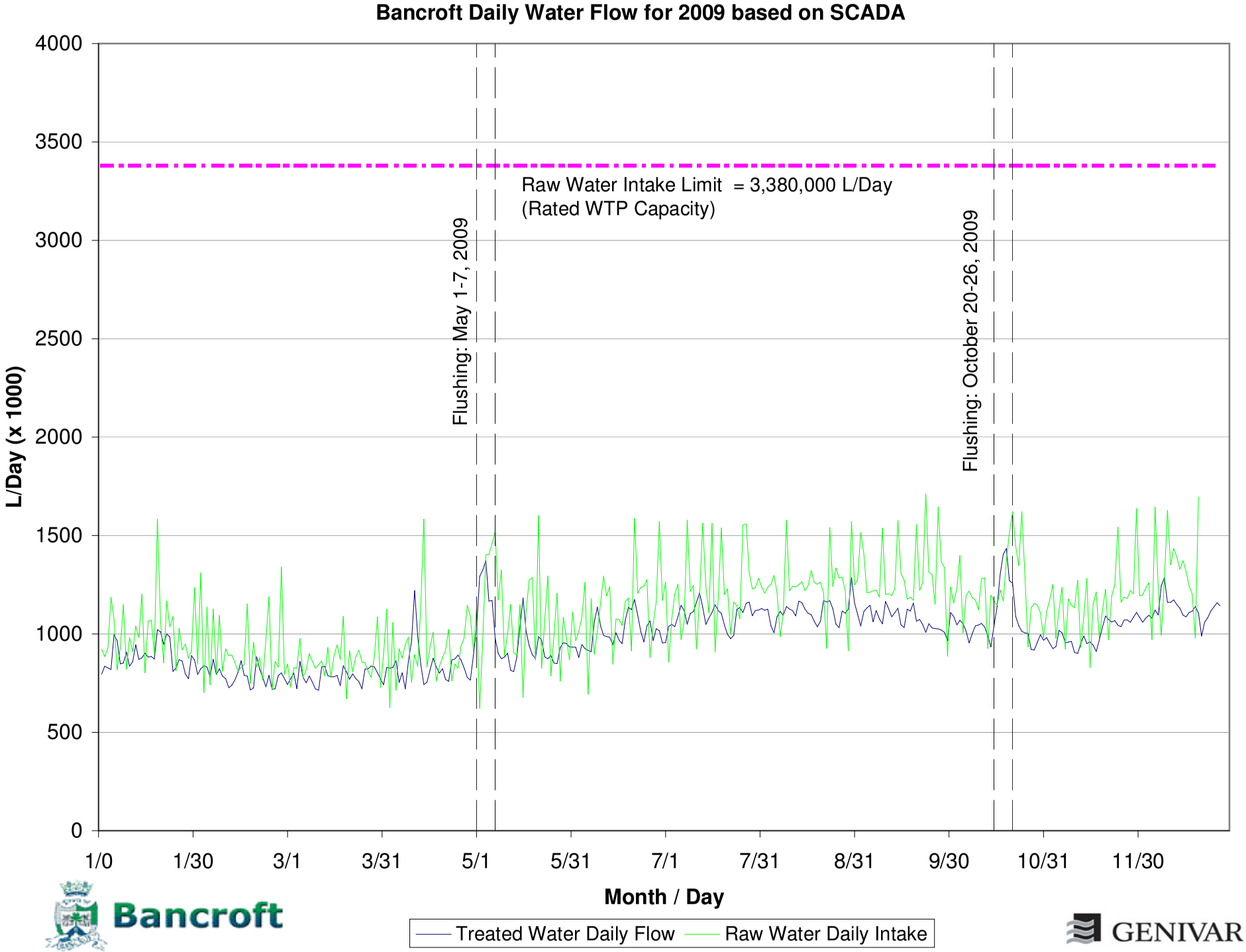
Bancroft Max Week Flows and HGLs for August 11 to 18, 2009 based on SCADA



Note: August 11, 2009 was a Tuesday
Tower average elevation set according to model result

Bancroft

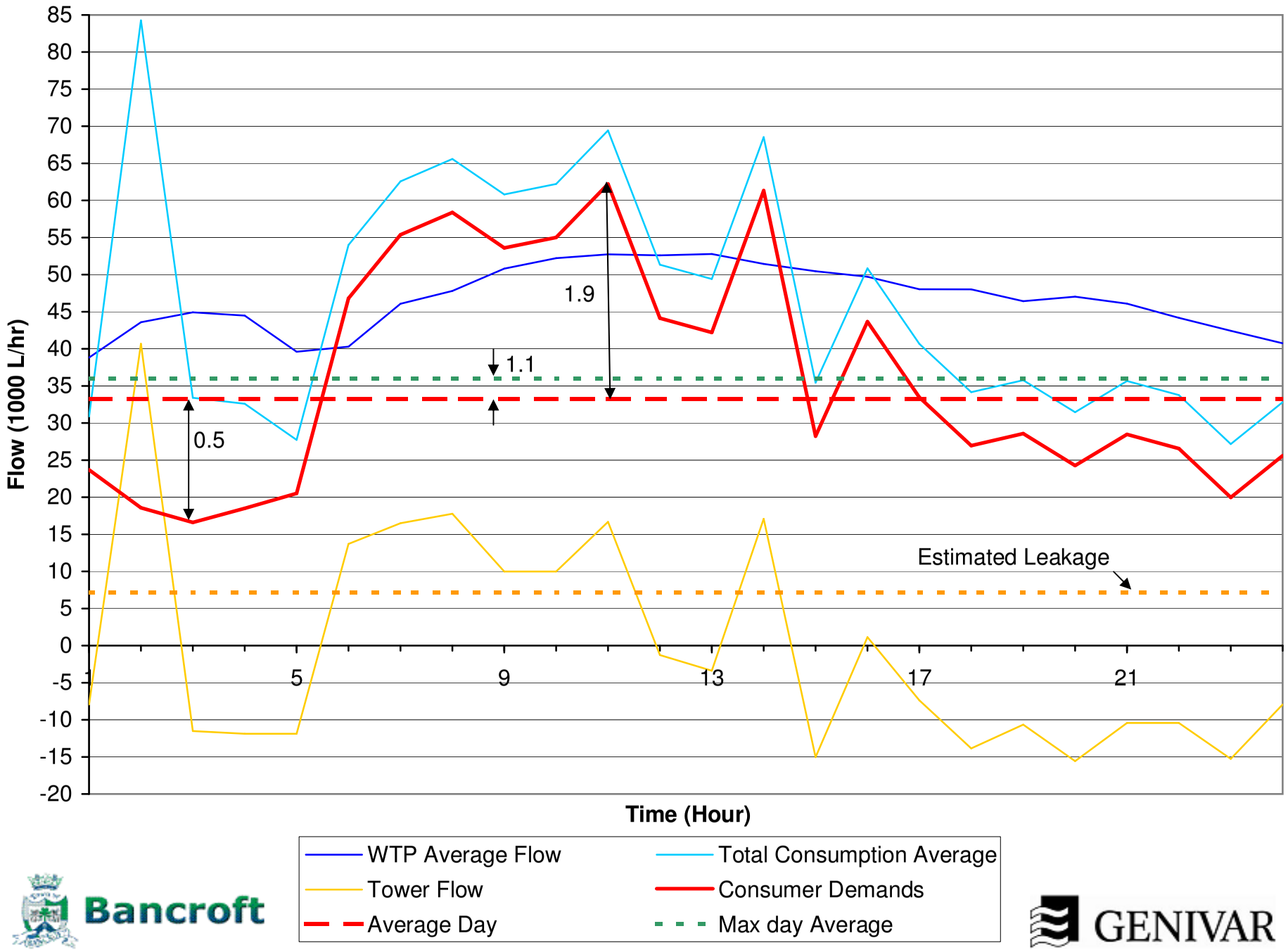
GENIVAR



Bancroft

GENIVAR

Bancroft Maximum Day Diurnal Curve



Bancroft

GENIVAR

Bancroft Max Day Diurnal Curve

Average Max Day Demand (L/hr)=	46271.42	**Peeking Factors**	
Average Day (L/h)=	40407.26	**Max Day**	**1.1**
(L/s)	11.22	**Peak Hour**	**1.9**
Estimated Leakage	7200 L/h		
Less Leakage (L/hr)=	33207.26		
(L/s)	9.22		

Consumer Demands

	Flow to System (L/hr)		Average Day	Max day Average (L/day)	Total System Consumption (L/hr)	Leakage (L/day)	Corrected flow (L/day)	Less flushing 75000 L	Percent application (%)	(L/s)	Diurnal (%)
	WTP	Tower									
12 AM	38827	-7943	33207	35946	30885	7200	23684.58	23684.578	0.00	7.113852	0.71
1 AM	43590	40680	33207	35946	84270	7200	77069.88	18569.878	0.78	5.158299	0.52
2 AM	44918	-11522	33207	35946	33396	7200	26195.51	16603.5	0.13	4.612083	0.46
3 AM	44484	-11883	33207	35946	32601	7200	25401.05	18493.058	0.09	5.136961	0.51
4 AM	39606	-11883	33207	35946	27723	7200	20522.73	20522.733		5.700759	0.57
5 AM	40297	13706	33207	35946	54003	7200	46802.90	46802.902		13.00081	1.30
6 AM	46073	16498	33207	35946	62571	7200	55370.65	55370.655		15.38074	1.54
7 AM	47806	17779	33207	35946	65585	7200	58385.08	58385.084		16.21808	1.62
8 AM	50813	9994	33207	35946	60807	7200	53606.57	53606.574		14.89071	1.49
9 AM	52220	9994	33207	35946	62214	7200	55014.34	55014.338		15.28176	1.53
10 AM	52739	16686	33207	35946	69424	7200	62224.15	62224.149		17.28449	1.73
11 AM	52607	-1273	33207	35946	51334	7200	44133.95	44133.953		12.25943	1.23
12 PM	52789	-3381	33207	35946	49408	7200	42208.18	42208.184		11.7245	1.17
1 PM	51440	17093	33207	35946	68533	7200	61332.62	61332.616		17.03684	1.70
2 PM	50467	-15034	33207	35946	35433	7200	28232.57	28232.569		7.84238	0.78
3 PM	49714	1142	33207	35946	50856	7200	43655.98	43655.98		12.12666	1.21
4 PM	48034	-7369	33207	35946	40665	7200	33464.77	33464.773		9.29577	0.93
5 PM	48011	-13853	33207	35946	34157	7200	26957.47	26957.465		7.488185	0.75
6 PM	46420	-10646	33207	35946	35774	7200	28573.79	28573.788		7.937163	0.79
7 PM	47031	-15566	33207	35946	31465	7200	24265.14	24265.137		6.740316	0.67
8 PM	46089	-10420	33207	35946	35669	7200	28469.20	28469.205		7.908112	0.79
9 PM	44182	-10420	33207	35946	33762	7200	26561.90	26561.9		7.378306	0.74
10 PM	42430	-15259	33207	35946	27171	7200	19971.28	19971.279		5.547577	0.55
11 PM	40753	-7943	33207	35946	32810	7200	25609.87	25609.868		7.113852	0.71
							average=	35946.424		10.0074	1
							total=	862714.17		240.1776	

Highlighted cells indicate hours for which there was no data.
For these cells, the average for the previous hour was assumed.

E. Model Calibration and Analysis

This section describes the method of model calibration and briefly describes the model results.

On the night of January 11 2010, GENIVAR staff conducted hydrant flow tests throughout the Bancroft system with the help of OCWA personnel. During this same time E-Log pressure sensors and data recorders were installed at four locations in the distribution system. The measured flows and data logger results as well as field pressure reading were used to create calibration data sets. These data sets were then inputted in to Bently WaterGEMS V8i genetic algorithm software to generate pipe C-factors to represent the carrying capacity of the pipes. The calibration results were compared to hydrant tests conducted by GENIVAR in December of 2009 as well as historical hydrant tests provided by the Town. Adjustments were made to the model as appropriate. The test locations are shown on the map contained in this section.

All hydrants and sensor locations were surveyed by GENIVAR staff to ensure proper elevation for conversion of sensor data and field pressure observations to a Hydraulic Grade Line (HGL).

Pipes external to the calibration were assigned C-factors according to MOE guidelines as follows.

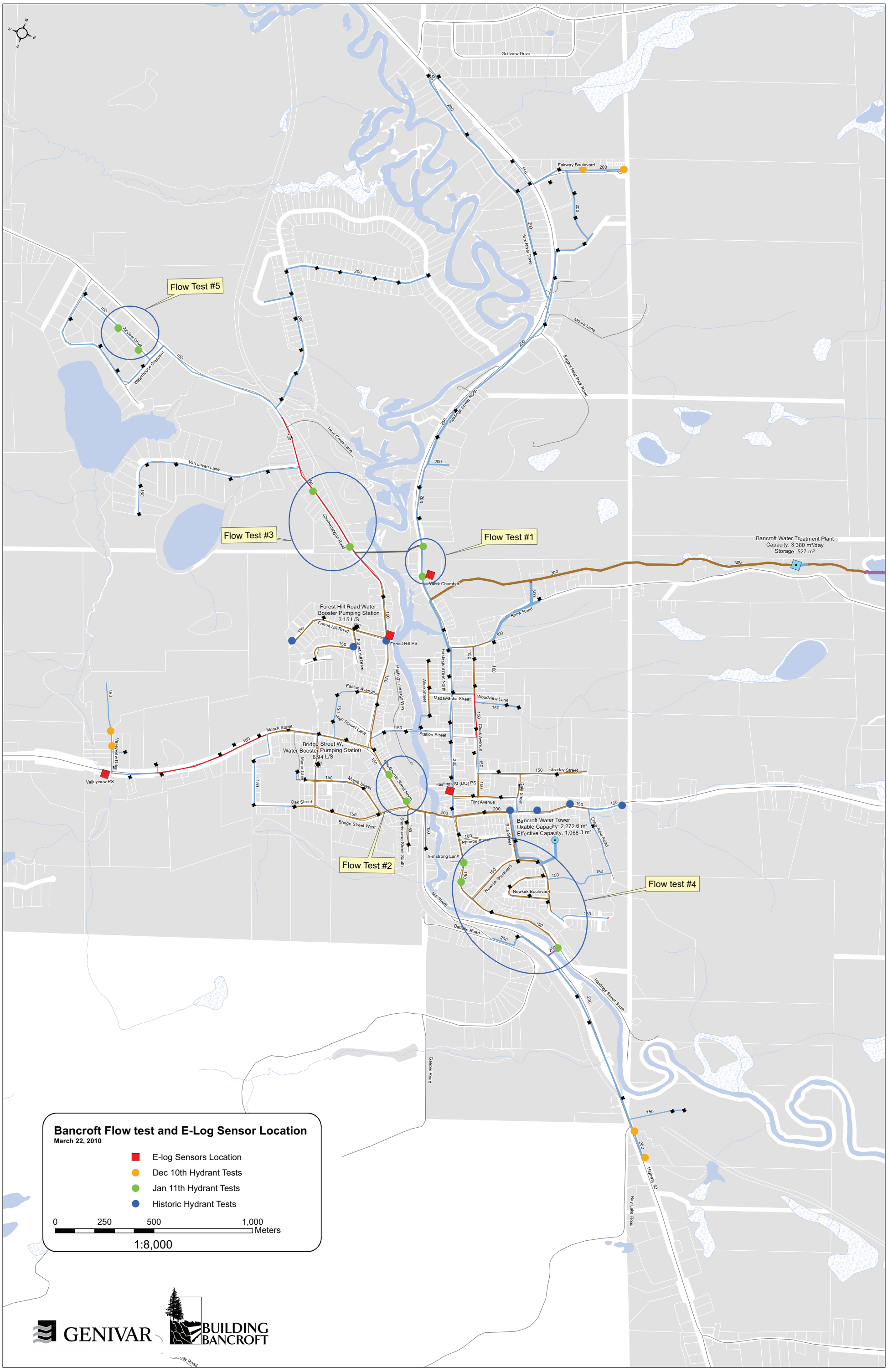
- 150 mm = 100
- 200 mm - 250 mm= 110

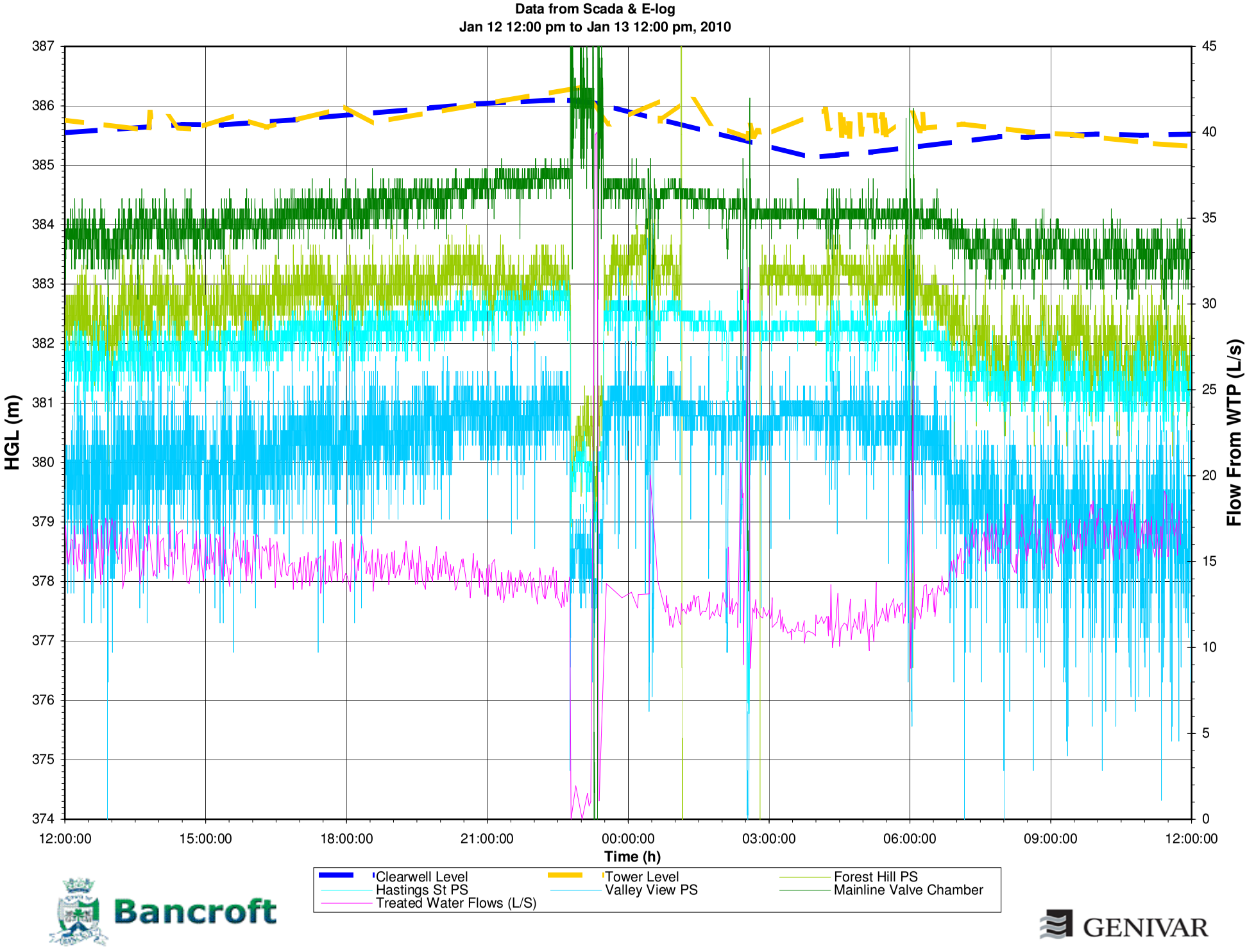
The graphs presented in this Appendix represent the data sets used in the system calibration. The calibration set had to be adjusted for time and in HGL to associate E-Log data to the SCADA data. During the testing a near zero flow condition was created in the main 300 mm waterman from the water treatment plane (WTP). This zero flow condition could be identified in both the SCADA and the E-Log data and appropriate adjustments to the pressure datum's and time steps could be made. Note that the E-Logs experienced a drift in measurement and needed to be adjusted to the datum of the WTP clear well level.

The SCADA tank levels were not associated to a reference elevation to create a reference datum. An estimate of the average tank level was determined from the model and applied to the relative levels in the SCADA data. Tank levels were not used in the calibration but are presented herein with relative levels as contained within the raw data over time with an assumed average tank level elevation of 385.7 m.

The model outputs presented in this section are for Fire Flow and Water Age for both the existing condition and the recommendation presented in this report. Fire flow is presented under the Maximum day demand condition while water age was determined under the average day flow using the Diurnal curve presented in this report. Note that the water age presented in the attached figures will vary depending on the set points of the proposed hydraulic valves. In the modeling results presented herein the tank is forced to vary by 4 m.

At time of reporting the model is not fully calibrated and true results may vary from those presented. It is the intent to recalibrate the model during the town flushing activities in May of 2010.


Golfview Drive
Fairway Boulevard
York River Drive
Moore Lane
Eagles Nest Park Road
Hastings Street North
Trout Creek Lane
Van Luven Lane
Chemaunagon Road
Flow Test #5
Flow Test #3
Flow Test #1
Flow Test #2
Flow test #4
Axview Drive
Watercrest Crescent
Valve Chamber
Bancroft Water Treatment Plant
Capacity: 3,380 m³/day
Storage: 527 m³
Snow Road
Forest Hill Road Water
Booster Pumping Station
3.15 L/S
Forest Hill Road
Forest Hill Drive
Forest Hill PS
Hastings Heritage Way
Alice Street
Madawaska Street
Woodview Lane
Easton Avenue
High School Lane
Monck Street
Valleyview Drive
Valleyview PS
Bridge Street W.
Water Booster Pumping Station
6.94 L/S
Manor Lane
Maple Street
Oak Street
Bridge Street West
Sherbourne Street North
Sherbourne Street South
Station Street
Cheek Avenue
Faraday Street
Hastings St (DQ) PS
Dale Street
Flint Avenue
Bancroft Water Tower
Usable Capacity: 2,272.6 m³
Effective Capacity: 1,068.3 m³
Clare Reid Road
Bliss Street
Phoebe Street
Armstrong Lane
Newkirk Boulevard
Mill Street
Battelle Road
Hastings Street South
Gerbel Road
Highway 62
Bay Lake Road
Bancroft Flow test and E-Log Sensor Location
March 22, 2010
E-log Sensors Location
Dec 10th Hydrant Tests
Jan 11th Hydrant Tests
Historic Hydrant Tests
0 250 500 1,000
Meters
1:8,000
GENIVAR
BUILDING BANCROFT



Bancroft

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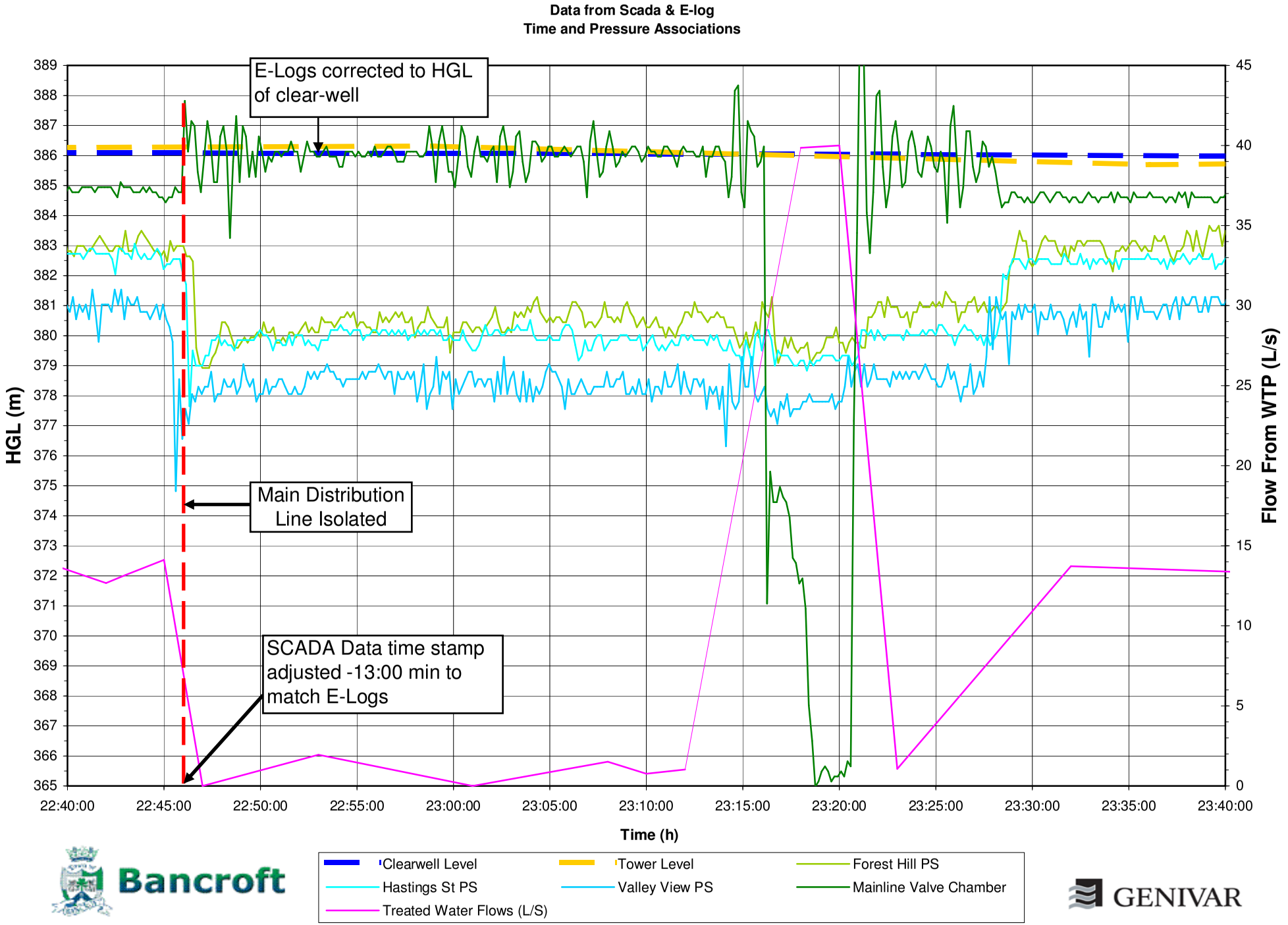

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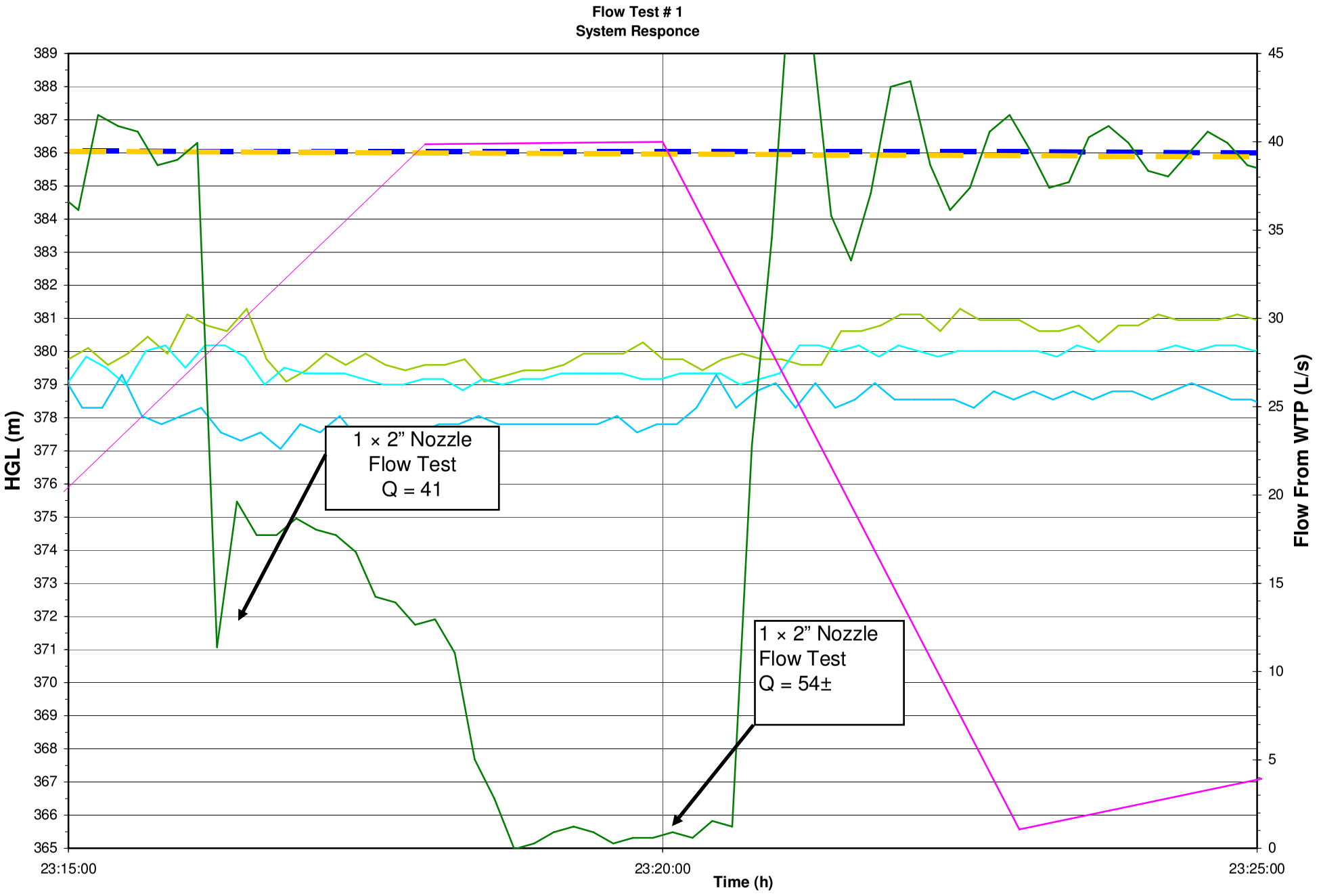

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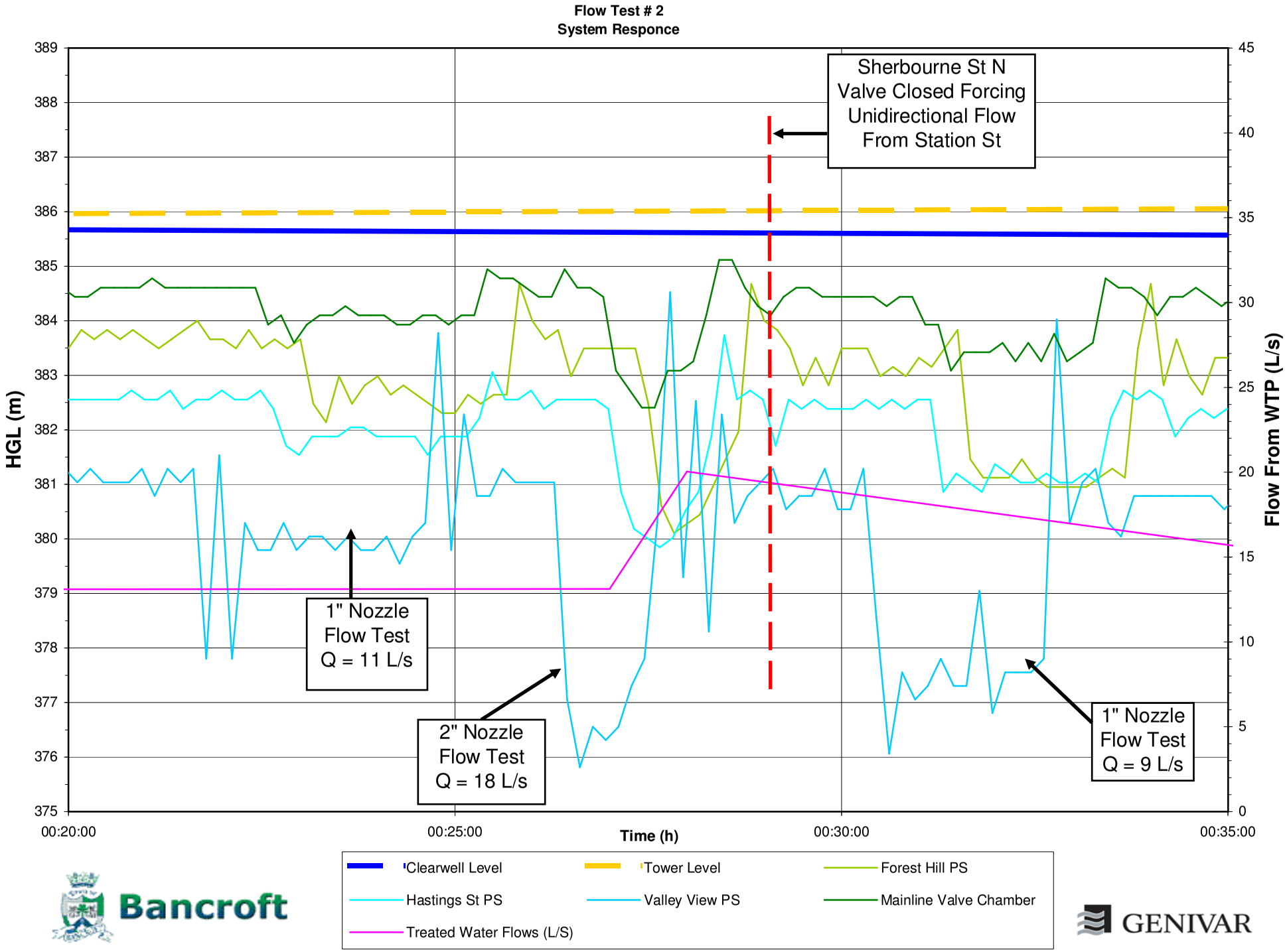

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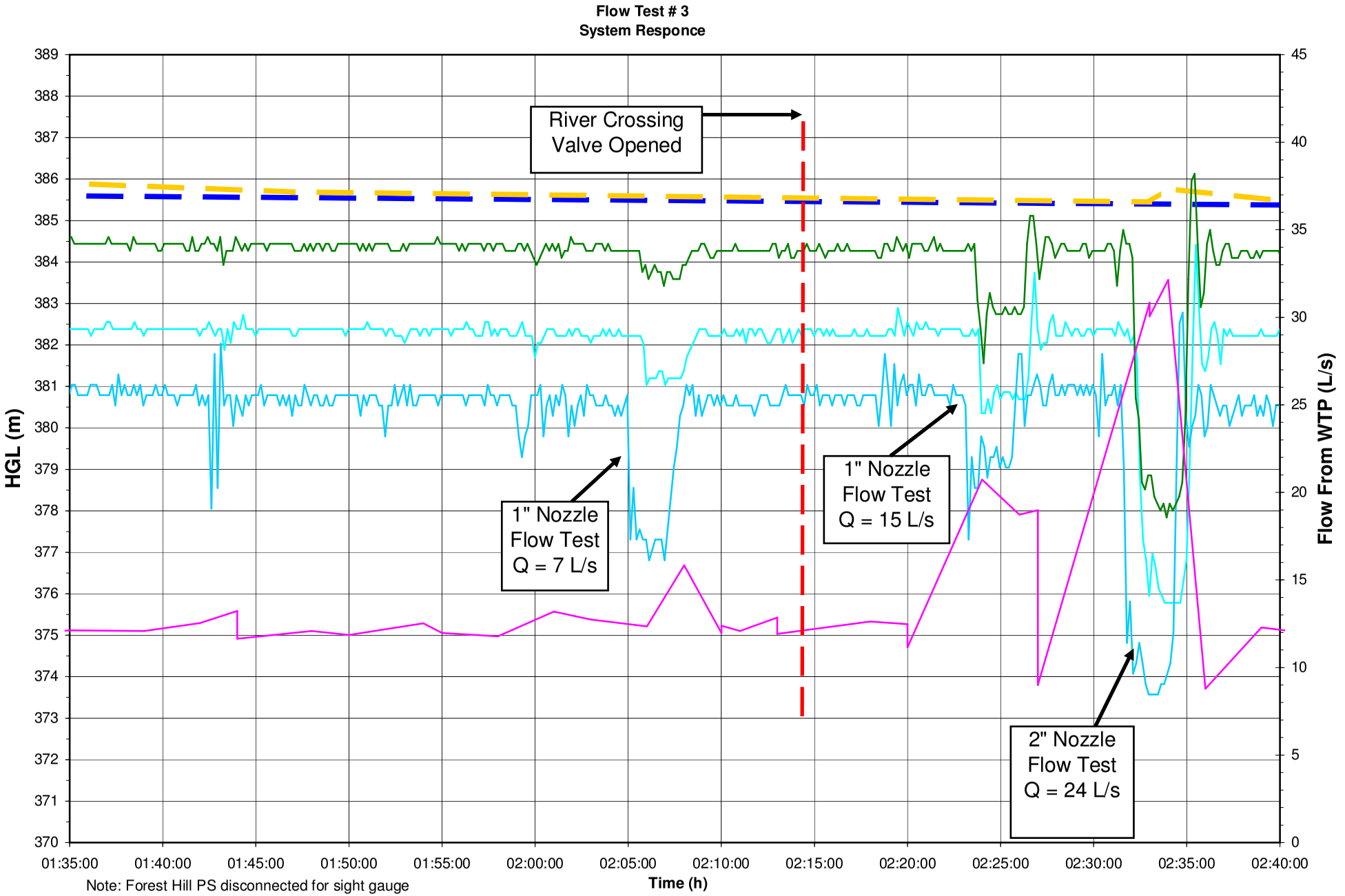

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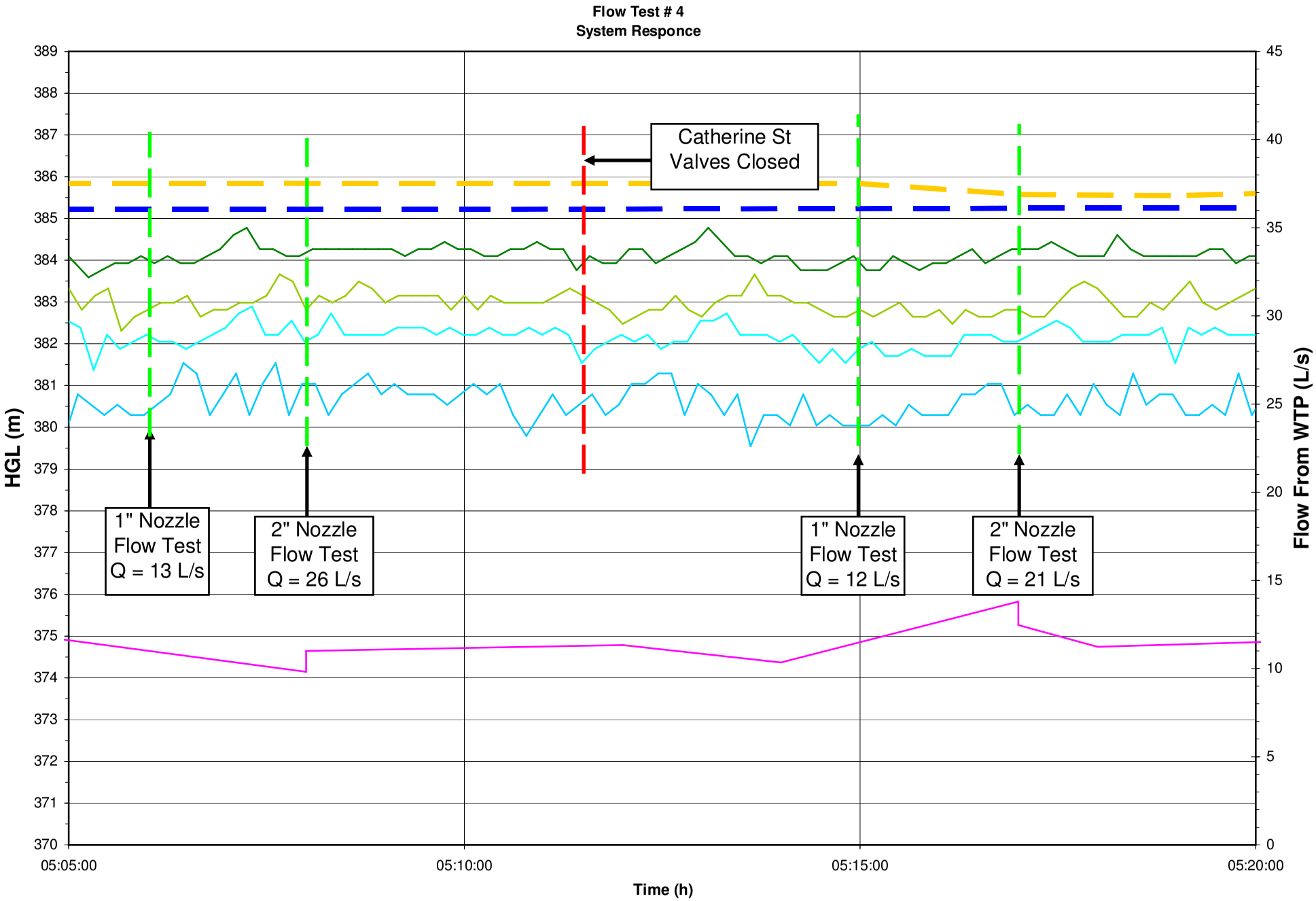

Bancroft

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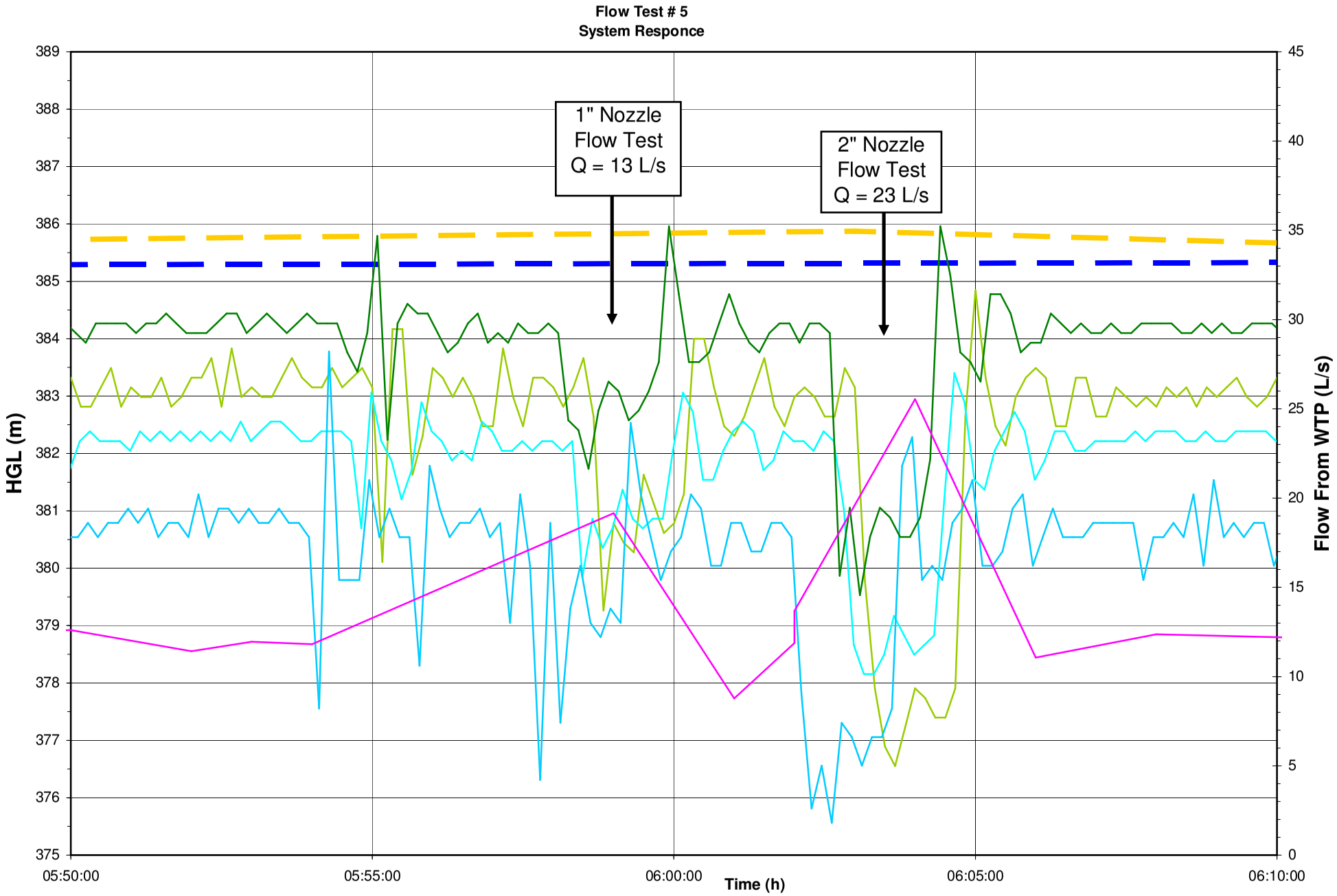

Bancroft

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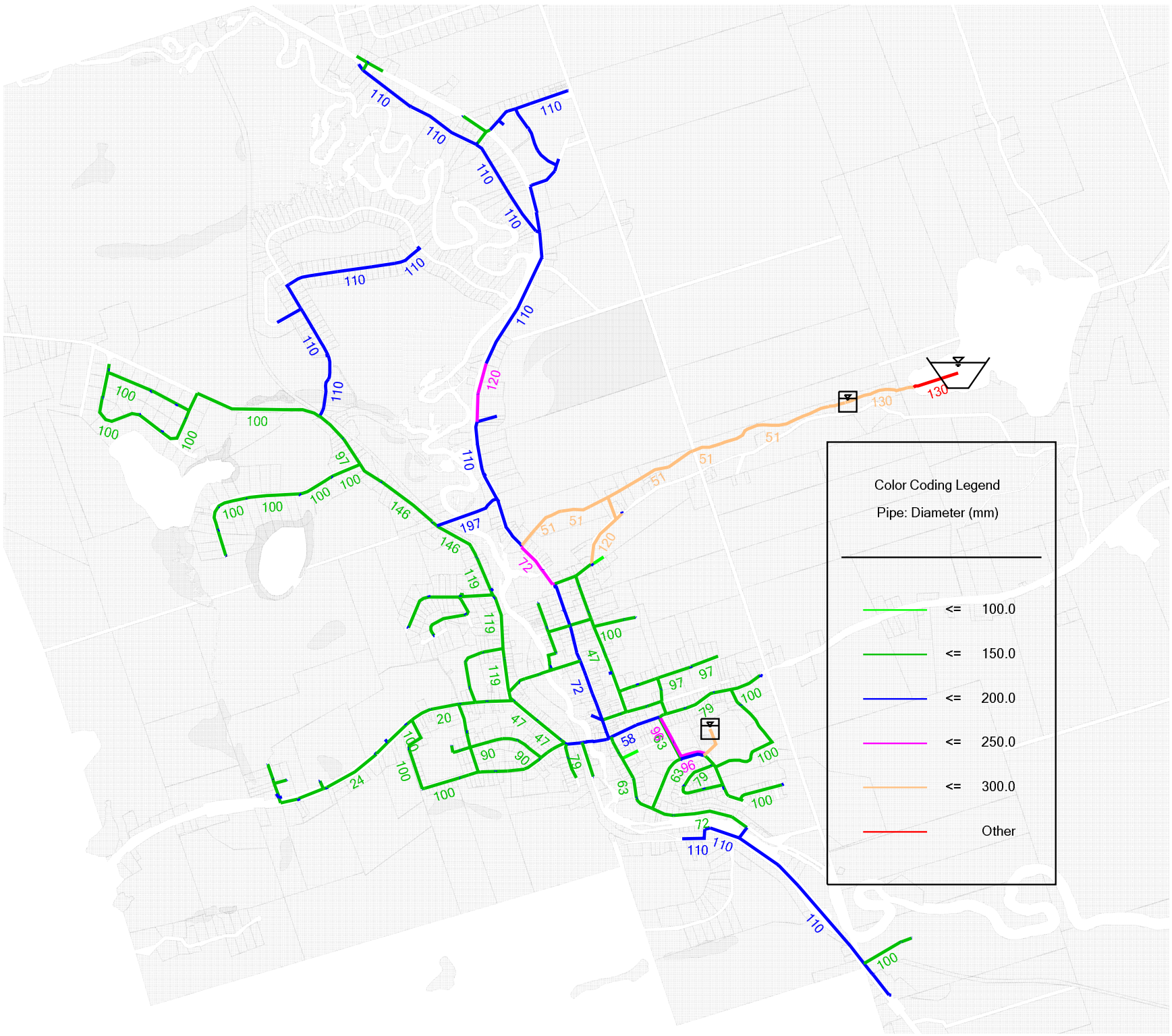
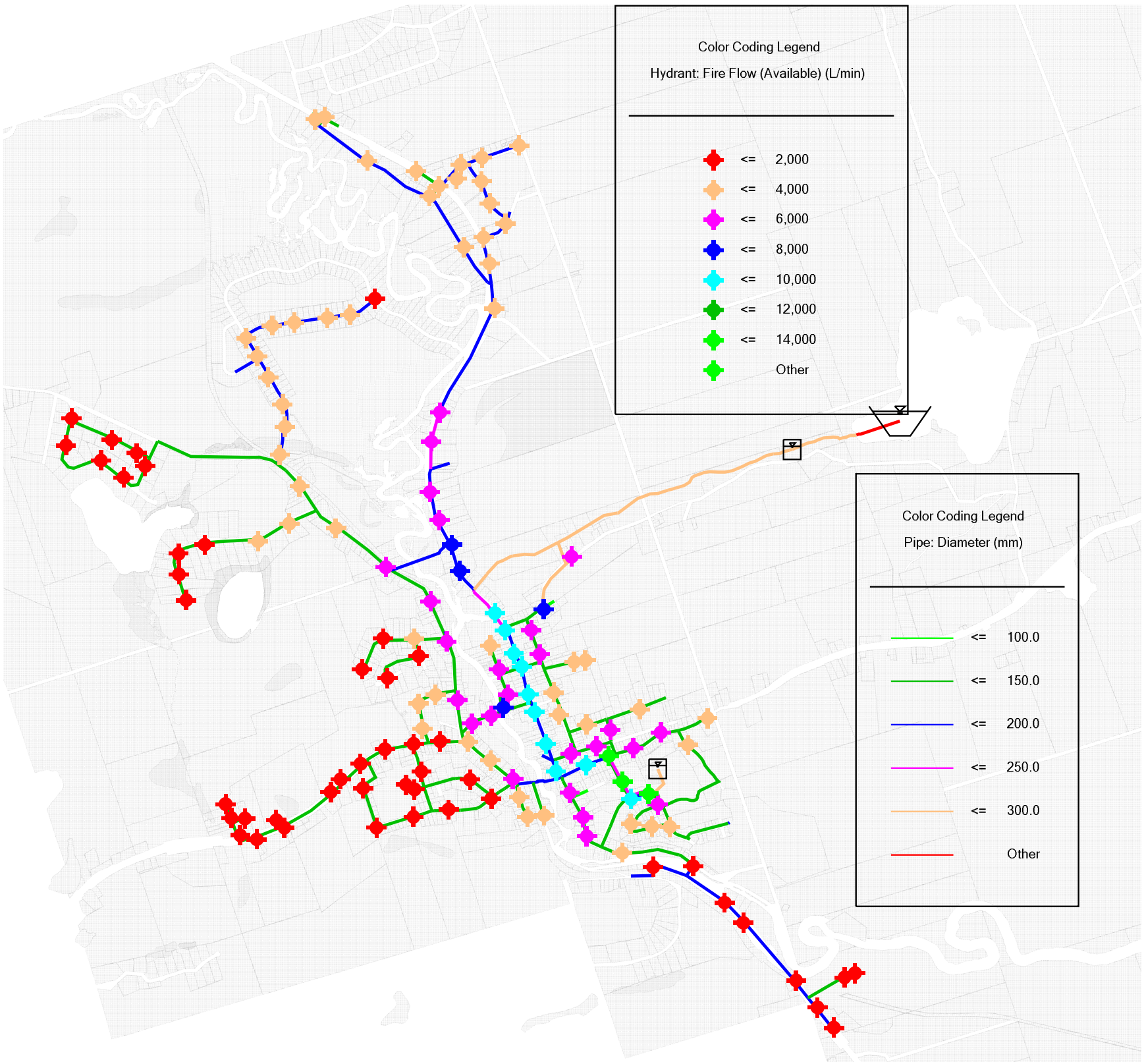
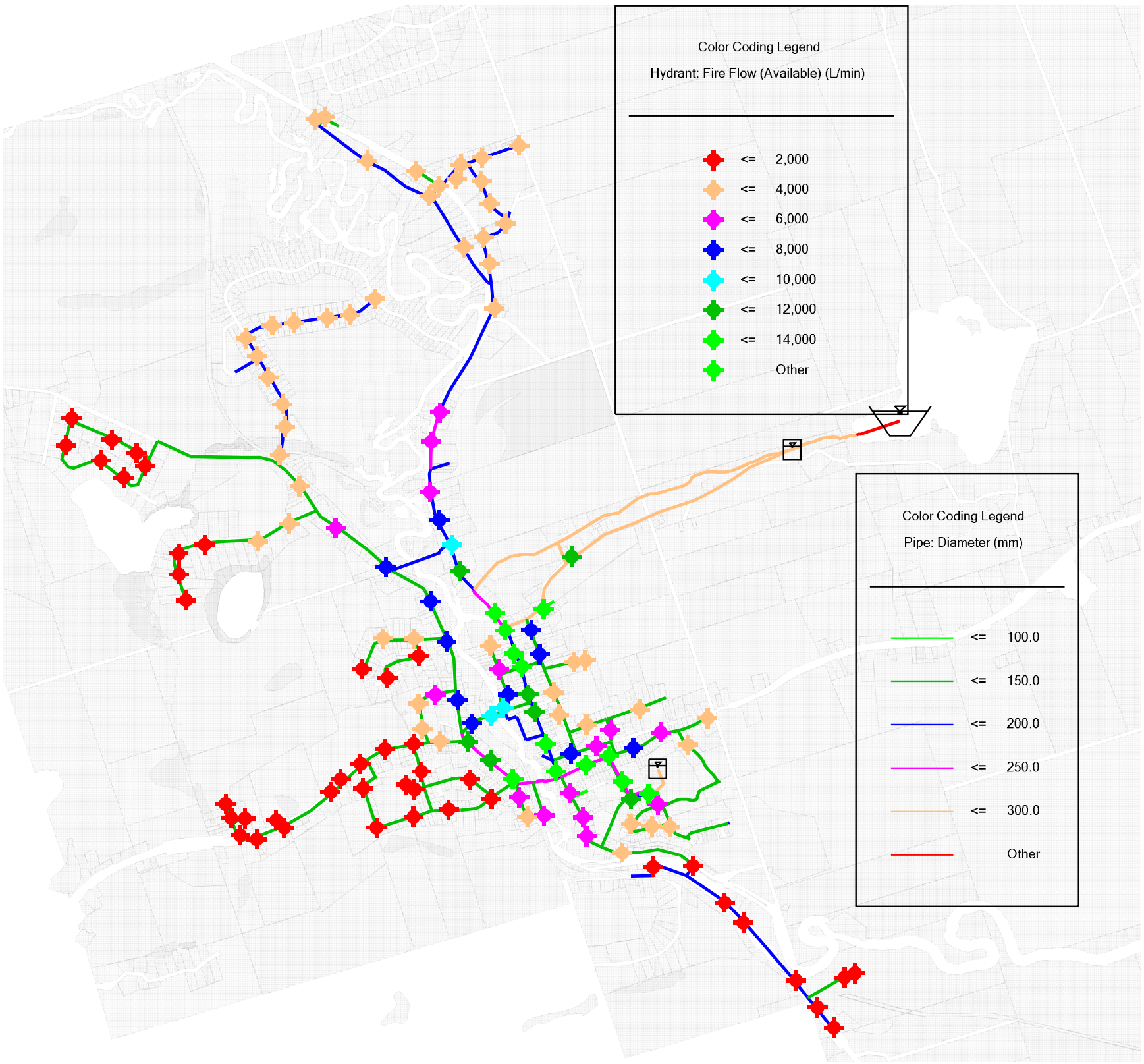
Active Scenario: Pipe C-Factors



Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666


Color Coding Legend
Hydrant: Fire Flow (Available) (L/min)
<= 2,000
<= 4,000
<= 6,000
<= 8,000
<= 10,000
<= 12,000
<= 14,000
Other
Color Coding Legend
Pipe: Diameter (mm)
<= 100.0
<= 150.0
<= 200.0
<= 250.0
<= 300.0
Other



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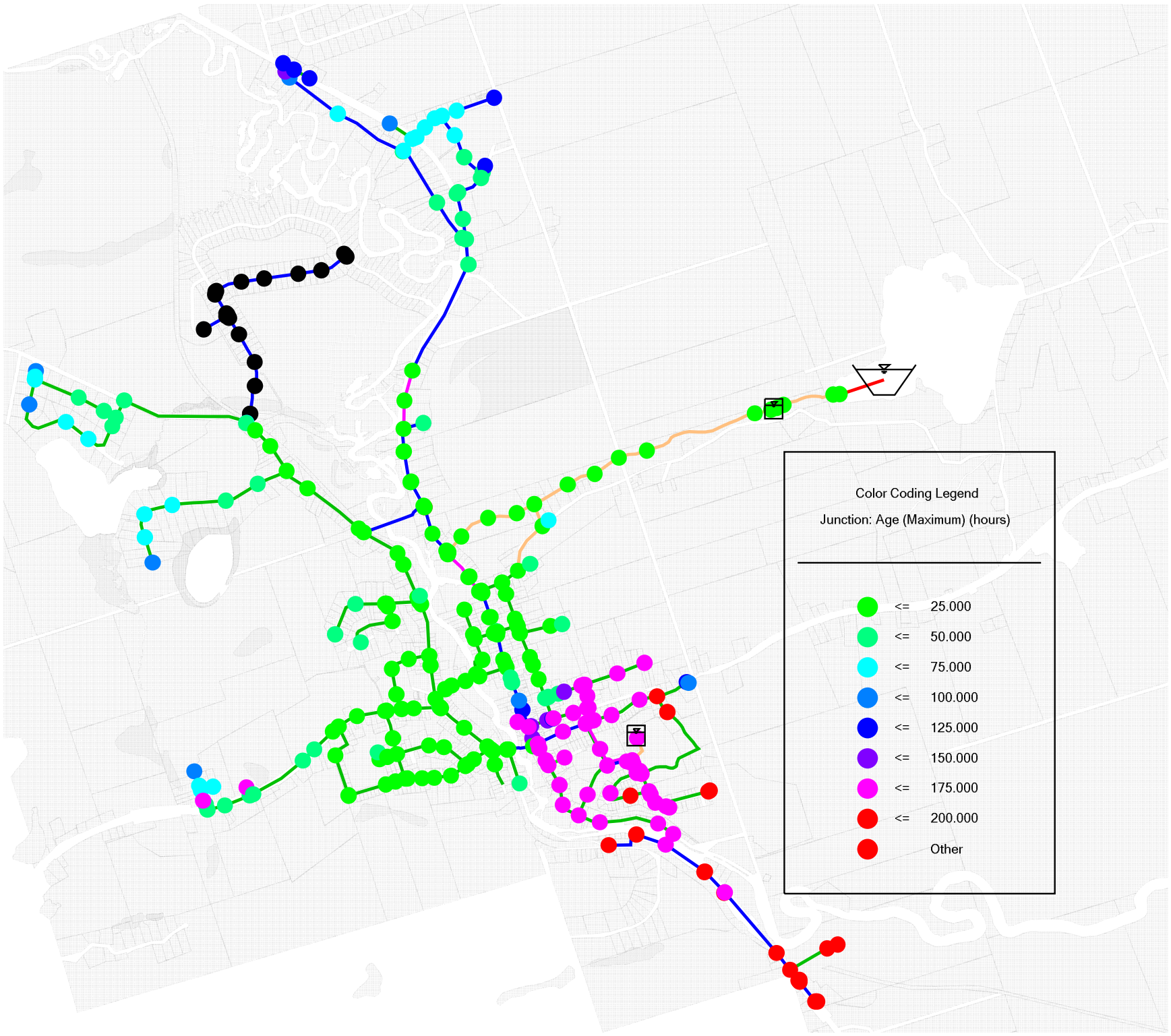
Color Coding Legend
Junction: Age (Maximum) (hours)
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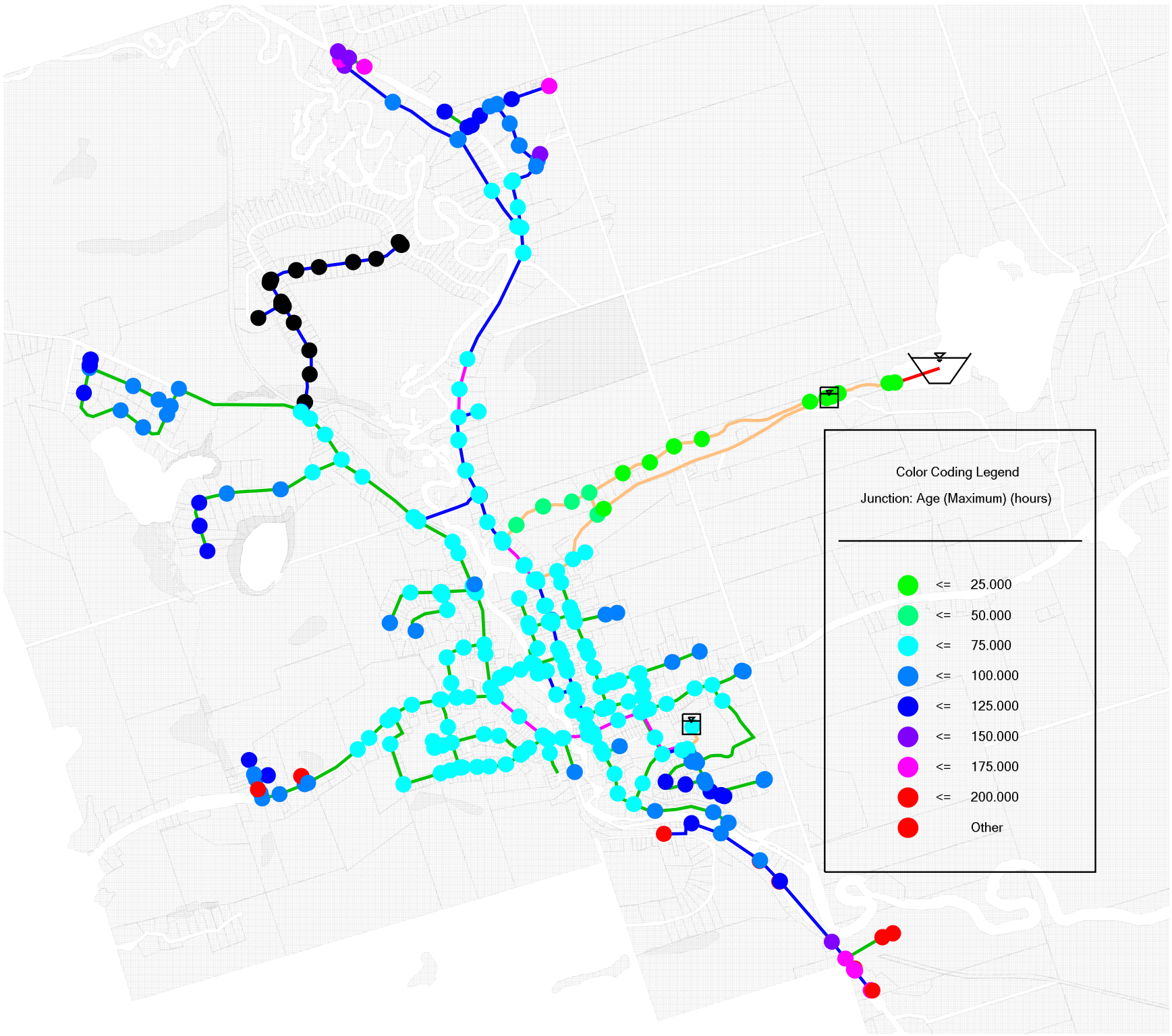
<= 50.000
<= 75.000
<= 100.000
<= 125.000
<= 150.000
<= 175.000
<= 200.000
Other



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+1-203-755-1666

UPGRADE TO BILLA ST
250 MM WATERMAIN

- UPGRADE 200 MM CONCRETE/AC SEWER ALONG THE BRIDGE CROSS-OVER AT BRIDGE STREET WEST TO 250 MM PVC PIPE

ADDITIONAL SYSTEM UPGRADES NOT SHOWN

FOR WATER

- 300 MM WATERMAIN ALONG SNOW ROAD FROM HASTINGS STREET TO FILTRATION PLANT

- FLOW CONTROL VALVES WITH SCADA CONTROL ON EXISTING AND PROPOSED FEEDERMAIN FROM FILTRATION PLANT

- CLEAN AND RELINE EXISTING 300 MM WATERMAIN FROM FILTRATION PLANT

FOR WASTEWATER

- INCREASE THE PIPE GRADIENT OR UPGRADE THE PIPE SIZE OF THREE DOWNSTREAM 300 MM PIPES TO 325 MM BETWEEN PHOEBE STREET AND CATHERINE STREET

Build Bancroft Proposed Site Servicing Plan

February 25, 2010

- Existing Manhole
- Proposed Manhole
- Existing Hydrant
- Proposed Hydrant
- Elevation Contour (5 m interval)
- Elevation Contour (1 m interval)
- Parcel
- Proposed Building
- Existing Sanitary Sewer
- Proposed Sanitary Sewer
- Proposed Sanitary Service Lateral
- Existing Sanitary Forced Main
- Proposed Sanitary Forced Main
- Existing Watermain
- Proposed Watermain
- Proposed Watermain Service Connection
- Replace Existing Watermain

0 25 50 100 Meters

1:1,000

GENIVAR

BUILDING BANCROFT

Build Bancroft
Site Servicing Preliminary Cost Estimate
3/26/2010

Item	Unit	Qty.	Per Unit	Total
				Roundup to nearest thousand
Water Infrastructure Improvements				
Bridge Street Watermain Upgrade				
Watermain 250 mm dia backfilled with granular B (in road work)	m	475	$328	$156,000
Watermain 250 mm dia installed on bridge	m	40	$250	$10,000
Watermain 250 mm dia Sherbourne St N	m	410	$328	$135,000
Fire Hydrants c/w leads & valves	ea	10	$4,934	$50,000
250mm Valve c/w box and stem assembly	ea	13	$2,914	$38,000
Valve Chamber	ea	2	$7,592	$16,000
			Subtotal	$389,000
Engineering 15%	L.S.			$58,350
Contingency 20%	L.S.			$77,800
			Total Bridge Street	**$526,000**
Snow Road Watermain Installation				
Watermain 300 mm dia backfilled with granular B (in road work)	m	1320	$353	$467,000
Watermain 300 mm dia backfilled with granular B (Hastings to Meadow)	m	220	$328	$73,000
Fire Hydrants c/w leads & valves	ea	4	$4,934	$20,000
300mm Valve c/w box and stem assembly	ea	5	$2,914	$15,000
Valve Chamber	ea	1	$7,592	$8,000
			Subtotal	$583,000
Engineering 15%	L.S.			$87,450
Contingency 20%	L.S.			$116,600
Rock Allowance 10%	L.S.			$58,300
			Total Snow Road	**$846,000**
SCADA upgrades				
Main Line Valve Chamber upgrades	L.S.	1	$50,000	$50,000
Flow Control Valves	ea	2	$15,000	$30,000
Control and communication installation	L.S.	1	$150,000	$150,000
			Subtotal	$230,000
Engineering 15%	L.S.			$34,500
Contingency 20%	L.S.			$46,000
			Total SCADA	**$311,000**
Clean and Line 300mm mainline from filtration plant to Hastings St	m	1900	$413	$785,000
Engineering 15%	L.S.			$117,750
Contingency 20%	L.S.			$157,000
			Total Clean and Line	**$1,060,000**
			Total Water	**$2,743,000**
Sanitary Improvements				
Concrete Precast Sanitary Maintenance Hole	ea.	6	$8,988.90	$54,000
300mm dia Concrete Sewer Pipe	m	275	$331.96	$92,000
250mm transmission PVC pipe (w/ avg 2.75m depth)	m	285	$424.00	$121,000
			Subtotal	$267,000
Engineering 15%	L.S.			$40,050
Contingency 20%	L.S.			$53,400
			Total Sanitary	**$361,000**
Storm System Improvements				
Catchbasin Remove and Replace (0+241 and 0+340)	ea	2	$3,800	$8,000
Storm Sewer 600mm dia (from Hastings to York River) 0+171	m	125	$400	$50,000
Stormwater retention / management	L.S.	1		$75,000
			Subtotal	$133,000
Engineering 15%	L.S.			$19,950
Contingency 20%	L.S.			$26,600
			Total Storm	**$180,000**
			Total System Upgrades	**$3,284,000**

Code	Facility	Storm Sewer			Catch Basin		Sanitary Sewer		Water Service				Communications
		Dimension (mm)	Length (m)	Location	Type	Location	150mm	100mm	50mm	150mm	Valves	Hydrants	
CS1	Community Facilites						-	8	5	5			5
CS2	Medical Clinic						45	20	10	10			10
CS3	Liquor Store						16	12	5				5
CS4	Post Office						16	16	15				15
CS5	Gazebo Shelter						8	0	na				
CS6	Picnic Pavilion						25	5					
CS7	Picnic Pavilion						25	5	50				
CS8	Gazebo						-	-					
CS9	Gazebo						-	-	50				
CS10	Shelter						-	-	no service				
GS1	Town Centre						62	-	10				10
HA1	Library/Public Meeting Space						-	29	30	30			30
HA2	Heritage Attraction/Museum						-	17	25	25			25
HA3	North Hastings Museum						-	15	30				30
HA4	Train Station Exist.						-	46	30				30
M1	Motel	400	30				17	-	25	25			25
CR1	Commercial / Retail							20	10				10
CR2	Commercial / Retail							15					15
CR2A	Commercial Theatre							15	15	15			15
CR3	Commercial / Retail							15	15				15
CR4	Commercial / Café						21	7	5				5
CR5	Commercial / Retail						19	7	5				5
CR6	Commercial / Retail						11	16	5				5
CR7	Commercial / Retail						8	15	15				15
CR8	Commercial / Restaurant						11	17	15				15
CR9	Commercial / Retail						6	10	135				10
CR10	Commercial / Retail						25	50	5				5
CR11	Commercial / Retail							32	10				10
CR12	Commercial / Retail							32	10				10
CR13	Commercial / Retail						25	30	135				30
RE1	Residential Condominium						205		90	90			90
Additional													
	Parking Lot (SW Station & Hastings)	450	80										
	Parking Lot (SW Station & Hastings)	300	40										
					Single Inlet CB	2							
	Parking Lot (W Hastings @ Flint)	450	120										
	Between CR4-CR9 to York River	600	115	0+255						280	3	4	

Bancroft Proposed Water Servicing System

March 05, 2010

- Pumps
- Filtration Plant
- Town of Bancroft Water Tower

Proposed Water Servicing Pipe

Notes

- Proposed Watermain
- Proposed Watermain Service Connection
- Replace Existing Watermain

Existing Water Servicing Pipe

MATERIAL

- BLACK FLEX POLY
- CAST IRON
- DUCTILE IRON; Ductile Iron
- POLY SERIES 60
- PVC
- Town of Bancroft

0 250 500 Meters

1:4,000

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BUILDING BANCROFT

Building Bancroft
OT-09-185-00-MA

Wastewater System Capacity Assessment - Final No.1

April 28, 2010

Prepared for:
Mr. Tyler Peters
Greenview Environmental Management
69 Cleak Avenue,
Bancroft, ON
K0L 1C0

Prepared by:
GENIVAR Ontario Inc.
600 Cochrane Drive, 5th Floor
Markham, Ontario L3R 5K3

Project No. OT-09-185-00-MA

GENIVAR

Project No. OT-09-185-00-MA

28 April 2010

Mr. Tyler Peters
Greenview Environmental Management
69 Cleak Avenue, P.O. Box 100
Bancroft, ON
K0L 1C0

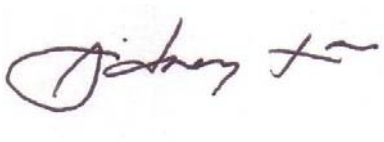
Re: Building Bancroft
Wastewater System Capacity Assessment - Final No.1

Dear Mr. Peters:

GENIVAR's Markham office is pleased to present the results of its hydraulic analysis of the Town of Bancroft Wastewater Collection System in support of the Building Bancroft development plan. To conduct this study, a trunk model of the Bancroft wastewater collection system has been created using SewerGEMS V8i modeling software with loading associated to the existing system condition. The model is contained on CD with this report.

This report describes the methodology used to develop the Bancroft Wastewater Collection Model and the system limitations identified. Based on the modeling, recommended system upgrades have been made to improve system performance, efficiency and increase available capacity for any future expansion.

Yours truly,
GENIVAR Consultants LP



Sidney Lau, P.Eng.
Project Engineer

600 Cochrane Drive, 5th Floor, Markham, Ontario L3R 5K3
Telephone: 905.475.7270 • Fax: 905.475.5994 • www.genivar.com

Executive Summary

In support of the Building Bancroft servicing study, GENIVAR developed a hydraulic model of the Bancroft Sanitary Sewer system. GIS mapping data and as-constructed plan and profile drawings were used to create the modeled network. Detailed modeling was carried out for the Building Bancroft Study area, major collection sewers and key pumping stations. Smaller individual systems were lumped together or "skeletonised" and applied to the larger system as an equivalent sanitary loading. System capacities and limitations have been identified and network upgrade recommendations have been made to increase system capacity and improved reliability.

ES-1 System Limitations and Recommended Solutions

System limitations and the associated recommended solutions are summarized below. The total estimated costs of the proposed sanitary sewer works is $860,000.

Constricted Sewers Due to Inconsistent Grade

Two locations have been identified in which a reduction in sewer slope compared to the adjacent sewers results in a reduction in carrying capacity of the pipe. This has a pinching effect on the flow and could result in sewer surcharge. These locations are as flows.

- Bridge Street West at the river crossing
- Hasting Street South between Phoebe Street and Newkirl Blvd

To increase carrying capacity of the identified constricted sewers the following recommendations are made:

- Replace 66m of sewer between manholes at the Bridge Street River Crossing with 250mm diameter sewer to match carrying capacity of upstream sewer.
- Replace 206m of sewer between Phoebe Street and Newkirl Blvd. Pipe to be installed with slope in line with that of adjacent sewers.

Hasting Street Dairy Queen Pump Station Capacity

The Hasting Street Dairy Queen Sanitary Pumping Station has a rated capacity of 37.9 L/s and transmits approximately 65% of the total sanitary flow of the Town. The entire Building Bancroft study area is within the catchment of this pump station. All development lands to the North along Hastings Street (HW62) and Chemashgon Rd as well as west along Monck Street (HW28) are also within the catchment area of this pumping station. Increasing the station capacity will be limited by the carrying capacity of a single 250 mm diameter force main along Hasting Street out-letting at Phoebe Street.

To increase the Hastings Street Pump Station Capacity and to facilitate potential future upgrades the following recommendation is made:

- Install second 250 mm diameter transmission forcemain from pump station to Phoebe Street. Note that Ministry of the Environment guidelines for all new sanitary pumping stations require two transmission force-mains.

ES-2 Building Bancroft Sanitary Site Servicing

To properly service the Building Bancroft design plan an additional 980 m of sanitary sewer and 6 manholes will be required. All sanitary laterals of the proposed Building Bancroft structures have been assigned as 100 mm diameter service connections. Connection points to the existing sanitary system are selected to facilitate the deepest basement (or ground floor) elevation while allowing gravity flow of sanitary discharge.

ES-3 Sanitary Collection System

The existing Town of Bancroft sanitary sewer collection system services an area of approximately 2,500 ha with an estimated population of 2,100 (2005). The system is comprised of a Sewage Treatment Plant with a rated capacity of 1,973 m^3/day, seven (7) sanitary pumping stations of various sizes and over 16,900m of sewer ranging in diameter between 100mm and 600mm. Existing wastewater collection and treatment serves only 56% of the population with water servicing.

The Bancroft Sewage Treatment Plant is subject to upgrades scheduled for 2010 which will increase the plant capacity to 5,500 m^3/day.

ES-4 Wastewater Loading

Sanitary loading was estimated based on a combination of water billing, Sewage Treatment Plant discharge records, pump station operating time logs and Community Profile from the 2006 Census. Based on the data and generally accepted wastewater production rates, the following sewage generation rates were used.

- Residential: 285 L / cap / day
- Commercial Institutional Industrial: 5 L / (m^2 gross floor area)/day

Peaking factors were applied to the sewage generation based on upstream population according to the Harmon equation. By associating Environment Canada records of rain events with periods of high flow at the treatment plant, an estimate of the infiltration and inflow was developed. Wet weather flow estimates were added to the peaked flow to produce the total design wastewater loading. The peak sanitary flow to the Sewage Treatment Plant under existing conditions was taken as 1,973 m^3/day.

Growth in the Town of Bancroft

Sanitary Loading based on the Building Bancroft development plan is estimated to result in an equivalent increased population of 235 representing 60 m^3/day increased sanitary flow.

ES-5 System Model

A skeletonised model of the sanitary sewer network was created using SewerGEMS V8i software. The model was developed from GIS data of system components provided by the County of Hastings GIS and Mapping Department. Sewer invert elevations were added to the network according to as-constructed drawings of the sanitary works. Key pump stations and the associated forcemains were characterized based on available pump information and engineering drawings. The forcemain friction factors were adjusted to produce flows at the rated capacity of the pump stations.

The wastewater generation was distributed based on the population distribution and applied to the collection system according to sanitary catchment areas. The system loading was calibrated to match these historical flow rates at the Sewage Treatment Plant as well as pump station operating time logs provided by the Ontario Clean Water Agency (OCWA) for 2009.

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Appendices

1. Introduction

This report outlines the details of the present wastewater collection system and components in the Town of Bancroft. A review of SCADA data (2009), environmental study report, GIS and As-Built drawings in relation to wastewater treatment facilities and sewage pumping stations (SPSs) in Bancroft was performed.

The criteria employed to evaluate the existing condition of the wastewater collection systems have included the pipe diameter, length and materials as provided by the available GIS and As-Built drawings. To complete the review of the wastewater systems, a hydraulic computer model was created using SewerGEMS V8i to simulate the system performance regarding the present system deficiencies and any future improvement capability due to the Building Bancroft project.

This report summarizes the performance assessment completed for the existing wastewater collection systems in the Town of Bancroft, Ontario. The report addresses:

- Regulatory Framework;
- Major Collection Areas;
- Wastewater Collection Infrastructure;
- Wastewater Treatment Facility;
- Wastewater Loading;
- Existing Sewage System Performance Review;
- Wastewater Projection;
- Building Bancroft Sanitary Site Servicing; and,
- Infrastructure Expansion and Rehabilitation Recommendations.

The purpose of this memorandum is to present the methodology of and results from the performance assessment review of the existing wastewater collection systems in the Town of Bancroft.

1.1 Background

The Town of Bancroft, located within the County of Hastings, has been identified for future growth in the *Draft Demographics Study and Vacant Land Analysis (North Hastings Market Area)* prepared by EcoVue Consulting Services Inc. and Peter Josephs and Associates Ltd. in 2008. The population figure for Town of Bancroft was 4,089 in 2001, according to Statistics Canada. Since 2002, there were a number of goals and objectives being developed to provide direction to guide the physical development of Hastings County with response to population, servicing and environmental.

One of the key components in the Official Plan of the County of Hastings, as approved by the Minister of Municipal Affairs and Housing, was the proposed Bancroft Revitalization which was basically the idea of redeveloping downtown Bancroft (BUA – Bancroft Urban Areas).

In this redevelopment process, a two-zone approach has been adapted to identify the different constraints on the provision of services of water supply and sewage collection. Through a public-private partnership, various potential sources of funding have been identified and the overall cost was estimated to be in the range of $80 million to $100 million.

From the EcoVue's report, it indicated that the projected population for the BUA (i.e. the former Village of Bancroft) will be from 3,838 in 2006 to 4,988 in 2025. The projected growth will have an impact on the water and sewer services offered by the town; and because of the future status of the Town of Bancroft to be the hub of "North Hastings". It is necessary for the Town to develop their own Community Improvement Plan, including the engineering servicing.

2. Bancroft Wastewater Collection Systems

The collection systems in Bancroft collect wastewater produced by the existing residential, commercial, institutional and industrial service areas. The wastewater is collected within relatively localized areas of Bancroft and is directed to the wastewater treatment plant; which is located on the southern part of the Town.

The existing wastewater collection and treatment systems in Bancroft are restricted to those properties situated within the Bancroft Urban Centre (BUC). The original wastewater systems were constructed in the 1970's. The average daily wastewater flow in 2009 was approximately 1,172 cubic meters per day (m^3/d). The servicing area of the entire wastewater collection systems of approximately 2,500 hectares with an estimated population of about 1,500 people . The coverage is only 37% of population. (See Drawing No. 1 in Appendix A)

Up to the present, only three-quarters of the water serviced population have a connection to the public wastewater collection system. The remainder rely on private sanitary systems.

2.1 Regulatory Framework

The implementation of the Building Bancroft project includes the consideration of all requirements from the local municipalities, agencies and government ministries such as the Ontario Ministry of the Environment's (MOE). In addition to the MOE's requirements, implementation of the requirements will need approval under the *Ontario Water Resources Act* for any proposed sewage servicing facilities.

A Certificate of Approval will be required from the MOE for any proposed sewage servicing facilities. All environmental impact assessments of the sewage disposal facilities must be in accordance with MOE guidelines to determine appropriate effluent limits. However, this is not the scope of work of this assessment.

2.2 Major Wastewater Collection Areas

Presently, there are eight (8) major collection areas (Southern Sewershed) within Bancroft that have developed over the past twenty years to service population growth. There is a large area which is un-sewered, that is the Northern Unsewered Area (Future Northern Sewershed). The un-sewered area includes the areas from the north of Hastings Street North SPS and to the south of Maxwall Settlement Road. For the wastewater collection boundary and the sewer system layout, refer to Drawing Nos. 2 and 3 in Appendix A.

Table 2-1 illustrates the characteristics of each wastewater collection area. The eight sewage collection areas (located within Southern Sewershed) are located south of Eagles Nest Park Road as described in the following sections.

2.2.1 North Collection Area - North Bancroft

The land use in this area is mostly comprised of commercial and light industrial, according to the Town's Zoning By-Law. The sewer pipes located in this area are mainly 250mm diameter in size with a servicing area of 17 hectares. The future development plan will be similar but with the introduction of Type 1 Residential Landuse in the north.

2.2.2 Central North Collection Area - Hastings Street / First Avenue

The Central North Area includes all commercial land use to the north of Station Street and the Snow Road East area, together with a small plot of multiple residential areas. It collects sewage from this area of 82.5 hectares.

2.2.3 Northwest Collection Area – Chemaushgon Road (Forest Hill SPS)

This area is serviced by Forest Hill SPS located at Chemaushgon Road and Forest Hill Road. There are 550 meters of forcemain between Forest Hill Road and Station Road. The area consists of mainly Type 1 Residential lands. The sewage flow is transmitted to the Dairy Queen SPS via the sewers on Station Street.

2.2.4 West Collection Area – Monck Street and Faraday Landfill Site

This is likely to be a major sewage generating area. Most of the properties are located along both sides of Monk Road. They consist of commercial centres, industrial complexes, educational buildings and a number of large retail centres. There are two SPSs located at Valleyview Drive and Faraday Landfill Site.

The sewage flows coming from this collection area include the regular commercial and industrial wastewater, plus the leachate flow from the Faraday Landfill. According to the background information of Faraday Landfill Leachate Transfer, the average quantity of leachate is 75 m^3/day with a peak flow of 200 m^3/day.

The average peak leachate flow of 1.5 L/s (i.e. 130 m^3/day) was adapted in the hydraulic model.

2.2.5 East Collection Area – Bridge Street East / Faraday Street / Flint Ave

All residential units, located within this sewage collection area, are of Type 1 Residential together with some community facilities. This sewage collection area serves 38.8 hectares of land and has about 1,800m of 200mm diameter sewers. All sewage generated from this area flows to the Hasting Street SPS that is the Hasting Street Dairy Queen SPS via Flint Avenue.

2.2.6 Central Collection Area – Downtown Bancroft

This central collection area is the key development zone in the Building Bancroft Project. It includes those developing areas along the Station Street and Hastings Street. It mainly consists of commercial centres and community facilities, together with multiple residences to the east of central collection area.

2.2.7 Central South Collection Area - Bridge Street West and Sherboume Street

The area mainly consists of residential units, either Type 1 or 2. No major new development will occur within this zone. All sewage flow will be collected and directed to the Dairy Queen SPS via a 200mm diameter sewer along Bridge Street.

2.2.8 South Collection Area – Newkirk Blvd / Hastings Street South / Hastings Street South SPS

The southern sewage collection area includes all areas south of Bridge Street and along both sides of Hastings Street South. The sub-divisions in Newkirk Blvd area and Hastings Street South SPS area are also included.

Within this collection area, there are a variety of land uses including residential (Type 1 and 2), local commercial, community facility, general to light industrial.

Table 2-1 Bancroft Sewage Collection Areas

Collection Area	Sub-Collection Area	Area (ha)	Pipe Lengths (m)
Northern	North Bancroft (1)	16.4	250mm – 766m
Central North	Snow Road (2)	2.1	200mm – 310m
			250mm – 51m
	Central North (3), (4), (5), (6)	22.7	200mm – 1,103m
Northwest	Chemaushgon Road (18), (19), (20)	23.6	200mm – 1807m
Western	Monck Street (21), (22)	75.8	150mm – 387m
			200mm – 2,616m
			FM – 1,008m
	Faraday Landfill Site	N/A	300mm – 7m
Eastern	Bridge Street East (9)	9.2	200mm – 432m
	Faraday Street (8)	8.9	200mm – 561m
	Flint Ave / Phoebe Street (7), (11)	14.3	200mm – 697m
	Billa Street (10)	6.4	200mm – 155m
Central	Downtown Bancroft (17)	7.9	200mm – 147m
			250mm – 267m
			300mm – 268m
			375mm – 60m
Central South	Bridge Street West (24)	7.7	200mm – 242m
	Sherboume Street (23)	17.1	200mm – 954m
Southern	Hastings Street South (12), (14), (16)	9.27	200mm – 325m
	Newkirk Blvd (13)	8.9	200mm – 201m
			250mm – 833m
	Hastings Street South SPS (15)	5.1	100mm – 96m
			200mm – 858m
(Trunk Sewer)	Along Hastings Street	N/A	200mm – 587m
			300mm – 671m
			375mm – 353m
			400mm – 164m
			600mm – 992m
	Sub-Total =	**230 ha**	**Appr. 16,900 m**

2.3 Major Wastewater Collection System and Transmission Infrastructure

According to the Bancroft Wastewater Treatment Plant (BWWTP) Class EA Environmental Study Report, conducted by Stantec Consulting Ltd. and dated December 2005, the current sanitary collection boundary of the existing urban wastewater sewage collection system is limited to the Bancroft Urban Centre.

The Town of Bancroft took ownership and assumed operation of the BWWTP from the MOE since 1985. The current treatment plant capacity is 1,100 m^3/day which is under the loading limit of 1,137 m^3/day. (Indicated in the *Inspection Report for Bancroft Waste Water Treatment Plant* by MOE in January 2002.)

The wastewater collection system in Bancroft is comprised of a network of gravity sewers and forcemains, and seven sanitary pumping stations. The following Table 2-2 illustrates the inventory of the sewer collection system in Bancroft.

Table 2-2 Bancroft Wastewater Collection System

Sanitary Facility	Items	No.	Pipe Lengths (m)	Capacity (m^3/day)
Gravity Sewer	100mm	1	96	N/A
	150mm	6	387	N/A
	200mm	174	11,412	N/A
	250mm	43	2,504	N/A
	300mm	14	946	N/A
	375mm	7	413	N/A
	400mm	2	164	N/A
	600mm	12	992	N/A
	Sub-Total =	**259**	**16,914**	
Forcemain	100mm		1,432	N/A
	150mm		1,098	N/A
	250mm		280	N/A
	Sub-Total =		**2,810**	
Sanitary Pumping Station	Hastings Street Dairy Queen SPS			5,011
	Hastings Street North SPS			985
	Highway 62 South SPS			1,426
	Forest Hill SPS			804
	Valleyview SPS			864
	Station Street SPS			N/A
	Bridge Street East SPS			N/A

2.3.1 Hastings Street North Main Sewer and Hastings Street North SPS

This section of main sewer consisted of 250mm diameter gravity pipe and carried the sewage flow from the northern part of Hastings Street to the pumping station, then lifted through a 7m long forcemain to the south. The current capacity of the Hastings Street North SPS is shown on Table 2-2.

2.3.2 Station Street Main Sewer

This sewer is one of the major sanitary transmission main located in the downtown core. It receives all the wastewater generated in the west and northwest parts of the Town; including the leachate flow from the Faraday Landfill Site. The present pipe sizes in this section include 250mm, 300mm and 375mm diameter sewers. Under the proposed Bancroft Revitalization, a community centre, government office facility, a motel, and a museum buildings will be within the catchment of this sewer.

2.3.3 Chemaushgon Road Sewer and Forest Hill SPS

The wastewater from the Chemaushgon Road area is collected by local sewers and transmitted to the Forest Hill SPS located at Chemaushgon Road and Forest Hill Road. The sewage is then pumped into the sewer main on Station Street. The total sewage generated in 2009 from this subdivision is approximately 30,000 m^3.

There are two pumps currently being operated in this SPS both with a rated capacity of 18.9 L/s.

2.3.4 Bridge Street West

This 200mm diameter main sewer collects the flows from Bridge Street West, Sherboume Street North, King Street and Maple Street. There are proposed apartment building and condominium units on the existing trail to the east of Sherboume Street.

2.3.5 Highway 62 South SPS

The pumping station located on Highway 62 south collects the sewage from the low land on the south of Hastings Street South before Newkirk Blvd. The average wastewater generated from this subdivision is about 11,000 m^3/day. The rated capacity of the pumps in this SPS is 9.5 L/s per the Town's records.

2.3.6 Hastings Street South Main Sewer

The wastewater transmission mains along Hastings Street South comprise 250mm, 300mm, 400mm and 600mm diameter sewer pipes after Hastings Street Dairy Queen SPS's forcemain. These sewers collect sewage from the main pumping station, Hastings Street South SPS, the Newkirk Blvd's subdivision and the local sewage inflows along Hastings Street South.

2.3.7 Monck Street West Sewer

The main sewers on the Monck Street serve the residential units, commercial and industrial complexes located on both sides of Monck Street. It also collects the leachate flow from the Faraday Landfill Site during non-peak hours.

During the peak operating time, leachate flow from the landfill site is about 200m^3 per day, using the existing leachate pumps (Flygt model CS3060) with the capacity of 9 L/s at 11m head.

2.3.8 Valleyview Drive SPS and Forcemain

This SPS collects flow from north of Valleyview Drive, plus the Faraday Landfill leachate from Highway 28. The sewage is pumped from the SPS to the downstream through a 150mm diameter PVC forcemain.

2.3.9 Faraday Landfill Site Forcemain

There is a small quantity of wastewater coming out from the Faraday Landfill to be treated at the Bancroft Wastewater Treatment Plant. The expected leachate flow to be used in our review assessment will be

130 m^3/day. The leachate is pumped from the landfill site to storage ponds then transferred to Valleyview Drive SPS.

2.3.10 Bancroft Pumping Stations & Wet Wells

Due to the topographical nature of the Town of Bancroft, there are several locations not serviced by gravity sewers . All in all, there are seven pumping facilities in this wastewater collection catchment. Only four of them were modeled in the hydraulic analysis. They are listed in the following Table 2-3.

Table 2-3 Bancroft Pumping Stations

Sanitary Pumping Station	Rated Capacity (L/s)	Simulated in SewerGEMS Model
Hastings Street Dairy Queen SPS	37.9	Yes
Hastings Street North SPS	N/A	Yes
Forest Hill SPS	18.9	Yes
Valleyview SPS	16	Yes
Highway 62 South SPS	9.5	No
Station Street SPS	7.07	No
Bridge Street East SPS	12.3	No

There is a wet well associated with each of the SPSs. All physical dimensions of the individual wet wells are shown in Table 2-4.

Table 2-4 Bancroft Sanitary Pumping Stations' Wet Wells

Sanitary Pumping Station	Wet Well Area	Invert Level (m)	Maximum Depth (m)
Hastings Street Dairy Queen SPS	9.6 m^2	320.8 m	2 m
Hastings Street North SPS	1.478 m^2	323.0 m	5 m
Forest Hill SPS	4.619 m^2	325.2 m	2.745 m
Valleyview SPS	5.9 m^2	334.65 m	2.29 m
Highway 62 South SPS	5.91 m^2	315.4 m	2.895 m
Station Street SPS	N/A	N/A	N/A
Bridge Street East SPS	N/A	N/A	N/A

2.3.11 Bancroft Forcemains

There are eight existing forcemains as follows:

Table 2-5 Bancroft Forcemains

Sanitary Pumping Station	Forcemain Size	Length
Hastings Street Dairy Queen SPS	250 mm	280 m
Hastings Street North SPS	150 mm	7 m
Forest Hill SPS	150 mm	546 m
Valleyview SPS	150 mm	545 m
Faraday Landfill Site	100 mm	1,432 m
Highway 62 South SPS	100 mm	95 m
Station Street SPS	N/A	12.7 m
Bridge Street East SPS	N/A	145 m

2.4 Existing Wastewater Treatment Facility

The BWWTP is located at the end of Hastings Street South on Part 1, Lot 54, Concession EHR, Bancroft; which is approximately 1.8 km south of Bridge Street. The plant was designed and built in 1974 with extended aeration treatment process.

The existing BWWTP was designed with a capacity of 909 m^3/day originally and changed the operation mode to contact stabilization with a revised plant capacity of 1,818 m^3/day. Under the Bancroft WWTP Class EA Environmental Study Report, the BWWTP was recommended to be expanded as follows:

- construction of three new sewerage pumping stations (SPSs);
- construction of a forcemain from the new north PS to the south PS (both are north of Hastings North SPS);
- construction of a forcemain from the south PS to the existing northern limit of wastewater collection system;
- modification of the existing extended aeration treatment process;
- construction of a new aerobic digester;
- construction of a new biosolids storage tank; and
- construction of a new UV effluent disinfection system with an addition of tertiary filtration.

2.5 Assessment Criteria

The basic assessment criterion of this report is the **hydraulic adequacy (capacity)** of the existing Bancroft Wastewater Collection System. The assessment should provide a standardized condition rating, allowing a quantitative comparison between various sections of the system. This assessment rating should also provide a guideline to indicate the hydraulic performance of each wastewater collector. SewerGEMS can identify the surcharging sewer pipeline.

This assessment model also allows the user to:

- understand the system operating constraints;
- establish the existing level of service;
- assess the impact of any proposed development;
- evaluate proposed upgrades or replacement work; and,
- develop system constraints based on development proposals.

The initial evaluation step was to derive the criteria that will be used to evaluate the system's performance. The laws or regulations from municipal, provincial, or federal authorities are well defined and limited certain criteria. However, there are no design criteria available from Town of Bancroft. As a result, the following performance criteria are adopted as a minimum:

- maximum allowable flow velocity of 3 m/s or less;
- minimum velocities should be between 0.6 m/s and 0.75 m/s;
- allowable "C" value should not exceed 120 for Design Friction Losses; and,
- surcharge should not be allowed under the Design Flow Condition.

3. Wastewater Unit Rate Development

Town of Bancroft was divided into two parts: the northern part being an unsewered area from Rawal Jerry Drive up to the Town's boundary (i.e. south of Maxwall Settlement Road) while the southern part is further sub-divided into numerous wastewater collection areas as discussed in Section 2.2.

These sub-catchment areas have been defined using existing population data and land use data, topographical data, future population and land use projections as well as existing/future domestic, industrial, commercial and institutional flows. Additional information used in the development of the sub-catchment areas was the areas currently serviced by each existing wastewater facility, such as SPSs.

3.1 Wastewater Flow Analysis and Projection

The derivation of the estimated wastewater flow for system analysis is typically based on the population census and theoretical design values. According to the population projection data and water consumption calculations, several methods are available to calculate the future wastewater flow rate. The most appropriate method adopted in this assignment is as follows:

Projected Wastewater Flow = Population x 285 L/cap/day + 80% x ICI + I/I

where, ICI = Industrial, Commercial and Institutional Flows

I/I = Infiltration and inflow Rates

Since there are no design criteria for wastewater flow for the Town of Bancroft, the wastewater flow estimation was based on the "*Design Guidelines for Sewage Works 2008 from MOE*" as shown on Table 3-3.

Dry Weather Flow

The above method uses a rate of 285 L/cap/day for dry weather flow and accounts for industrial, commercial, and institutional land use.

At least 70% to 90% of water consumption reaches the sewer system. Based on the record of water consumption bills, the average water demand for each land plot was derived and assigned to each major junction of the hydraulic model.

According to the Bancroft WWTP Class EA Environmental Study Report, the average daily flow for the years of 2002 to 2004 is about 1,073 m^3/day with the peak day flow of 1,700 m^3/day. However, when the hydraulic performance of the collection system was analyzed, a peak flow rate has to be determined in order to evaluate the collection system.

The method adopted in this assessment is the modified Harmon Equation for peaking factor using the following equation for combined land use,

$$K_{ap} = K_{av} \times \left[1 + \frac{14}{4 + \sqrt{P + P_e}}\right]$$

where, $$K_{av} = \frac{A_r + 0.80 \times (A_i + A_c)}{A_r + A_i + A_c}$$

and
P = tributary population, in thousands
P_e = equivalent tributary population, in thousands
A_r = Residential Area
A_i = Industrial Area
A_c = Commercial Area

For simplicity, the peaking factor can be determined for the Downtown Bancroft Redevelopment Project using the following Harmon Formula:

$$M = 1 + 14 / (4 + P^{0.5})$$

$$= 1 + 14 / (4 + 0.235^{0.5})$$

$$= 4.12$$

Industrial, Commercial and Institutional Flows (ICI)

The water demand and wastewater loading varies among ICI users. The custom demands for large volume users require special considerations regarding flow calculation. All cases should be reviewed on an individual basis. As compared with domestic wastewater flow, there is no peaking factor for industrial, commercial and institutional flows (i.e. PF = 1 for ICI Sector).

For the proposed Building Bancroft area, all ICI flows were based on the following Table:

Table 3-1 Wastewater Loading for ICI flows

Facility	Gross Floor Area (m^2)	Unit Flow (L/d)	Est. No. of People	WW Loading (m^3/day)	Design Flow (m^3/day)
Community Facilities	1,017	5	14	5.10	21.0
Medical Clinic	1,461	250	20	1.00	4.10
Liquor Store	372	250	5	0.25	1.04
Post Office	438	250	6	0.30	1.23
Town Centre	1,130	5	15	5.65	23.3
Library	437	19	6	0.23	0.93
Heritage Attraction / Museum	1,005	11	14	0.30	1.24
North Hastings Museum	200	11	3	0.06	0.25
Train Station	242	45	3	0.30	1.22
Motel	2,800	190	38	14.5	59.6
Commercial / Retail (CR 1)	195	250	3	1.33	5.46
Commercial / Retail (CR 2)	200	250	3	1.36	5.60
Commercial / Retail (CR 2A)	630	11	9	0.19	0.78
Commercial / Retail (CR 3)	120	250	2	0.82	3.36
Commercial / Retail (CR 4)	130	23	2	0.08	0.34
Commercial / Retail (CR 5)	140	250	2	0.95	3.92
Commercial / Retail (CR 6)	90	250	1	0.61	2.52

Table 3-1 Wastewater Loading for ICI flows

Facility	Gross Floor Area (m^2)	Unit Flow (L/d)	Est. No. of People	WW Loading (m^3/day)	Design Flow (m^3/day)
Commercial / Retail (CR 7)	113	250	2	0.77	3.17
Commercial / Retail (CR 8)	321	34	4	0.30	1.22
Commercial / Retail (CR 9)	400	250	5	2.72	11.2
Commercial / Retail (CR 10)	26	250	1	0.18	0.73
Commercial / Retail (CR 11)	133	250	2	0.90	3.73
Commercial / Retail (CR 12)	106	250	1	0.72	2.97
Commercial / Retail (CR 13)	40	250	1	0.27	1.12
Residential Condominium	4,800	285	72	20.5	84.6
Sub-Total =	**16,546**		**235**	**60.1**	**248**

Based on sewage unit flows and equivalent population factor listed in Table 3-3.

Infiltration and Inflow (I/I)

Half of the infiltration and inflow (I/I) are recognized to come from private properties. This assumption is reasonable, since most of the I/I sources are related to residential development (i.e. foundation drains and roof leaders connected to the sewer system). Thus, I/I and ground water are the major contributors to wastewater flows.

In the assessment of I/I allowance, a more conservative design standard of 0.14 L/mm-d/m (per millimetre of pipe diameter per day and per meter of pipe length) was used as per MOE Guidelines. The calculated I/I are about 560 m^3/day for the existing collection system and together shown on the following Table 3-2 for the proposed developments of Building Bancroft project.

Table 3-2 Typical Infiltration and inflow rate for Downtown Bancroft Developments

Southern Sub	150mm Lateral (m)	100mm Lateral (m)	I / I (L/s)
Community Facilities	-	8	0.0013
Medical Clinic	45	20	0.0142
Liquor Store	16	12	0.0058
Post Office	16	16	0.0065
Town Centre	62	-	0.1076
Library	-	29	0.0047
Heritage Attraction / Museum	-	17	0.0028
North Hastings Museum	-	15	0.0024
Train Station	-	46	0.0075
Motel	17	-	0.0295
Commercial / Retail (CR 1)	-	20	0.0032
Commercial / Retail (CR 2)	-	15	0.0024
Commercial / Retail (CR 2A)	-	15	0.0024
Commercial / Retail (CR 3)	-	15	0.0024
Commercial / Retail (CR 4)	21	7	0.0062
Commercial / Retail (CR 5)	19	7	0.0058

Table 3-2 Typical Infiltration and inflow rate for Downtown Bancroft Developments

Southern Sub	150mm Lateral (m)	100mm Lateral (m)	I / I (L/s)
Commercial / Retail (CR 6)	11	16	0.0053
Commercial / Retail (CR 7)	8	15	0.0044
Commercial / Retail (CR 8)	11	17	0.0054
Commercial / Retail (CR 9)	6	10	0.0031
Commercial / Retail (CR 10)	25	50	0.0142
Commercial / Retail (CR 11)	-	32	0.0052
Commercial / Retail (CR 12)	-	32	0.0052
Commercial / Retail (CR 13)	25	30	0.0109
Residential Condominium	185	-	0.3212
Sub-Total =			**0.60** (52 m^3/day)

All wastewater unit rates are based on the following information from MOE Guidelines:

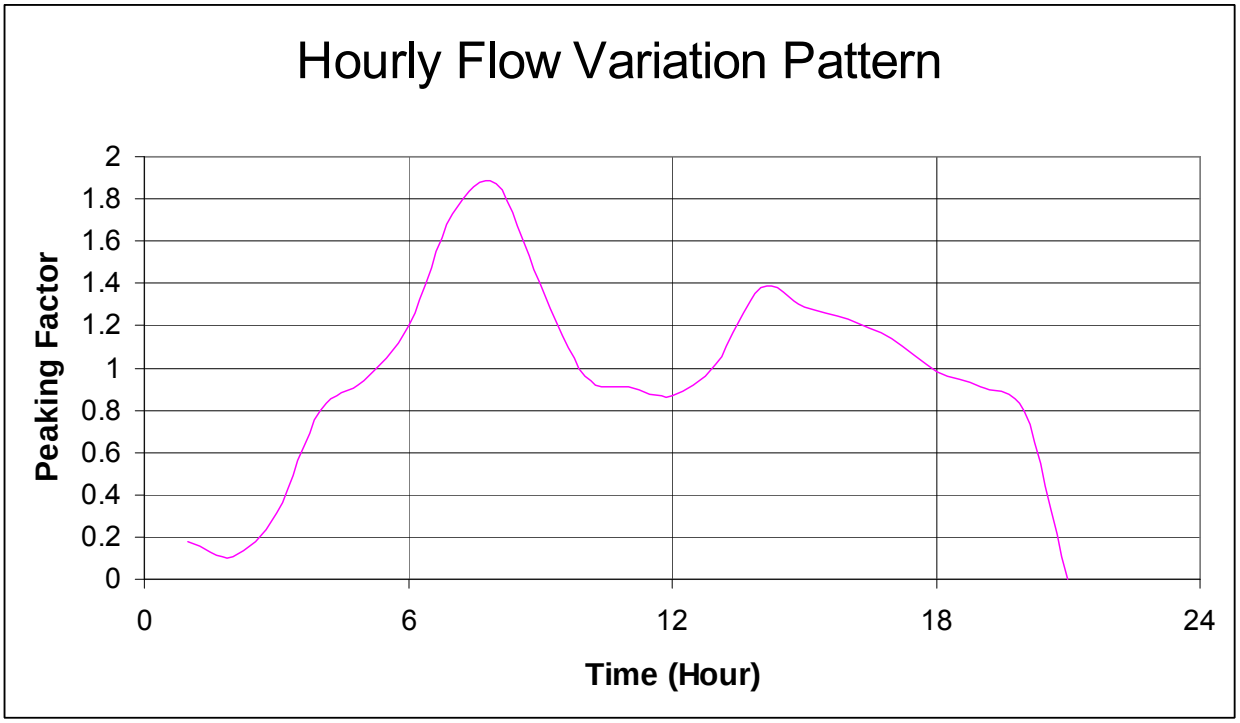
Table 3-3 Sewage Unit Flows and Equivalent Population Factor

Land Use	Unit Average Dry Weather Flow	Infiltration and inflow (L/day)
Residential	285 litres/capita/day	0.14 litre / mm of pipe dia. / m of pipe length / day
Commercial	250 litres/capita/day	
Motel	190 litres/capita/day	
Institutional	5 litres/capita/day 136 capita/ha of floor area	

Design Assumption

Sanitary sewer modeling was based on the above design criteria with the typical hourly flow variation patterns for residential and non-residential sewage used in the model as shown in the following Figure 3.1: Typical Hourly Flow Variation Pattern.

Figure 3.1 Typical Hourly Flow Variation Pattern



(Source: A diurnal pattern for sanitary loading in Figure 6-2 from Computer Applications in Hydraulic Engineering, Haestad Methods Engineering, 1997-2001)

3.2 Growth of the Town of Bancroft

Population projections have been studied and the general findings can be found in the Bancroft WWTP Environmental Study Report Section 4.0. The population data and projections were performed using 2005 population data. Base statistics data, historical population, land use trends, and growth factors were also used in that report. The projected population growth for the Town of Bancroft is also shown in the table below. The population was expected to grow at a constant low growth rate of 10% to high growth rate of 28%.

Table 3-4 Population Forecasts for the Town of Bancroft (Source: BWWTP ES Report)

	Service Population	
Year	Low Growth (10%)	High Growth (28%)
2005	2,100	2,100
2010	2,320	2,680
2015	2,560	3,420
2020	2,830	4,370
2025	3,120	5,570

The subsequent population data was distributed into water distribution zones based on the current land use types and population densities. The distributed population of Bancroft is then summarized and projected to the Year of 2025 as follows:

Table 3-5 Population Distribution and Forecasts for the Town of Bancroft

Year	Population connected with wastewater collection system	
	Year 2001	Year 2025 (Projected)
Rural Bancroft North	*857*	*1,045*
Bancroft North	433	528
Bancroft Central	1,035	1,263
Bancroft South	*974*	1,188
Rural Bancroft South	*686*	*837*
Bancroft Hospital	104	127
Total =	4,089	4,988
People in wastewater connection area	Approx. 1,500	Approx. 3,100

People without the connection of wastewater collection system (assumed) are in Italic.

3.3 Projected Wastewater Generation Rates

Using the results of the population forecast (Section 3.2), the population was assumed to grow at a constant rate of 10% for low growth or 28% for high growth. Based on the boundaries of each wastewater collection system, the serviced population and the wastewater generated can then be distributed by their respective area sizes.

According to the BWWTP EA Report, the average wastewater projections are shown in the Table 3-6.

Table 3-6 Average Daily Flow of Bancroft WWTP (Source: BWWTP EA Report)

Year	Average Daily Wastewater Flow (m^3/day)
2005	1,008
2010	1,194
2015	1,311
2020	1,411
2025	1,584 (approx. 1,600)

The above projected wastewater flow can be further distributed among various components that are the future dry weather flow, infiltration and inflow and Downtown development flow rates plus the additional I/I. The projected flows of each component are estimated as follows:

Table 3-7 Year 2025 Project Flow Rates of various components

Components	Average Daily Wastewater Flow (m^3/day)
Dry Weather Flow of population 3,100	885
Infiltration and Inflow of existing system	560
Downtown New Development Flow	125
Infiltration and Inflow due to new sewers	52
Total =	Approx. 1,600

4. Wastewater System Models

This assessment report presents the hydraulic modeling results from SewerGEMS and optimizes a cost-effective design to expand the BUA wastewater collection system. The main task of this capacity assessment is to evaluate the carrying capacity of the existing wastewater collection system due to the proposed Building Bancroft project and due to the expected population increase by the year 2025.

GENIVAR evaluated existing wastewater collection and transmission infrastructure, developed alternatives to improve and/or connect existing systems, planned new infrastructure and upgrades to achieve the same percentage of coverage and ensured the system will have sufficient capacity to handle Building Bancroft Developments and future growth to 2025.

4.1 Computer Model Setup Overview

The SewerGEMS model was developed initially based on the existing available information. It is reasonable and practical just to model those major sewers along the Hastings Street, Station Street, Bridge Street, Sherboume Street, Monck Street and the associated force mains. The model only considered the following pumping stations :

- Hastings Street Main Sewerage Pumping Station
- Forest Hill Sewerage Pumping Station
- Valleyview Drive Sewerage Pumping Station
- Hasting Street North Sewerage Pumping Station
- Faraday Landfill Transfer Pumping Station

Pump curves were obtained for the pumps in Hastings Street Dairy Queen SPS and Forest Hill SPS (Enclosed in the Appendix D) while the others were modeled based on the rated capacity of the respective pumps. Figures D-1 to D-5 show the average flow rates for the five pumps at Dairy Queen SPS, Forest Hill SPS, Valleyview Drive SPS, Hasting Street North SPS and Highway 62 South SPS. Since there is no flow monitoring data available to confirm the hydraulic performance of the existing sanitary sewerage system and to define the sub-catchment inlet flows. All the sanitary flows going into the collection system are approximately allocated to each of major junctions according to the population mapping from GIS.

4.2 Hydraulic Analysis of Existing System Performance

The wastewater systems serving the BUA comprise some 17 km of trunk, collector and local sewers, seven (7) pumping stations, 2.8 km of pressure mains and one wastewater treatment plan

The physical condition of the Bancroft wastewater collection system was investigated by conducting a Closed Circuit Television (CCTV) survey of a number of representative sample sewers. The survey provided information only on the internal surface and structural condition of a selection of sewer pipes. There is no existing flow data available to confirm the model results or to calibrate the system parameters.

In evaluating a wastewater collection system one of the most important aspects to be considered is the hydraulic carrying capacity of the system. This determines the adequacy of each length of sewer to convey present and projected future flow rates. To carry out the hydraulic analysis, current sewer data together with present and future flow rates were built into a hydraulic model. The model was then used to determine the flow characteristics of the sewers, i.e. whether flowing partially full or surcharged and to relate projected wastewater flow rates to the carrying capacity of the receiving sewer and trunk lines based their size, slope and roughness.

After initial model simulation, the parameter of Manning's 'n' of the force mains was calibrated to achieve the expected flow rates. The result was based on the following calibration of the 'n' values of the force mains as indicated on the following Table 4-1. The calibration of the values of Manning's 'n' in this procedure accounts for all the friction loss along the transmission main, including minor losses due to localized components, such as fitting, valves and meters and pressure head loss.

Table 4-1 Forced mains of Bancroft Sewer System

Model Label	Start-node Id	Diameter (mm)	Material	Manning's n
pp_temp-3	Valleyview Drive SPS	150	PVC	0.029
PP-4	Faraday Landfill Transfer PS	100	HDPE	0.029
PP-5	PJ-3	100	HDPE	0.029
PP-6	Hastings Street North SPS	150	PVC	0.029
PP-7	PJ-8	100	PVC	0.029
PP-8	PJ-6	100	HDPE	0.029
PP-9	PJ-5	100	HDPE	0.029
PP-10	PJ-2	100	HDPE	0.029
PP-11	PJ-7	100	HDPE	0.029
PP-43	Forest Hill Road SPS	150	PVC	0.00525
PP-44	Valleyview Drive SPS	150	PVC	0.01
PP-88	Hastings Street Dairy Queen SPS	250	PVC	0.06

The projected wastewater flows for the years of 2006 and 2025 were determined based on average daily wastewater flows, as well as the infiltration for each sub-area and the peak wastewater flows for Building Bancroft projects.

Due to the limited design data of the existing sewer system, the simplification of the existing hydraulic model layout, and to allow the projected growth that will occur within the immediate vicinity of BUA, all sub-catchment inflows were lumped into a "node-inflow" input into the nearby junction at each intersection.

The simulation and comparison of the trunk sewer pipelines were carried out for the following separate conditions:

Existing Scenario (Dry Weather Flow Condition)

Under this scenario, the existing conditions of the system were modeled using the average daily wastewater flows generated from each property. The data used in this pre-development model was based on 2006 water bill records. It was assumed that almost 90% of the water uses will eventually re-enter the sewer system.

The total average daily catchment flows (Dry Weather Flows) for all sub-areas are about 512m^3/day under existing condition. After simulation, the peak flow of the final discharge pipe going into treatment plant is 1,501 m^3/day per average.

The main Hastings Street Pumping Station delivered 325 m^3/day out of 512 m^3/day flows; that is about 63% of the daily total.

Existing Scenario with Downtown Development (Wet Weather Flow Condition)

For this scenario, the daily average wastewater flow rates were used in the model. The additional wastewater generated from all new downtown developments (i.e. the design flows in Table 3.1) were added into the model, together with the wet weather flow rate of infiltration and inflow of approximately 560 m^3/day.

The peak wet weather flow rate is 2,048 m^3/day, while the daily average WWF rate of 1,232 m^3/day is achieved.

The Hastings Street Dairy Queen SPS operates at longer cycles with durations greater than one hour. It delivers close to 70% of the total flow.

Future Scenario with Building Bancroft Project (Wet Weather Flow Condition)

Under this future scenario, the projected wastewater production for the year 2025 is 1,717 m^3/day during wet weather flow conditions including the leachate. The peak flow is close to 2,319 m^3/day.

5. Wastewater System Capacities and Limitations

According to the model results, the Town's sewer system has sufficient capacity to handle peak dry-weather flows. It is our understanding that there has not been any major surcharge problem under wet weather flow conditions. During storm events, large surplus flows of groundwater infiltration and surface water runoff enter sanitary collection systems through system deficiencies and openings on maintenance holes, overwhelming downstream treatment plants.

This unnecessary and excessive infiltration and inflow of at least 36,500 litres each year for every person connected to a jointed system must be considered during the sizing of pipe diameters and of pipe installation slope, in addition to the diurnal peak flow rates which must also be accommodated for the collection system and the wastewater treatment plant.

Under wet weather flow conditions, all sanitary loadings, together with the infiltration and inflow rates, were simulated under daily average and design flow conditions. It is understood that wastewater from the pumping stations temporarily filled-up the sewer pipelines and the I/I was trucked away. However, sufficient data is currently not available to establish the exact infiltration and inflow levels for the Town. Thus, the existing wastewater collection system's infiltration and inflow values could only be calculated based on general design guidelines from MOE. Flow information from monitoring data will be useful to calibrate the sewer model in terms of wastewater input.

For this wastewater system capacity assessment, one of the biggest design challenges is how to calibrate the hydraulic model for the existing wastewater collection system. The accuracy of simulation results is so critical because it is one of the most important factors on which key design decisions are based.

It is important that a hydraulic model be calibrated using data from actual field conditions, usually through the use of temporary flow meters placed within the collection system. Using the data collected from the system ensures that real conditions currently existing in the wastewater system are modeled. Typically, old wastewater systems do not perform as efficiently as they were originally designed to perform.

In this assessment process, the model was calibrated for some of the SPSs. Not all the pipe flows and the collection area inflows were subject to calibration.

Existing Capacity of Sanitary Collection System

In the existing conditions, there are two separate scenarios which are the Dry Weather Flow (DWF) and Wet Weather Flow (WWF). Both scenarios considered the daily average wastewater flows plus the leachate flow of 129 m^3/day from Faraday Landfill Site. GENIVAR reviewed the existing sanitary model and identified the following issues according to the model's results:

Existing DWF

- No surcharging of gravity sewers (i.e. hydraulic grade line is lower than sewer crown) was noted in the sanitary collection network;
- Existing model results indicated lower mean sewage flow;
- The available pipe capacities of gravity sewers ranged from 40 % to 99 %;
- The daily average wastewater flow (DWF) to BWWTP is about 511 m^3/day with the peak flow of 1,501 m^3/day (without leachate flow);
- The daily average wastewater flow (DWF) to BWWTP is about 640 m^3/day with the peak flow of 1,560 m^3/day (with leachate flow);
- The main Hastings Street SPS operated at one to two cycles per hour with a total flow of 325 - 443 m^3/day (approximately 63% to 69% of the total wastewater in the system).

Existing WWF

- Minor surcharging of gravity sewers at certain intersections due to lumped inflow (a fixed loading using a lumped approach) from subdivisions, the sewer pipes at the Hastings Street North before and after the Hastings Street North SPS; those surcharge phenomenon are instantaneous and appear at the manhole location(s) only (See Figure 5.1);
- Surcharge on the first three gravity pipes along Monck Street downstream of the forcemain from the Valleyview Drive SPS (See Figure 5.2);
- The daily average wastewater (WWF) flow to BWWTP is about 1,165 m^3/day with the peak flow of 2,023 m^3/day (with leachate flow);
- The daily average wastewater (WWF) flow to BWWTP is about 1,000 m^3/day with the peak flow of 2,325 m^3/day (without leachate flow);

Figure 5.1 Sewer Profile along Hastings Street North to Dairy Queen SPS under existing condition (WWF)

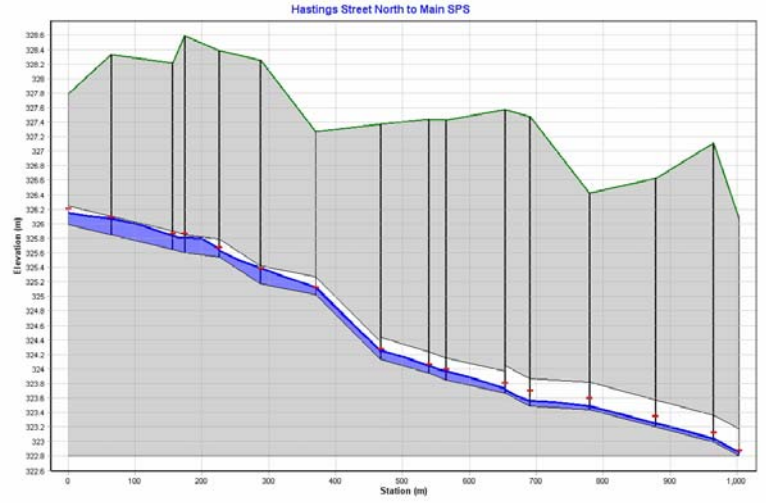
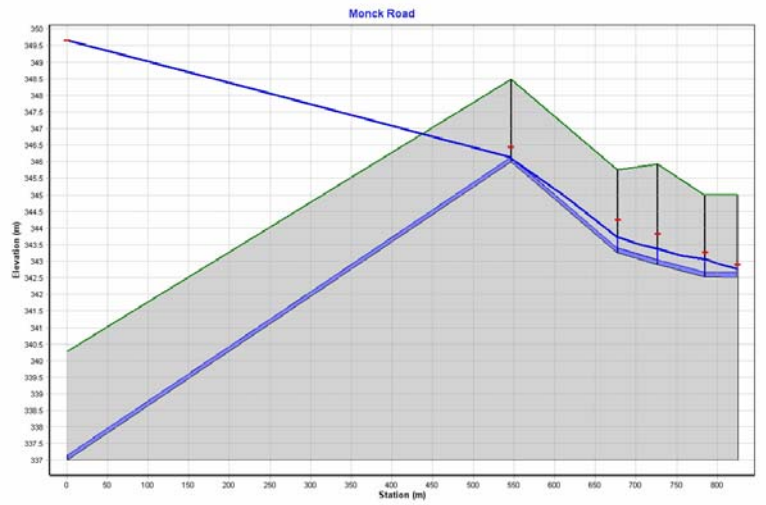


Figure 5.2 Sewer Profile along Monck Street after Valleyview Dr forcemain under existing condition (WWF)



Future Capacity of Sanitary Collection System

Under the future condition, there are two aspects which were investigated. The first scenario was to look at the impact of Building Bancroft on the existing wastewater collection system, especially to the Hastings Street Dairy Queen SPS and to the downstream sewers, together with the evaluation of associated forcemain; while the second scenario was simulated under the design flow condition (Both conditions are of WWF.)

Existing daily average WWF condition with downtown developments

- Surcharge appears at the location where Monck Street sewer is connected with Valleyview Drive forcemain (See Figure 5-3);
- Surcharge also appears at the locations before and after the Hastings Street North SPS due to the lumped inflows from sub-catchments (See Figure 5-4);
- The existing daily average wastewater (WWF) flow to BWWTP is about 1,250 m^3/day with the peak flow of 2,048 m^3/day; and,
- The main Hastings Street SPS operates at longer cycles during the evening with less idle time with a total flow of 852 m^3/day (approximately 69% of the total wastewater in the system).

Figure 5.3 Sewer Profile along Monck Street after Valleyview Dr forcemain under existing daily average WWF condition w/ downtown developments

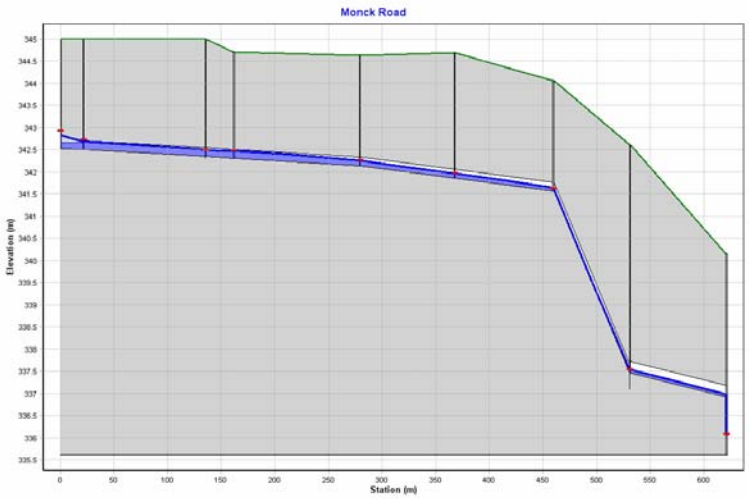


Figure 5.4 Sewer Profile along Hastings Street North before and after Hastings Street North SPS w/ downtown developments

Post Development Design WWF

In the post development condition, all wastewater loadings into the system from all collection areas and Building Bancroft area are using the Harmon Factor (Refer to Section 3.1) to determine the design flows. The peaking factor for the Downtown Bancroft Redevelopment Project was calculated based on the estimated equivalent population of 235. The modified Harmon Factor is 4.12. As a result, the additional flows from all of the future redevelopments in Building Bancroft area are 60 m^3/day and 248 m^3/day for daily average and design flow rates, respectively.

- Minor surcharging of gravity sewers before and after the Hastings Street North SPS due to lumped inflow from sub-divisions;
- Surcharge also found on the gravity pipes along Monck Street connecting with the forcemain from the Valleyview Drive SPS;
- Local surcharge at the Bridge Street West upstream of the river cross-over (See Figure 5.5);
- The existing design wastewater (WWF) flow to BWWTP is about 2,515 m^3/day with the peak flow of 2,877 m^3/day;
- The Hastings Street Dairy Queen SPS operated on a continuous basis with a total flow of 1,692 m^3/day (approximately 67% of the total wastewater in the system); and,
- All the above phenomenon is mainly due to the design flow rate.

Figure 5.5 Sewer Profile along Bridge Street West at the River Cross-over

2025 Projected Wastewater Flow under WWF conditions with Building Bancroft Project

In the Year 2025 projected condition, there are two scenarios (out of possible three options) being reviewed. That is the projected daily average wastewater flow (Year 2025) with the average daily flow and design flow from the area of Building Bancroft Project. Both scenarios consider wet weather flow conditions (the worse scenario).

The second scenario is under the condition of design flow rates. The results of the projected wastewater flow rates are illustrated in the following table:

Table 5-1 Results for Scenario of Year 2025 Projected Flow Rate under WWF condition with/without Building Bancroft Project

	Pre-Development	Post-Development
Average WWF Rate to BWWTP	1,717	1,867
- Hastings Street Dairy Queen SPS outflow / Total Average Flow Rate	76%	74%
Peak WWF Rate to BWWTP	2,319	2,461
- Hastings Street Dairy Queen SPS outflow / Total Peak Flow Rate	76%	74%
Issues:		
(i) under both scenarios, the Dairy Queen SPS operates almost 18 to 20 hours per day; and		
(ii) it indicates that it was near the design capacity.		

6. Wastewater Infrastructure Expansion and Rehabilitation Recommendations

Bancroft's publicly owned wastewater collection and treatment systems have operated since 1974. Due to the potential of the Building Bancroft Re-development project, the existing wastewater collection system has been evaluated and recommendations are proposed for any replacement and/or expansion work.

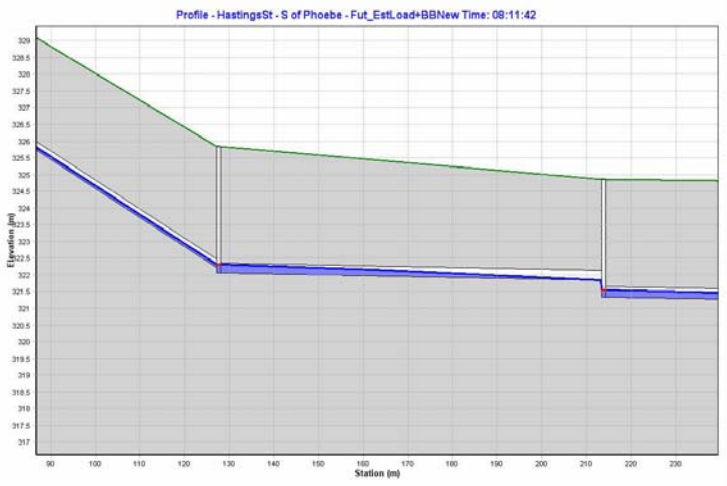
This assessment report provides an overview of existing facilities and identifies any immediate measures to improve the existing wastewater collection system. Of the total residences in Bancroft, an estimated of less than 40 percent discharge to publicly owned wastewater treatment and collection systems and the remainder discharge to individual private sewage treatment systems.

There are about one hundred sewer pipes, with a total length of 6,640 metre that were analyzed. 38% of the Bancroft wastewater collection system was included in this hydraulic model.

From the hydraulic model results in Section 5, the following issues were identified:

- the collection system has sufficient capacity to handle peak dry weather flows;
- there is no significant surcharge occurred on the system under the wet weather flows condition;
- the Bridge Street West sewer at the river crossing experiences a hydraulic jump and surcharge appears at the upstream of the pipeline;
- the Hastings Street Dairy Queen SPS is running at a rated capacity of 37.9 L/s with a total headloss of 12.13m; it indicates that the pump pressure is adequate. But for the future capacity, there will be not enough pressure to deliver the projected flow rate according to the pump curve in Appendix D;
- under the scenarios of design flow rates with Building Bancroft and Year 2025 projected wastewater flow, the pump at Dairy Queen SPS almost operates over 90% of time;
- if all the design flow rates are simulated under the constant peak condition, instead of pattern flow, and the Dairy Queen SPS delivers over 58 L/s; then the downstream sewer will experience surcharge problems (See Figure 6.1); and,
- there are only a few sewers at the upstream of the downtown area (along Hasting Street North) experience surcharge in the manhole locations (due to lumped sub-catchments' inflows); future detail modeling is needed for any new developments to the north Bancroft and to the both sides of Monck Street in order to evaluate the impact on the downstream sewers;

Figure 6.1 Sewer Profile along Hastings Street South of Phoebe Street



7. Building Bancroft WASTEWATER Site Servicing

As part of the Building Bancroft site servicing analysis, all proposed Building Bancroft sites have been preliminarily assigned as 100 mm service connections.

The additional sewers include six locations of 150 mm sewers with connection to the proposed residential condominium, to the main cluster of proposed commercial/retail, to the Town Centre, etc. The Building Bancroft Site Servicing Plan (Wastewater) is enclosed in Appendix E at the end of this report.

The proposed invert levels of the lateral pipes for the Building Bancroft site servicing connection are shown in Appendix E.

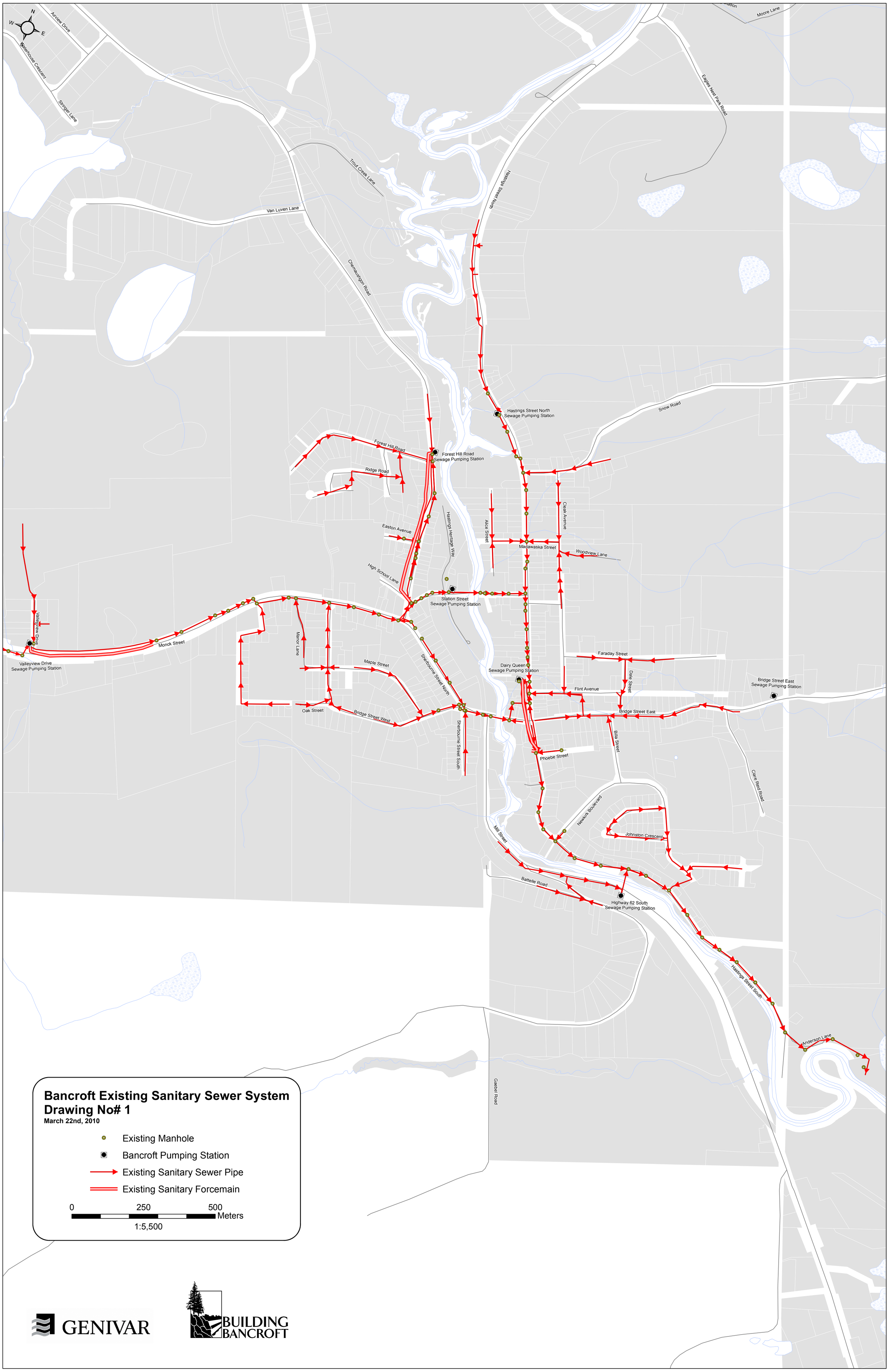
8. Conclusions

Based on the modeling analysis the following recommendations are made

- Replace 66m of sewer along Bridge Street West between manhole at the Bridge Street River Crossing with 250mm diameter sewer to match carrying capacity of upstream sewer;
- Replace 206m of sewer along Hastings Street between Phoebe Street and Newkirk Blvd to match the slope in line with that of the adjacent sewer;
- Install second 250 mm diameter transmission forcemain from Hasting Street Dairy Queen SPS to Phoebe Street and connect to the second pump; and,
- Prior to any commercial development along Monck Street, the development loadings should be determined and further analysis of the collection system will be required to evaluate system requirements to facilitate adequate site servicing in this commercial zoned area.

Appendix A

Drawings



Bancroft Existing Sanitary Sewer System
Drawing No# 1
March 22nd, 2010

- Existing Manhole
- Bancroft Pumping Station
- Existing Sanitary Sewer Pipe
- Existing Sanitary Forcemain

0 250 500 Meters

1:5,500

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Existing Bancroft Sanitary Sewer System

Bancroft Existing and Proposed Sanitary Collection Areas and Future Site Drawing #2

March 22nd, 2010

- Proposed Collection Area North
- Existing Collection Area South
- Future Site
- Town of Bancroft

0 250 500 1,000 Meters

1:7,000

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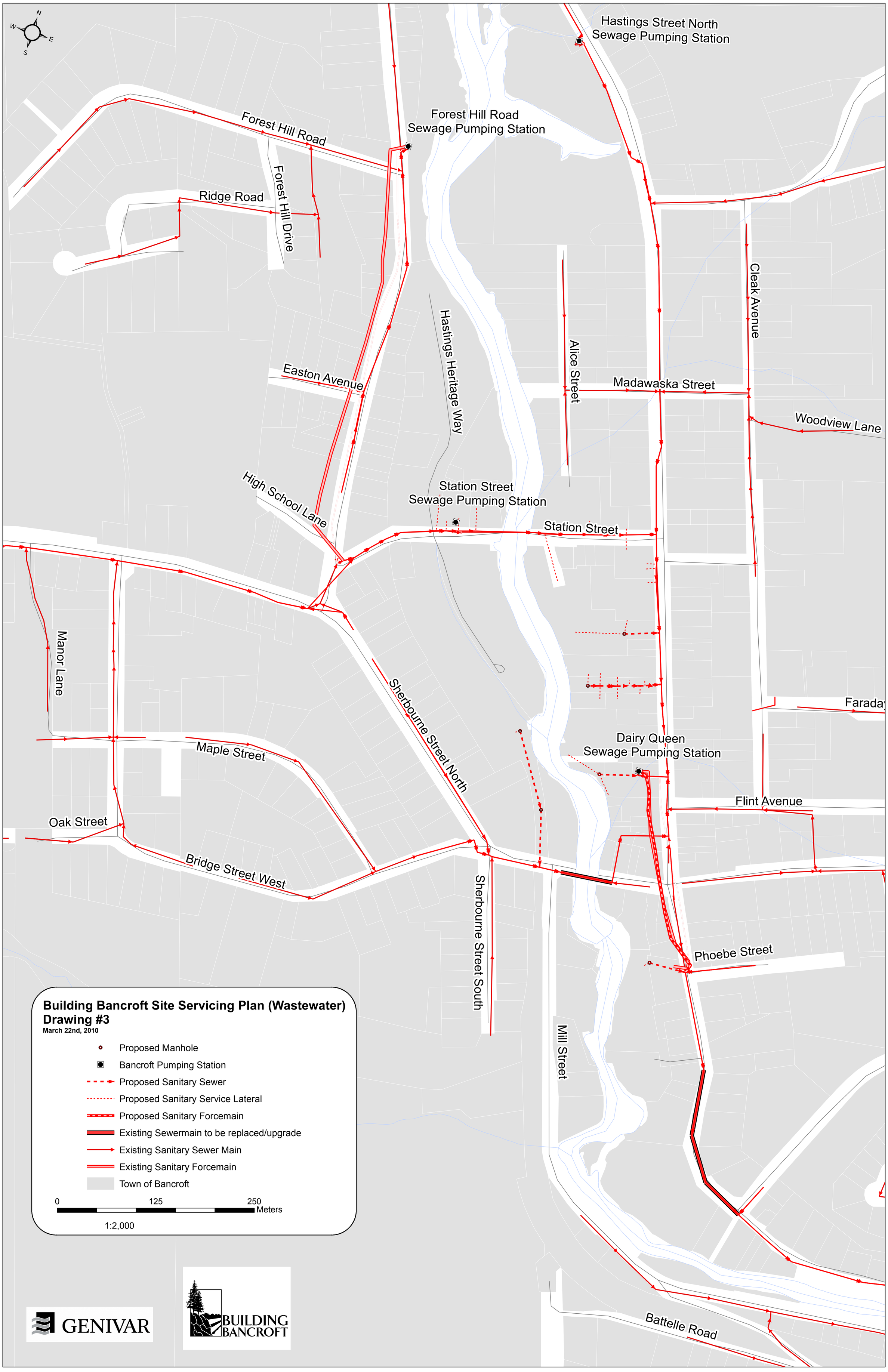
BUILDING BANCROFT

Bancroft Existing and Proposed Sanitary Collection Areas and Future Site Drawing #2


N
W
E
S
Forest Hill Road
Forest Hill Road
Sewage Pumping Station
Hastings Street North
Sewage Pumping Station
Ridge Road
Forest Hill Drive
Hastings Heritage Way
Alice Street
Cleak Avenue
Madawaska Street
Woodview Lane
Easton Avenue
High School Lane
Station Street
Sewage Pumping Station
Station Street
Manor Lane
Sherbourne Street North
Maple Street
Dairy Queen
Sewage Pumping Station
Flint Avenue
Oak Street
Bridge Street West
Sherbourne Street South
Phoebe Street
Mill Street
Battelle Road
Building Bancroft Site Servicing Plan (Wastewater)
Drawing #3
March 22nd, 2010
Proposed Manhole
Bancroft Pumping Station
Proposed Sanitary Sewer
Proposed Sanitary Service Lateral
Proposed Sanitary Forcemain
Existing Sewermain to be replaced/upgrade
Existing Sanitary Sewer Main
Existing Sanitary Forcemain
Town of Bancroft
0
125
250
Meters
1:2,000
GENIVAR
BUILDING BANCROFT

Appendix B

Sewer Data List (SewerGEMS Model)

Label	Diameter (mm)	Start Node	Elevation (Start Invert) (m)	Stop Node	Elevation (Stop Invert) (m)	Length (Scaled) (m)	Is Active?
Bancroft_Sewer_Main-101	250	Bancroft_Manholes-55	333.22	Bancroft_Manholes-61	322.22	125.806	TRUE
Bancroft_Sewer_Main-104	200	Bancroft_Manholes-7	342.5	MH-7	342.34	113.043	TRUE
Bancroft_Sewer_Main-105	200	MH-7	342.34	Bancroft_Manholes-30	342.3	25.306	TRUE
Bancroft_Sewer_Main-109	200	Bancroft_Manholes-13	342.13	Bancroft_Manholes-33	341.85	87.439	TRUE
Bancroft_Sewer_Main-110	150	Bancroft_Manholes-9	343.25	Bancroft_Manholes-11	342.9	48.25	TRUE
Bancroft_Sewer_Main-111	150	Bancroft_Manholes-6	342.51	Bancroft_Manholes-7	342.5	20.268	TRUE
Bancroft_Sewer_Main-112	150	Bancroft_Manholes-11	342.9	Bancroft_Manholes-12	342.52	57.334	TRUE
Bancroft_Sewer_Main-113	150	Bancroft_Manholes-10	345.98	Bancroft_Manholes-9	343.25	130.449	TRUE
Bancroft_Sewer_Main-122	200	Bancroft_Manholes-45	335.068	Bancroft_Manholes-228	333.54	15.278	TRUE
Bancroft_Sewer_Main-123	200	Bancroft_Manholes-43	337.16	Bancroft_Manholes-45	335.068	15.996	TRUE
Bancroft_Sewer_Main-124	200	Bancroft_Manholes-42	341.528	Bancroft_Manholes-59	340.157	90.142	TRUE
Bancroft_Sewer_Main-125	200	Bancroft_Manholes-46	333.08	Bancroft_Manholes-52	327.416	61.778	TRUE
Bancroft_Sewer_Main-126	200	Bancroft_Manholes-52	327.386	Bancroft_Manholes-51	327.078	27.753	TRUE
Bancroft_Sewer_Main-128	200	Bancroft_Manholes-50	325.984	Bancroft_Manholes-53	323.54	60.735	TRUE
Bancroft_Sewer_Main-129	375	MH-1	322.8	WW-1	322.54	7.206	TRUE
Bancroft_Sewer_Main-138	300	Bancroft_Manholes-67	318.33	Bancroft_Manholes-68	317.92	97.645	TRUE
Bancroft_Sewer_Main-139	300	Bancroft_Manholes-63	321.09	Bancroft_Manholes-64	320.98	58.669	TRUE
Bancroft_Sewer_Main-14	200	Bancroft_Manholes-44	345.11	Bancroft_Manholes-43	337.16	74.587	TRUE
Bancroft_Sewer_Main-140	300	Bancroft_Manholes-62	321.34	Bancroft_Manholes-63	321.2	61.71	TRUE
Bancroft_Sewer_Main-152	375	Bancroft_Manholes-167	323.2	Bancroft_Manholes-141	322.99	85.921	TRUE
Bancroft_Sewer_Main-153	375	Bancroft_Manholes-169	323.49	Bancroft_Manholes-168	323.44	87.191	TRUE
Bancroft_Sewer_Main-154	375	Bancroft_Manholes-166	323.67	Bancroft_Manholes-169	323.49	37.664	TRUE
Bancroft_Sewer_Main-155	375	Bancroft_Manholes-171	323.9	Bancroft_Manholes-166	323.67	58.385	TRUE
Bancroft_Sewer_Main-156	300	Bancroft_Manholes-172	325.67	Bancroft_Manholes-170	324.83	41.171	TRUE
Bancroft_Sewer_Main-157	250	Bancroft_Manholes-37	333.73	Bancroft_Manholes-39	332.76	21.548	TRUE
Bancroft_Sewer_Main-158	250	Bancroft_Manholes-38	336	Bancroft_Manholes-37	334.83	24.078	TRUE
Bancroft_Sewer_Main-16	200	Bancroft_Manholes-33	341.85	Bancroft_Manholes-34	341.56	90.74	TRUE
Bancroft_Sewer_Main-160	200	Bancroft_Manholes-40	341.376	Bancroft_Manholes-41	340.797	26.418	TRUE
Bancroft_Sewer_Main-162	200	Bancroft_Manholes-34	341.56	Bancroft_Manholes-32	337.46	70.7	TRUE
Bancroft_Sewer_Main-173	250	Bancroft_Manholes-207	323.86	WW-5	323.8	81.806	TRUE
Bancroft_Sewer_Main-181	250	Bancroft_Manholes-253	325.65	Bancroft_Manholes-203	325.6	16.424	TRUE
Bancroft_Sewer_Main-192	300	Bancroft_Manholes-174	323.85	Bancroft_Manholes-166	323.67	86.672	TRUE
Bancroft_Sewer_Main-193	300	Bancroft_Manholes-175	323.94	Bancroft_Manholes-174	323.85	25.119	TRUE
Bancroft_Sewer_Main-196	250	Bancroft_Manholes-197	325.02	Bancroft_Manholes-176	324.13	96.683	TRUE
Bancroft_Sewer_Main-197	250	Bancroft_Manholes-195	325.54	Bancroft_Manholes-196	325.17	60.899	TRUE
Bancroft_Sewer_Main-199	250	Bancroft_Manholes-205	325.99	Bancroft_Manholes-204	325.85	64.616	TRUE

Label	Diameter (mm)	Start Node	Elevation (Start Invert) (m)	Stop Node	Elevation (Stop Invert) (m)	Length (Scaled) (m)	Is Active?
Bancroft_Sewer_Main-20	200	Bancroft_Manholes-51	327.08	Bancroft_Manholes-50	326.995	66.061	TRUE
Bancroft_Sewer_Main-200	600	Bancroft_Manholes-127	316.291	Bancroft_Manholes-125	316.233	47.442	TRUE
Bancroft_Sewer_Main-201	600	Bancroft_Manholes-126	316.416	Bancroft_Manholes-127	316.355	102.71	TRUE
Bancroft_Sewer_Main-202	600	Bancroft_Manholes-128	316.45	Bancroft_Manholes-126	316.416	102.72	TRUE
Bancroft_Sewer_Main-203	600	Bancroft_Manholes-129	316.593	Bancroft_Manholes-128	316.51	92.187	TRUE
Bancroft_Sewer_Main-204	600	Bancroft_Manholes-134	316.687	Bancroft_Manholes-129	316.638	109.108	TRUE
Bancroft_Sewer_Main-205	600	Bancroft_Manholes-135	316.78	Bancroft_Manholes-134	316.715	95.59	TRUE
Bancroft_Sewer_Main-206	600	Bancroft_Manholes-133	316.89	Bancroft_Manholes-135	316.84	95.214	TRUE
Bancroft_Sewer_Main-207	600	Bancroft_Manholes-131	316.982	Bancroft_Manholes-133	316.922	74.198	TRUE
Bancroft_Sewer_Main-208	600	Bancroft_Manholes-132	317.06	Bancroft_Manholes-131	317.01	73.65	TRUE
Bancroft_Sewer_Main-209	600	Bancroft_Manholes-130	317.147	Bancroft_Manholes-132	317.09	94.481	TRUE
Bancroft_Sewer_Main-21	200	Bancroft_Manholes-53	323.54	Bancroft_Manholes-57	323.43	60.676	TRUE
Bancroft_Sewer_Main-211	600	Bancroft_Manholes-110	317.306	Bancroft_Manholes-130	317.18	105.912	TRUE
Bancroft_Sewer_Main-221	200	Bancroft_Manholes-89	330.4	Bancroft_Manholes-88	329.1	111.397	TRUE
Bancroft_Sewer_Main-222	200	Bancroft_Manholes-90	330.665	Bancroft_Manholes-89	330.476	83.732	TRUE
Bancroft_Sewer_Main-223	200	Bancroft_Manholes-85	333.332	Bancroft_Manholes-84	331.845	59.569	TRUE
Bancroft_Sewer_Main-226	400	Bancroft_Manholes-68	317.87	Bancroft_Manholes-111	317.711	65.341	TRUE
Bancroft_Sewer_Main-232	150	Bancroft_Manholes-12	342.52	Bancroft_Manholes-6	342.51	38.894	TRUE
Bancroft_Sewer_Main-239	200	Bancroft_Manholes-228	333.54	Bancroft_Manholes-46	333.081	4.307	TRUE
Bancroft_Sewer_Main-24	200	Bancroft_Manholes-60	333.747	Bancroft_Manholes-55	333.22	89.235	TRUE
Bancroft_Sewer_Main-241	250	Bancroft_Manholes-39	331.65	Bancroft_Manholes-36	330.68	21.174	TRUE
Bancroft_Sewer_Main-26	300	Bancroft_Manholes-61	322.06	Bancroft_Manholes-62	321.84	84.364	TRUE
Bancroft_Sewer_Main-27	200	Bancroft_Manholes-65	322.93	Bancroft_Manholes-64	319.34	47.2	TRUE
Bancroft_Sewer_Main-28	300	Bancroft_Manholes-64	319.34	Bancroft_Manholes-66	318.82	89.678	TRUE
Bancroft_Sewer_Main-3	200	Bancroft_Manholes-3	337.5	WW-4	334.65	15.311	TRUE
Bancroft_Sewer_Main-34	300	Bancroft_Manholes-66	318.75	Bancroft_Manholes-67	318.42	94.441	TRUE
Bancroft_Sewer_Main-35	400	Bancroft_Manholes-111	317.64	Bancroft_Manholes-110	317.43	94.756	TRUE
Bancroft_Sewer_Main-44	200	Bancroft_Manholes-88	329.114	Bancroft_Manholes-107	329.022	24.117	TRUE
Bancroft_Sewer_Main-49	200	Bancroft_Manholes-87	331.436	Bancroft_Manholes-84	331.14	52.671	TRUE
Bancroft_Sewer_Main-5	200	Bancroft_Manholes-30	342.3	Bancroft_Manholes-13	342.13	116.595	TRUE
Bancroft_Sewer_Main-50	200	Bancroft_Manholes-83	335.923	Bancroft_Manholes-85	333.393	72.171	TRUE
Bancroft_Sewer_Main-51	200	Bancroft_Manholes-84	331.14	Bancroft_Manholes-90	330.742	93.07	TRUE
Bancroft_Sewer_Main-53	300	Bancroft_Manholes-36	329.34	Bancroft_Manholes-173	326.66	57.294	TRUE
Bancroft_Sewer_Main-54	300	Bancroft_Manholes-170	324.24	Bancroft_Manholes-171	323.9	57.153	TRUE
Bancroft_Sewer_Main-61	250	Bancroft_Manholes-196	325.17	Bancroft_Manholes-197	325.02	81.948	TRUE
Bancroft_Sewer_Main-65	300	Bancroft_Manholes-176	324.13	Bancroft_Manholes-175	323.94	70.007	TRUE

Label	Diameter (mm)	Start Node	Elevation (Start Invert) (m)	Stop Node	Elevation (Stop Invert) (m)	Length (Scaled) (m)	Is Active?
Bancroft_Sewer_Main-66	250	Bancroft_Manholes-204	325.85	Bancroft_Manholes-253	325.65	90.857	TRUE
Bancroft_Sewer_Main-71	375	Bancroft_Manholes-168	323.44	Bancroft_Manholes-167	323.2	96.881	TRUE
Bancroft_Sewer_Main-72	375	Bancroft_Manholes-141	322.99	MH-1	322.8	37.313	TRUE
Bancroft_Sewer_Main-73	250	Bancroft_Manholes-137	323.2	Bancroft_Manholes-141	323.02	40.979	TRUE
Bancroft_Sewer_Main-74	250	Bancroft_Manholes-57	323.43	Bancroft_Manholes-137	323.2	34.134	TRUE
CO-1	200	Bancroft_Manholes-107	328.224	WW-2	327.508	10.673	TRUE
CO-10A	200	MH-111	338.328	Bancroft_Manholes-47	334.09	91.551	TRUE
CO-11	200	MH-2	338.43	Bancroft_Manholes-38	337.78	14.735	TRUE
CO-11a	200	MH-20	336.93	WW-4	336.64	51.213	TRUE
CO-12	200	MH-19	339.21	MH-20	338.6	51.103	TRUE
CO-13	200	MH-18	343.83	MH-19	339.26	105.067	TRUE
CO-14	200	MH-17	349.34	MH-18	343.88	87.05	TRUE
CO-15	200	MH-16	351.45	MH-17	349.39	63.307	TRUE
CO-16	200	MH-15	354.17	MH-16	351.5	53.121	TRUE
CO-17	200	MH-14	357.74	MH-15	354.22	110.957	TRUE
CO-18	200	MH-13	358.95	MH-14	357.79	89.019	TRUE
CO-19	200	MH-12	359.98	MH-13	359	98.125	TRUE
CO-20	200	MH-011	360.38	MH-12	360.03	92.398	TRUE
CO-21	200	MH-010	360.71	MH-011	360.43	94.165	TRUE
CO-22	200	MH-09	365.16	MH-010	360.76	98.69	TRUE
CO-23	200	MH-08	365.3	MH-09	365.21	16.07	TRUE
CO-25	300	Faraday	383	WW-8	382.5	6.907	TRUE
CO-3	600	Bancroft_Manholes-125	316.233	OF-1	316	4.124	TRUE
CO-4	200	Bancroft_Manholes-41	340.766	Bancroft_Manholes-32	340.31	44.553	TRUE
CO-44	250	Bancroft_Manholes-32	337.46	Bancroft_Manholes-38	336.92	87.961	TRUE
CO-5	250	Bancroft_Manholes-203	325.6	Bancroft_Manholes-195	325.54	50.88	TRUE
CO-55	300	Bancroft_Manholes-173	326.66	Bancroft_Manholes-172	325.67	109.758	TRUE
CO-8	200	Bancroft_Manholes-47	334	Bancroft_Manholes-228	333.543	18	TRUE
CO-99	200	Bancroft_Manholes-59	339.852	MH-111	338.358	91.275	TRUE
Bancroft_Sewer_Main-1	200	Bancroft_Manholes-1	338.88	Bancroft_Manholes-2	338.43	55.072	FALSE
Bancroft_Sewer_Main-10	200	Bancroft_Manholes-20	359.88	Bancroft_Manholes-14	355.54	60.448	FALSE
Bancroft_Sewer_Main-100	200	Bancroft_Manholes-238	348.2	Bancroft_Manholes-30	342.3	126.208	FALSE
Bancroft_Sewer_Main-102	250	Bancroft_Manholes-116	343.33	Bancroft_Manholes-114	338.38	62.205	FALSE
Bancroft_Sewer_Main-103	200	Bancroft_Manholes-219	337.5	MH-10	341.58	173.47	FALSE
Bancroft_Sewer_Main-106	200	Bancroft_Manholes-14	355.54	Bancroft_Manholes-17	349.54	90.58	FALSE
Bancroft_Sewer_Main-107	200	Bancroft_Manholes-18	345.92	Bancroft_Manholes-13	342.13	75.069	FALSE

Label	Diameter (mm)	Start Node	Elevation (Start Invert) (m)	Stop Node	Elevation (Stop Invert) (m)	Length (Scaled) (m)	Is Active?
Bancroft_Sewer_Main-108	200	MH-6	348	Bancroft_Manholes-18	345.92	35.376	FALSE
Bancroft_Sewer_Main-11	200	Bancroft_Manholes-22	367.5	Bancroft_Manholes-23	366.54	82.246	FALSE
Bancroft_Sewer_Main-114	150	Bancroft_Manholes-8	342.5	Bancroft_Manholes-10	345.98	99.241	FALSE
Bancroft_Sewer_Main-115	200	MH-10	341.58	Bancroft_Manholes-5	339.4	56.181	FALSE
Bancroft_Sewer_Main-116	200	Bancroft_Manholes-5	339.4	Bancroft_Manholes-2	338.43	23.077	FALSE
Bancroft_Sewer_Main-117	200	Bancroft_Manholes-19	363.8	Bancroft_Manholes-20	359.88	50.555	FALSE
Bancroft_Sewer_Main-118	200	Bancroft_Manholes-29	359.26	Bancroft_Manholes-27	361.8	83.966	FALSE
Bancroft_Sewer_Main-119	200	Bancroft_Manholes-27	361.8	Bancroft_Manholes-28	358.85	63.783	FALSE
Bancroft_Sewer_Main-12	200	Bancroft_Manholes-25	360.93	Bancroft_Manholes-26	352.35	86.982	FALSE
Bancroft_Sewer_Main-120	200	Bancroft_Manholes-24	365.38	Bancroft_Manholes-25	360.93	97.623	FALSE
Bancroft_Sewer_Main-121	200	Bancroft_Manholes-26	352.35	Bancroft_Manholes-44	345.11	56.483	FALSE
Bancroft_Sewer_Main-127	200	Bancroft_Manholes-49	339.41	Bancroft_Manholes-46	333.08	123.76	FALSE
Bancroft_Sewer_Main-13	200	Bancroft_Manholes-28	358.85	Bancroft_Manholes-26	352.35	169.608	FALSE
Bancroft_Sewer_Main-130	200	Bancroft_Manholes-140	326.64	Bancroft_Manholes-137	323.2	57.939	FALSE
Bancroft_Sewer_Main-131	200	Bancroft_Manholes-69	323.07	Bancroft_Manholes-71	322.94	67.539	FALSE
Bancroft_Sewer_Main-132	200	Bancroft_Manholes-71	322.94	Bancroft_Manholes-70	322.94	66.379	FALSE
Bancroft_Sewer_Main-133	200	Bancroft_Manholes-73	322.96	Bancroft_Manholes-72	322.75	75.688	FALSE
Bancroft_Sewer_Main-134	200	Bancroft_Manholes-72	322.75	Bancroft_Manholes-81	321.96	84.798	FALSE
Bancroft_Sewer_Main-135	200	Bancroft_Manholes-80	321.2	Bancroft_Manholes-82	319.63	36.965	FALSE
Bancroft_Sewer_Main-136	200	Bancroft_Manholes-78	333.13	Bancroft_Manholes-79	333.3	93.805	FALSE
Bancroft_Sewer_Main-137	200	Bancroft_Manholes-75	323.75	Bancroft_Manholes-72	322.75	7.192	FALSE
Bancroft_Sewer_Main-142	200	Bancroft_Manholes-164	328.727	Bancroft_Manholes-145	328.736	41.555	FALSE
Bancroft_Sewer_Main-143	200	Bancroft_Manholes-163	329.641	Bancroft_Manholes-164	328.727	85.058	FALSE
Bancroft_Sewer_Main-144	200	Bancroft_Manholes-161	332.5	Bancroft_Manholes-163	329.641	44.579	FALSE
Bancroft_Sewer_Main-145	200	Bancroft_Manholes-162	338.74	Bancroft_Manholes-161	332.5	80.458	FALSE
Bancroft_Sewer_Main-146	200	Bancroft_Manholes-159	339.7	Bancroft_Manholes-162	338.74	28.981	FALSE
Bancroft_Sewer_Main-147	200	Bancroft_Manholes-160	341.86	Bancroft_Manholes-224	339.19	60.537	FALSE
Bancroft_Sewer_Main-148	200	Bancroft_Manholes-157	342.66	Bancroft_Manholes-158	343.15	23.846	FALSE
Bancroft_Sewer_Main-149	200	Bancroft_Manholes-153	341.53	Bancroft_Manholes-151	341.34	93.312	FALSE
Bancroft_Sewer_Main-15	200	Bancroft_Manholes-48	333.63	Bancroft_Manholes-49	339.41	103.024	FALSE
Bancroft_Sewer_Main-150	200	Bancroft_Manholes-155	341.4	Bancroft_Manholes-151	341.34	79.036	FALSE
Bancroft_Sewer_Main-151	200	Bancroft_Manholes-150	337.91	Bancroft_Manholes-147	335.51	38.386	FALSE
Bancroft_Sewer_Main-163	200	Bancroft_Manholes-105	350.46	Bancroft_Manholes-106	345.66	69.747	FALSE
Bancroft_Sewer_Main-164	200	Bancroft_Manholes-106	345.66	Bancroft_Manholes-104	342.07	69.77	FALSE
Bancroft_Sewer_Main-165	200	Bancroft_Manholes-104	342.07	Bancroft_Manholes-101	342.5	39.303	FALSE
Bancroft_Sewer_Main-166	200	Bancroft_Manholes-101	342.5	Bancroft_Manholes-102	342.99	88.771	FALSE

Label	Diameter (mm)	Start Node	Elevation (Start Invert) (m)	Stop Node	Elevation (Stop Invert) (m)	Length (Scaled) (m)	Is Active?
Bancroft_Sewer_Main-167	200	Bancroft_Manholes-103	342.59	Bancroft_Manholes-91	339.11	58.443	FALSE
Bancroft_Sewer_Main-168	200	Bancroft_Manholes-93	348.5	Bancroft_Manholes-91	339.11	59.913	FALSE
Bancroft_Sewer_Main-169	200	Bancroft_Manholes-95	355.5	Bancroft_Manholes-92	347.77	55.394	FALSE
Bancroft_Sewer_Main-170	200	Bancroft_Manholes-98	367.02	Bancroft_Manholes-96	364.6	11.209	FALSE
Bancroft_Sewer_Main-171	200	Bancroft_Manholes-99	377.5	Bancroft_Manholes-97	376.78	75.917	FALSE
Bancroft_Sewer_Main-172	200	Bancroft_Manholes-109	333.31	Bancroft_Manholes-107	328.026	104.325	FALSE
Bancroft_Sewer_Main-174	250	Bancroft_Manholes-209	324.57	Bancroft_Manholes-207	323.86	63.968	FALSE
Bancroft_Sewer_Main-175	250	Bancroft_Manholes-210	323.81	Bancroft_Manholes-209	324.57	53.403	FALSE
Bancroft_Sewer_Main-176	250	Bancroft_Manholes-208	327.15	Bancroft_Manholes-210	323.81	119.668	FALSE
Bancroft_Sewer_Main-177	250	Bancroft_Manholes-217	322.55	Bancroft_Manholes-215	323.5	76.294	FALSE
Bancroft_Sewer_Main-178	250	Bancroft_Manholes-211	326.37	Bancroft_Manholes-208	327.15	13.977	FALSE
Bancroft_Sewer_Main-179	250	Bancroft_Manholes-213	323.88	Bancroft_Manholes-211	326.37	82.378	FALSE
Bancroft_Sewer_Main-180	250	Bancroft_Manholes-203	325.6	Bancroft_Manholes-202	326.94	25.539	FALSE
Bancroft_Sewer_Main-182	200	Bancroft_Manholes-259	328.42	Bancroft_Manholes-195	325.54	89.996	FALSE
Bancroft_Sewer_Main-183	200	Bancroft_Manholes-201	335.03	Bancroft_Manholes-259	328.42	70.697	FALSE
Bancroft_Sewer_Main-184	200	Bancroft_Manholes-200	340.16	Bancroft_Manholes-201	335.03	56.853	FALSE
Bancroft_Sewer_Main-185	200	Bancroft_Manholes-198	329.57	Bancroft_Manholes-192	327.57	31.702	FALSE
Bancroft_Sewer_Main-186	200	Bancroft_Manholes-193	327.39	Bancroft_Manholes-177	327.3	89.081	FALSE
Bancroft_Sewer_Main-187	200	Bancroft_Manholes-180	330.99	Bancroft_Manholes-179	330.08	14.389	FALSE
Bancroft_Sewer_Main-188	200	Bancroft_Manholes-181	331.41	Bancroft_Manholes-180	330.99	51.713	FALSE
Bancroft_Sewer_Main-189	200	Bancroft_Manholes-186	337.19	Bancroft_Manholes-179	330.08	49.02	FALSE
Bancroft_Sewer_Main-190	200	Bancroft_Manholes-185	345.08	Bancroft_Manholes-184	341.46	35.555	FALSE
Bancroft_Sewer_Main-191	200	MH-5	343.82	Bancroft_Manholes-183	345.55	22.022	FALSE
Bancroft_Sewer_Main-194	200	Bancroft_Manholes-189	325.36	Bancroft_Manholes-176	324.13	36.71	FALSE
Bancroft_Sewer_Main-195	200	Bancroft_Manholes-190	324.34	Bancroft_Manholes-191	323.77	75.704	FALSE
Bancroft_Sewer_Main-198	250	MH-3	324.49	Bancroft_Manholes-205	324.79	11.78	FALSE
Bancroft_Sewer_Main-2	200	Bancroft_Manholes-2	338.43	Bancroft_Manholes-3	337.5	68.385	FALSE
Bancroft_Sewer_Main-210	250	Bancroft_Manholes-113	324.25	Bancroft_Manholes-110	317.306	18.517	FALSE
Bancroft_Sewer_Main-212	250	Bancroft_Manholes-121	347.5	Bancroft_Manholes-124	347.5	65.988	FALSE
Bancroft_Sewer_Main-213	250	Bancroft_Manholes-121	347.5	Bancroft_Manholes-122	347.5	74.796	FALSE
Bancroft_Sewer_Main-214	250	Bancroft_Manholes-118	347.5	Bancroft_Manholes-119	347.5	52.042	FALSE
Bancroft_Sewer_Main-215	250	Bancroft_Manholes-122	347.5	Bancroft_Manholes-118	347.5	37.496	FALSE
Bancroft_Sewer_Main-216	250	Bancroft_Manholes-120	347.15	Bancroft_Manholes-115	345.04	54.402	FALSE
Bancroft_Sewer_Main-217	250	Bancroft_Manholes-115	345.04	Bancroft_Manholes-117	344.04	59.709	FALSE
Bancroft_Sewer_Main-218	250	Bancroft_Manholes-117	344.04	Bancroft_Manholes-116	343.33	21.935	FALSE
Bancroft_Sewer_Main-219	250	Bancroft_Manholes-112	339.38	Bancroft_Manholes-113	324.25	71.973	FALSE

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Bancroft_Sewer_Main-22	200	Bancroft_Manholes-255	328.45	Bancroft_Manholes-50	325.984	48.402	FALSE
Bancroft_Sewer_Main-220	200	Bancroft_Manholes-86	337.36	Bancroft_Manholes-87	331.436	53.477	FALSE
Bancroft_Sewer_Main-224	200	Bancroft_Manholes-23	366.54	Bancroft_Manholes-19	363.8	31.202	FALSE
Bancroft_Sewer_Main-225	200	Bancroft_Manholes-241	343.07	Bancroft_Manholes-242	343.34	74.254	FALSE
Bancroft_Sewer_Main-227	250	Bancroft_Manholes-202	326.94	Bancroft_Manholes-195	325.54	25.384	FALSE
Bancroft_Sewer_Main-228	200	Bancroft_Manholes-194	326.87	Bancroft_Manholes-193	327.39	27.031	FALSE
Bancroft_Sewer_Main-229	200	Bancroft_Manholes-184	341.46	Bancroft_Manholes-186	337.19	39.09	FALSE
Bancroft_Sewer_Main-23	250	Bancroft_Manholes-136	325.38	Bancroft_Manholes-57	323.43	34.418	FALSE
Bancroft_Sewer_Main-230	200	Bancroft_Manholes-178	326.44	Bancroft_Manholes-176	324.13	51.992	FALSE
Bancroft_Sewer_Main-231	200	Bancroft_Manholes-218	337.5	Bancroft_Manholes-219	337.5	104.134	FALSE
Bancroft_Sewer_Main-233	200	Bancroft_Manholes-230	349.96	Bancroft_Manholes-229	342.77	77.667	FALSE
Bancroft_Sewer_Main-234	200	Bancroft_Manholes-231	352.5	Bancroft_Manholes-230	349.96	85.049	FALSE
Bancroft_Sewer_Main-235	200	Bancroft_Manholes-232	356.66	Bancroft_Manholes-231	352.5	77.206	FALSE
Bancroft_Sewer_Main-236	200	Bancroft_Manholes-233	353.52	Bancroft_Manholes-232	356.66	79.607	FALSE
Bancroft_Sewer_Main-237	200	Bancroft_Manholes-236	362.5	Bancroft_Manholes-235	357.5	83.838	FALSE
Bancroft_Sewer_Main-238	0	Bancroft_Manholes-237	362.5	Bancroft_Manholes-21	366.92	61.332	FALSE
Bancroft_Sewer_Main-242	0	Bancroft_Manholes-225	329.41	Bancroft_Manholes-143	331.318	131.361	FALSE
Bancroft_Sewer_Main-243	0	Bancroft_Manholes-237	362.5	Bancroft_Manholes-21	366.92	61.332	FALSE
Bancroft_Sewer_Main-244	0	Bancroft_Manholes-239	353.37	Bancroft_Manholes-238	348.2	85.514	FALSE
Bancroft_Sewer_Main-245	200	Bancroft_Manholes-229	342.77	Bancroft_Manholes-7	342.5	24.914	FALSE
Bancroft_Sewer_Main-246	200	Bancroft_Manholes-256	355.39	Bancroft_Manholes-15	355.14	41.046	FALSE
Bancroft_Sewer_Main-247	200	Bancroft_Manholes-224	339.19	Bancroft_Manholes-159	339.7	7.359	FALSE
Bancroft_Sewer_Main-29	250	Bancroft_Manholes-124	347.5	Bancroft_Manholes-123	347.5	68.031	FALSE
Bancroft_Sewer_Main-30	250	Bancroft_Manholes-119	347.5	Bancroft_Manholes-120	347.15	106.591	FALSE
Bancroft_Sewer_Main-31	250	Bancroft_Manholes-123	347.5	Bancroft_Manholes-115	345.04	106.225	FALSE
Bancroft_Sewer_Main-32	250	Bancroft_Manholes-114	338.38	Bancroft_Manholes-112	339.38	33.076	FALSE
Bancroft_Sewer_Main-36	200	Bancroft_Manholes-79	333.3	Bancroft_Manholes-76	330.24	87.386	FALSE
Bancroft_Sewer_Main-37	200	Bancroft_Manholes-70	322.94	Bancroft_Manholes-73	322.96	72.859	FALSE
Bancroft_Sewer_Main-38	200	Bancroft_Manholes-76	330.24	Bancroft_Manholes-74	325.71	95.582	FALSE
Bancroft_Sewer_Main-39	200	Bancroft_Manholes-81	321.96	Bancroft_Manholes-80	321.2	75.376	FALSE
Bancroft_Sewer_Main-40	200	Bancroft_Manholes-77	332.57	Bancroft_Manholes-76	330.24	59.137	FALSE
Bancroft_Sewer_Main-41	200	Bancroft_Manholes-108	333.49	Bancroft_Manholes-109	333.31	107.262	FALSE
Bancroft_Sewer_Main-45	200	Bancroft_Manholes-102	342.99	Bancroft_Manholes-103	342.59	90.36	FALSE
Bancroft_Sewer_Main-46	200	Bancroft_Manholes-91	339.11	Bancroft_Manholes-88	329.1	120.48	FALSE
Bancroft_Sewer_Main-47	200	Bancroft_Manholes-92	347.77	Bancroft_Manholes-93	348.5	29.375	FALSE
Bancroft_Sewer_Main-48	200	Bancroft_Manholes-100	377.5	Bancroft_Manholes-99	377.5	49.416	FALSE

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Bancroft_Sewer_Main-55	200	Bancroft_Manholes-191	323.77	Bancroft_Manholes-187	323.47	90.4	FALSE
Bancroft_Sewer_Main-56	200	Bancroft_Manholes-188	323.33	Bancroft_Manholes-187	323.47	94.585	FALSE
Bancroft_Sewer_Main-57	200	Bancroft_Manholes-187	323.47	Bancroft_Manholes-189	325.36	83.53	FALSE
Bancroft_Sewer_Main-58	200	Bancroft_Manholes-177	327.3	Bancroft_Manholes-178	326.44	60.68	FALSE
Bancroft_Sewer_Main-59	200	Bancroft_Manholes-192	327.57	Bancroft_Manholes-194	326.87	66.794	FALSE
Bancroft_Sewer_Main-6	200	Bancroft_Manholes-15	355.14	Bancroft_Manholes-14	355.54	56.381	FALSE
Bancroft_Sewer_Main-60	200	Bancroft_Manholes-199	343.73	Bancroft_Manholes-200	340.16	92.769	FALSE
Bancroft_Sewer_Main-62	200	Bancroft_Manholes-182	332.5	Bancroft_Manholes-181	331.41	96.284	FALSE
Bancroft_Sewer_Main-63	200	Bancroft_Manholes-179	330.08	Bancroft_Manholes-177	327.3	28.742	FALSE
Bancroft_Sewer_Main-64	200	Bancroft_Manholes-183	345.55	Bancroft_Manholes-185	345.08	58.286	FALSE
Bancroft_Sewer_Main-67	250	Bancroft_Manholes-216	325.43	MH-9	323.64	32.27	FALSE
Bancroft_Sewer_Main-68	250	Bancroft_Manholes-215	323.5	Bancroft_Manholes-212	324.34	117.962	FALSE
Bancroft_Sewer_Main-69	250	Bancroft_Manholes-214	325.68	Bancroft_Manholes-212	324.34	19.087	FALSE
Bancroft_Sewer_Main-7	200	Bancroft_Manholes-17	349.54	MH-6	348	22.966	FALSE
Bancroft_Sewer_Main-70	250	Bancroft_Manholes-212	324.34	Bancroft_Manholes-213	323.88	92.895	FALSE
Bancroft_Sewer_Main-75	200	Bancroft_Manholes-138	324.783	Bancroft_Manholes-140	326.64	63.206	FALSE
Bancroft_Sewer_Main-78	200	Bancroft_Manholes-143	331.318	Bancroft_Manholes-260	329.693	39.973	FALSE
Bancroft_Sewer_Main-79	200	Bancroft_Manholes-144	327.937	Bancroft_Manholes-260	327.62	83.736	FALSE
Bancroft_Sewer_Main-8	200	Bancroft_Manholes-16	357.48	Bancroft_Manholes-14	355.54	40.995	FALSE
Bancroft_Sewer_Main-80	200	Bancroft_Manholes-146	330.464	Bancroft_Manholes-144	328.669	107.774	FALSE
Bancroft_Sewer_Main-81	200	Bancroft_Manholes-148	337.28	Bancroft_Manholes-147	335.51	20.703	FALSE
Bancroft_Sewer_Main-82	200	Bancroft_Manholes-147	335.51	Bancroft_Manholes-149	332.5	52.505	FALSE
Bancroft_Sewer_Main-83	200	Bancroft_Manholes-145	328.736	Bancroft_Manholes-144	328.029	43.561	FALSE
Bancroft_Sewer_Main-84	200	Bancroft_Manholes-151	341.34	Bancroft_Manholes-150	337.91	93.526	FALSE
Bancroft_Sewer_Main-85	200	Bancroft_Manholes-152	339.95	Bancroft_Manholes-153	341.53	76.278	FALSE
Bancroft_Sewer_Main-86	200	Bancroft_Manholes-154	345.29	Bancroft_Manholes-155	341.4	91.895	FALSE
Bancroft_Sewer_Main-87	200	Bancroft_Manholes-158	343.15	Bancroft_Manholes-160	341.86	59.799	FALSE
Bancroft_Sewer_Main-89	200	Bancroft_Manholes-234	353.1	Bancroft_Manholes-233	353.52	80.847	FALSE
Bancroft_Sewer_Main-9	200	Bancroft_Manholes-21	366.92	Bancroft_Manholes-19	363.8	68.398	FALSE
Bancroft_Sewer_Main-92	200	Bancroft_Manholes-94	349.79	Bancroft_Manholes-92	347.77	54.472	FALSE
Bancroft_Sewer_Main-93	200	Bancroft_Manholes-97	376.78	Bancroft_Manholes-98	367.02	37.618	FALSE
Bancroft_Sewer_Main-94	200	Bancroft_Manholes-96	364.6	Bancroft_Manholes-95	355.5	122.461	FALSE
Bancroft_Sewer_Main-95	200	Bancroft_Manholes-74	325.71	Bancroft_Manholes-75	323.75	14.067	FALSE
Bancroft_Sewer_Main-96	200	Bancroft_Manholes-139	327.215	Bancroft_Manholes-138	326.916	63.44	FALSE
Bancroft_Sewer_Main-97	200	Bancroft_Manholes-235	357.5	Bancroft_Manholes-234	353.1	85.003	FALSE
Bancroft_Sewer_Main-98	200	Bancroft_Manholes-242	343.34	Bancroft_Manholes-114	338.38	126.778	FALSE

Label	Diameter (mm)	Start Node	Elevation (Start Invert) (m)	Stop Node	Elevation (Stop Invert) (m)	Length (Scaled) (m)	Is Active?
Bancroft_Sewer_Main-99	200	MH-11	333.22	Bancroft_Manholes-138	324.612	96.589	FALSE
CO-10	200	Bancroft_Manholes-149	332.5	Bancroft_Manholes-145	328.172	15.027	FALSE
CO-2	200	Bancroft_Manholes-82	319.63	WW-3	316.4	21.565	FALSE
CO-6	200	Bancroft_Manholes-206	323.83	WW-5	323.8	11.26	FALSE
CO-6	200	Bancroft_Manholes-56	334.22	Bancroft_Manholes-54	330.66	67.07	FALSE
CO-7	200	Bancroft_Manholes-54	330.66	Bancroft_Manholes-254	329.12	18.814	FALSE
CO-88	200	Bancroft_Manholes-254	329.12	Bancroft_Manholes-255	328.45	12.729	FALSE
CO-9	200	Bancroft_Manholes-260	327.62	Bancroft_Manholes-139	327.367	71.792	FALSE
PP-33	100	Highway 62 South Sewage Pumping Station	315.4	Bancroft_Manholes-68	317.87	96.451	FALSE

Appendix C

Wastewater Flow Loading List

Infiltration			DWF Base Flow				WWF			Downtown Base Flow		Downtown Design Factor (4.12)		
			Is Active?	Label	Base Flow (m^3/day)		Label	Base Flow (m^3/day)						
			FALSE	Bancroft_Manholes-1	0		Bancroft_Manholes-1	0		MH 171	6.415	26.4298		
MH207	26.8		FALSE	Bancroft_Manholes-100	1.788		Bancroft_Manholes-100	1.788		MH 169	3.36	13.8432		
MH195	18.2		FALSE	Bancroft_Manholes-101	1.788		Bancroft_Manholes-101	1.788		MH 168	0.25	1.03		
MH176	46.9		FALSE	Bancroft_Manholes-102	3.129		Bancroft_Manholes-102	3.129		MH 167	5.73	23.6076		
MH137	41.9		FALSE	Bancroft_Manholes-103	1.341		Bancroft_Manholes-103	1.341		MH 170	20.12	82.8944		
MH60	9.6		FALSE	Bancroft_Manholes-104	1.341		Bancroft_Manholes-104	1.341		MH 36	0.89	3.6668		
MH63	1.3		FALSE	Bancroft_Manholes-105	1.341		Bancroft_Manholes-105	1.341		MH-1	0.45	1.854		
MH110	34.8		FALSE	Bancroft_Manholes-106	2.235		Bancroft_Manholes-106	2.235		MH 172	1.62	6.6744		
MH65	0		FALSE	Bancroft_Manholes-108	1.341		Bancroft_Manholes-108	1.341		MH 52	20.52	84.5424		
MH68	142.8		FALSE	Bancroft_Manholes-109	1.341		Bancroft_Manholes-109	1.341			**Total**	**Total**		
MH55	7.8		FALSE	Bancroft_Manholes-112	0		Bancroft_Manholes-112	0			59.355	244.5426		
MH141	22.6		FALSE	Bancroft_Manholes-113	0.306		Bancroft_Manholes-113	0.306						
MH188	28.9		FALSE	Bancroft_Manholes-114	0		Bancroft_Manholes-114	0						
MH107	12.4		FALSE	Bancroft_Manholes-115	0.306		Bancroft_Manholes-115	0.306						
MH87	9.3		FALSE	Bancroft_Manholes-116	0		Bancroft_Manholes-116	0						
MH3	59.1		FALSE	Bancroft_Manholes-117	0.612		Bancroft_Manholes-117	0.612						
MH13	42.6		FALSE	Bancroft_Manholes-118	1.531		Bancroft_Manholes-118	1.531						
MH228	26.7		FALSE	Bancroft_Manholes-119	1.837		Bancroft_Manholes-119	1.837						
MH46	6.8		FALSE	Bancroft_Manholes-120	2.449		Bancroft_Manholes-120	2.449						
			FALSE	Bancroft_Manholes-121	1.837		Bancroft_Manholes-121	1.837						
Total	538.5		FALSE	Bancroft_Manholes-122	1.531		Bancroft_Manholes-122	1.531						
			FALSE	Bancroft_Manholes-123	7.56		Bancroft_Manholes-123	7.56						
			FALSE	Bancroft_Manholes-124	1.837		Bancroft_Manholes-124	1.837						
			FALSE	Bancroft_Manholes-136	3.158		Bancroft_Manholes-136	3.158						
			FALSE	Bancroft_Manholes-138	2.105		Bancroft_Manholes-138	2.105						
			FALSE	Bancroft_Manholes-139	3.175		Bancroft_Manholes-139	3.175						
			FALSE	Bancroft_Manholes-14	0.306		Bancroft_Manholes-14	0.306						
			FALSE	Bancroft_Manholes-140	10.526		Bancroft_Manholes-140	10.526						
			FALSE	Bancroft_Manholes-143	0.918		Bancroft_Manholes-143	0.918						
			FALSE	Bancroft_Manholes-144	0.612		Bancroft_Manholes-144	0.612						
			FALSE	Bancroft_Manholes-145	0.306		Bancroft_Manholes-145	0.306						
			FALSE	Bancroft_Manholes-146	2.521		Bancroft_Manholes-146	2.521						
			FALSE	Bancroft_Manholes-147	0		Bancroft_Manholes-147	0						
			FALSE	Bancroft_Manholes-148	0.447		Bancroft_Manholes-148	0.447						
			FALSE	Bancroft_Manholes-149	0.306		Bancroft_Manholes-149	0.306						
			FALSE	Bancroft_Manholes-15	0.612		Bancroft_Manholes-15	0.612						
			FALSE	Bancroft_Manholes-150	0.894		Bancroft_Manholes-150	0.894						
			FALSE	Bancroft_Manholes-151	1.341		Bancroft_Manholes-151	1.341						
			FALSE	Bancroft_Manholes-152	2.235		Bancroft_Manholes-152	2.235						
			FALSE	Bancroft_Manholes-153	3.941		Bancroft_Manholes-153	3.941						
			FALSE	Bancroft_Manholes-154	1.341		Bancroft_Manholes-154	1.341						
			FALSE	Bancroft_Manholes-155	2.235		Bancroft_Manholes-155	2.235						
			FALSE	Bancroft_Manholes-156	1.053		Bancroft_Manholes-156	1.053						
			FALSE	Bancroft_Manholes-157	0.447		Bancroft_Manholes-157	0.447						
			FALSE	Bancroft_Manholes-158	0.753		Bancroft_Manholes-158	0.753						
			FALSE	Bancroft_Manholes-159	0.612		Bancroft_Manholes-159	0.612						
			FALSE	Bancroft_Manholes-16	1.225		Bancroft_Manholes-16	1.225						
			FALSE	Bancroft_Manholes-160	2.4		Bancroft_Manholes-160	2.4						
			FALSE	Bancroft_Manholes-161	1.812		Bancroft_Manholes-161	1.812						
			FALSE	Bancroft_Manholes-162	1.953		Bancroft_Manholes-162	1.953						
			FALSE	Bancroft_Manholes-163	2.259		Bancroft_Manholes-163	2.259						
			FALSE	Bancroft_Manholes-164	1.365		Bancroft_Manholes-164	1.365						
			FALSE	Bancroft_Manholes-165	0		Bancroft_Manholes-165	0						
			FALSE	Bancroft_Manholes-17	2.411		Bancroft_Manholes-17	2.411						
			FALSE	Bancroft_Manholes-177	1.053		Bancroft_Manholes-177	1.053						
			FALSE	Bancroft_Manholes-178	4.21		Bancroft_Manholes-178	4.21						
			FALSE	Bancroft_Manholes-179	1.053		Bancroft_Manholes-179	1.053						

Infiltration			DWF Base Flow				WWF			Downtown Base Flow		Downtown Design Factor (4.12)		
			Is Active?	Label	Base Flow (m^3/day)		Label	Base Flow (m^3/day)						
			FALSE	Bancroft_Manholes-18	1.053		Bancroft_Manholes-18	1.053						
			FALSE	Bancroft_Manholes-180	0.536		Bancroft_Manholes-180	0.536						
			FALSE	Bancroft_Manholes-181	2.105		Bancroft_Manholes-181	2.105						
			FALSE	Bancroft_Manholes-182	0		Bancroft_Manholes-182	0						
			FALSE	Bancroft_Manholes-183	1.053		Bancroft_Manholes-183	1.053						
			FALSE	Bancroft_Manholes-184	3.178		Bancroft_Manholes-184	3.178						
			FALSE	Bancroft_Manholes-185	2.125		Bancroft_Manholes-185	2.125						
			FALSE	Bancroft_Manholes-186	2.105		Bancroft_Manholes-186	2.105						
			FALSE	Bancroft_Manholes-187	2.146		Bancroft_Manholes-187	2.146						
			FALSE	Bancroft_Manholes-188	1.61		Bancroft_Manholes-188	1.61						
			FALSE	Bancroft_Manholes-189	5.263		Bancroft_Manholes-189	5.263						
			FALSE	Bancroft_Manholes-19	0.918		Bancroft_Manholes-19	0.918						
			FALSE	Bancroft_Manholes-190	13.889		Bancroft_Manholes-190	13.889						
			FALSE	Bancroft_Manholes-191	12.793		Bancroft_Manholes-191	12.793						
			FALSE	Bancroft_Manholes-192	3.158		Bancroft_Manholes-192	3.158						
			FALSE	Bancroft_Manholes-193	3.158		Bancroft_Manholes-193	3.158						
			FALSE	Bancroft_Manholes-194	4.21		Bancroft_Manholes-194	4.21						
			FALSE	Bancroft_Manholes-198	4.21		Bancroft_Manholes-198	4.21						
			FALSE	Bancroft_Manholes-199	0.894		Bancroft_Manholes-199	0.894						
			FALSE	Bancroft_Manholes-2	0		Bancroft_Manholes-2	0						
			FALSE	Bancroft_Manholes-20	0.612		Bancroft_Manholes-20	0.612						
			FALSE	Bancroft_Manholes-200	1.788		Bancroft_Manholes-200	1.788						
			FALSE	Bancroft_Manholes-201	3.605		Bancroft_Manholes-201	3.605						
			FALSE	Bancroft_Manholes-202	1.053		Bancroft_Manholes-202	1.053						
			FALSE	Bancroft_Manholes-206	1.053		Bancroft_Manholes-206	1.053						
			FALSE	Bancroft_Manholes-208	1.5		Bancroft_Manholes-208	1.5						
			FALSE	Bancroft_Manholes-209	3.158		Bancroft_Manholes-209	3.158						
			FALSE	Bancroft_Manholes-21	1.531		Bancroft_Manholes-21	1.531						
			FALSE	Bancroft_Manholes-210	4.21		Bancroft_Manholes-210	4.21						
			FALSE	Bancroft_Manholes-211	2.105		Bancroft_Manholes-211	2.105						
			FALSE	Bancroft_Manholes-212	1.053		Bancroft_Manholes-212	1.053						
			FALSE	Bancroft_Manholes-213	1.5		Bancroft_Manholes-213	1.5						
			FALSE	Bancroft_Manholes-214	0.447		Bancroft_Manholes-214	0.447						
			FALSE	Bancroft_Manholes-215	1.053		Bancroft_Manholes-215	1.053						
			FALSE	Bancroft_Manholes-216	0.894		Bancroft_Manholes-216	0.894						
			FALSE	Bancroft_Manholes-217	7.827		Bancroft_Manholes-217	7.827						
			FALSE	Bancroft_Manholes-218	0		Bancroft_Manholes-218	0						
			FALSE	Bancroft_Manholes-219	0		Bancroft_Manholes-219	0						
			FALSE	Bancroft_Manholes-22	1.531		Bancroft_Manholes-22	1.531						
			FALSE	Bancroft_Manholes-220	2.682		Bancroft_Manholes-220	2.682						
			FALSE	Bancroft_Manholes-221	0		Bancroft_Manholes-221	0						
			FALSE	Bancroft_Manholes-222	1.053		Bancroft_Manholes-222	1.053						
			FALSE	Bancroft_Manholes-223	0.447		Bancroft_Manholes-223	0.447						
			FALSE	Bancroft_Manholes-224	0.447		Bancroft_Manholes-224	0.447						
			FALSE	Bancroft_Manholes-225	1.053		Bancroft_Manholes-225	1.053						
			FALSE	Bancroft_Manholes-226	0		Bancroft_Manholes-226	0						
			FALSE	Bancroft_Manholes-227	2.105		Bancroft_Manholes-227	2.105						
			FALSE	Bancroft_Manholes-229	0.612		Bancroft_Manholes-229	0.612						
			FALSE	Bancroft_Manholes-23	0.918		Bancroft_Manholes-23	0.918						
			FALSE	Bancroft_Manholes-230	0.612		Bancroft_Manholes-230	0.612						
			FALSE	Bancroft_Manholes-231	1.359		Bancroft_Manholes-231	1.359						
			FALSE	Bancroft_Manholes-232	0		Bancroft_Manholes-232	0						
			FALSE	Bancroft_Manholes-233	0		Bancroft_Manholes-233	0						
			FALSE	Bancroft_Manholes-234	0		Bancroft_Manholes-234	0						
			FALSE	Bancroft_Manholes-235	0		Bancroft_Manholes-235	0						
			FALSE	Bancroft_Manholes-236	0		Bancroft_Manholes-236	0						
			FALSE	Bancroft_Manholes-237	0		Bancroft_Manholes-237	0						

Infiltration			DWF Base Flow				WWF			Downtown Base Flow		Downtown Design Factor (4.12)		
			Is Active?	Label	Base Flow (m³/day)		Label	Base Flow (m³/day)						
			FALSE	Bancroft_Manholes-238	0		Bancroft_Manholes-238	0						
			FALSE	Bancroft_Manholes-239	1.665		Bancroft_Manholes-239	1.665						
			FALSE	Bancroft_Manholes-24	2.143		Bancroft_Manholes-24	2.143						
			FALSE	Bancroft_Manholes-240	0.536		Bancroft_Manholes-240	0.536						
			FALSE	Bancroft_Manholes-241	0.612		Bancroft_Manholes-241	0.612						
			FALSE	Bancroft_Manholes-242	1.053		Bancroft_Manholes-242	1.053						
			FALSE	Bancroft_Manholes-244	4.21		Bancroft_Manholes-244	4.21						
			FALSE	Bancroft_Manholes-245	2.105		Bancroft_Manholes-245	2.105						
			FALSE	Bancroft_Manholes-246	1.053		Bancroft_Manholes-246	1.053						
			FALSE	Bancroft_Manholes-247	1.053		Bancroft_Manholes-247	1.053						
			FALSE	Bancroft_Manholes-248	0		Bancroft_Manholes-248	0						
			FALSE	Bancroft_Manholes-249	0		Bancroft_Manholes-249	0						
			FALSE	Bancroft_Manholes-25	1.225		Bancroft_Manholes-25	1.225						
			FALSE	Bancroft_Manholes-250	1.053		Bancroft_Manholes-250	1.053						
			FALSE	Bancroft_Manholes-251	2.123		Bancroft_Manholes-251	2.123						
			FALSE	Bancroft_Manholes-254	1.053		Bancroft_Manholes-254	1.053						
			FALSE	Bancroft_Manholes-255	1.053		Bancroft_Manholes-255	1.053						
			FALSE	Bancroft_Manholes-256	5.645		Bancroft_Manholes-256	5.645						
			FALSE	Bancroft_Manholes-257	2.752		Bancroft_Manholes-257	2.752						
			FALSE	Bancroft_Manholes-258	1.589		Bancroft_Manholes-258	1.589						
			FALSE	Bancroft_Manholes-259	3.158		Bancroft_Manholes-259	3.158						
			FALSE	Bancroft_Manholes-26	2.449		Bancroft_Manholes-26	2.449						
			FALSE	Bancroft_Manholes-260	2.907		Bancroft_Manholes-260	2.907						
			FALSE	Bancroft_Manholes-261	0.447		Bancroft_Manholes-261	0.447						
			FALSE	Bancroft_Manholes-27	1.225		Bancroft_Manholes-27	1.225						
			FALSE	Bancroft_Manholes-28	2.143		Bancroft_Manholes-28	2.143						
			FALSE	Bancroft_Manholes-29	1.225		Bancroft_Manholes-29	1.225						
			FALSE	Bancroft_Manholes-4	0		Bancroft_Manholes-4	0						
			FALSE	Bancroft_Manholes-48	6.709		Bancroft_Manholes-48	6.709						
			FALSE	Bancroft_Manholes-49	11.771		Bancroft_Manholes-49	11.771						
			FALSE	Bancroft_Manholes-5	0		Bancroft_Manholes-5	0						
			FALSE	Bancroft_Manholes-54	1.053		Bancroft_Manholes-54	1.053						
			FALSE	Bancroft_Manholes-56	0.306		Bancroft_Manholes-56	0.306						
			FALSE	Bancroft_Manholes-58	1.682		Bancroft_Manholes-58	1.682						
			FALSE	Bancroft_Manholes-69	0.306		Bancroft_Manholes-69	0.306						
			FALSE	Bancroft_Manholes-70	0		Bancroft_Manholes-70	0						
			FALSE	Bancroft_Manholes-71	0		Bancroft_Manholes-71	0						
			FALSE	Bancroft_Manholes-72	0		Bancroft_Manholes-72	0						
			FALSE	Bancroft_Manholes-73	0		Bancroft_Manholes-73	0						
			FALSE	Bancroft_Manholes-74	0		Bancroft_Manholes-74	0						
			FALSE	Bancroft_Manholes-75	0		Bancroft_Manholes-75	0						
			FALSE	Bancroft_Manholes-76	0.306		Bancroft_Manholes-76	0.306						
			FALSE	Bancroft_Manholes-77	0.918		Bancroft_Manholes-77	0.918						
			FALSE	Bancroft_Manholes-78	0		Bancroft_Manholes-78	0						
			FALSE	Bancroft_Manholes-79	0		Bancroft_Manholes-79	0						
			FALSE	Bancroft_Manholes-8	0		Bancroft_Manholes-8	0						
			FALSE	Bancroft_Manholes-80	0		Bancroft_Manholes-80	0						
			FALSE	Bancroft_Manholes-81	0		Bancroft_Manholes-81	0						
			FALSE	Bancroft_Manholes-82	0		Bancroft_Manholes-82	0						
			FALSE	Bancroft_Manholes-86	8.34		Bancroft_Manholes-86	8.34						
			FALSE	Bancroft_Manholes-91	0.894		Bancroft_Manholes-91	0.894						
			FALSE	Bancroft_Manholes-92	0.447		Bancroft_Manholes-92	0.447						
			FALSE	Bancroft_Manholes-93	0.894		Bancroft_Manholes-93	0.894						
			FALSE	Bancroft_Manholes-94	1.341		Bancroft_Manholes-94	1.341						
			FALSE	Bancroft_Manholes-95	0.447		Bancroft_Manholes-95	0.447						
			FALSE	Bancroft_Manholes-96	0		Bancroft_Manholes-96	0						
			FALSE	Bancroft_Manholes-97	0.894		Bancroft_Manholes-97	0.894						

Infiltration			DWF Base Flow				WWF			Downtown Base Flow		Downtown Design Factor (4.12)		
			Is Active?	Label	Base Flow (m^3/day)		Label	Base Flow (m^3/day)						
			FALSE	Bancroft_Manholes-98	0.894		Bancroft_Manholes-98	0.894						
			FALSE	Bancroft_Manholes-99	1.341		Bancroft_Manholes-99	1.341						
			FALSE	MH-3	2.105		MH-3	2.105						
			FALSE	MH-4	0		MH-4	0						
			FALSE	MH-5	3.694		MH-5	3.694						
			FALSE	MH-6	0		MH-6	0						
			FALSE	MH-9	0		MH-9	0						
			FALSE	MH-10	0		MH-10	0						
			FALSE	MH-11	5.104		MH-11	5.104						
			TRUE	Bancroft_Manholes-10	0.306		Bancroft_Manholes-10	0.306						
			TRUE	Bancroft_Manholes-107	0.894		Bancroft_Manholes-107	0.894						
			TRUE	Bancroft_Manholes-11	0		Bancroft_Manholes-11	0						
			TRUE	Bancroft_Manholes-110	0.024		Bancroft_Manholes-110	0.024						
			TRUE	Bancroft_Manholes-111	1.225		Bancroft_Manholes-111	1.225						
			TRUE	Bancroft_Manholes-12	0		Bancroft_Manholes-12	0						
			TRUE	Bancroft_Manholes-125	0		Bancroft_Manholes-125	0						
			TRUE	Bancroft_Manholes-126	0		Bancroft_Manholes-126	0						
			TRUE	Bancroft_Manholes-127	0		Bancroft_Manholes-127	0						
			TRUE	Bancroft_Manholes-128	0		Bancroft_Manholes-128	0						
			TRUE	Bancroft_Manholes-129	0		Bancroft_Manholes-129	0						
			TRUE	Bancroft_Manholes-13	3.734		Bancroft_Manholes-13	3.734						
			TRUE	Bancroft_Manholes-130	0.612		Bancroft_Manholes-130	0.612						
			TRUE	Bancroft_Manholes-131	0		Bancroft_Manholes-131	0						
			TRUE	Bancroft_Manholes-132	0.612		Bancroft_Manholes-132	0.612						
			TRUE	Bancroft_Manholes-133	0		Bancroft_Manholes-133	0						
			TRUE	Bancroft_Manholes-134	0		Bancroft_Manholes-134	0						
			TRUE	Bancroft_Manholes-135	0		Bancroft_Manholes-135	0						
			TRUE	Bancroft_Manholes-137	1.137		Bancroft_Manholes-137	1.137						
			TRUE	Bancroft_Manholes-141	4.211		Bancroft_Manholes-141	4.211						
			TRUE	Bancroft_Manholes-166	2.105		Bancroft_Manholes-166	2.105						
			TRUE	Bancroft_Manholes-167	8.421		Bancroft_Manholes-167	8.421						
			TRUE	Bancroft_Manholes-168	10.526		Bancroft_Manholes-168	10.526						
			TRUE	Bancroft_Manholes-169	5.263		Bancroft_Manholes-169	5.263						
			TRUE	Bancroft_Manholes-170	6.316		Bancroft_Manholes-170	6.316						
			TRUE	Bancroft_Manholes-171	5.263		Bancroft_Manholes-171	5.263						
			TRUE	Bancroft_Manholes-172	1.052		Bancroft_Manholes-172	1.052						
			TRUE	Bancroft_Manholes-173	1.052		Bancroft_Manholes-173	1.052						
			TRUE	Bancroft_Manholes-174	2.105		Bancroft_Manholes-174	2.105						
			TRUE	Bancroft_Manholes-175	4.21		Bancroft_Manholes-175	4.21						
			TRUE	Bancroft_Manholes-176	0		Bancroft_Manholes-176	0						
			TRUE	Bancroft_Manholes-195	1.028		Bancroft_Manholes-195	1.028						
			TRUE	Bancroft_Manholes-196	5.263		Bancroft_Manholes-196	5.263						
			TRUE	Bancroft_Manholes-197	9.366		Bancroft_Manholes-197	9.366						
			TRUE	Bancroft_Manholes-203	0		Bancroft_Manholes-203	0						
			TRUE	Bancroft_Manholes-204	4.21		Bancroft_Manholes-204	4.21						
			TRUE	Bancroft_Manholes-205	1.053		Bancroft_Manholes-205	1.053						
			TRUE	Bancroft_Manholes-207	3.157		Bancroft_Manholes-207	3.157						
			TRUE	Bancroft_Manholes-228	0		Bancroft_Manholes-228	0						
			TRUE	Bancroft_Manholes-253	1.053		Bancroft_Manholes-253	1.053						
			TRUE	Bancroft_Manholes-3	0.612		Bancroft_Manholes-3	0.612						
			TRUE	Bancroft_Manholes-30	1.665		Bancroft_Manholes-30	1.665						
			TRUE	Bancroft_Manholes-32	2.401		Bancroft_Manholes-32	2.401						
			TRUE	Bancroft_Manholes-33	3.33		Bancroft_Manholes-33	3.33						
			TRUE	Bancroft_Manholes-34	3.012		Bancroft_Manholes-34	3.012						
			TRUE	Bancroft_Manholes-36	3.637		Bancroft_Manholes-36	3.637						
			TRUE	Bancroft_Manholes-37	1.053		Bancroft_Manholes-37	1.053						
			TRUE	Bancroft_Manholes-38	1.07		Bancroft_Manholes-38	1.07						

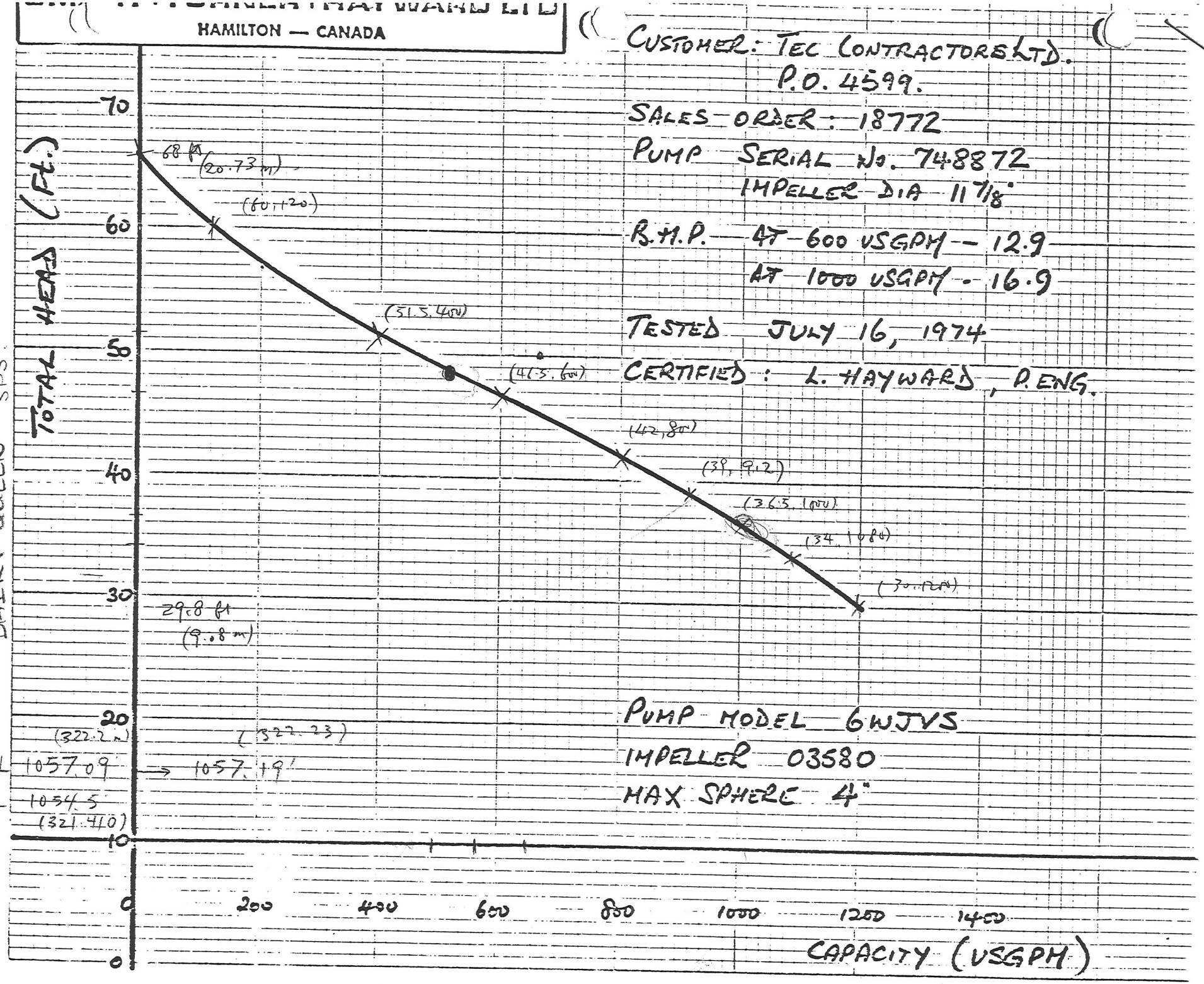
Infiltration			DWF Base Flow				WWF			Downtown Base Flow		Downtown Design Factor (4.12)		
			Is Active?	Label	Base Flow (m^3/day)		Label	Base Flow (m^3/day)						
			TRUE	Bancroft_Manholes-39	0		Bancroft_Manholes-39	0						
			TRUE	Bancroft_Manholes-40	2.446		Bancroft_Manholes-40	2.446						
			TRUE	Bancroft_Manholes-41	1.598		Bancroft_Manholes-41	1.598						
			TRUE	Bancroft_Manholes-42	0.834		Bancroft_Manholes-42	0.834						
			TRUE	Bancroft_Manholes-43	0.306		Bancroft_Manholes-43	0.306						
			TRUE	Bancroft_Manholes-44	2.601		Bancroft_Manholes-44	2.601						
			TRUE	Bancroft_Manholes-45	0.306		Bancroft_Manholes-45	0.306						
			TRUE	Bancroft_Manholes-46	23.826		Bancroft_Manholes-46	23.826						
			TRUE	Bancroft_Manholes-47	1.053		Bancroft_Manholes-47	1.053						
			TRUE	Bancroft_Manholes-50	2.105		Bancroft_Manholes-50	2.105						
			TRUE	Bancroft_Manholes-51	2.105		Bancroft_Manholes-51	2.105						
			TRUE	Bancroft_Manholes-52	2.105		Bancroft_Manholes-52	2.105						
			TRUE	Bancroft_Manholes-53	6.316		Bancroft_Manholes-53	6.316						
			TRUE	Bancroft_Manholes-55	1.265		Bancroft_Manholes-55	1.265						
			TRUE	Bancroft_Manholes-57	4.21		Bancroft_Manholes-57	4.21						
			TRUE	Bancroft_Manholes-59	3.587		Bancroft_Manholes-59	3.587						
			TRUE	Bancroft_Manholes-6	0		Bancroft_Manholes-6	0						
			TRUE	Bancroft_Manholes-60	12.839		Bancroft_Manholes-60	12.839						
			TRUE	Bancroft_Manholes-61	3.061		Bancroft_Manholes-61	3.061						
			TRUE	Bancroft_Manholes-62	0.612		Bancroft_Manholes-62	0.612						
			TRUE	Bancroft_Manholes-63	1.359		Bancroft_Manholes-63	1.359						
			TRUE	Bancroft_Manholes-64	0.918		Bancroft_Manholes-64	0.918						
			TRUE	Bancroft_Manholes-65	0.776		Bancroft_Manholes-65	0.776						
			TRUE	Bancroft_Manholes-66	1.531		Bancroft_Manholes-66	1.531						
			TRUE	Bancroft_Manholes-67	0.612		Bancroft_Manholes-67	0.612						
			TRUE	Bancroft_Manholes-68	0.612		Bancroft_Manholes-68	0.612						
			TRUE	Bancroft_Manholes-7	1.053		Bancroft_Manholes-7	1.053						
			TRUE	Bancroft_Manholes-83	2.642		Bancroft_Manholes-83	2.642						
			TRUE	Bancroft_Manholes-84	3.556		Bancroft_Manholes-84	3.556						
			TRUE	Bancroft_Manholes-85	5.445		Bancroft_Manholes-85	5.445						
			TRUE	Bancroft_Manholes-87	1.788		Bancroft_Manholes-87	1.788						
			TRUE	Bancroft_Manholes-88	0.937		Bancroft_Manholes-88	0.937						
			TRUE	Bancroft_Manholes-89	1.474		Bancroft_Manholes-89	1.474						
			TRUE	Bancroft_Manholes-9	0.306		Bancroft_Manholes-9	0.306						
			TRUE	Bancroft_Manholes-90	2.503		Bancroft_Manholes-90	2.503						
			TRUE	MH-1	8.395		MH-1	8.395						
			TRUE	MH-2	1.517		MH-2	1.517						
			TRUE	MH-7	1.672		MH-7	1.672						
			TRUE	MH-111	2.295		MH-111	2.295						
			TRUE	MH-20	0		MH-20	0						
			TRUE	MH-19	0		MH-19	0						
			TRUE	MH-18	0		MH-18	0						
			TRUE	MH-17	0		MH-17	0						
			TRUE	MH-16	0		MH-16	0						
			TRUE	MH-15	0		MH-15	0						
			TRUE	MH-14	0		MH-14	0						
			TRUE	MH-13	0		MH-13	0						
			TRUE	MH-12	0		MH-12	0						
			TRUE	MH-011	0		MH-011	0						
			TRUE	MH-010	0		MH-010	0						
			TRUE	MH-09	0		MH-09	0						
			TRUE	MH-08	0		MH-08	0						
			TRUE	Faraday	0		Faraday	129						
					Total Base Flow		MH207	26.8						
					511.115		MH195	18.2						
							MH176	46.9						
							MH137	41.9						

Infiltration			DWF Base Flow				WWF			Downtown Base Flow		Downtown Design Factor (4.12)		
			Is Active?	Label		Base Flow (m^3/day)	Label	Base Flow (m^3/day)						
							MH60	9.6						
							MH63	1.3						
							MH110	34.8						
							MH65	0						
							MH68	142.8						
							MH55	7.8						
							MH141	22.6						
							MH188	28.9						
							MH107	12.4						
							MH87	9.3						
							MH3	59.1						
							MH13	42.6						
							MH228	26.7						
							MH46	6.8						
								Total Flow						
								1178.615						

Appendix D

Pump Curve (Hastings Street Dairy Queen SPS and Forest Hill SPS)

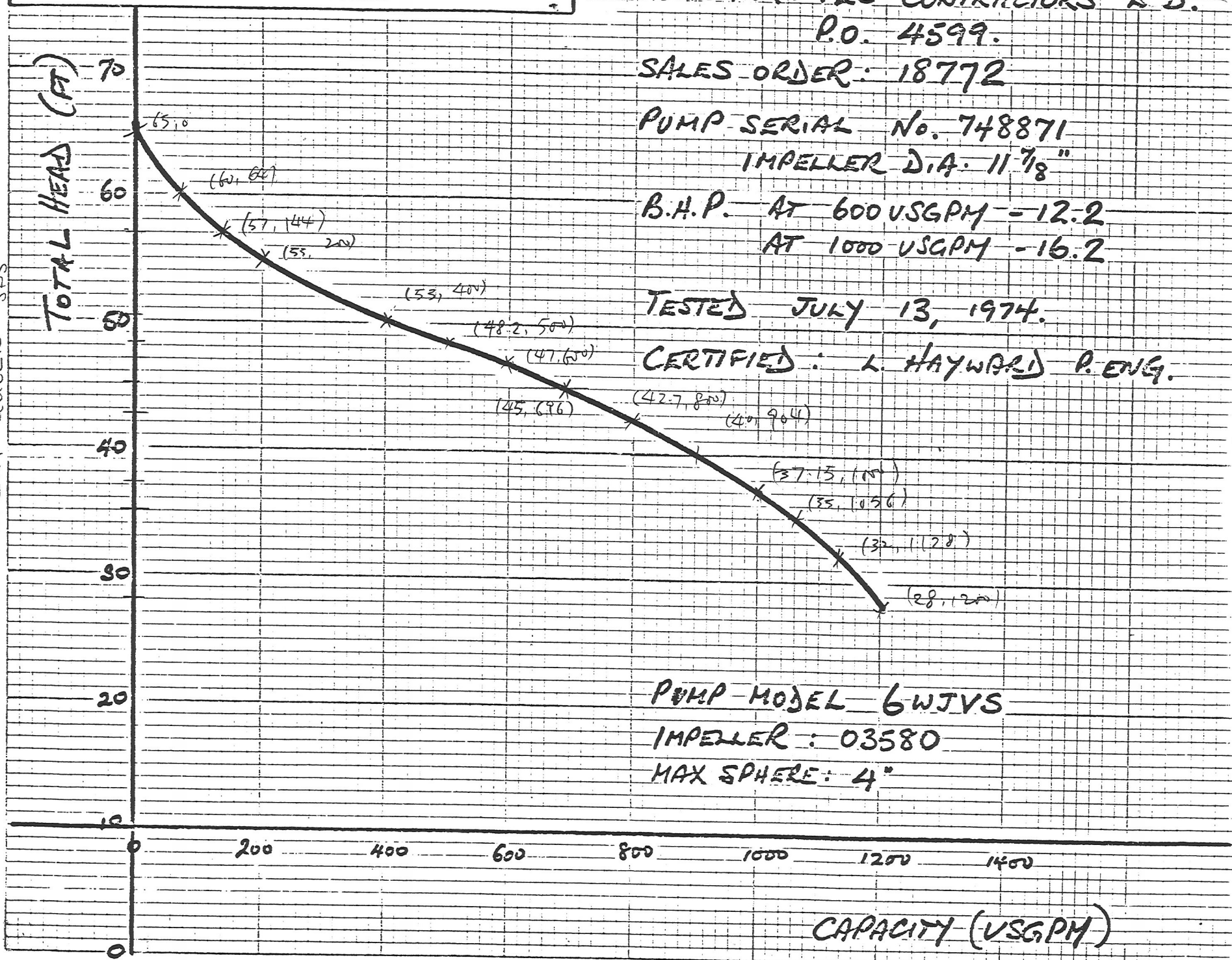
HAMILTON — CANADA



HAMILTON — CANADA

CUSTOMER: TEC CONTRACTORS LTD.
P.O. 4599.
SALES ORDER: 18772
PUMP SERIAL No. 748871
IMPELLER DIA: 11 7/8"
B.H.P. AT 600 USGPM - 12.2
AT 1000 USGPM - 16.2
TESTED JULY 13, 1974.
CERTIFIED: L. HAYWARD P. ENG.

PUMP MODEL 6WJVS
IMPELLER: 03580
MAX SPHERE: 4"



DAIRY QUEEN SPS

SMART TURNER HAYWARD

PERFORMANCE CURVE

PRODUCT	TYPE
NP3127.181	MT

DATE	PROJECT	CURVE NO	ISSUE
2010-01-27		63-438-00-3704	5

	1/1-LOAD	3/4-LOAD	1/2-LOAD
MOTOR COS PHI	0.88	0.86	0.79
MOTOR EFFICIENCY	84.0 %	85.0 %	84.5 %
GEAR EFFICIENCY	---	---	---

MOTOR SHAFT POWER	10	hp
STARTING CURRENT ...	55	A
RATED CURRENT ...	9.7	A
RATED SPEED	1735	rpm
TOT.MOM.OF INERTIA ...	0.048	kgm2
NO. OF BLADES	2	

IMPELLER DIAMETER: 202 mm

MOTORTYPE	STATOR	REV
21-12-4AL	52D	11

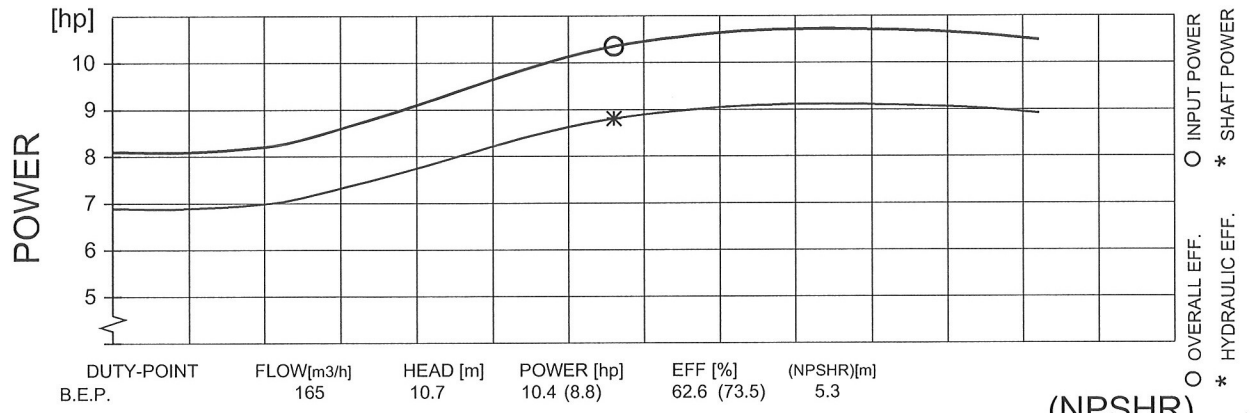
FREQ.	PHASES	VOLTAGE	POLES
60 Hz	3	600 V	4

GEARTYPE	RATIO
---	---

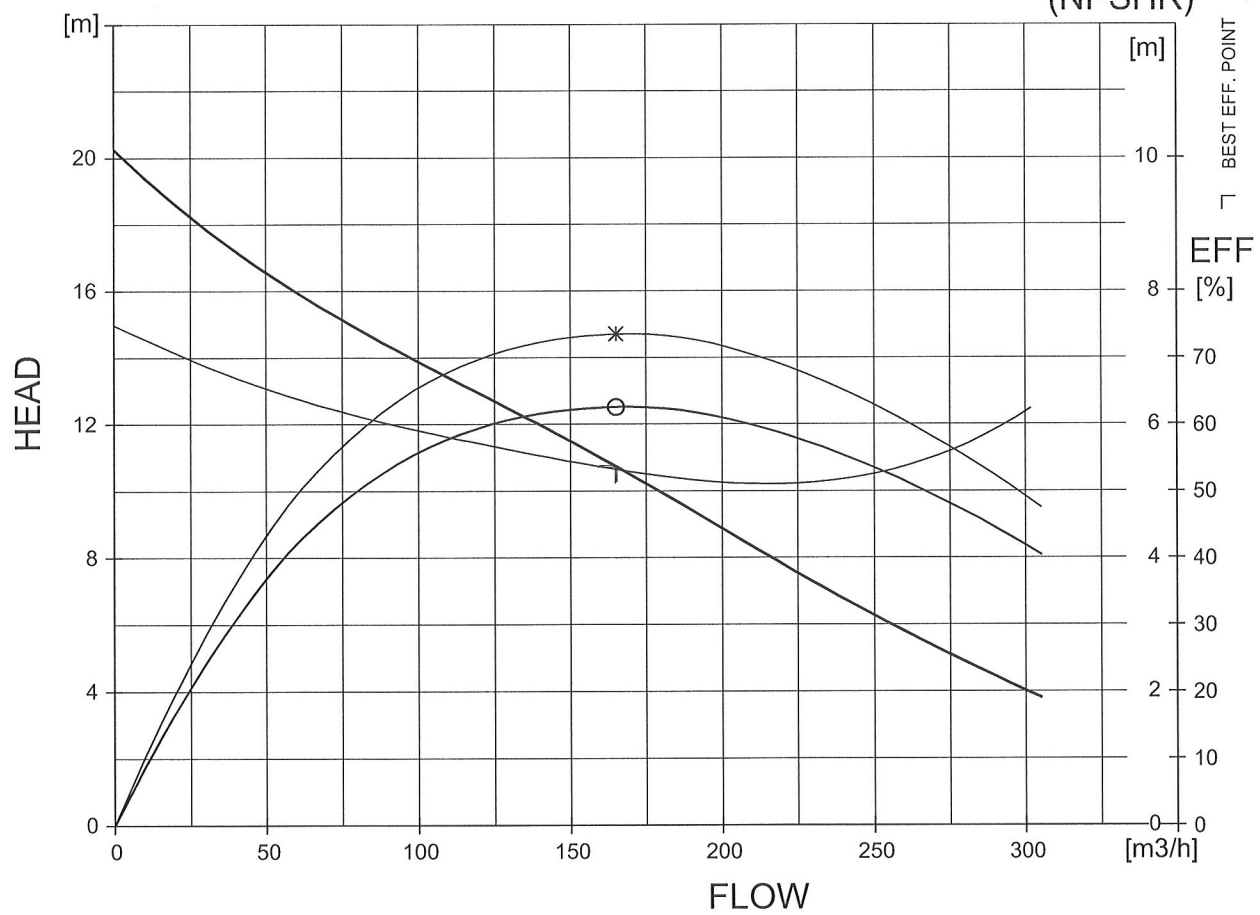
COMMENTS

INLET/OUTLET: -/100 mm

IMP. THROUGHLET: ---



DUTY-POINT	FLOW[m3/h]	HEAD [m]	POWER [hp]	EFF [%]	(NPSHR)[m]
B.E.P.	165	10.7	10.4 (8.8)	62.6 (73.5)	5.3



(NPSHR) = (NPSH3) + margins

Performance with clear water and rating data at 40 °C

FLYGT CURVE

FLYPS3.1.6.5 (20090313)

Pump Curve For Bancroft Sewer System

PS Dairy Qeen SPS #748872

Head	68	60	51.5	46.5	42	39	36.5	34.1	30	Ft	USGPM
Capacity	0	120	400	600	800	912	1000	1080	1200	USGPM	1
											L/min
											3.7854
Head	20.73	18.29	15.70	**14.17**	12.80	11.89	11.13	10.39	9.14	m	
Capacity	0	454	1514	2271	3028	3452	3785	4088	4542	L/min	
	0.0	7.6	25.2	**37.9**	50.5	57.5	63.1	68.1	75.7	L/s	

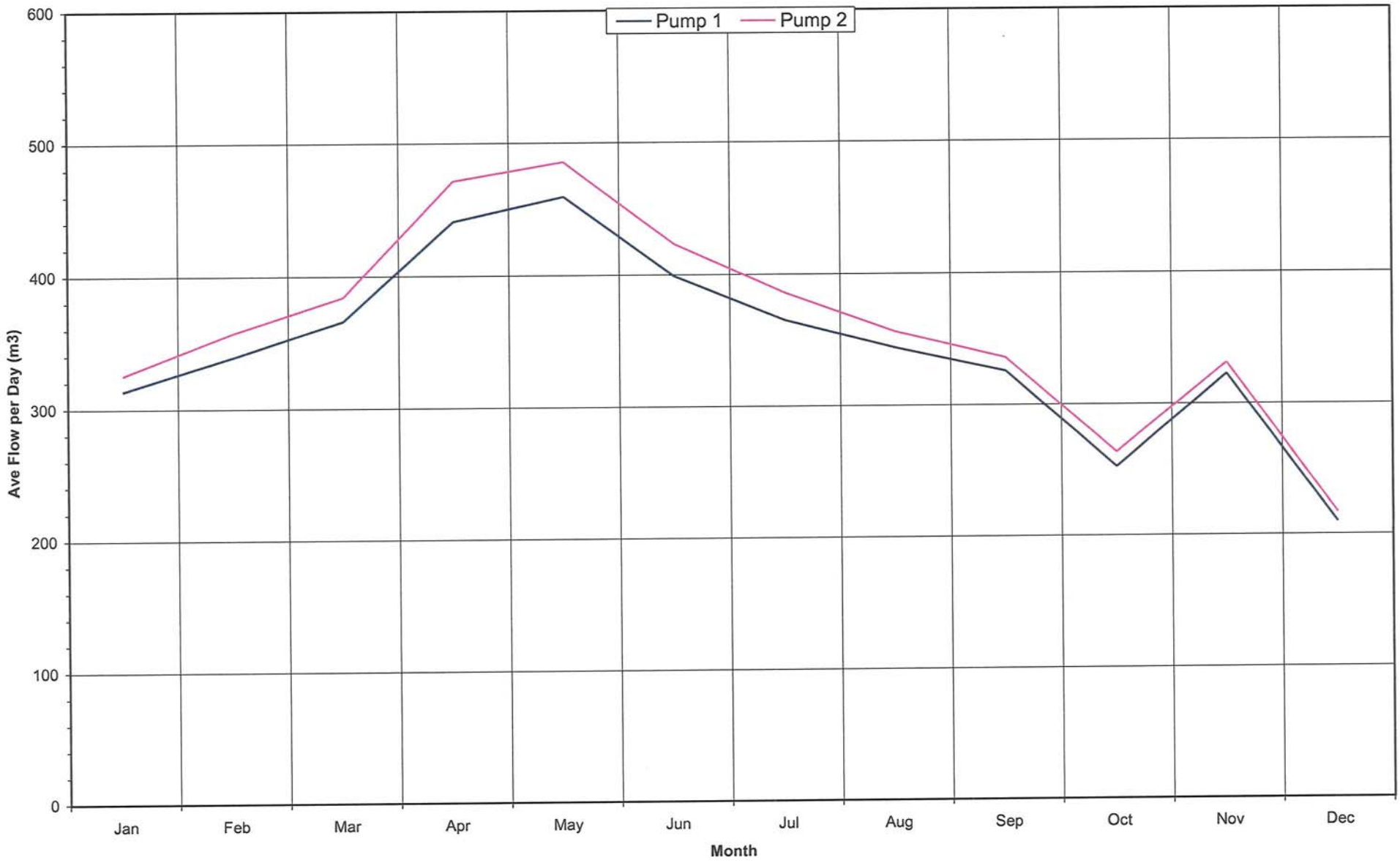
PS Dairy Qeen SPS #748871

Head	65	60	57	55	53	48.2	47	45	42.7	40	37.15	35	32	28 Ft
Capacity	0	64	144	200	400	500	600	696	800	904	1000	1056	1128	1200 USGPM
Head	19.81	18.29	17.37	16.76	16.15	14.69	**14.33**	13.72	13.01	12.19	11.32	10.67	9.75	8.53 m
Capacity	0	242	545	757	1514	1893	2271	2635	3028	3422	3785	3997	4270	4542 L/min
	0.0	4.0	9.1	12.6	25.2	31.5	**37.9**	43.9	50.5	57.0	63.1	66.6	71.2	75.7 L/s

PS Forest Hill SPS NP3127.181

Head	20.33	18.22	16.56	16.00	15.33	14.00	13.56	12.67	12.00	11.44	6.33	5.11	4.00	
Capacity	0	25	50	60	75	96	108	125	141	150	250	275	300	m^3/hr
	0.0	6.9	13.9	16.7	20.8	26.7	29.9	34.7	39.2	41.7	69.4	76.4	83.3	L/s

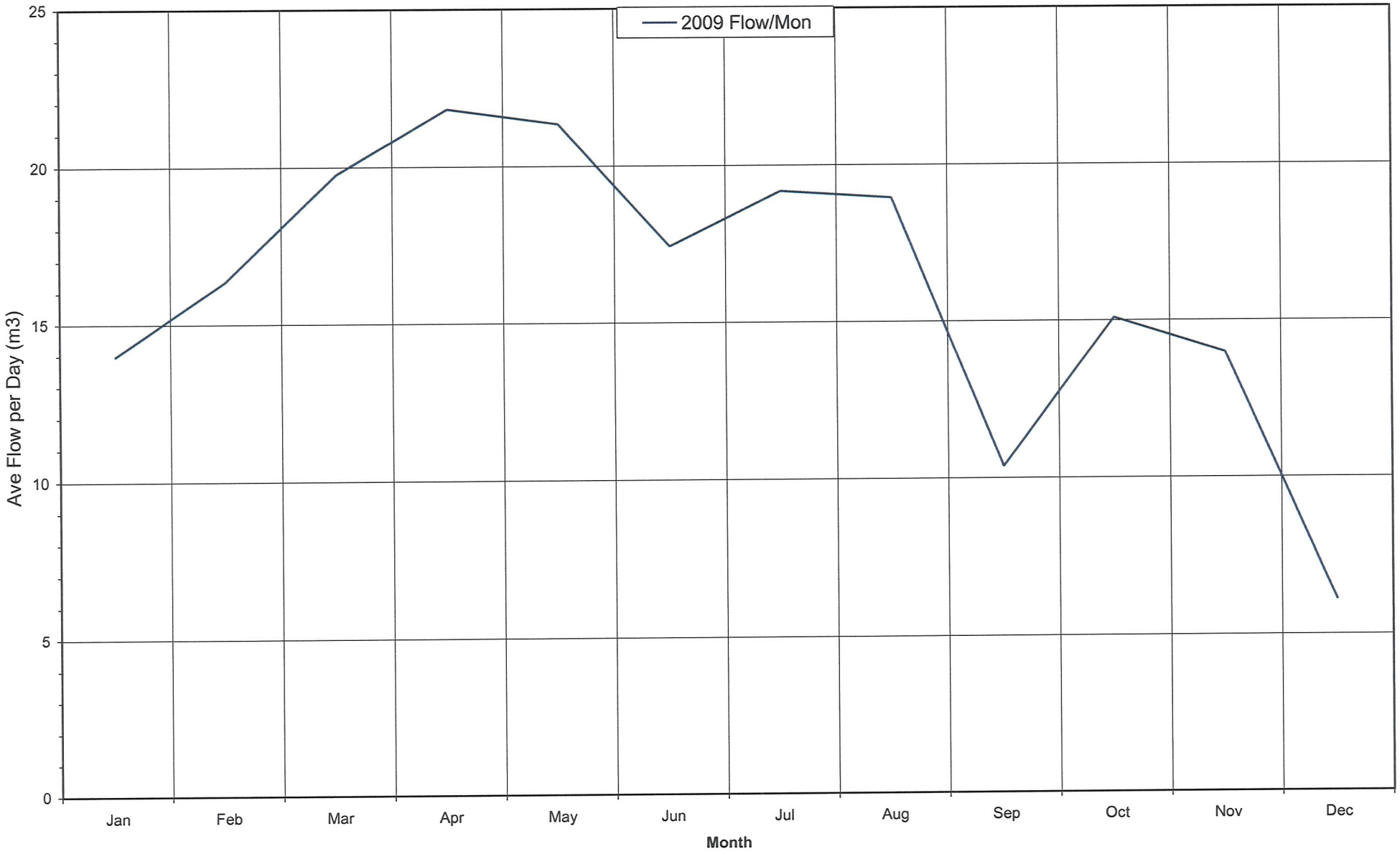
Figure D - 1: Dairy Queen SPS Q/Mon



Bancroft

GENIVAR

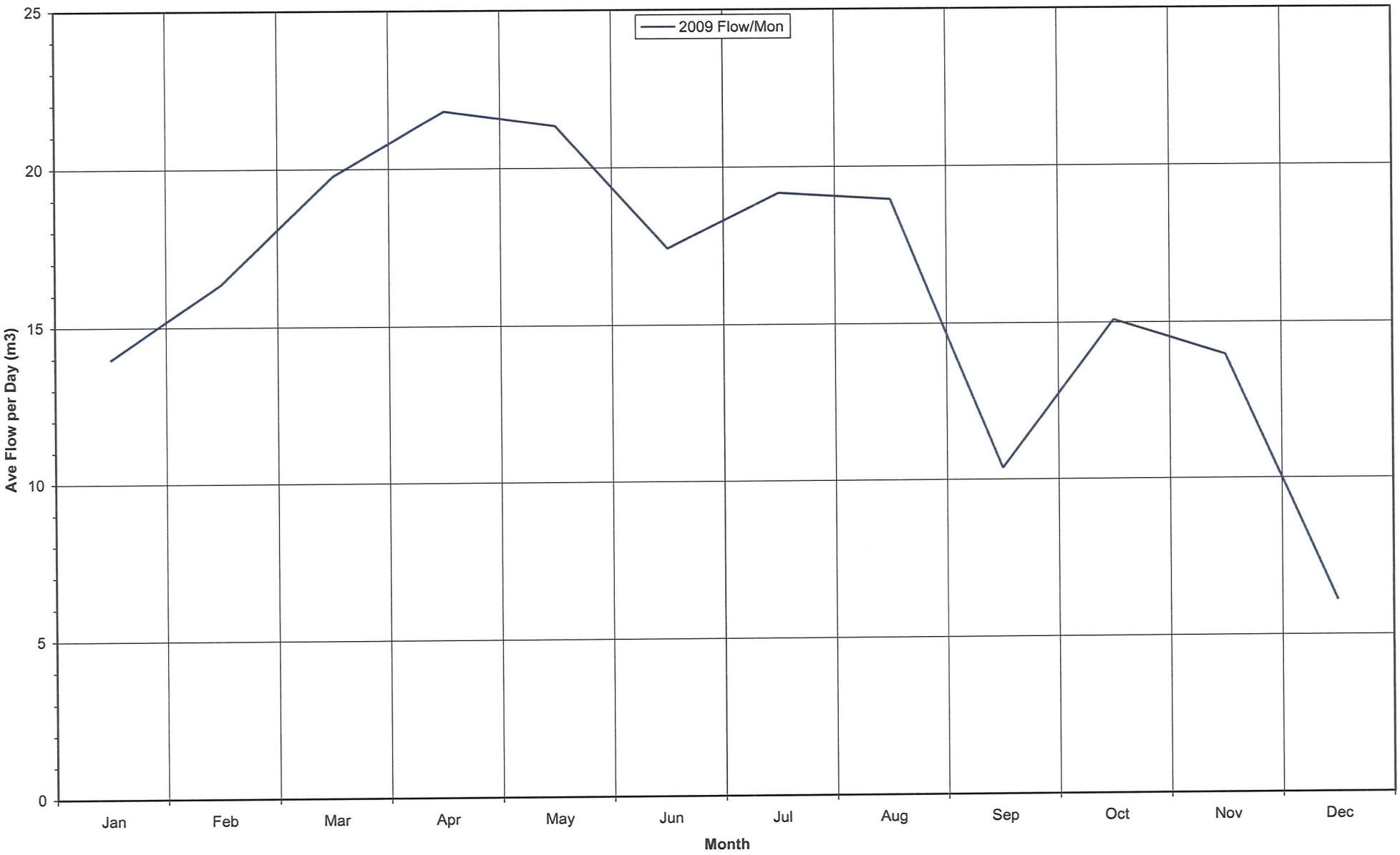
Figure D - 2: Hasting St N SPS Q/Mon



Bancroft

GENIVAR

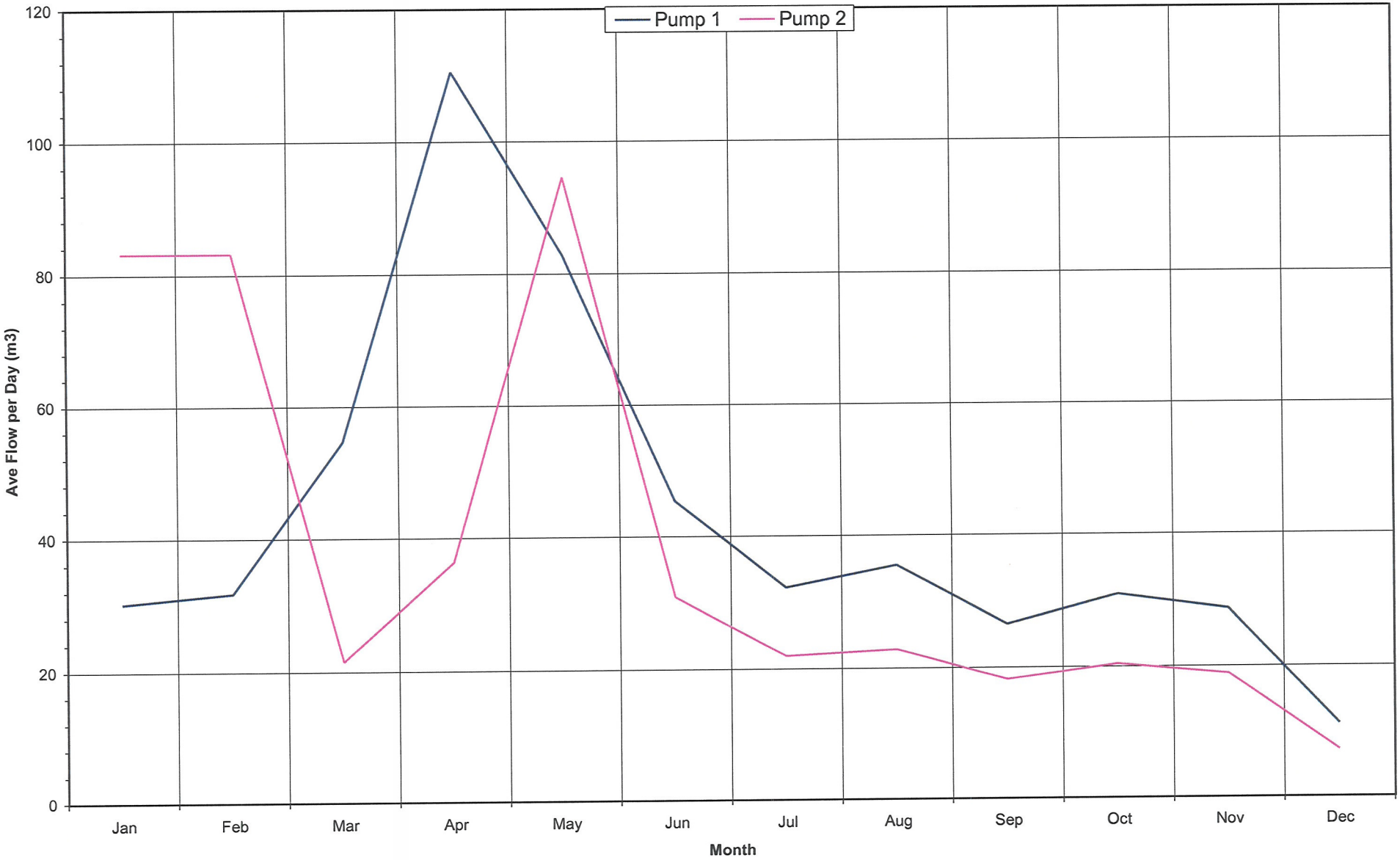
Figure D - 3: Hwy 62S SPS Q/Mon



Bancroft

GENIVAR

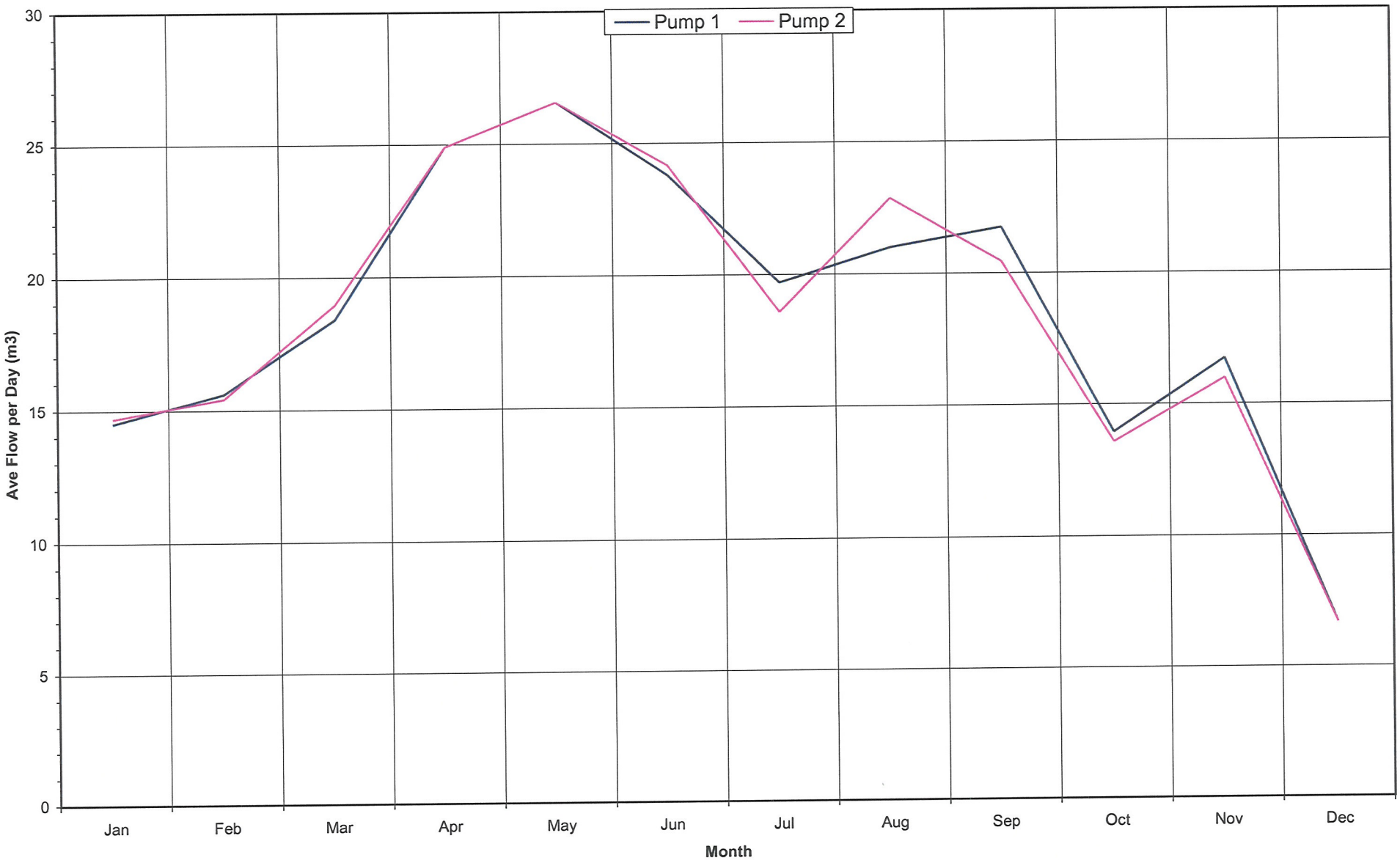
Figure D - 4: Forest Hill SPS Q/Mon



Bancroft

GENIVAR

Figure D - 5: Valleyview SPS Q/Mon



Bancroft

GENIVAR

Appendix E

Building Bancroft Site Servicing - Wastewater

Type	CODE	Facility		Inlet	Length	Drain To Node #	MH BL	D/S IL	*Min FL*	Existing GL	Slope	Status
PU	CS1	COMMUNITY FACILITIES		#171	8	171		323.820	*324.48*	**327**	2.00%	**Ok**
PR	CS2	MEDICAL CLINIC		#169	64	169		323.665	*325.45*	**326**	2.00%	**Ok**
PR	CS3	LIQUOR STORE		#168	67	168		323.520	*325.36*	**326.4**	2.00%	**Ok**
PR	CS4	POST OFFICE		#167	71.5	#168 / #167		323.520	*325.45*	**326.2**	2.00%	**Ok**
PU	CS5	GAZEBO SHELTER			-							
PU	CS6	PICNIC PAVILION		#50 / #156	57	#56		333.320	*324.85*	**330**		**Ok**
PU	CS7	PICNIC PAVILION				#56						
PU	CS8	GAZEBO		#50	-	#56						
PU	CS9	GAZEBO		#51	-	#51						
PU	CS10	SHELTER		#52	-	#52						
		TOWN CENTRE	Route 2		175	#165		323.520	*326.21*	**326.5**	1.25%	**Ok**
		TOWN CENTRE	Route 1		62	#170		325.500	*326.93*	**< 327**	1.50%	**No**
PU	GS1	TOWN CENTRE		#170	~~62~~	~~#170~~		~~325.500~~	~~*327.24*~~	~~**< 327**~~	2.00%	**No**
PU	HA1	LIBRARY		#36 / #173	29	#173	326.313	326.513	*327.45*	**327.45**	1.50%	**Ok**
PU	HA2	HERTIAGE ATTRACTION / MUSEUM			17	#85	326.556	326.756	*327.60*	**328**	2.00%	**Ok**
PU	HA3	NORTH HASTINGS MESEUM			15	#83	326.660	326.860	*327.59*	**327.6**	1.50%	**Ok**
PU												

Type	CODE	Facility		Inlet	Length	Drain To Node #	MH BL	D/S IL	*Min FL*	Existing GL	Slope	Status
PR	M1	MOTEL		#170	17	#170 / #171		324.060	*324.90*	**326.6**		**Ok**
PR	CR1	COMMERICAL / RETAIL		#171	20	#171		323.820	*324.72*	**327**		**Ok**
PR	CR2	COMMERICAL / RETAIL		#169	15	#169		323.765	*324.57*	**327**		**Ok**
PR	CR2A	COMMERICAL THEATRE		#169	15	#169		323.762	*324.56*	**326.7**		**Ok**
PR	CR3	COMMERICAL / RETAIL		#169	15	#169		323.752	*324.55*	**326.7**		**Ok**
PR	CR4	COMMERICAL / CAFÉ		#172 / #168/167	28	#167		323.520	*324.58*	**326**	2.00%	**Ok**
PR	CR5	COMMERICAL / RETAIL		#168 / #167	47	#167		323.520	*324.96*	**326**	2.00%	**Ok**
PR	CR6	COMMERICAL / RETAIL		#168 / #167	93.5	#167		323.520	*325.89*	**326.2**	2.00%	**Ok**
PR	CR7	COMMERICAL / RETAIL			108	#167		323.520	*326.18*	**326.2**	2.00%	**Ok**
PR	CR8	COMMERICAL / RESTAURANT		#167	94.5	#167		323.520	*325.91*	**326.2**	2.00%	**Ok**
PR	CR9	COMMERICAL / RETAIL		#167	37	#167		323.520	*324.76*	**326.3**	2.00%	**Ok**
PR	CR10	COMMERICAL / RETAIL		#50	100	PS		323.025	*325.53*	**326.4**		**Ok**
PR	CR11	COMMERICAL / RETAIL		#168	106.5	#172		323.665	*326.30*	**326.2**	2.00%	
PR	CR12	COMMERICAL / RETAIL				#172		323.665	*326.30*	**326.2**	2.00%	
PR	CR13	COMMERICAL / RETAIL		#50	80	PS		323.025	*325.13*	**326.2**		**Ok**
PR	RE1	RESIDENTIAL CONDOMINUM		#59 / #11	183.5	#52		327.470	*331.64*	**332**		**Ok**

Appendix F

SewerGEMS Hydraulic Model Results

Is Active?	Label	Base Flow (m^3/day)	Time (hours)	Updated TP Output - Flow (m^3/day)	Vol (m^3)	Time (hours)	DQ SPS output - Flow (m^3/day)	Vol (m^3)
TRUE	Bancroft_Manholes-10	0.306	0	0	0	0	0	0
TRUE	Bancroft_Manholes-107	0.894	0.083	0.407	0.001407542	0.083	0	0
TRUE	Bancroft_Manholes-11	0	0.166	0.813	0.00277775	0.166	0	0
TRUE	Bancroft_Manholes-110	0.024	0.248	1.22	0.004219167	0.248	0	0
TRUE	Bancroft_Manholes-111	1.225	0.331	1.626	0.00562325	0.331	0	0
TRUE	Bancroft_Manholes-12	0	0.414	7.676	0.026546167	0.414	0	0
TRUE	Bancroft_Manholes-125	0	0.497	8.988	0.030709	0.497	0	0
TRUE	Bancroft_Manholes-126	0	0.579	9.504	0.032868	0.579	0	0
TRUE	Bancroft_Manholes-127	0	0.662	9.14	0.031609167	0.662	0	0
TRUE	Bancroft_Manholes-128	0	0.745	7.785	0.026923125	0.745	0	0
TRUE	Bancroft_Manholes-129	0	0.828	4.065	0.014058125	0.828	0	0
TRUE	Bancroft_Manholes-13	3.734	0.911	4.472	0.015279333	0.911	0	0
TRUE	Bancroft_Manholes-130	0.612	0.993	4.878	0.01686975	0.993	0	0
TRUE	Bancroft_Manholes-131	0	1.076	4.995	0.017274375	1.076	0	0
TRUE	Bancroft_Manholes-132	0.612	1.159	4.909	0.016976958	1.159	0	0
TRUE	Bancroft_Manholes-133	0	1.242	4.824	0.016482	1.242	0	0
TRUE	Bancroft_Manholes-134	0	1.324	4.739	0.016389042	1.324	0	0
TRUE	Bancroft_Manholes-135	0	1.407	4.654	0.016095083	1.407	0	0
TRUE	Bancroft_Manholes-137	1.137	1.49	4.568	0.015797667	1.49	0	0
TRUE	Bancroft_Manholes-141	4.211	1.573	4.483	0.015503708	1.573	0	0
TRUE	Bancroft_Manholes-166	2.105	1.656	4.398	0.0150265	1.656	0	0
TRUE	Bancroft_Manholes-167	8.421	1.738	4.313	0.014915792	1.738	0	0
TRUE	Bancroft_Manholes-168	10.526	1.821	4.227	0.014618375	1.821	0	0
TRUE	Bancroft_Manholes-169	5.263	1.904	4.142	0.014324417	1.904	0	0
TRUE	Bancroft_Manholes-170	6.316	1.987	4.057	0.013861417	1.987	0	0
TRUE	Bancroft_Manholes-171	5.263	2.069	3.972	0.0137365	2.069	0	0
TRUE	Bancroft_Manholes-172	1.052	2.152	3.886	0.013439083	2.152	0	0
TRUE	Bancroft_Manholes-173	1.052	2.235	3.801	0.013145125	2.235	0	0
TRUE	Bancroft_Manholes-174	2.105	2.318	7.824	0.027058	2.318	0	0
TRUE	Bancroft_Manholes-175	4.21	2.401	8.345	0.028512083	2.401	0	0
TRUE	Bancroft_Manholes-176	0	2.483	8.676	0.0300045	2.483	0	0
TRUE	Bancroft_Manholes-195	1.028	2.566	8.897	0.030768792	2.566	0	0
TRUE	Bancroft_Manholes-196	5.263	2.649	8.917	0.030837958	2.649	0	0
TRUE	Bancroft_Manholes-197	9.366	2.732	8.965	0.030630417	2.732	0	0
TRUE	Bancroft_Manholes-203	0	2.814	8.905	0.030796458	2.814	0	0
TRUE	Bancroft_Manholes-204	4.21	2.897	8.792	0.030405667	2.897	0	0

Is Active?	Label	Base Flow (m^3/day)	Time (hours)	Updated TP Output - Flow (m^3/day)	Vol (m^3)	Time (hours)	DQ SPS output - Flow (m^3/day)	Vol (m^3)
TRUE	Bancroft_Manholes-205	1.053	2.98	8.624	0.029824667	2.98	0	0
TRUE	Bancroft_Manholes-207	3.157	3.063	8.483	0.029337042	3.063	0	0
TRUE	Bancroft_Manholes-228	0	3.146	8.406	0.0287205	3.146	0	0
TRUE	Bancroft_Manholes-253	1.053	3.228	8.212	0.028399833	3.228	0	0
TRUE	Bancroft_Manholes-3	0.612	3.311	8.045	0.027822292	3.311	0	0
TRUE	Bancroft_Manholes-30	1.665	3.394	7.971	0.027566375	3.394	0	0
TRUE	Bancroft_Manholes-32	2.401	3.477	7.786	0.026602167	3.477	0	0
TRUE	Bancroft_Manholes-33	3.33	3.559	7.609	0.026314458	3.559	0	0
TRUE	Bancroft_Manholes-34	3.012	3.642	7.618	0.026345583	3.642	0	0
TRUE	Bancroft_Manholes-36	3.637	3.725	8.147	0.028175042	3.725	0	0
TRUE	Bancroft_Manholes-37	1.053	3.808	8.676	0.0300045	3.808	0	0
TRUE	Bancroft_Manholes-38	1.07	3.891	9.631	0.032905917	3.891	0	0
TRUE	Bancroft_Manholes-39	0	3.973	10.597	0.036647958	3.973	0	0
TRUE	Bancroft_Manholes-40	2.446	4.056	11.563	0.039988708	4.056	0	0
TRUE	Bancroft_Manholes-41	1.598	4.139	12.529	0.043329458	4.139	0	0
TRUE	Bancroft_Manholes-42	0.834	4.222	13.495	0.046107917	4.222	0	0
TRUE	Bancroft_Manholes-43	0.306	4.304	14.461	0.050010958	4.304	0	0
TRUE	Bancroft_Manholes-44	2.601	4.387	15.427	0.053351708	4.387	0	0
TRUE	Bancroft_Manholes-45	0.306	4.47	16.393	0.056692458	4.47	0	0
TRUE	Bancroft_Manholes-46	23.826	4.553	17.359	0.060033208	4.553	0	0
TRUE	Bancroft_Manholes-47	1.053	4.636	18.325	0.062610417	4.636	0	0
TRUE	Bancroft_Manholes-50	2.105	4.718	19.291	0.066714708	4.718	0	0
TRUE	Bancroft_Manholes-51	2.105	4.801	20.257	0.070055458	4.801	0	0
TRUE	Bancroft_Manholes-52	2.105	4.884	21.223	0.073396208	4.884	0	0
TRUE	Bancroft_Manholes-53	6.316	4.967	22.189	0.075812417	4.967	0	0
TRUE	Bancroft_Manholes-55	1.265	5.049	22.703	0.078514542	5.049	0	0
TRUE	Bancroft_Manholes-57	4.21	5.132	23.073	0.079794125	5.132	0	0
TRUE	Bancroft_Manholes-59	3.587	5.215	23.443	0.081073708	5.215	0	0
TRUE	Bancroft_Manholes-6	0	5.298	23.813	0.082353292	5.298	0	0
TRUE	Bancroft_Manholes-60	12.839	5.381	24.183	0.08262525	5.381	1,475.60	5.041623083
TRUE	Bancroft_Manholes-61	3.061	5.463	25.243	0.087298708	5.463	1,395.60	4.826436167
TRUE	Bancroft_Manholes-62	0.612	5.546	27.056	0.093568667	5.546	0.00	0
TRUE	Bancroft_Manholes-63	1.359	5.629	29.042	0.100436917	5.629	0.00	0
TRUE	Bancroft_Manholes-64	0.918	5.712	30.978	0.1058415	5.712	0	0
TRUE	Bancroft_Manholes-65	0.776	5.794	32.966	0.114007417	5.794	0	0
TRUE	Bancroft_Manholes-66	1.531	5.877	35.703	0.123472875	5.877	0	0

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TRUE	Bancroft_Manholes-67	0.612	5.96	44.31	0.15323875	5.96	0	0
TRUE	Bancroft_Manholes-68	0.612	6.043	93.157	0.322167958	6.043	0	0
TRUE	Bancroft_Manholes-7	1.053	6.126	244.632	0.835826	6.126	0	0
TRUE	Bancroft_Manholes-83	2.642	6.208	495.172	1.712469833	6.208	0	0
TRUE	Bancroft_Manholes-84	3.556	6.291	682.20	2.359281917	6.291	1,469.89	5.083362667
TRUE	Bancroft_Manholes-85	5.445	6.374	703.18	2.43183775	6.374	1,400.94	4.8449175
TRUE	Bancroft_Manholes-87	1.788	6.457	634.61	2.168237167	6.457	0	0
TRUE	Bancroft_Manholes-88	0.937	6.539	545.74	1.88735775	6.539	0	0
TRUE	Bancroft_Manholes-89	1.474	6.622	451.87	1.56270325	6.622	0.00	0
TRUE	Bancroft_Manholes-9	0.306	6.705	369.36	1.277352708	6.705	0.00	0
TRUE	Bancroft_Manholes-90	2.503	6.788	310.82	1.074929542	6.788	0	0
TRUE	Faraday	0	6.871	274.94	0.93938175	6.871	0	0
TRUE	MH-010	0	6.953	302.63	1.046578125	6.953	0	0
TRUE	MH-011	0	7.036	426.48	1.474899625	7.036	0	0
TRUE	MH-08	0	7.119	610.71	2.112021458	7.119	0	0
TRUE	MH-09	0	7.202	733.36	2.50564325	7.202	1,709.18	5.839712
TRUE	MH-1	8.395	7.284	703.54	2.433075833	7.284	1,457.92	5.041976792
TRUE	MH-111	2.295	7.367	640.98	2.216729417	7.367	1,393.23	4.818239917
TRUE	MH-12	0	7.45	549.24	1.899448083	7.45	0	0
TRUE	MH-13	0	7.533	456.571	1.578974708	7.533	0.00	0
TRUE	MH-14	0	7.616	373.004	1.274430333	7.616	0.00	0
TRUE	MH-15	0	7.698	314.456	1.087493667	7.698	0.00	0
TRUE	MH-16	0	7.781	285.24	0.986465375	7.781	0	0
TRUE	MH-17	0	7.864	344.17	1.1902615	7.864	0	0
TRUE	MH-18	0	7.947	547.74	1.871451833	7.947	1,470.30	5.023528417
TRUE	MH-19	0	8.029	831.96	2.877208833	8.029	1,419.80	4.910145125
TRUE	MH-2	1.517	8.112	987.78	3.4160725	8.112	0	0
TRUE	MH-20	0	8.195	961.97	3.326819833	8.195	0	0
TRUE	MH-7	1.672	8.278	847.37	2.930498292	8.278	0	0
FALSE	Bancroft_Manholes-1	0	8.361	712.05	2.432823833	8.361	0.00	0
FALSE	Bancroft_Manholes-100	1.788	8.443	599.36	2.072793583	8.443	1,691.44	5.849573708
FALSE	Bancroft_Manholes-101	1.788	8.526	538.62	1.862713667	8.526	1,439.92	4.979706042
FALSE	Bancroft_Manholes-102	3.129	8.609	566.76	1.960041542	8.609	1,390.84	4.810002167
FALSE	Bancroft_Manholes-103	1.341	8.692	673.42	2.300865333	8.692	0	0
FALSE	Bancroft_Manholes-104	1.341	8.774	796.49	2.754521	8.774	0	0
FALSE	Bancroft_Manholes-105	1.341	8.857	847.14	2.929695958	8.857	0	0

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FALSE	Bancroft_Manholes-106	2.235	8.94	833.55	2.882686833	8.94	0	0
FALSE	Bancroft_Manholes-108	1.341	9.023	819.17	2.832962917	9.023	1,692.10	5.851849292
FALSE	Bancroft_Manholes-109	1.341	9.106	883.96	3.020179583	9.106	1,441.61	4.925497417
FALSE	Bancroft_Manholes-112	0	9.188	1,005.13	3.4760815	9.188	1,392.43	4.815469792
FALSE	Bancroft_Manholes-113	0.306	9.271	1,111.57	3.844179583	9.271	0.00	0
FALSE	Bancroft_Manholes-114	0	9.354	1,111.87	3.845199792	9.354	0	0
FALSE	Bancroft_Manholes-115	0.306	9.437	1,022.82	3.494628167	9.437	0	0
FALSE	Bancroft_Manholes-116	0	9.519	906.83	3.136116958	9.519	0	0
FALSE	Bancroft_Manholes-117	0.612	9.602	845.38	2.92361275	9.602	1,474.04	5.097725125
FALSE	Bancroft_Manholes-118	1.531	9.685	875.16	3.026584625	9.685	1,410.62	4.878397625
FALSE	Bancroft_Manholes-119	1.837	9.768	996.43	3.445969792	9.768	0.00	0
FALSE	Bancroft_Manholes-120	2.449	9.851	1,105.87	3.77838575	9.851	0.00	0
FALSE	Bancroft_Manholes-121	1.837	9.933	1,113.89	3.85221675	9.933	0	0
FALSE	Bancroft_Manholes-122	1.531	10.016	1,031.58	3.567550958	10.016	0	0
FALSE	Bancroft_Manholes-123	7.56	10.099	916.71	3.170285292	10.099	1,699.37	5.876974083
FALSE	Bancroft_Manholes-124	1.837	10.182	842.51	2.87855875	10.182	1,438.24	4.9139935
FALSE	Bancroft_Manholes-136	3.158	10.264	841.88	2.91149475	10.264	0	0
FALSE	Bancroft_Manholes-138	2.105	10.347	886.95	3.067361833	10.347	0.00	0
FALSE	Bancroft_Manholes-139	3.175	10.43	921.17	3.185709458	10.43	0.00	0
FALSE	Bancroft_Manholes-14	0.306	10.513	898.24	3.1063995	10.513	0	0
FALSE	Bancroft_Manholes-140	10.526	10.596	834.90	2.85256475	10.596	1,703.09	5.818884
FALSE	Bancroft_Manholes-143	0.918	10.678	779.83	2.696894792	10.678	1,447.81	5.007023417
FALSE	Bancroft_Manholes-144	0.612	10.761	767.78	2.655253	10.761	1,379.46	4.770642875
FALSE	Bancroft_Manholes-145	0.306	10.844	807.03	2.790985667	10.844	0	0
FALSE	Bancroft_Manholes-146	2.521	10.927	843.31	2.8812955	10.927	0	0
FALSE	Bancroft_Manholes-147	0	11.009	846.20	2.926445125	11.009	0	0
FALSE	Bancroft_Manholes-148	0.447	11.092	808.42	2.795782375	11.092	0.00	0
FALSE	Bancroft_Manholes-149	0.306	11.175	798.99	2.763184125	11.175	0.00	0
FALSE	Bancroft_Manholes-15	0.612	11.258	847.43	2.930681583	11.258	0.00	0
FALSE	Bancroft_Manholes-150	0.894	11.341	974.39	3.3291795	11.341	0	0
FALSE	Bancroft_Manholes-151	1.341	11.423	1,080.56	3.73692975	11.423	1,700.81	5.881974833
FALSE	Bancroft_Manholes-152	2.235	11.506	1,089.34	3.76730775	11.506	1,438.35	4.97429375
FALSE	Bancroft_Manholes-153	3.941	11.589	981.24	3.393461917	11.589	0	0
FALSE	Bancroft_Manholes-154	1.341	11.672	841.47	2.875025917	11.672	0	0
FALSE	Bancroft_Manholes-155	2.235	11.754	689.05	2.382978417	11.754	0	0
FALSE	Bancroft_Manholes-156	1.053	11.837	560.59	1.938696708	11.837	0	0

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FALSE	Bancroft_Manholes-157	0.447	11.92	461.099	1.594634042	11.92	0	0
FALSE	Bancroft_Manholes-158	0.753	12.003	395.111	1.366425542	12.003	0	0
FALSE	Bancroft_Manholes-159	0.612	12.086	392.04	1.339466583	12.086	1,691.82	5.78037475
FALSE	Bancroft_Manholes-16	1.225	12.168	466.90	1.614688917	12.168	1,438.20	4.973781917
FALSE	Bancroft_Manholes-160	2.4	12.251	596.47	2.062805917	12.251	0	0
FALSE	Bancroft_Manholes-161	1.812	12.334	692.547	2.395058375	12.334	0	0
FALSE	Bancroft_Manholes-162	1.953	12.417	696.67	2.380299417	12.417	0	0
FALSE	Bancroft_Manholes-163	2.259	12.499	636.118	2.199908083	12.499	0	0
FALSE	Bancroft_Manholes-164	1.365	12.582	553.899	1.915567375	12.582	0	0
FALSE	Bancroft_Manholes-165	0	12.665	493.67	1.707275417	12.665	0	0
FALSE	Bancroft_Manholes-17	2.411	12.748	489.347	1.692325042	12.748	0	0
FALSE	Bancroft_Manholes-177	1.053	12.831	553.53	1.891241167	12.831	0	0
FALSE	Bancroft_Manholes-178	4.21	12.913	660.47	2.284121958	12.913	1,475.58	5.103061333
FALSE	Bancroft_Manholes-179	1.053	12.996	717.87	2.482647583	12.996	1,408.22	4.870108
FALSE	Bancroft_Manholes-18	1.053	13.079	695.99	2.406955042	13.079	0.00	0
FALSE	Bancroft_Manholes-180	0.536	13.162	629.376	2.150368	13.162	0.00	0
FALSE	Bancroft_Manholes-181	2.105	13.244	540.203	1.868202042	13.244	0	0
FALSE	Bancroft_Manholes-182	0	13.327	452.32	1.564273333	13.327	0	0
FALSE	Bancroft_Manholes-183	1.053	13.41	377.131	1.304244708	13.41	0	0
FALSE	Bancroft_Manholes-184	3.178	13.493	341.914	1.182452583	13.493	0	0
FALSE	Bancroft_Manholes-185	2.125	13.576	363.00	1.240246583	13.576	0	0
FALSE	Bancroft_Manholes-186	2.105	13.658	480.46	1.66159775	13.658	1,467.56	5.075315125
FALSE	Bancroft_Manholes-187	2.146	13.741	647.52	2.239336542	13.741	1,385.19	4.790462583
FALSE	Bancroft_Manholes-188	1.61	13.824	749.37	2.591578167	13.824	0	0
FALSE	Bancroft_Manholes-189	5.263	13.907	736.72	2.517130083	13.907	0	0
FALSE	Bancroft_Manholes-19	0.918	13.989	649.28	2.2454405	13.989	0	0
FALSE	Bancroft_Manholes-190	13.889	14.072	554.65	1.918161125	14.072	0.00	0
FALSE	Bancroft_Manholes-191	12.793	14.155	462.16	1.5982895	14.155	0.00	0
FALSE	Bancroft_Manholes-192	3.158	14.238	410.24	1.418746667	14.238	0	0
FALSE	Bancroft_Manholes-193	3.158	14.321	426.05	1.4556845	14.321	0	0
FALSE	Bancroft_Manholes-194	4.21	14.403	525.59	1.817668875	14.403	0	0
FALSE	Bancroft_Manholes-198	4.21	14.486	660.94	2.28575775	14.486	1,471.68	5.089563458
FALSE	Bancroft_Manholes-199	0.894	14.569	737.87	2.5517935	14.569	1,391.13	4.810987792
FALSE	Bancroft_Manholes-2	0	14.652	707.734	2.418091167	14.652	0	0
FALSE	Bancroft_Manholes-20	0.612	14.734	634.192	2.193247333	14.734	0	0
FALSE	Bancroft_Manholes-200	1.788	14.817	538.85	1.863526375	14.817	0	0

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FALSE	Bancroft_Manholes-201	3.605	14.9	451.15	1.560230542	14.9	0	0
FALSE	Bancroft_Manholes-202	1.053	14.983	372.08	1.28676975	14.983	0.00	0
FALSE	Bancroft_Manholes-206	1.053	15.066	334.14	1.141651833	15.066	0.00	0
FALSE	Bancroft_Manholes-208	1.5	15.148	352.71	1.219792208	15.148	0	0
FALSE	Bancroft_Manholes-209	3.158	15.231	465.81	1.610908958	15.231	1,474.92	5.100778833
FALSE	Bancroft_Manholes-21	1.531	15.314	629.855	2.178248542	15.314	1,423.60	4.9232695
FALSE	Bancroft_Manholes-210	4.21	15.397	734.315	2.508909583	15.397	1,375.12	4.698313
FALSE	Bancroft_Manholes-211	2.105	15.479	716.389	2.477511958	15.479	0	0
FALSE	Bancroft_Manholes-212	1.053	15.562	645.33	2.231748958	15.562	0	0
FALSE	Bancroft_Manholes-213	1.5	15.645	549.22	1.899375458	15.645	0.00	0
FALSE	Bancroft_Manholes-214	0.447	15.728	471.06	1.629085958	15.728	0.00	0
FALSE	Bancroft_Manholes-215	1.053	15.811	440.56	1.505260333	15.811	0	0
FALSE	Bancroft_Manholes-216	0.894	15.893	519.98	1.798274542	15.893	1,473.66	5.096404042
FALSE	Bancroft_Manholes-217	7.827	15.976	730.15	2.525098625	15.976	1,419.18	4.907983667
FALSE	Bancroft_Manholes-218	0	16.059	962.12	3.327328208	16.059	0	0
FALSE	Bancroft_Manholes-219	0	16.142	1,042.25	3.56100375	16.142	0	0
FALSE	Bancroft_Manholes-22	1.531	16.224	977.08	3.379064875	16.224	0.00	0
FALSE	Bancroft_Manholes-220	2.682	16.307	846.33	2.926901625	16.307	0.00	0
FALSE	Bancroft_Manholes-221	0	16.39	726.29	2.511742542	16.39	1,475.71	5.103504
FALSE	Bancroft_Manholes-222	1.053	16.473	652.59	2.256880667	16.473	1,402.44	4.850098083
FALSE	Bancroft_Manholes-223	0.447	16.556	666.02	2.275582	16.556	0	0
FALSE	Bancroft_Manholes-224	0.447	16.638	743.54	2.571419542	16.638	0	0
FALSE	Bancroft_Manholes-225	1.053	16.721	830.31	2.871495667	16.721	0.00	0
FALSE	Bancroft_Manholes-226	0	16.804	857.73	2.966309333	16.804	0.00	0
FALSE	Bancroft_Manholes-227	2.105	16.887	829.60	2.834476917	16.887	0	0
FALSE	Bancroft_Manholes-229	0.612	16.969	804.50	2.782229167	16.969	1,694.41	5.859838042
FALSE	Bancroft_Manholes-23	0.918	17.052	822.28	2.843701042	17.052	1,434.65	4.961504833
FALSE	Bancroft_Manholes-230	0.612	17.135	879.55	3.041787458	17.135	0	0
FALSE	Bancroft_Manholes-231	1.359	17.218	910.53	3.148926625	17.218	0	0
FALSE	Bancroft_Manholes-232	0	17.301	883.59	3.01892225	17.301	0	0
FALSE	Bancroft_Manholes-233	0	17.383	798.81	2.762554708	17.383	0	0
FALSE	Bancroft_Manholes-234	0	17.466	701.13	2.424727417	17.466	0.00	0
FALSE	Bancroft_Manholes-235	0	17.549	632.86	2.188633917	17.549	1,696.21	5.8660665
FALSE	Bancroft_Manholes-236	0	17.632	615.55	2.103132583	17.632	1,445.88	4.940086583
FALSE	Bancroft_Manholes-237	0	17.714	667.80	2.309471542	17.714	1,382.10	4.779769417
FALSE	Bancroft_Manholes-238	0	17.797	740.11	2.55953325	17.797	0	0

Is Active?	Label	Base Flow (m^3/day)	Time (hours)	Updated TP Output - Flow (m^3/day)	Vol (m^3)	Time (hours)	DQ SPS output - Flow (m^3/day)	Vol (m^3)
FALSE	Bancroft_Manholes-239	1.665	17.88	772.59	2.671870292	17.88	0	0
FALSE	Bancroft_Manholes-24	2.143	17.963	740.76	2.561805375	17.963	0	0
FALSE	Bancroft_Manholes-240	0.536	18.046	680.209	2.324047417	18.046	0	0
FALSE	Bancroft_Manholes-241	0.612	18.128	643.935	2.226941875	18.128	0.00	0
FALSE	Bancroft_Manholes-242	1.053	18.211	693.396	2.3979945	18.211	0.00	0
FALSE	Bancroft_Manholes-244	4.21	18.294	835.88	2.890741292	18.294	0.00	0
FALSE	Bancroft_Manholes-245	2.105	18.377	993.80	3.395473083	18.377	1,699.68	5.80722975
FALSE	Bancroft_Manholes-246	1.053	18.459	1,039.80	3.595957708	18.459	1,443.15	4.990900667
FALSE	Bancroft_Manholes-247	1.053	18.542	973.83	3.367832208	18.542	1,373.83	4.751151708
FALSE	Bancroft_Manholes-248	0	18.625	833.88	2.883831542	18.625	0	0
FALSE	Bancroft_Manholes-249	0	18.708	691.93	2.392921125	18.708	0	0
FALSE	Bancroft_Manholes-25	1.225	18.791	561.36	1.917983417	18.791	0	0
FALSE	Bancroft_Manholes-250	1.053	18.873	464.01	1.604694333	18.873	0	0
FALSE	Bancroft_Manholes-251	2.123	18.956	415.30	1.436256208	18.956	0	0
FALSE	Bancroft_Manholes-254	1.053	19.039	453.30	1.5676625	19.039	0	0
FALSE	Bancroft_Manholes-255	1.053	19.122	621.27	2.1226725	19.122	0.00	0
FALSE	Bancroft_Manholes-256	5.645	19.204	848.53	2.934489208	19.204	1,467.28	5.0743295
FALSE	Bancroft_Manholes-257	2.752	19.287	971.06	3.358256083	19.287	1,399.60	4.840276417
FALSE	Bancroft_Manholes-258	1.589	19.37	939.88	3.250407958	19.37	0	0
FALSE	Bancroft_Manholes-259	3.158	19.453	822.40	2.844116042	19.453	0	0
FALSE	Bancroft_Manholes-26	2.449	19.536	682.68	2.332472917	19.536	0	0
FALSE	Bancroft_Manholes-260	2.907	19.618	560.02	1.936728917	19.618	0	0
FALSE	Bancroft_Manholes-261	0.447	19.701	461.10	1.5946375	19.701	0	0
FALSE	Bancroft_Manholes-27	1.225	19.784	407.17	1.408133042	19.784	0	0
FALSE	Bancroft_Manholes-28	2.143	19.867	426.14	1.45596125	19.867	0	0
FALSE	Bancroft_Manholes-29	1.225	19.949	534.24	1.847569625	19.949	1,466.90	5.073029167
FALSE	Bancroft_Manholes-4	0	20.032	681.571	2.357099708	20.032	1,403.59	4.854089
FALSE	Bancroft_Manholes-48	6.709	20.115	756.689	2.616882792	20.115	0	0
FALSE	Bancroft_Manholes-49	11.771	20.198	730.858	2.527550583	20.198	0	0
FALSE	Bancroft_Manholes-5	0	20.281	645.016	2.203804667	20.281	0	0
FALSE	Bancroft_Manholes-54	1.053	20.363	552.592	1.911047333	20.363	0	0
FALSE	Bancroft_Manholes-56	0.306	20.446	464.363	1.605922042	20.446	0	0
FALSE	Bancroft_Manholes-58	1.682	20.529	416.36	1.439915125	20.529	0	0
FALSE	Bancroft_Manholes-69	0.306	20.612	437.07	1.493325917	20.612	0	0
FALSE	Bancroft_Manholes-70	0	20.694	543.36	1.879109625	20.694	0	0
FALSE	Bancroft_Manholes-71	0	20.777	684.99	2.368916833	20.777	0	0

Is Active?	Label	Base Flow (m^3/day)	Time (hours)	Updated TP Output - Flow (m^3/day)	Vol (m^3)	Time (hours)	DQ SPS output - Flow (m^3/day)	Vol (m^3)
FALSE	Bancroft_Manholes-72	0	20.86	756.16	2.615046417	20.86	1,705.53	5.898298167
FALSE	Bancroft_Manholes-73	0	20.943	714.26	2.470145708	20.943	1,450.91	5.017737333
FALSE	Bancroft_Manholes-74	0	21.026	645.08	2.204009667	21.026	1,382.79	4.724515417
FALSE	Bancroft_Manholes-75	0	21.108	546.43	1.889733625	21.108	0	0
FALSE	Bancroft_Manholes-76	0.306	21.191	454.12	1.57050525	21.191	0	0
FALSE	Bancroft_Manholes-77	0.918	21.274	369.48	1.277774625	21.274	0	0
FALSE	Bancroft_Manholes-78	0	21.357	311.15	1.063092417	21.357	0	0
FALSE	Bancroft_Manholes-79	0	21.439	275.38	0.952359292	21.439	0	0
FALSE	Bancroft_Manholes-8	0	21.522	320.54	1.108534167	21.522	0	0
FALSE	Bancroft_Manholes-80	0	21.605	503.75	1.742131958	21.605	0	0
FALSE	Bancroft_Manholes-81	0	21.688	774.72	2.67924	21.688	0	0
FALSE	Bancroft_Manholes-82	0	21.771	944.96	3.228620167	21.771	0.00	0
FALSE	Bancroft_Manholes-86	8.34	21.853	925.16	3.199511667	21.853	0.00	0
FALSE	Bancroft_Manholes-91	0.894	21.936	812.47	2.809792083	21.936	1,698.64	5.874459875
FALSE	Bancroft_Manholes-92	0.447	22.019	671.63	2.322706583	22.019	1,438.65	4.975313958
FALSE	Bancroft_Manholes-93	0.894	22.102	564.88	1.929989583	22.102	0	0
FALSE	Bancroft_Manholes-94	1.341	22.184	456.80	1.579749375	22.184	0	0
FALSE	Bancroft_Manholes-95	0.447	22.267	366.01	1.265788042	22.267	0	0
FALSE	Bancroft_Manholes-96	0	22.35	299.00	1.034048583	22.35	1,732.49	5.991531375
FALSE	Bancroft_Manholes-97	0.894	22.433	243.05	0.840541	22.433	1,720.17	5.948914333
FALSE	Bancroft_Manholes-98	0.894	22.516	207.25	0.708087083	22.516	1,697.29	5.799087833
FALSE	Bancroft_Manholes-99	1.341	22.598	214.08	0.740363458	22.598	1,455.56	5.0338255
FALSE	MH-10	0	22.681	303.51	1.049621458	22.681	1,402.98	4.8519725
FALSE	MH-11	5.104	22.764	488.674	1.689997583	22.764	0.00	0
FALSE	MH-3	2.105	22.847	686.23	2.344632833	22.847	0	0
FALSE	MH-4	0	22.929	834.43	2.885747458	22.929	0	0
FALSE	MH-5	3.694	23.012	993.70	3.436528542	23.012	0	0
FALSE	MH-6	0	23.095	1,208.01	4.177687417	23.095	1,468.97	5.080184458
FALSE	MH-9	0	23.178	1,417.67	4.902785792	23.178	1,391.22	4.811309417
		Total Flow (DWH)	23.261	1,501.86	5.131337917	23.261	0	0
		511.115	23.343	1,445.71	4.999743625	23.343	0	0
			23.426	1,281.36	4.431373458	23.426	0	0
			23.509	1,091.79	3.775777208	23.509	0	0
			23.592	931.02	3.180988417	23.592	0	0
			23.674	826.11	2.856949917	23.674	0	0

Is Active?	Label	Base Flow (m^3/day)	Time (hours)	Updated TP Output - Flow (m^3/day)	Vol (m^3)	Time (hours)	DQ SPS output - Flow (m^3/day)	Vol (m^3)
			23.757	805.97	2.787306	23.757	0.00	0
			23.84	832.13	2.877776	23.84	0.00	0
			23.923	840.11	2.695340083	23.923	0	0
			24					
				AVG Flow	Sum		AVG Flow	Sum
				511.99	513.05		324.69	324.86
					Peak			Peak
					1,501.86			1,732.49
					Avg (l/s)			Avg (l/s)
					5.92580602			3.757945402

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29	Bancroft_Manholes-10	0.306	0	112.055	0.387524	0	0	0
30	Bancroft_Manholes-100	1.789	0.083	109.695	0.379362	0.083	0	0
31	Bancroft_Manholes-101	1.789	0.166	107.437	0.367076	0.166	0	0
32	Bancroft_Manholes-102	3.132	0.248	108.481	0.375163	0.248	0	0
33	Bancroft_Manholes-103	1.342	0.331	107.472	0.371674	0.331	0	0
34	Bancroft_Manholes-104	1.342	0.414	110.877	0.38345	0.414	0	0
35	Bancroft_Manholes-105	1.342	0.497	118.248	0.404014	0.497	0	0
36	Bancroft_Manholes-106	2.237	0.579	131.266	0.453962	0.579	0	0
37	Bancroft_Manholes-107	0.895	0.662	146.964	0.508251	0.662	0	0
37	Bancroft_Manholes-107	12.4	0.745	168.196	0.581678	0.745	0	0
38	Bancroft_Manholes-108	1.342	0.828	182.738	0.631969	0.828	0	0
39	Bancroft_Manholes-109	1.342	0.911	197.364	0.674327	0.911	0	0
40	Bancroft_Manholes-11	0	0.993	203.468	0.70366	0.993	0	0
41	Bancroft_Manholes-110	0.024	1.076	212.44	0.734688	1.076	0	0
41	Bancroft_Manholes-110	34.8	1.159	216.48	0.74866	1.159	0	0
42	Bancroft_Manholes-111	1.226	1.242	219.048	0.748414	1.242	0	0
43	Bancroft_Manholes-112	0	1.324	220.233	0.761639	1.324	0	0
44	Bancroft_Manholes-113	0.306	1.407	221.449	0.765844	1.407	0	0
45	Bancroft_Manholes-114	0	1.49	222.017	0.767809	1.49	0	0
46	Bancroft_Manholes-115	0.306	1.573	222.528	0.769576	1.573	0	0
47	Bancroft_Manholes-116	0	1.656	223.082	0.762197	1.656	0	0
48	Bancroft_Manholes-117	0.613	1.738	223.611	0.773321	1.738	1,467.66	5.0756575
49	Bancroft_Manholes-118	1.532	1.821	223.795	0.773958	1.821	1,403.32	4.853144875
50	Bancroft_Manholes-119	1.838	1.904	224.115	0.775064	1.904	0.00	0
51	Bancroft_Manholes-12	0	1.987	224.441	0.76684	1.987	0.00	0
52	Bancroft_Manholes-120	2.451	2.069	224.853	0.777617	2.069	0.00	0
53	Bancroft_Manholes-121	1.838	2.152	227.219	0.785799	2.152	0	0
54	Bancroft_Manholes-122	1.532	2.235	236.692	0.81856	2.235	0	0
55	Bancroft_Manholes-123	7.566	2.318	289.053	0.999642	2.318	0	0
56	Bancroft_Manholes-124	1.838	2.401	426.328	1.456621	2.401	0	0
57	Bancroft_Manholes-125	0	2.483	654.871	2.264762	2.483	0	0
58	Bancroft_Manholes-126	0	2.566	863.424	2.986008	2.566	0	0
59	Bancroft_Manholes-127	0	2.649	936.047	3.237163	2.649	0	0
60	Bancroft_Manholes-128	0	2.732	873.30	2.983785	2.732	0	0
61	Bancroft_Manholes-129	0	2.814	770.40	2.6643	2.814	0	0
62	Bancroft_Manholes-13	42.6	2.897	649.95	2.24774	2.897	1,469.43	5.081771833
62	Bancroft_Manholes-13	3.737	2.98	559.235	1.934021	2.98	1,390.65	4.809320875
63	Bancroft_Manholes-130	0.613	3.063	482.857	1.66988	3.063	0	0
64	Bancroft_Manholes-131	0	3.146	412.696	1.410045	3.146	0.00	0

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65	Bancroft_Manholes-132	0.613	3.228	356.251	1.232035	3.228	0.00	0
66	Bancroft_Manholes-133	0	3.311	318.75	1.102344	3.311	1,688.96	5.840976292
67	Bancroft_Manholes-134	0	3.394	301.56	1.042895	3.394	1,457.41	5.040192292
68	Bancroft_Manholes-135	0	3.477	327.112	1.117633	3.477	1,415.71	4.83700575
69	Bancroft_Manholes-136	3.16	3.559	444.54	1.537357	3.559	1,376.41	4.760084583
70	Bancroft_Manholes-137	41.9	3.642	663.26	2.293788	3.642	0.00	0
70	Bancroft_Manholes-137	1.138	3.725	885.52	3.062434	3.725	0.00	0
71	Bancroft_Manholes-138	2.107	3.808	1,022.47	3.536049	3.808	0	0
72	Bancroft_Manholes-139	3.178	3.891	1,126.10	3.847512	3.891	0	0
73	Bancroft_Manholes-14	0.306	3.973	1,277.62	4.418436	3.973	1,698.96	5.875563083
74	Bancroft_Manholes-140	10.535	4.056	1,461.73	5.055163	4.056	1,444.90	4.99695275
75	Bancroft_Manholes-141	4.214	4.139	1,570.59	5.431613	4.139	1,379.94	4.772299417
75	Bancroft_Manholes-141	22.6	4.222	1,532.60	5.236387	4.222	0	0
76	Bancroft_Manholes-143	0.919	4.304	1,376.58	4.760683	4.304	0	0
77	Bancroft_Manholes-144	0.613	4.387	1,197.09	4.139943	4.387	0	0
78	Bancroft_Manholes-145	0.306	4.47	1,041.41	3.601557	4.47	0.00	0
79	Bancroft_Manholes-146	2.523	4.553	977.32	3.379898	4.553	0.00	0
80	Bancroft_Manholes-147	0	4.636	1,027.97	3.512224	4.636	1,474.29	5.03714725
81	Bancroft_Manholes-148	0.447	4.718	1,156.82	4.000676	4.718	1,402.19	4.849223125
82	Bancroft_Manholes-149	0.306	4.801	1,259.54	4.35592	4.801	0	0
83	Bancroft_Manholes-15	0.613	4.884	1,230.68	4.256115	4.884	0	0
84	Bancroft_Manholes-150	0.895	4.967	1,121.98	3.833445	4.967	0	0
85	Bancroft_Manholes-151	1.342	5.049	976.278	3.376295	5.049	0	0
86	Bancroft_Manholes-152	2.237	5.132	856.40	2.961703	5.132	1,727.75	5.975145792
87	Bancroft_Manholes-153	3.945	5.215	805.03	2.784076	5.215	1,720.82	5.951151875
88	Bancroft_Manholes-154	1.342	5.298	850.82	2.942412	5.298	1,708.09	5.907158417
89	Bancroft_Manholes-155	2.237	5.381	948.61	3.241091	5.381	1,701.40	5.813120083
90	Bancroft_Manholes-156	1.053	5.463	1,031.48	3.567184	5.463	1,702.61	5.888192917
91	Bancroft_Manholes-157	0.447	5.546	1,014.55	3.508642	5.546	1,706.26	5.900812375
92	Bancroft_Manholes-158	0.754	5.629	965.98	3.340688	5.629	1,701.71	5.885066583
93	Bancroft_Manholes-159	0.613	5.712	946.51	3.233923	5.712	1,692.65	5.78322425
94	Bancroft_Manholes-16	1.226	5.794	1,062.40	3.67412	5.794	1,611.31	5.572454
95	Bancroft_Manholes-160	2.402	5.877	1,324.08	4.57911	5.877	1,696.78	5.868044667
96	Bancroft_Manholes-161	1.814	5.96	1,620.64	5.6047	5.96	1,465.85	5.069394458
97	Bancroft_Manholes-162	1.955	6.043	1,798.65	6.220331	6.043	1,422.74	4.920312625
98	Bancroft_Manholes-163	2.261	6.126	1,883.50	6.435295	6.126	1,381.58	4.720412
99	Bancroft_Manholes-164	1.367	6.208	1,889.09	6.533113	6.208	0	0
100	Bancroft_Manholes-165	0	6.291	1,870.47	6.468719	6.291	0	0
101	Bancroft_Manholes-166	2.107	6.374	1,854.75	6.414333	6.374	0	0

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102	Bancroft_Manholes-167	5.73	6.457	1,869.53	6.387571	6.457	1,711.04	5.84603625
103	Bancroft_Manholes-168	0.25	6.539	1,890.62	6.538377	6.539	1,610.90	5.571036083
104	Bancroft_Manholes-169	3.36	6.622	1,908.93	6.601727	6.622	1,462.93	5.059313417
105	Bancroft_Manholes-17	2.413	6.705	1,826.78	6.317607	6.705	1,397.22	4.832066333
106	Bancroft_Manholes-170	20.12	6.788	1,665.46	5.759709	6.788	0	0
107	Bancroft_Manholes-171	6.415	6.871	1,459.05	4.98507	6.871	0	0
108	Bancroft_Manholes-172	1.62	6.953	1,281.11	4.430495	6.953	0	0
109	Bancroft_Manholes-173	52	7.036	1,168.46	4.040914	7.036	0	0
110	Bancroft_Manholes-174	2.107	7.119	1,170.04	4.046371	7.119	0	0
111	Bancroft_Manholes-175	4.214	7.202	1,275.04	4.356376	7.202	0	0
112	Bancroft_Manholes-176	0	7.284	1,385.19	4.790435	7.284	1,708.33	5.907967667
112	Bancroft_Manholes-176	46.9	7.367	1,417.72	4.902941	7.367	1,461.37	5.0539115
113	Bancroft_Manholes-177	1.053	7.45	1,313.92	4.54397	7.45	1,399.91	4.841358875
114	Bancroft_Manholes-178	4.214	7.533	1,161.76	4.017746	7.533	0	0
115	Bancroft_Manholes-179	1.053	7.616	980.093	3.348651	7.616	0	0
116	Bancroft_Manholes-18	1.053	7.698	824.91	2.8528	7.698	0	0
117	Bancroft_Manholes-180	0.537	7.781	718.68	2.485418	7.781	0	0
118	Bancroft_Manholes-181	2.107	7.864	696.15	2.407515	7.864	1,704.41	5.894417917
119	Bancroft_Manholes-182	0	7.947	809.76	2.766683	7.947	1,714.38	5.857461583
120	Bancroft_Manholes-183	1.053	8.029	1,033.19	3.573115	8.029	1,723.31	5.959780417
121	Bancroft_Manholes-184	3.181	8.112	1,211.95	4.191341	8.112	1,722.12	5.955661542
122	Bancroft_Manholes-185	2.127	8.195	1,244.82	4.305013	8.195	1,714.28	5.928551667
123	Bancroft_Manholes-186	2.107	8.278	1,152.94	3.987234	8.278	1,701.69	5.885018167
124	Bancroft_Manholes-187	2.147	8.361	1,045.23	3.571209	8.361	1,617.55	5.526629167
125	Bancroft_Manholes-188	22.6	8.443	1,003.79	3.47144	8.443	1,706.12	5.900335125
125	Bancroft_Manholes-188	1.611	8.526	1,100.49	3.805861	8.526	1,698.78	5.874954417
126	Bancroft_Manholes-189	5.267	8.609	1,332.95	4.609768	8.609	1,696.15	5.865848625
127	Bancroft_Manholes-19	0.919	8.692	1,606.51	5.488916	8.692	1,618.49	5.52982375
128	Bancroft_Manholes-190	13.901	8.774	1,782.50	6.164479	8.774	1,700.92	5.882358708
129	Bancroft_Manholes-191	12.803	8.857	1,842.74	6.372809	8.857	1,460.80	5.0519195
130	Bancroft_Manholes-192	3.16	8.94	1,832.15	6.336179	8.94	1,406.30	4.863436875
131	Bancroft_Manholes-193	3.16	9.023	1,803.50	6.23709	9.023	0	0
132	Bancroft_Manholes-194	4.214	9.106	1,790.29	6.116828	9.106	0	0
133	Bancroft_Manholes-195	18.2	9.188	1,793.06	6.20101	9.188	1,712.91	5.923817208
133	Bancroft_Manholes-195	1.029	9.271	1,806.76	6.248368	9.271	1,744.17	6.031917792
134	Bancroft_Manholes-196	5.267	9.354	1,827.55	6.32026	9.354	1,745.45	6.036344458
135	Bancroft_Manholes-197	9.374	9.437	1,827.36	6.243477	9.437	1,745.12	5.962489917
136	Bancroft_Manholes-198	4.214	9.519	1,773.36	6.132884	9.519	1,728.84	5.978918833
137	Bancroft_Manholes-199	0.895	9.602	1,675.51	5.794455	9.602	1,701.54	5.884502875

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138	Bancroft_Manholes-2	0	9.685	1,563.78	5.408073	9.685	1,456.46	5.036920708
139	Bancroft_Manholes-20	0.613	9.768	1,509.54	5.220496	9.768	1,399.46	4.839795708
140	Bancroft_Manholes-200	1.789	9.851	1,543.84	5.27477	9.851	0.00	0
141	Bancroft_Manholes-201	3.608	9.933	1,671.66	5.78114	9.933	0.00	0
142	Bancroft_Manholes-202	1.053	10.016	1,808.00	6.25267	10.016	0.00	0
143	Bancroft_Manholes-203	0	10.099	1,925.16	6.657835	10.099	1,724.38	5.963494667
144	Bancroft_Manholes-204	4.214	10.182	1,981.54	6.770268	10.182	1,704.97	5.825303917
145	Bancroft_Manholes-205	1.053	10.264	1,964.74	6.794733	10.264	1,616.38	5.589977375
146	Bancroft_Manholes-206	1.053	10.347	1,860.88	6.435526	10.347	1,699.70	5.878129167
147	Bancroft_Manholes-207	3.16	10.43	1,681.69	5.815841	10.43	1,612.87	5.57782825
147	Bancroft_Manholes-207	26.8	10.513	1,486.53	5.14092	10.513	1,703.50	5.891267375
148	Bancroft_Manholes-208	1.501	10.596	1,302.22	4.449252	10.596	1,704.40	5.823349583
149	Bancroft_Manholes-209	3.16	10.678	1,204.28	4.164809	10.678	1,712.90	5.923768792
150	Bancroft_Manholes-21	1.532	10.761	1,204.02	4.163909	10.761	1,713.17	5.924706
151	Bancroft_Manholes-210	4.214	10.844	1,290.88	4.46428	10.844	1,702.91	5.88924425
152	Bancroft_Manholes-211	2.107	10.927	1,424.89	4.868388	10.927	1,615.09	5.518207083
153	Bancroft_Manholes-212	1.053	11.009	1,540.03	5.325934	11.009	1,694.48	5.860062833
154	Bancroft_Manholes-213	1.501	11.092	1,631.05	5.640708	11.092	1,457.72	5.041288583
155	Bancroft_Manholes-214	0.447	11.175	1,722.92	5.958428	11.175	1,408.76	4.871961667
156	Bancroft_Manholes-215	1.053	11.258	1,796.06	6.211357	11.258	0	0
157	Bancroft_Manholes-216	0.895	11.341	1,846.41	6.308568	11.341	0	0
158	Bancroft_Manholes-217	7.833	11.423	1,850.77	6.40059	11.423	0	0
159	Bancroft_Manholes-218	0	11.506	1,838.40	6.357814	11.506	1,715.32	5.93215525
160	Bancroft_Manholes-219	0	11.589	1,829.72	6.327768	11.589	1,612.79	5.577555042
161	Bancroft_Manholes-22	1.532	11.672	1,811.04	6.187717	11.672	1,463.79	5.00127225
162	Bancroft_Manholes-220	2.684	11.754	1,741.74	6.023521	11.754	1,397.15	4.83182425
163	Bancroft_Manholes-221	0	11.837	1,618.31	5.596655	11.837	0	0
164	Bancroft_Manholes-222	1.053	11.92	1,446.37	5.00203	11.92	0	0
165	Bancroft_Manholes-223	0.447	12.003	1,279.65	4.425442	12.003	0	0
166	Bancroft_Manholes-224	0.447	12.086	1,180.14	4.032152	12.086	0	0
167	Bancroft_Manholes-225	1.053	12.168	1,180.43	4.082317	12.168	0	0
168	Bancroft_Manholes-226	0	12.251	1,286.81	4.450232	12.251	0	0
169	Bancroft_Manholes-227	2.107	12.334	1,390.40	4.808456	12.334	1,696.25	5.866180625
170	Bancroft_Manholes-228	0	12.417	1,417.58	4.843412	12.417	1,447.26	4.944798167
170	Bancroft_Manholes-228	26.7	12.499	1,312.30	4.538364	12.499	1,385.20	4.790476417
171	Bancroft_Manholes-229	0.613	12.582	1,158.89	4.007835	12.582	0	0
172	Bancroft_Manholes-23	0.919	12.665	979.52	3.3875	12.665	0.00	0
173	Bancroft_Manholes-230	0.613	12.748	819.09	2.832686	12.748	0.00	0
174	Bancroft_Manholes-231	1.36	12.831	710.93	2.429021	12.831	0.00	0

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175	Bancroft_Manholes-232	0	12.913	684.69	2.367897	12.913	1,720.48	5.949989875
176	Bancroft_Manholes-233	0	12.996	779.88	2.697095	12.996	1,706.01	5.899947792
177	Bancroft_Manholes-234	0	13.079	997.83	3.450832	13.079	1,696.62	5.867480958
178	Bancroft_Manholes-235	0	13.162	1,192.31	4.073736	13.162	1,689.90	5.773807917
179	Bancroft_Manholes-236	0	13.244	1,237.81	4.280756	13.244	1,615.76	5.587819375
180	Bancroft_Manholes-237	0	13.327	1,176.94	4.070237	13.327	1,718.10	5.941755583
181	Bancroft_Manholes-238	0	13.41	1,137.86	3.935092	13.41	1,720.71	5.950774917
182	Bancroft_Manholes-239	1.666	13.493	1,185.18	4.098754	13.493	1,717.74	5.940527875
183	Bancroft_Manholes-24	2.145	13.576	1,355.12	4.62999	13.576	1,704.89	5.82502375
184	Bancroft_Manholes-240	0.537	13.658	1,558.73	5.390594	13.658	1,614.99	5.585166833
185	Bancroft_Manholes-241	0.613	13.741	1,699.08	5.875975	13.741	1,690.51	5.846347083
186	Bancroft_Manholes-242	1.053	13.824	1,752.58	6.061016	13.824	1,447.84	5.007113333
187	Bancroft_Manholes-244	4.214	13.907	1,771.30	6.051955	13.907	1,395.35	4.767452667
188	Bancroft_Manholes-245	2.107	13.989	1,790.10	6.190756	13.989	0.00	0
189	Bancroft_Manholes-246	1.053	14.072	1,816.27	6.281274	14.072	0	0
190	Bancroft_Manholes-247	1.053	14.155	1,816.59	6.28237	14.155	0	0
191	Bancroft_Manholes-248	0	14.238	1,810.40	6.260974	14.238	1,698.15	5.87276875
192	Bancroft_Manholes-249	0	14.321	1,807.44	6.175413	14.321	1,447.51	4.945672833
193	Bancroft_Manholes-25	1.226	14.403	1,792.12	6.197762	14.403	1,383.93	4.78609125
194	Bancroft_Manholes-250	1.053	14.486	1,732.92	5.993008	14.486	0.00	0
195	Bancroft_Manholes-251	2.124	14.569	1,596.32	5.520589	14.569	0	0
196	Bancroft_Manholes-253	1.053	14.652	1,432.08	4.892923	14.652	0	0
197	Bancroft_Manholes-254	1.053	14.734	1,293.68	4.473973	14.734	0	0
198	Bancroft_Manholes-255	1.053	14.817	1,220.38	4.220464	14.817	0	0
199	Bancroft_Manholes-256	5.65	14.9	1,254.36	4.338005	14.9	0.00	0
200	Bancroft_Manholes-257	2.755	14.983	1,340.99	4.63759	14.983	1,689.89	5.844206375
201	Bancroft_Manholes-258	1.59	15.066	1,354.08	4.626447	15.066	1,460.29	4.989324167
202	Bancroft_Manholes-259	3.16	15.148	1,286.86	4.450391	15.148	1,423.26	4.922114417
203	Bancroft_Manholes-26	2.451	15.231	1,135.37	3.926478	15.231	1,391.21	4.81128175
204	Bancroft_Manholes-260	2.909	15.314	978.59	3.384304	15.314	0.00	0
205	Bancroft_Manholes-261	0.447	15.397	831.08	2.83953	15.397	0	0
206	Bancroft_Manholes-27	1.226	15.479	749.43	2.591793	15.479	1,468.42	5.078268542
207	Bancroft_Manholes-28	2.145	15.562	794.16	2.746467	15.562	1,424.66	4.926952625
208	Bancroft_Manholes-29	1.226	15.645	1,031.07	3.565777	15.645	1,386.36	4.794484625
209	Bancroft_Manholes-3	0.613	15.728	1,380.37	4.773769	15.728	0.00	0
209	Bancroft_Manholes-3	59.1	15.811	1,613.43	5.512546	15.811	0	0
210	Bancroft_Manholes-30	1.666	15.893	1,650.63	5.708429	15.893	1,701.90	5.885744417
211	Bancroft_Manholes-32	2.403	15.976	1,588.15	5.492345	15.976	1,612.63	5.57699825
212	Bancroft_Manholes-33	3.332	16.059	1,562.06	5.402121	16.059	1,474.88	5.1006405

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213	Bancroft_Manholes-34	3.015	16.142	1,573.18	5.375018	16.142	1,420.99	4.855038917
214	Bancroft_Manholes-36	0.89	16.224	1,587.89	5.491446	16.224	0.00	0
215	Bancroft_Manholes-37	1.053	16.307	1,555.14	5.378203	16.307	0.00	0
216	Bancroft_Manholes-38	1.071	16.39	1,467.34	5.07454	16.39	0	0
217	Bancroft_Manholes-39	0	16.473	1,406.10	4.862752	16.473	0	0
218	Bancroft_Manholes-4	0	16.556	1,406.71	4.806263	16.556	1,718.64	5.872002917
219	Bancroft_Manholes-40	2.448	16.638	1,456.96	5.038664	16.638	1,690.52	5.846392042
220	Bancroft_Manholes-41	1.6	16.721	1,514.66	5.238196	16.721	1,446.78	5.003433667
221	Bancroft_Manholes-42	0.835	16.804	1,476.88	5.107526	16.804	1,388.04	4.800287708
222	Bancroft_Manholes-43	0.306	16.887	1,366.11	4.667525	16.887	0.00	0
223	Bancroft_Manholes-44	2.603	16.969	1,202.19	4.157574	16.969	0.00	0
224	Bancroft_Manholes-45	0.306	17.052	1,064.62	3.681825	17.052	0.00	0
225	Bancroft_Manholes-46	23.846	17.135	1,012.26	3.500719	17.135	0	0
225	Bancroft_Manholes-46	6.8	17.218	1,109.16	3.835831	17.218	0	0
226	Bancroft_Manholes-47	1.053	17.301	1,308.06	4.469208	17.301	1,471.78	5.028581667
227	Bancroft_Manholes-48	6.715	17.383	1,483.78	5.131399	17.383	1,443.21	4.991094333
228	Bancroft_Manholes-49	11.781	17.466	1,495.74	5.172774	17.466	1,441.93	4.986664208
229	Bancroft_Manholes-5	0	17.549	1,371.96	4.744698	17.549	1,462.73	5.05862175
230	Bancroft_Manholes-50	2.107	17.632	1,188.16	4.05953	17.632	1,695.44	5.792743083
231	Bancroft_Manholes-51	2.107	17.714	997.19	3.448626	17.714	1,728.12	5.976415
232	Bancroft_Manholes-52	20.52	17.797	880.05	3.043506	17.797	1,745.45	6.036344458
233	Bancroft_Manholes-53	6.321	17.88	882.13	3.050682	17.88	1,745.45	6.036344458
234	Bancroft_Manholes-54	1.053	17.963	1,109.15	3.835793	17.963	1,745.45	6.036344458
235	Bancroft_Manholes-55	1.266	18.046	1,496.17	5.111924	18.046	1,745.45	5.963617417
235	Bancroft_Manholes-55	7.8	18.128	1,857.05	6.422298	18.128	1,745.45	6.036344458
236	Bancroft_Manholes-56	0.306	18.211	1,989.97	6.881966	18.211	1,730.66	5.98519225
237	Bancroft_Manholes-57	4.214	18.294	2,028.45	7.015063	18.294	1,705.48	5.898107958
238	Bancroft_Manholes-58	1.684	18.377	2,026.40	6.923547	18.377	1,462.72	4.997630083
239	Bancroft_Manholes-59	3.59	18.459	2,013.50	6.963361	18.459	1,406.67	4.864726833
240	Bancroft_Manholes-6	0	18.542	2,007.24	6.941705	18.542	0.00	0
241	Bancroft_Manholes-60	12.85	18.625	2,006.51	6.939167	18.625	0.00	0
241	Bancroft_Manholes-60	9.6	18.708	2,011.93	6.957914	18.708	0.00	0
242	Bancroft_Manholes-61	3.064	18.791	2,023.41	6.913328	18.791	0.00	0
243	Bancroft_Manholes-62	0.613	18.873	2,022.04	6.992871	18.873	1,691.04	5.848176542
244	Bancroft_Manholes-63	1.3	18.956	1,974.60	6.828818	18.956	1,450.15	5.015112458
244	Bancroft_Manholes-63	1.36	19.039	1,862.16	6.43997	19.039	1,395.50	4.826111083
245	Bancroft_Manholes-64	0.919	19.122	1,676.37	5.727598	19.122	0	0
246	Bancroft_Manholes-65	0.777	19.204	1,461.70	5.055053	19.204	0	0
247	Bancroft_Manholes-66	1.532	19.287	1,243.36	4.299967	19.287	0	0

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248	Bancroft_Manholes-67	0.613	19.37	1,086.25	3.756625	19.37	0.00	0
249	Bancroft_Manholes-68	0.613	19.453	1,013.53	3.505118	19.453	0.00	0
249	Bancroft_Manholes-68	142.8	19.536	1,075.68	3.675233	19.536	0.00	0
250	Bancroft_Manholes-69	0.306	19.618	1,208.60	4.179738	19.618	1,473.65	5.096383292
251	Bancroft_Manholes-7	1.053	19.701	1,300.22	4.496608	19.701	1,435.62	4.964859417
252	Bancroft_Manholes-70	0	19.784	1,274.27	4.406857	19.784	1,413.72	4.889108083
253	Bancroft_Manholes-71	0	19.867	1,142.48	3.903473	19.867	1,393.45	4.760937083
254	Bancroft_Manholes-72	0	19.949	985.02	3.406527	19.949	0.00	0
255	Bancroft_Manholes-73	0	20.032	830.04	2.870569	20.032	0.00	0
256	Bancroft_Manholes-74	0	20.115	734.17	2.539018	20.115	1,696.30	5.866353542
257	Bancroft_Manholes-75	0	20.198	748.41	2.588237	20.198	1,464.18	5.063612125
258	Bancroft_Manholes-76	0.306	20.281	934.86	3.194105	20.281	1,420.64	4.853843083
259	Bancroft_Manholes-77	0.919	20.363	1,264.50	4.373076	20.363	1,382.65	4.781657667
260	Bancroft_Manholes-78	0	20.446	1,526.05	5.277603	20.446	0.00	0
261	Bancroft_Manholes-79	0	20.529	1,582.83	5.47394	20.529	0	0
262	Bancroft_Manholes-8	0	20.612	1,536.69	5.250364	20.612	1,473.98	5.036112
263	Bancroft_Manholes-80	0	20.694	1,511.36	5.226776	20.694	1,427.10	4.935384042
264	Bancroft_Manholes-81	0	20.777	1,577.73	5.456313	20.777	1,373.46	4.749896333
265	Bancroft_Manholes-82	0	20.86	1,672.57	5.784301	20.86	0.00	0
266	Bancroft_Manholes-83	2.644	20.943	1,708.85	5.909769	20.943	0.00	0
267	Bancroft_Manholes-84	3.559	21.026	1,659.38	5.669548	21.026	0.00	0
268	Bancroft_Manholes-85	5.449	21.108	1,582.83	5.473943	21.108	0.00	0
269	Bancroft_Manholes-86	8.347	21.191	1,544.29	5.340683	21.191	0	0
270	Bancroft_Manholes-87	9.3	21.274	1,554.97	5.377598	21.274	0	0
270	Bancroft_Manholes-87	1.789	21.357	1,564.65	5.345894	21.357	0	0
271	Bancroft_Manholes-88	0.938	21.439	1,496.51	5.175437	21.439	1,691.00	5.848048583
272	Bancroft_Manholes-89	1.475	21.522	1,358.52	4.698225	21.522	1,446.62	5.002890708
273	Bancroft_Manholes-9	0.306	21.605	1,169.12	4.043203	21.605	1,396.73	4.830351
274	Bancroft_Manholes-90	2.505	21.688	980.26	3.390069	21.688	0.00	0
275	Bancroft_Manholes-91	0.895	21.771	802.96	2.743457	21.771	0	0
276	Bancroft_Manholes-92	0.447	21.853	673.65	2.329696	21.853	1,742.64	6.026626542
277	Bancroft_Manholes-93	0.895	21.936	583.15	2.016737	21.936	1,745.45	6.036344458
278	Bancroft_Manholes-94	1.342	22.019	574.10	1.985419	22.019	1,745.45	6.036344458
279	Bancroft_Manholes-95	0.447	22.102	690.35	2.358699	22.102	1,735.70	5.930315167
280	Bancroft_Manholes-96	0	22.184	937.78	3.24317	22.184	1,720.64	5.950557042
281	Bancroft_Manholes-97	0.895	22.267	1,192.50	4.124056	22.267	1,711.71	5.919670667
282	Bancroft_Manholes-98	0.895	22.35	1,326.45	4.587306	22.35	1,711.95	5.920507583
283	Bancroft_Manholes-99	1.342	22.433	1,397.24	4.832104	22.433	1,712.18	5.921285708
284	MH-1	0.45	22.516	1,488.06	5.084215	22.516	1,704.07	5.822252833

ID	Label	Base Flow (m^3/day)	Time (hours)	Updated Output - Flow (m^3/day)	Vol (m^3)	Time (hours)	DQ SPS output - Flow (m^3/day)	Vol (m^3)
285	MH-2	1.518	22.598	1,639.61	5.670314	22.598	1,690.54	5.846433542
286	MH-3	2.107	22.681	1,787.75	6.182635	22.681	1,462.45	5.057643042
287	MH-4	0	22.764	1,884.79	6.518222	22.764	1,422.12	4.918168458
288	MH-5	3.697	22.847	1,931.09	6.597901	22.847	1,382.86	4.724775083
289	MH-6	0	22.929	1,955.55	6.762937	22.929	0.00	0
290	MH-7	1.673	23.012	1,960.44	6.779852	23.012	0.00	0
291	MH-9	0	23.095	1,997.56	6.908215	23.095	0.00	0
292	MH-10	0	23.178	2,033.08	7.031072	23.178	0.00	0
293	MH-11	5.109	23.261	2,048.46	6.998891	23.261	1,721.17	5.880653917
576	MH-111	2.296	23.343	2,004.11	6.930891	23.343	1,693.71	5.85741375
597	MH-20	0	23.426	1,883.17	6.512633	23.426	1,448.66	5.009938792
599	MH-19	0	23.509	1,680.38	5.811325	23.509	1,387.20	4.797386167
601	MH-18	0	23.592	1,451.98	4.960915	23.592	0	0
603	MH-17	0	23.674	1,224.86	4.235967	23.674	0.00	0
605	MH-16	0	23.757	1,063.17	3.6768	23.757	0.00	0
607	MH-15	0	23.84	996.99	3.447931	23.84	0	0
609	MH-14	0	23.923	1,285.61	4.124675	23.923	0	0
611	MH-13	0	24	**Sum**	**Peak**	24	**Sum**	**Peak**
613	MH-12	0	**Avg Flow**	1236.140594	2048.456	**Avg Flow**	851.9581	1745.449
615	MH-011	0	1236.1626		**Avg (l/s)**	851.644093		**Avg (l/s)**
617	MH-010	0			14.30744			9.856991819
619	MH-09	0						
621	MH-08	0						
654	Faraday	129						
	Total Flow	1232.006						

Building Bancroft
0T-09-185-00-MA

Stormwater System
Assessment – Final
May 6, 2010

Prepared for:
Greenview Environmental Management
69 Cleak Avenue,
Bancroft, ON
K0L1C0

Prepared by:
GENIVAR, Ontario Inc.
69 Cleak Avenue,
Bancroft, ON
K0L1C0

Project No. OT-09-185-00-MA

GENIVAR

Project No. OT-09-185-00-MA

May 4, 2010

Mr. Tyler Peters,
Greenview Environmental Management
69 Cleak Ave., PO Box 100
Bancroft, Ontario

Re: Building Bancroft
Stormwater System Assessment

Mr. Peters,

GENIVAR's Bancroft office is pleased to present the results of the stormwater systems analysis conducted as part of the Building Bancroft development plan. To conduct this analysis, the existing stormwater infrastructure for the Town of Bancroft was assessed under current conditions and those proposed after the completion of the project.

This report outlines the steps taken and the results of the analysis. Recommendations for system modifications and new construction are given to ensure the infrastructure will adequately convey surface runoff from future construction.

Yours truly,
GENIVAR Consultants LP

Gord Krieger, P.Eng.
Principal, Transportation Ontario

Table of Contents

List of Tables

1. Introduction

The purpose of this report is to present the findings of the Stormwater Infrastructure Study conducted for the Building Bancroft project.

2. Methodology

The work completed involved several tasks required to develop an accurate understanding of the current stormwater infrastructure within the Building Bancroft study area. Completed tasks include:

1. Assemble as-built drawings of completed road works for the Town.
2. From the drawings collect information on existing infrastructure (e.g. pipe diameter, length, slope, material, location).
3. Augment missing or deficient information with previously assembled survey data in the downtown area.
4. Identify locations where data are missing or incomplete.
5. Obtain accurate up to date information from field measurements (e.g. inverts, pipe diameter, material, location).
6. Combine all information in tabular form.
7. Add pipe locations to existing survey drawing of downtown Bancroft.
8. Determine approximate drainage areas using available topographic information.
9. Conduct a hydrologic analysis to determine peak system flows.
10. Update expected system inflows based on planned development.
11. Identify areas where replacement of existing infrastructure or additional stormwater management will be required.

3. Results

From the study it is expected that the proposed construction for the Building Bancroft project will have a minimal impact on the existing stormwater infrastructure. As part of the current Building Bancroft proposal, five parking lots are planned – of primary consideration are three on the east side of the York River; two to the west of Hastings St. and one associated with a planned motel on Station St. **Figure 1** is attached which indicates the locations of the proposed parking lots and their associated outfalls. In addition, one of the outfalls overlaps with the proposed work and should be removed and replaced in a location which doesn't interfere with the proposed buildings.

Figure 1 (**Appendix A**) shows the proposed parking lots at:

A – The proposed motel development north of Station St.
B – West of Hastings St and south of Station St.
C – West of Hastings St, west of Flint St.

Figure 1 (**Appendix B**) show the additional parking areas on the west side of the York River. The drainage of these two small lots is not significant and will be conveyed primarily with open ditches and without impact to existing systems.

Calculations on the capacity of the existing stormwater infrastructure are included in **Appendix C**. These calculations quantify and show the following:

1. That the existing stormwater infrastructure is capable of conveying water from a 5 year acute storm. In two specific, small locations, localized flooding of catch basins will occur. However, both catch basins are in areas where excess water is easily conveyed by other nearby catch basins. No arterial sewers are stressed beyond their capacity by a 5 year design storm.
2. Additional pipe installations with a conservative minimum slope will adequately convey surface water and the system as a whole will not be impacted by the proposed developments.

It should be noted that the location and configuration of drainage for the proposed parking lots is not a final design and may change. However, since the time of collection is short (for the small drainage area) the main stormwater outfalls will be able to convey the rainwater appropriately regardless of the parking lot drainage configuration.

For the purposes of this study it was assumed that the runoff coefficient for the lands considered for development in the Building Bancroft project would have an 'R' value of 0.9. In some areas this is a significant increase, however, these areas are immediately adjacent to the York river and the effect of increased runoff into the storm system will be minute at these locations.

As part of the proposed construction, raised concrete curb "bump-outs" which partially protect on-street parking are planned for some sections of Hastings St. In two locations catch basins currently exist where there are proposed bump-outs. These catch basins will have to be removed and replaced in new locations to ensure proper drainage is maintained. These catch basins are shown in **Appendix D**.

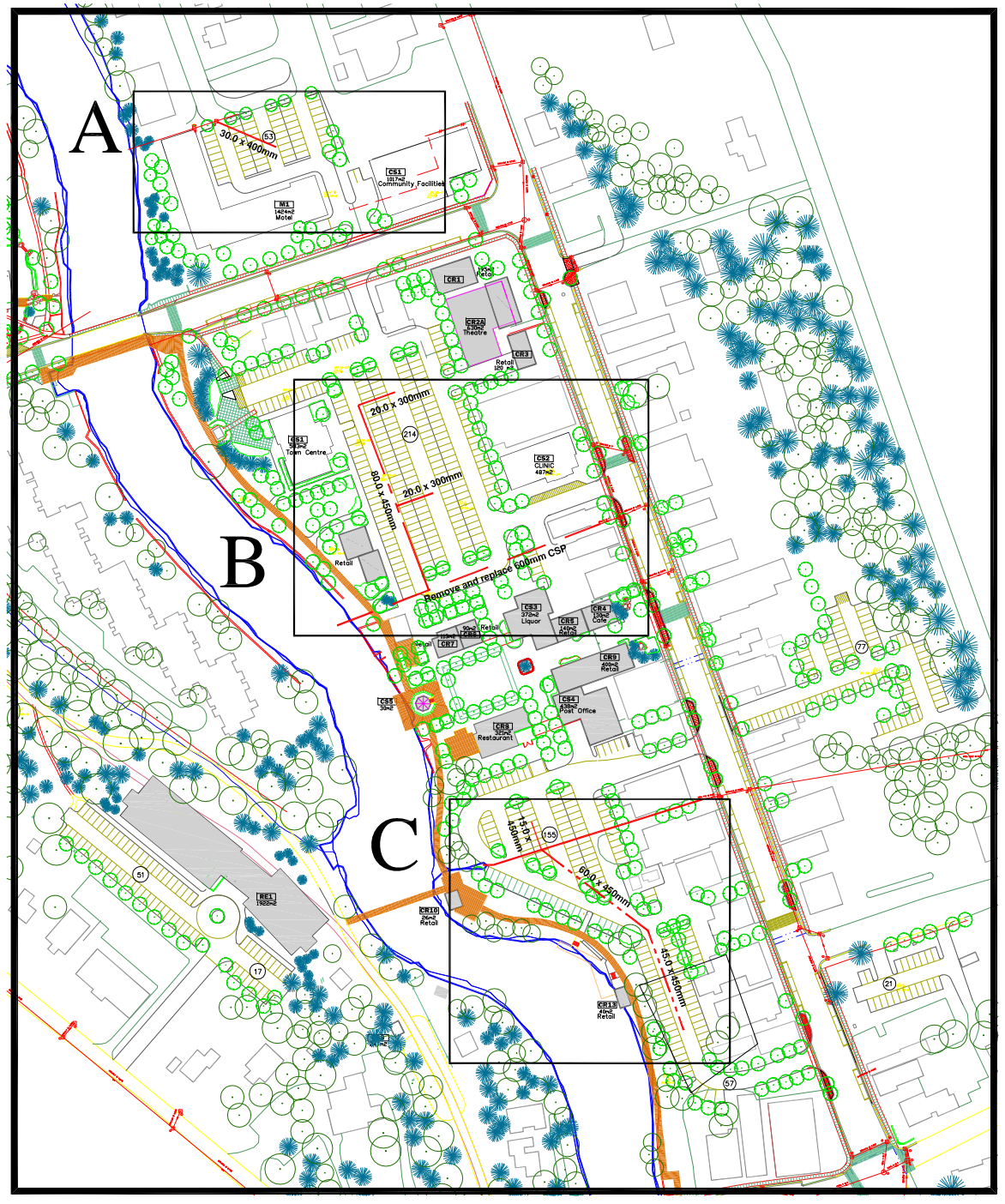
4. Conclusions

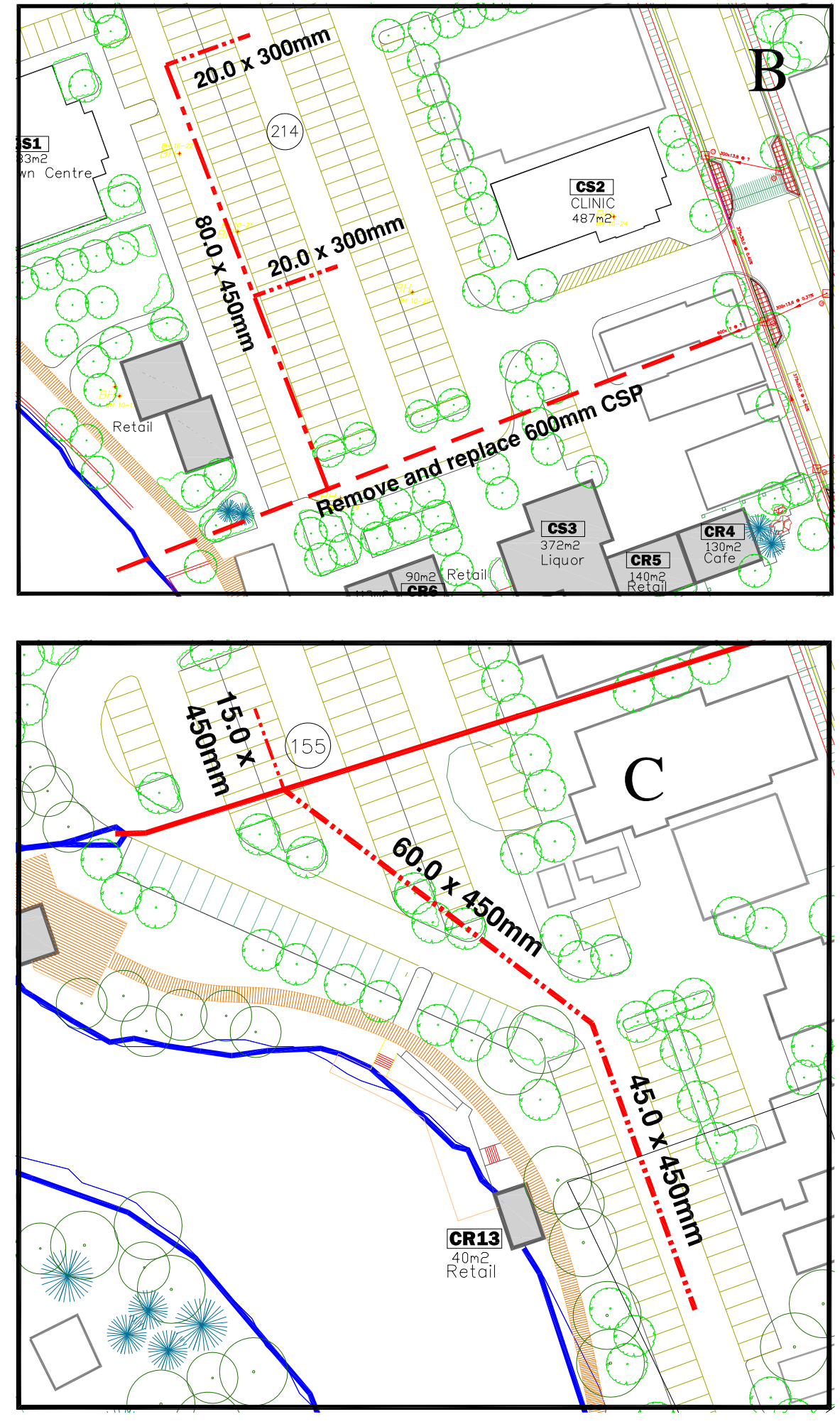
Overall the impact of the Building Bancroft project on the existing stormwater system would be minimal. Surface water runoff from the proposed parking lot developments will tie in with nearby existing outfalls. **Table 1** summarzies the pipe installations and replacements required.

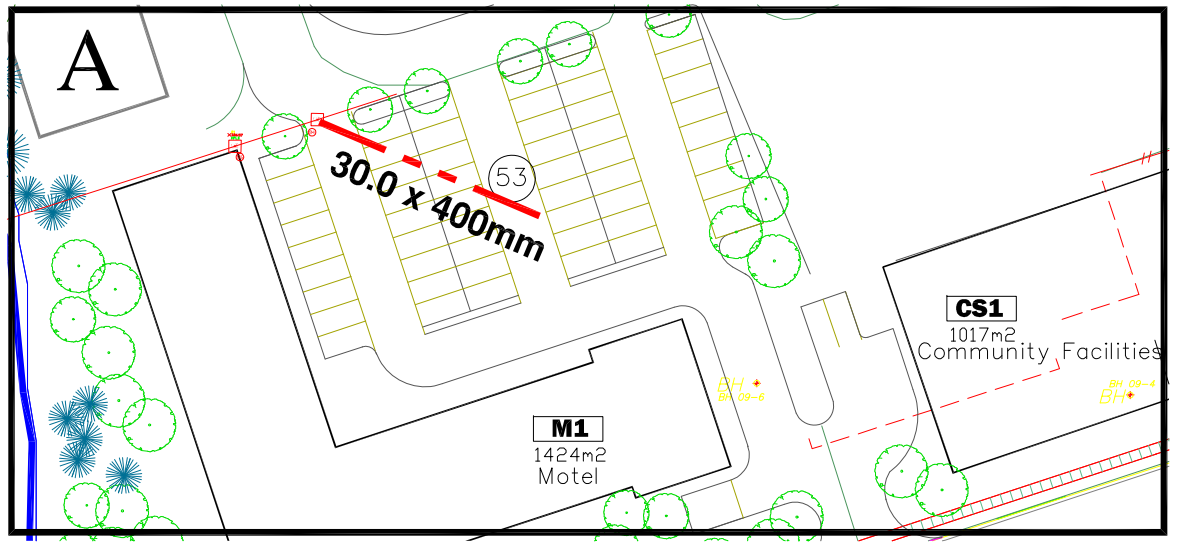
Table 1 - New Stormwater Pipe Installation Locations

Description	Size (mm)	Length (m)
Remove and replace existing pipe	600	125
Parking Lot (SW corner of Station and Hastings St.)	450	80
	300	40
Parking Lot (W of Hastings across from Flint St.)	450	120
Parking Lot (N of Station at proposed motel parking lot)	400	30

APPENDIX A:
Stormwater system installations







LEGEND

- EXISTING FACILITIES
- PROPOSED FACILITIES
- VEHICULAR PARKING
- BUS PARKING
- BOARDWALK/DECK/BRIDGE
- PEDESTRIAN CROSSING
- STREETSCAPE BUMP-OUT
- PASSENGER DROP-OFF
- EXISTING DECID./ CONIFEROUS TREES
- PROPOSED DECID./ CONIFEROUS TREES
- NEW STORM SEWER
- REMOVE AND REPLACE EXISTING STORM SEWER

Building Bancroft: Storm Sewer Improvements

Appendix A

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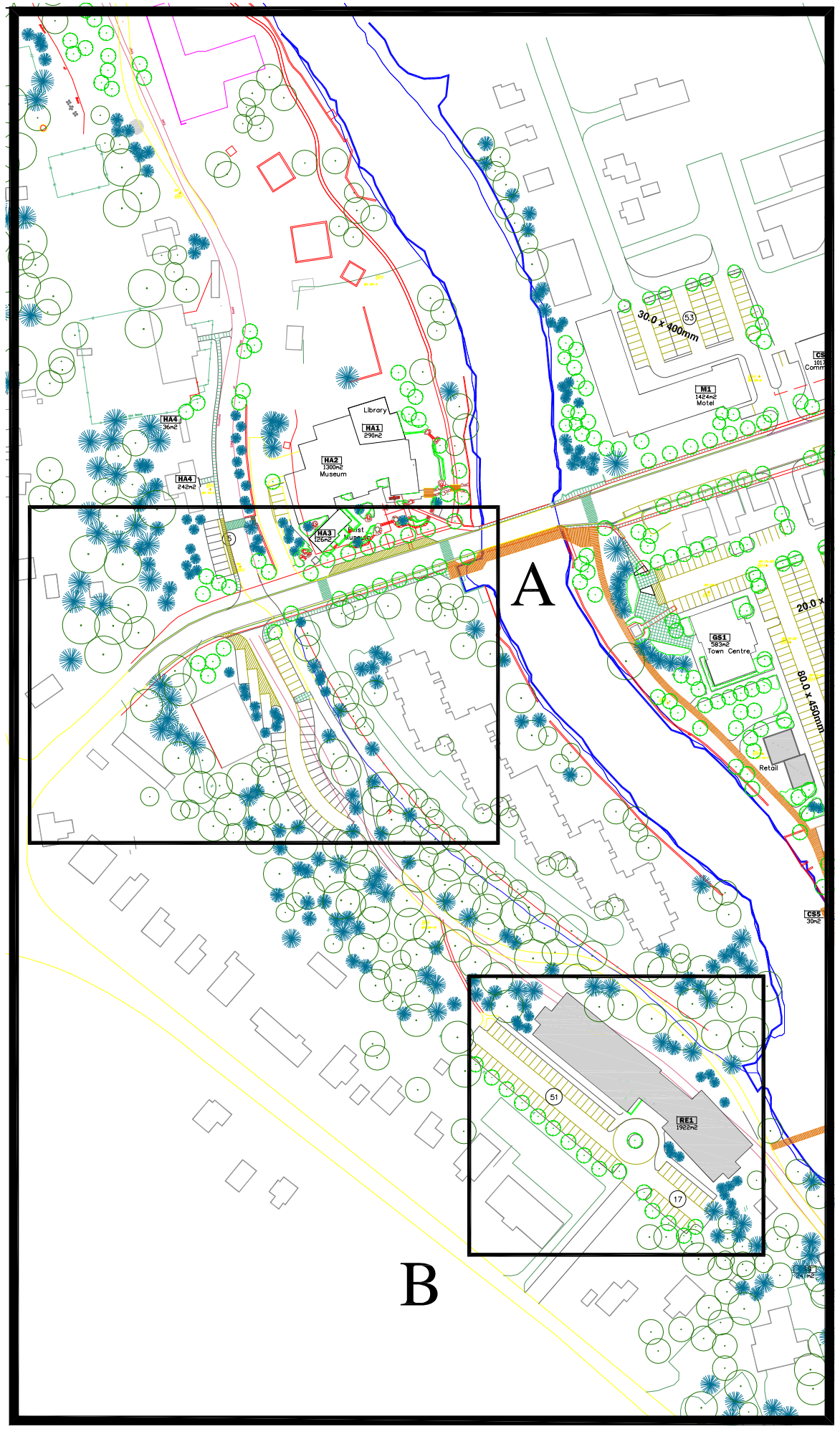
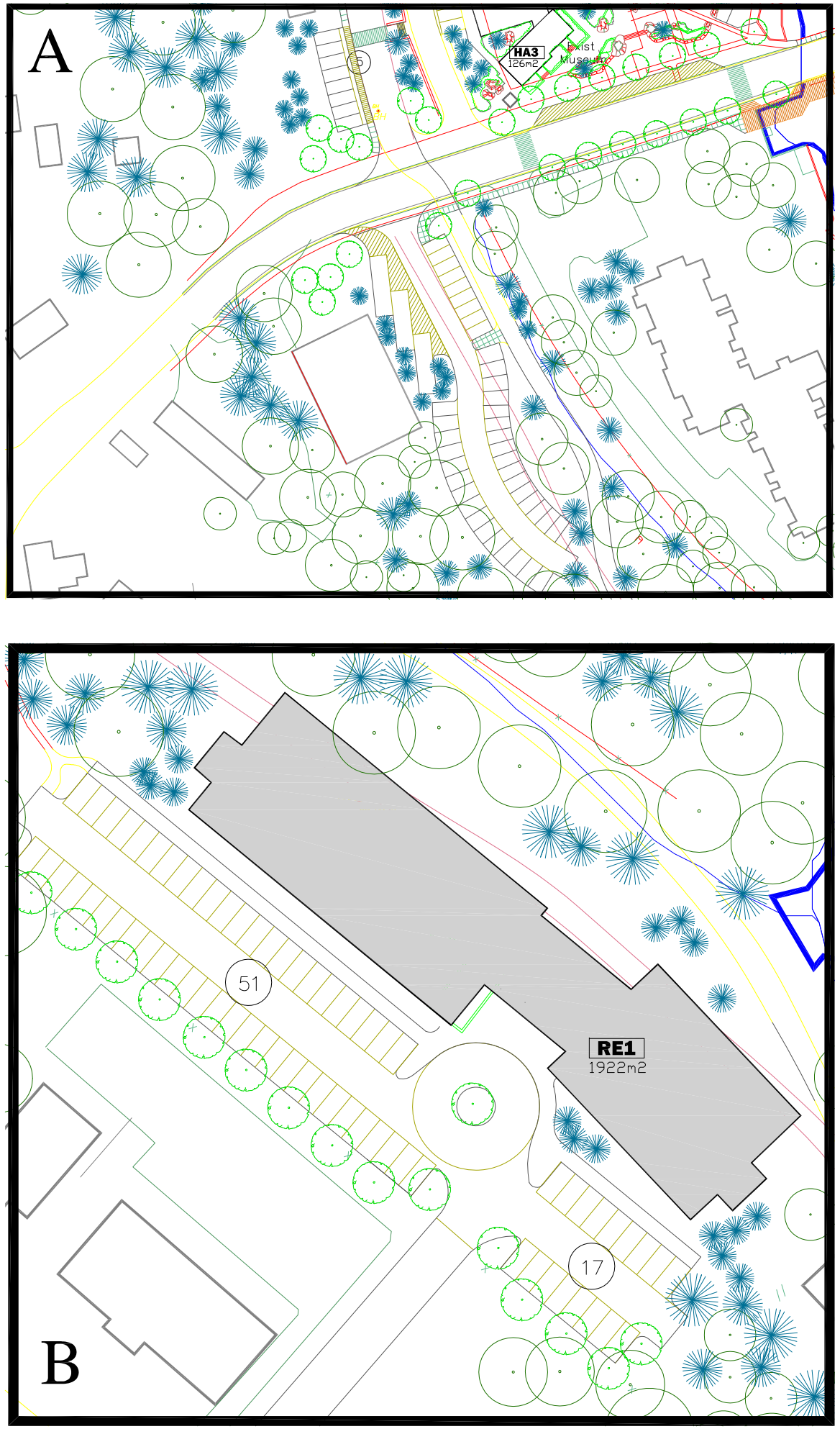
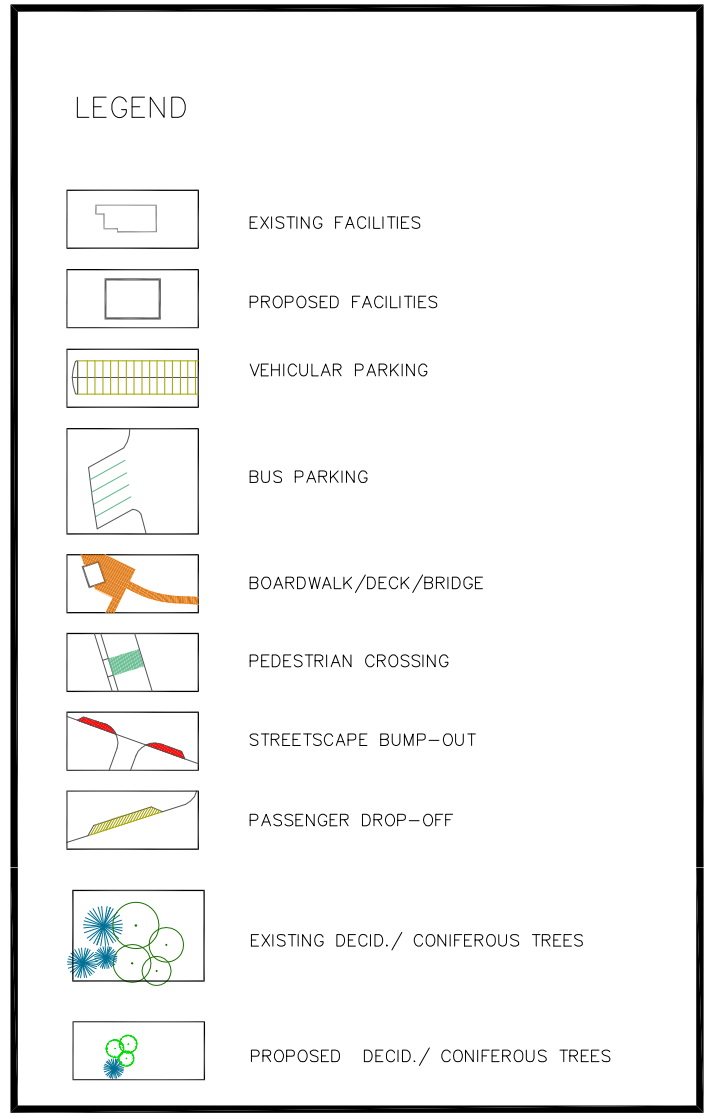
APPENDIX B:
Additional Parking Lot Locations







Building Bancroft:
Additional Parking
West of York River

Appendix B

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APPENDIX C:
Stormwater System Capacity Calculations

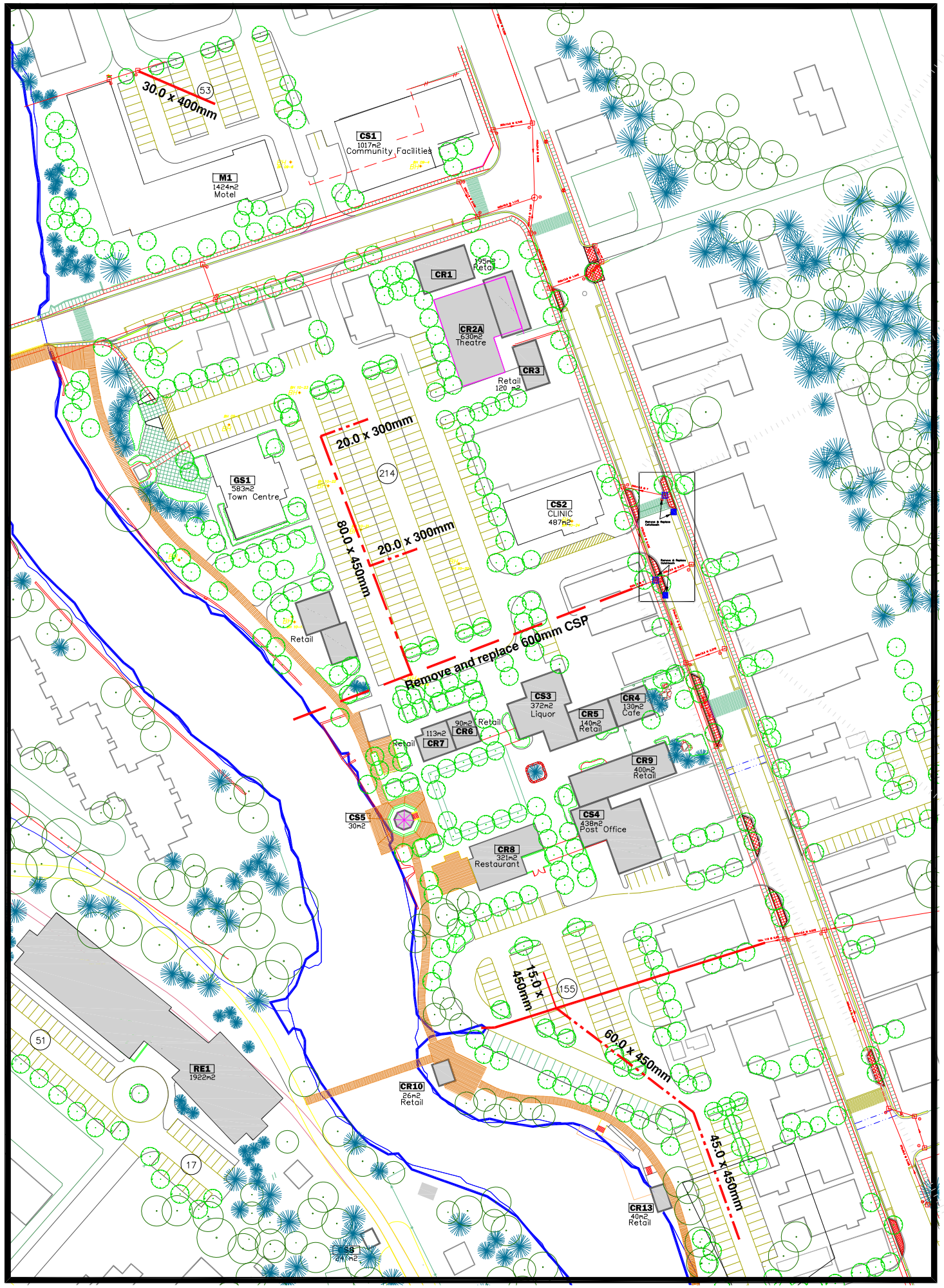
Catch Basin	Area		R	2.78 x A x R	i		Time	Cumulative 2.78AR	Max Flow	Length	Pipe Size	Manning's Number	Slope	Area	Perimeter	Hydraulic Radius	Max Flow	Velocity	Time (minutes)
					Initial Time:		10.00												
32	0.123	ha	0.4	0.137	85.86	mm/hr	10.50	0.14	**11.8**	28.3	300	0.012	0.4	0.071	0.942	0.075	**66.3**	0.94	0.50
33	0.645	ha	0.4	0.717	85.86	mm/hr	10.25	0.72	**61.5**	13.6	300	0.012	0.37	0.071	0.942	0.075	**63.7**	0.90	0.25
34	0.085	ha	0.4	0.094	83.88	mm/hr	10.96	0.95	**79.5**	30	375	0.012	0.4	0.110	1.178	0.09375	**120.1**	1.09	0.46
35	0.240	ha	0.4	0.267	85.86	mm/hr	10.25	0.27	**22.9**	13.6	300	0.012	0.37	0.071	0.942	0.075	**63.7**	0.90	0.25
36	0.821	ha	0.4	0.913	85.86	mm/hr	10.26	0.91	**78.4**	13.8	300	0.012	0.37	0.071	0.942	0.075	**63.7**	0.90	0.26
37	0.160	ha	0.4	0.178	84.84	mm/hr	10.71	1.09	**92.6**	30	375	0.012	0.4	0.110	1.178	0.09375	**120.1**	1.09	0.46
38	0.073	ha	0.4	0.081	83.07	mm/hr	12.12	2.39	**198.3**	125	600	0.012	0.4	0.283	1.885	0.15	**420.7**	1.49	1.40

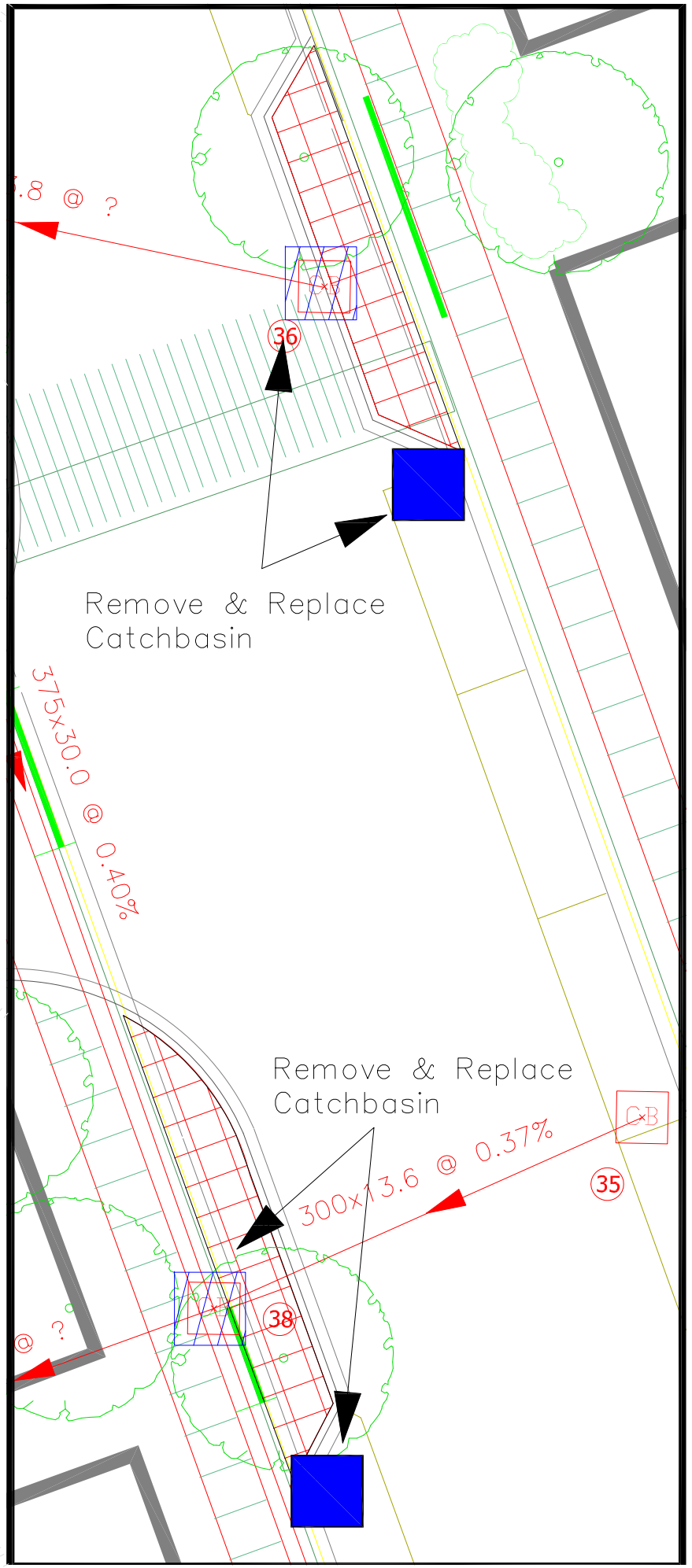
Catch Basin	Area		R	2.78 x A x R	i		Time	Cumulative 2.78AR	Max Flow	Length	Pipe Size	Manning's Number	Slope	Area	Perimeter	Hydraulic Radius	Max Flow	Velocity	Time (minutes)
					Initial Time:		10.00												
32	0.123	ha	0.4	0.137	85.86	mm/hr	10.50	0.14	**11.8**	28.3	300	0.012	0.4	0.071	0.942	0.075	**66.3**	0.94	0.50
33	0.645	ha	0.4	0.717	85.86	mm/hr	10.25	0.72	**61.5**	13.6	300	0.012	0.37	0.071	0.942	0.075	**63.7**	0.90	0.25
34	0.085	ha	0.4	0.094	83.88	mm/hr	10.96	0.95	**79.5**	30	375	0.012	0.4	0.110	1.178	0.09375	**120.1**	1.09	0.46
35	0.240	ha	0.4	0.267	85.86	mm/hr	10.25	0.27	**22.9**	13.6	300	0.012	0.37	0.071	0.942	0.075	**63.7**	0.90	0.25
36	0.821	ha	0.4	0.913	85.86	mm/hr	10.26	0.91	**78.4**	13.8	300	0.012	0.37	0.071	0.942	0.075	**63.7**	0.90	0.26
37	0.160	ha	0.4	0.178	84.84	mm/hr	10.71	1.09	**92.6**	30	375	0.012	0.4	0.110	1.178	0.09375	**120.1**	1.09	0.46
38	0.073	ha	0.4	0.081	83.07	mm/hr	11.61	2.39	**198.3**	80	600	0.012	0.4	0.283	1.885	0.15	**420.7**	1.49	0.90
125	0.215	ha	0.9	0.538	85.86	mm/hr	10.71	0.54	**46.2**	20	300	0.012	0.1	0.071	0.942	0.075	**33.1**	0.47	0.71
126	0.187	ha	0.9	0.468	83.08	mm/hr	11.93	1.01	**83.5**	45	450	0.012	0.1	0.159	1.414	0.1125	**97.7**	0.61	1.22
127	0.149	ha	0.9	0.374	85.86	mm/hr	10.71	0.37	**32.1**	20	300	0.012	0.1	0.071	0.942	0.075	**33.1**	0.47	0.71
128	0.082	ha	0.9	0.205	83.08	mm/hr	11.66	0.58	**48.1**	35	450	0.012	0.1	0.159	1.414	0.1125	**97.7**	0.61	0.95
129	0.129	ha	0.9	0.322	78.74	mm/hr	12.44	4.29	**338.0**	45	600	0.012	0.4	0.283	1.885	0.15	**420.7**	1.49	0.50

Catch Basin	Area		R	2.78 x A x R	i		Time	Cumulative 2.78AR	Max Flow	Length	Pipe Size	Manning's Number	Slope	Area	Perimeter	Hydraulic Radius	Max Flow	Velocity	Time (minutes)
					Initial Time:		10.00												
87	0.208	ha	0.2	0.115	85.86	mm/hr	10.40	0.12	**9.9**	23.44	900	0.012	0.1	0.636	2.827	0.225	**620.2**	0.97	0.40
88	1.005	ha	0.2	0.559	84.27	mm/hr	10.58	0.67	**56.8**	10.68	900	0.012	0.1	0.636	2.827	0.225	**620.2**	0.97	0.18
90	1.005	ha	0.2	0.559	83.57	mm/hr	10.67	1.23	**103.0**	19.03	900	0.012	1.29	0.636	2.827	0.225	**2227.5**	3.50	0.09
91	1.005	ha	0.2	0.559	83.22	mm/hr	12.60	1.79	**149.1**	112.7	900	0.012	0.1	0.636	2.827	0.225	**620.2**	0.97	1.93
26	0.239	ha	0.4	0.266	85.86	mm/hr	10.52	0.27	**22.8**	35	375	0.012	0.43	0.110	1.178	0.09375	**124.6**	1.13	0.52
27	0.790	ha	0.4	0.878	85.86	mm/hr	10.20	0.88	**75.4**	11	300	0.012	0.4	0.071	0.942	0.075	**66.3**	0.94	0.20
28	0.228	ha	0.4	0.254	85.08	mm/hr	10.36	1.13	**96.3**	9	300	0.012	0.4	0.071	0.942	0.075	**66.3**	0.94	0.16
29	0.186	ha	0.4	0.207	83.82	mm/hr	11.36	1.60	**134.5**	62	450	0.012	0.4	0.159	1.414	0.1125	**195.3**	1.23	0.84
30	0.952	ha	0.4	1.058	76.57	mm/hr	12.78	4.45	**341.1**	13.9	600	0.012	0.3	0.283	1.885	0.15	**364.3**	1.29	0.18
31	0.112	ha	0.4	0.125	76.01	mm/hr	14.28	4.58	**348.1**	110	750	0.012	0.2	0.442	2.356	0.1875	**539.4**	1.22	1.50

Catch Basin	Area		R	2.78 x A x R	i		Time	Cumulative 2.78AR	Max Flow	Length	Pipe Size	Manning's Number	Slope	Area	Perimeter	Hydraulic Radius	Max Flow	Velocity	Time (minutes)
					Initial Time:		10.00												
87	0.208	ha	0.2	0.115	85.86	mm/hr	10.40	0.12	**9.9**	23.44	900	0.012	0.1	0.636	2.827	0.225	**620.2**	0.97	0.40
88	1.005	ha	0.2	0.559	84.27	mm/hr	10.58	0.67	**56.8**	10.68	900	0.012	0.1	0.636	2.827	0.225	**620.2**	0.97	0.18
90	1.005	ha	0.2	0.559	83.57	mm/hr	10.67	1.23	**103.0**	19.03	900	0.012	1.29	0.636	2.827	0.225	**2227.5**	3.50	0.09
91	1.005	ha	0.2	0.559	83.22	mm/hr	12.60	1.79	**149.1**	112.7	900	0.012	0.1	0.636	2.827	0.225	**620.2**	0.97	1.93
26	0.239	ha	0.4	0.266	85.86	mm/hr	10.52	0.27	**22.8**	35	375	0.012	0.43	0.110	1.178	0.09375	**124.6**	1.13	0.52
27	0.790	ha	0.4	0.878	85.86	mm/hr	10.20	0.88	**75.4**	11	300	0.012	0.4	0.071	0.942	0.075	**66.3**	0.94	0.20
28	0.228	ha	0.4	0.254	85.08	mm/hr	10.36	1.13	**96.3**	9	300	0.012	0.4	0.071	0.942	0.075	**66.3**	0.94	0.16
29	0.186	ha	0.4	0.207	83.82	mm/hr	11.36	1.60	**134.5**	62	450	0.012	0.4	0.159	1.414	0.1125	**195.3**	1.23	0.84
30	0.952	ha	0.4	1.058	76.57	mm/hr	12.78	4.45	**341.1**	13.9	600	0.012	0.3	0.283	1.885	0.15	**364.3**	1.29	0.18
31	0.112	ha	0.4	0.125	76.01	mm/hr	13.87	4.58	**348.1**	80	750	0.012	0.2	0.442	2.356	0.1875	**539.4**	1.22	1.09
130	0.093	ha	0.9	0.234	85.86	mm/hr	11.22	0.23	**20.1**	45	450	0.012	0.1	0.159	1.414	0.1125	**97.7**	0.61	1.22
131	0.156	ha	0.9	0.390	81.21	mm/hr	12.71	0.62	**50.7**	55	450	0.012	0.1	0.159	1.414	0.1125	**97.7**	0.61	1.49
132	0.137	ha	0.9	0.342	85.86	mm/hr	10.54	0.34	**29.3**	20	450	0.012	0.1	0.159	1.414	0.1125	**97.7**	0.61	0.54
133	0.232	ha	0.9	0.580	76.21	mm/hr	13.12	6.12	**466.8**	30	750	0.012	0.2	0.442	2.356	0.1875	**539.4**	1.22	0.41

APPENDIX D:
Catch Basin Removal Locations





LEGEND

- EXISTING FACILITIES
- PROPOSED FACILITIES
- VEHICULAR PARKING
- BUS PARKING
- BOARDWALK/DECK/BRIDGE
- PEDESTRIAN CROSSING
- STREETSCAPE BUMP-OUT
- PASSENGER DROP-OFF
- EXISTING DECID./ CONIFEROUS TREES
- PROPOSED DECID./ CONIFEROUS TREES
- REMOVE CATCHBASIN
- CATCH BASIN – NEW INSTALLATION

Building Bancroft: Catch Basin Removals & Installations

Appendix D

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constructive people

Building Bancroft

Transportation Impact Study

Final Report

GENIVAR Project Number *– OT-09-185-00-OT*
May 2010

www.genivar.com

GENIVAR
15 Fitzgerald Road, Suite 100
Ottawa, Ontario, CANADA K2H 9G1
Telephone: 613-829-2800
Fax: 613-829-8299

Building Bancroft

Transportation Impact Study

Final Report

May 2010

GENIVAR

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List of Figures

1.0 EXECUTIVE SUMMARY

The **Building Bancroft** project is a proposed multi use development located in the central area of the Town of Bancroft. This report has examined the impact of the proposed development on the adjacent transportation network; the key findings are summarized below.

- The **Building Bancroft** site is well serviced by a variety of roadways including an east/west highway (i.e. Highway 28), and a north/south highway (i.e. Highway 62).
- The counts used in the technical analysis reflect a typical weekday and encompass "normal" traffic volumes experienced in the Town of Bancroft.
- The technical analysis indicates that the road network is currently performing well in the morning and afternoon peak travel hours.
- It is estimated that the **Building Bancroft** development will generate 572 vehicle trips (total 2-Way trips) in the morning peak hour and 519 trips (total 2-Way trips) in the afternoon peak hour.
- Considering the 2014 horizon (i.e. assumed build out), the road network will continue to perform well in the morning and afternoon peak travel hours (with the traffic generated by the development). The transportation network in the area has sufficient spare capacity to accommodate the proposed uses based on the current roadway configuration.
- At the Chemaushgon Road/Station Street intersection, the southbound left turn currently exhibits a poor Level of Service (i.e. LOS "E" and "F", respectively in the morning and afternoon peak hours). This is primarily due to the current signing pattern which gives the right of way to the westbound movements while stopping northbound and southbound movements. However changes are not envisioned at this location because of existing sightline concerns in this area. **This is an existing issue and is not related to the Building Bancroft development.**
- During the completion of this review, it was indicated that operational issues exist at the Mill Street/Bridge Street intersection in the summer months. Specifically, the northbound approach exhibits lengthy queues primarily caused by the northbound left turn movements being delayed due to insufficient gaps available in the eastbound/westbound movements. Because no exclusive left turn lane exists, northbound right turn movements (the dominant movement on the approach) experience significant delays and long queues result. Consideration should be given to developing an exclusive left turn lane with sufficient storage to accommodate left turning vehicles. Although this may not significantly improve delays to northbound left turn movements, the overall delay on the northbound approach would be significantly reduced (i.e. allow the other

northbound movements to move freely). **It is also noted that this is an existing issue and is not related to the Building Bancroft development. The operational needs of this intersection should be fully examined and mitigation measures should be explored independent of the Building Bancroft development.**

- It is our understanding that the current on street parking supply in the downtown area is generally adequate – there is a sufficient supply of parking to meet current needs.
- The **Building Bancroft** concept plan includes a series of internal parking areas dispersed throughout the site. In total, 422 spaces are provided within the **Building Bancroft** site. The parking areas are accessed from Hastings Street North and Station Street and the larger parking facilities are located near the high traffic generators such as the retail/commercial uses.
- The on-site parking facilities will be supplemented by the municipal (i.e. on-street) parking.

In summary, the overall impact of the proposed **Building Bancroft** development upon the transportation system is minimal. The projected increase in traffic resulting from the development at build out can be easily accommodated by the current road network/configuration.

2.0 INTRODUCTION

Building Bancroft is a development that will transform the Town of Bancroft's downtown core. The conceptual plan includes a variety of land use arrangements and strategies to transform part of the Bancroft urban area into a functional, attractive and appealing destination. The ***Building Bancroft*** Concept Plan considered in this review was developed through a series of community visioning sessions, design workshops and other planning activities. The generalized study area is illustrated in ***Figure 1.*** It is noted that specific analyses extend beyond the limits illustrated below.

Figure 1
Study Area

The report, completed by ***GENIVAR,*** assesses the impact of the proposed ***Building Bancroft*** development on the adjacent transportation network and identifies, where warranted, the specific improvements and modifications that are required to support this initiative. It is one of a number of technical documents that will determine the overall infrastructure needs of the development. Specifically, the information and analysis in this document will assist planning staff in the development of transportation facilities that enhance travel to/from and within the study area, service the proposed uses and provide appropriate levels of mobility for both local and non-local users. This transportation review is based upon concept-level development plans dated February, 2010.

3.0 BACKGROUND

The Bancroft urban area is home to approximately 3500 permanent residents and a number of businesses and industries. The Town and more specifically, the **Building Bancroft** site are well serviced by a variety of roadways for east/west movements (i.e. Monck Street, Sherbourne Street, and Bridge Street) and north/south movements (i.e. Highway 62, also known as Hastings Street North). These high capacity roadways accommodate local traffic as well as inter-regional traffic travelling to/from locations such as Peterborough, Belleville, Toronto and Ottawa.

The Town of Bancroft is bisected by the York River. There are two crossings of the river within the downtown area - one on Station Street and the other on Bridge Street. These two crossings generally form the north and south limits of the **Building Bancroft** development.

4.0 WORK PROGRAM

The work program included a series of integrated tasks which satisfy the typical requirements for a **Traffic Impact Study (TIS),** including:

1. Undertake an inventory of transportation and land use conditions in the study area documenting:
    a. Existing roads including jurisdiction, function, number of lanes and posted speed limits
    b. Existing intersections including type of control, lane configurations, turning restrictions, and other relevant data (e.g., non-standard lane widths, grades, etc.)
    c. Location of existing parking facilities, both on-street and off-street
    d. Existing access points to adjacent developments
    e. Existing bicycle facilities, pedestrian sidewalks and pathway networks, if applicable
    f. Major local trip generators/attractors (existing and planned)
2. Obtain base mapping and development information (timing, staging, etc.).
3. Identify possible areas of concerns associated with the project including seasonal traffic issues.

4. Identify current (2009) traffic volumes on the critical road links and intersections in the morning and afternoon peak hours (referred to as ***background traffic***).
5. Assess the performance of the existing transportation system (i.e. ***background traffic*** volumes).
6. Identify future (2014) traffic volumes on critical road links and intersections in the peak hours.
7. Identify the traffic generated by the other planned and/or approved developments in the study area and assign to the road network. The sum of the future traffic and the traffic generated by planned and/or approved developments is referred to as the ***future background traffic.***
8. Identify the traffic generated by the proposed Building Bancroft development in the peak hours of travel (i.e. ***BB development traffic***) and assign to the road network.
9. Identify the 2014 ***future total traffic*** (i.e. sum of ***future background*** and ***BB development traffic***)
10. Complete an assessment of future system performance (based on current roadway configuration) and identify locations that exhibit capacity and/or operational issues.
11. Identify the design elements required to mitigate the capacity and/or operational issues (for all modes of travel), possibly including:
    a. Transportation system modifications (e.g. additional through and/or auxiliary lanes)
    b. Changes to existing traffic controls (e.g., new traffic signals, stop signs, etc.)
    c. New or modified elements of the bicycle and pedestrian networks
    d. Community impact mitigation measures
12. Examine the parking conditions in the study area.

In addition, select comments are also provided on the proposed arrangement of the **Building Bancroft** development focussing on the traffic, access, parking and site servicing needs.

5.0 EXISTING CONDITIONS

5.1 Transportation Facilities

The key roadways adjacent to the **Building Bancroft** site provide a variety of roles and functions in the local transportation network. The facilities include arterial roads, which prioritize the movement of traffic (i.e. higher speed, higher capacity) and collector/local roads, which provide more localized functions (i.e. lower speeds, lower capacity and more emphasis on local access). The characteristics of the key roadways near the **Building Bancroft** development are summarized in ***Figure 2.***

Figure 2 ***Key Transportation Facilities***			
Name	**Function**	**Basic Lanes**	**Posted Speed**
Bridge Street/Sherbourne Street/ Monck Street	Arterial	2	50 km/h
Hastings/Mill Street (Highway 62)	Arterial	2	50 km/h
Station Street	Collector	2	50 km/h
Chemaushgon Road	Collector	2	50 km/h
Madawaska Street	Local	2	50 km/h

The function of these roadways must be considered in the future planning and design activities for the **Building Bancroft** development. In general terms, the primary accesses to the site should be located on arterial and/or collector roadways. Arterials and collectors are also planned and designed to accommodate higher volumes of traffic including large vehicles such as tour buses and tractor-trailers.

Existing pedestrian facilities within the study area are provided in ***Figure 3.***

Figure 3 ***Existing Pedestrian Facilities***	
Name	**Pedestrian Facilities**
Bridge Street/Sherbourne Street/ Monck Street	• Sidewalks/both sides
Hastings Street North/ Mill Street	• Sidewalks/both sides
Station Street	• Sidewalks/both sides
Chemaushgon Road	• Sidewalks/both sides/south of Station Street • East side/north of Station Street
Madawaska Street	• Sidewalks/both sides west of Hastings Street North • North side/east of Hastings Street North

Figure 3 indicates that sidewalks are provided on all streets in the immediate study area facilitating pedestrian travel. There are no dedicated bicycle facilities on any roadways in the Town of Bancroft.

5.1.1 Current Intersection Controls

The intersections and intersection controls in the study area include:

- **Signalized Intersections:**
  - Hastings Street North/Bridge Street
  - Hastings Street North /Station Street
  - Hastings Street North / /Madawaska Street

- **Unsignalized Intersections (Stop Condition on Minor Road):**
  - Bridge Street/Mill Street
  - Bridge Street/Sherbourne Street
  - Monck Street/Sherbourne Street/Chemaushgon Road
  - Station Street /Chemaushgon Road
  - Hastings Street North/Flint Avenue

5.1.2 Current (2009) Traffic Volumes

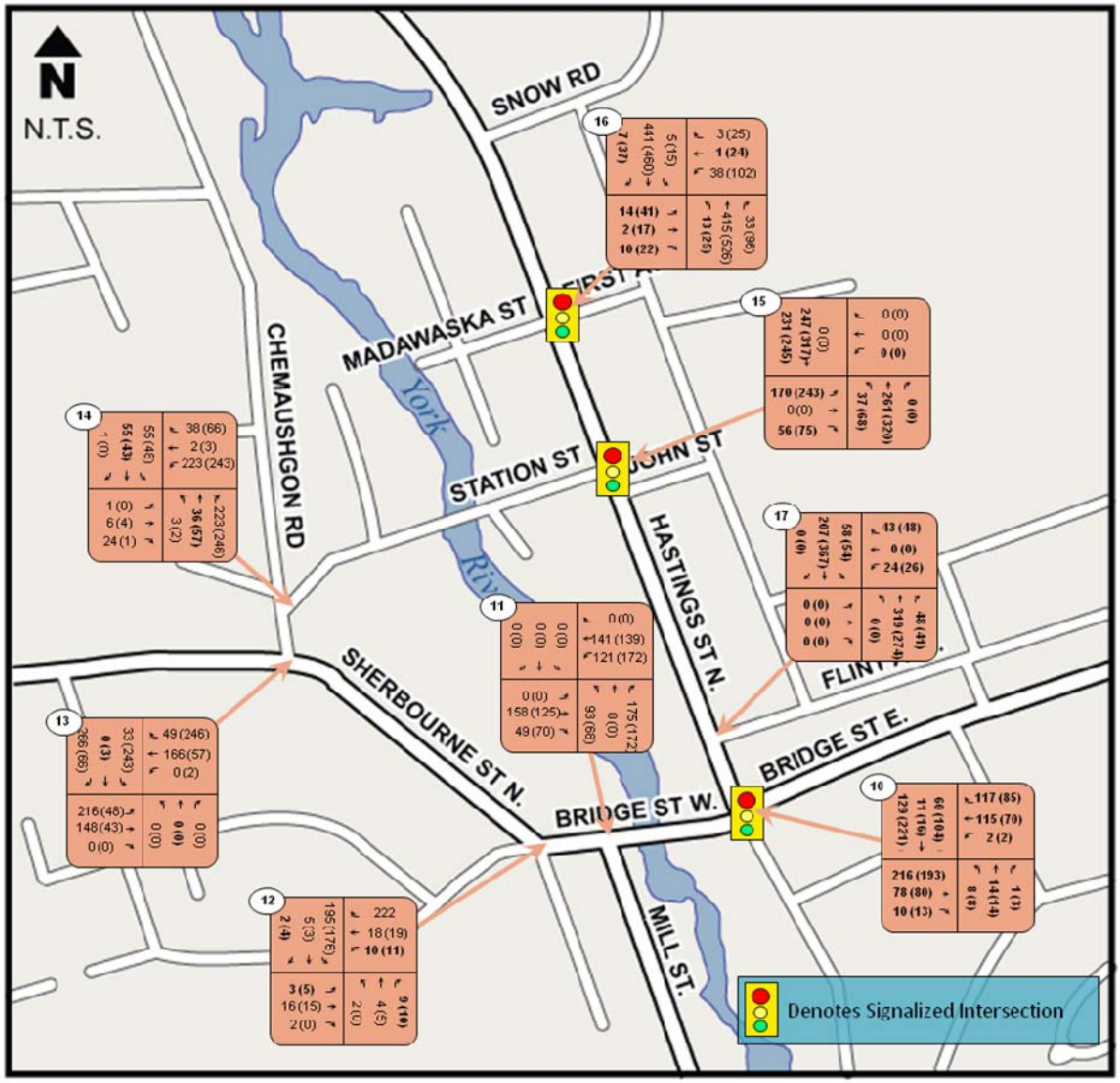
Traffic data was collected in November/December 2009 at a number of key locations within the Town of Bancroft, in the vicinity of the **Building Bancroft** development site. The counts encompassed the morning (7:00 am to 9:00 am) and afternoon (4:00 pm to 6:00 pm) peak periods when vehicular activity on areas roads is greatest. The count locations and dates are illustrated in ***Figure 4.***

Figure 4
Intersection Count Dates

Key #	Location	Count
10	Hastings Street/Bridge Street	December, 2009
11	Mill Street/Bridge Street	December, 2009
12	Bridge Street/Sherbourne Street	December, 2009
13	Sherbourne Street /Monck Street/ Chemaushgon Road	December, 2009
14	Chemaushgon Road/Station Street	November, 2009
15	Station Street /Hastings Street	December, 2009
16	Madawaska/First/Hastings Street	December, 2009
17	Hastings Street /Flint Avenue	December, 2009

The count dates listed above reflect a typical weekday and encompass “normal” traffic volumes in the Town of Bancroft. In the two count periods (i.e. morning and afternoon peak periods), traffic activity is comprised of a multitude of trip types including work-related trips, shopping trips, school trips, personal trips and a number of others. The morning and afternoon peak period volumes were rationalized to determine the busiest one hour period (in each of the two peak periods); these values were then used to assess transportation system performance. The current (2009) morning and afternoon peak hour traffic volumes are illustrated in ***Figure 5.***

Figure 5
Current (2009) Morning and Afternoon Peak Hour Traffic Volumes



The operational efficiency of the transportation system within the Bancroft urban area was evaluated using the SYNCHRO traffic simulation model. SYNCHRO is a tool that can identify the performance characteristics of a transportation network, identify areas of concern and assess the benefits of various alternative modification and improvement measures. The results are discussed in the following section of this report.

5.1.3 Roadway Capacity

The quality of operation of a transportation facility (e.g. intersection, ramp, highway, etc.) is expressed in terms of Level of Service (LOS). LOS is typically based on a quantitative value that is derived through the assessment of specific measures of efficiency such as vehicle delays, vehicle densities, ability to pass, etc.

LOS is denoted from LOS "A" (best operation) to LOS "F" (breakdown conditions). For signalized intersections, the LOS is based on the average stopped delay incurred by each vehicle entering the intersection. For unsignalized intersections, the LOS is based on the delays incurred by the most problematic movement - typically the left turn from the minor street to the major street. In both instances, lower delay values are preferred. Signalized intersections have a major impact on the mobility function of a roadway. The interruption in traffic flow caused by traffic control signals (by assigning green time to each competing approach) creates delays and affects capacity. Signalized intersections often represent the governing element in determining the need for transportation improvements. The results, based on the SYNCHRO traffic model, are presented in ***Figure 6.***

Figure 6
Current (2009) Morning and Afternoon Peak Hour Intersection Performance

Intersection			AM Peak Hour *(PM Peak Hour)*			
			Volume-to-Capacity		Level of Service	
			Critical Ratio	Critical Movement	Overall Delay/LOS	Critical Movement
10		Hastings/Bridge	0.55 *(0.42)*	EBL *(EBL)*	9/A *(7/A)*	EBL *(EBL)*
11		Bridge / Mill	0.47 *(0.43)*	NBL/R *(NBL/R)*	7/B *(7/B)*	NBL/R *(NBL/R)*
12		Bridge / Sherbourne	N/A	N/A	N/A	N/A
13		Monck/Sherbourne/ Chemaushgon	0.34 *(0.35)*	SBR *(SBL)*	6/A *(5/A)*	SBL *(SBL)*
14		Chemaushgon / Station	0.32 *(0.42)*	NBT/R *(NBT/R)*	11/A *(12/A)*	SBL *(SBL)*
15		Station / Hastings	0.48 *(0.59)*	NBT *(NBT)*	9/A *(11/B)*	NBL/T *(NBL/T)*
16		Madawaska / Hastings	0.52 *(0.68)*	NBT *(NBT)*	9/A *(11/B)*	WBL *(WBL)*
17		Flint / Hastings	0.23 *(0.20)*	NBT/R *(NBT/R)*	2/A *(2/A)*	WBL *(WBL)*

Notes: NB = Northbound/WB = Westbound/SB=Southbound/EB=Eastbound/R=Right Turn/T=Through/L=Left Turn

Signalized Intersection Unsignalized Intersection

It is noted that the phasing/timing plans for the intersections with traffic control signals have been optimized for the purposes of the technical analysis.

Figure 6 indicates acceptable operations at all intersections within the study area. The only location which exhibits minor delays includes the movement turning left onto County Road 28 from Chemaushgon Road (i.e. southbound left turn at Monck/Sherbourne/Chemaushgon intersection).

In addition to the above analysis, concerns were also raised regarding operational issues that occur during the summer months at the Mill Street/Bridge Street intersection (i.e. Intersection 11). Although the November volumes do not indicate a problem, summer traffic volumes result in a significant amount of queuing on the northbound approach. It was indicated that this queuing concern is primarily caused northbound left turning traffic being delayed due to insufficient gaps in the eastbound/westbound traffic flow. Because no exclusive left turning lane exists, the northbound right turn movement (the dominant movement) experiences significant delays and long queues result.

5.2 Parking Conditions

On-street parking is currently provided in the following locations within the Bancroft central area:

- **Hastings Street North:** From Phoebe Street north to Station Street, both sides of roadway;
- **Sherbourne Street North:** From Bridge Street to Monck Street, northeast side of street ONLY;
- **Sherbourne Street:** East side North of Bridge Street and both sides south of Bridge Street;
- **Bridge Street West:** West of intersection with Hastings Street on both sides of roadway to York River bridge;
- **Flint Avenue:** From Hastings Street to Cleak Avenue, both sides of roadway; and
- **Station Street:** From River Street to Hastings Street, both sides of roadway.

On-street parking areas near the **Building Bancroft** site are graphically illustrated in ***Figure 7.***

Figure 7
Current (2009) On Street Parking in Bancroft Downtown Area

It is our understanding that the current on-street parking supply is generally adequate – there is a sufficient parking to meet current needs. To supplement the current on-street parking supply, the **Building Bancroft** concept plan also includes a series of internal parking areas dispersed throughout the site. The parking areas are accessed from Hastings Street North and Station Street; the larger parking facilities are located near the higher traffic generators (i.e. the retail/commercial uses.

6.0 REVIEW OF CONCEPT PLAN

Public and agency input combined with the various technical analyses resulted in the development of a preferred concept plan (see

Figure** 8**).

Figure 8
Building Bancroft Concept Plan

Although some features of the **Building Bancroft** Concept Plan may change during the subsequent design, approvals and implementation process, it is considered a reasonable model of future development for the site.

6.1 Future Background Traffic

A 5-year planning horizon (i.e. 2014) was used to assess the future traffic operations. The 2014 traffic volumes were derived in the following manner:

- All 2009 volumes were factored by an average annual growth rate of 1.0%. This accounts for population growth in the Town and increased trip making; and
- The annual growth value was applied equally to all turning movements at all intersections.

In addition, the 2014 planning horizon assumes that all of the land uses within the **Building Bancroft** Concept Plan are fully developed (i.e. build out).

6.2 Traffic Zones

To facilitate the traffic analysis, the area near the **Building Bancroft** development was grouped into 5 unique zones. The zones were identified based on geographic restrictions/elements (i.e. York River) and transportation facilities (i.e. adjacent roadways). The traffic zones are shown in ***Figure 9.***

Figure 9
Traffic Zones

The vehicle trips generated by each zone were calculated based on the proposed uses within the zone and distributed to the roadway network.

6.3 Trip Generation

Each use identified in the **Building Bancroft** development will generate a certain level of vehicular, pedestrian and cycling activity. The most onerous transportation mode, from a roadway capacity perspective, relates to the vehicular demands. In addition, the most problematic times include the morning and afternoon peak hours. The projected auto demands, using **Institute of Transportation Engineers (ITE) Trip Generation Handbook, 6th Edition** are summarized in ***Figure 10.***

Figure 10
Institute of Transportation Engineers Land Uses

Traffic Zone #	ITE Code	ITE Land Use	Unit of Measure	Program Areas Where Used
1	590	Library	Gross Floor Area (m^2)[1]	HA1, HA2, HA3, HA4
2	320	Motel	# rooms	M1

		Residential Community Centre	Gross Floor Area (m^2)[1]	CS1
3	230	Residential Condominium/Townhouse	# Units	RE1
	412	County Park	Acreage	CS10
4	720	Medical/Dental Office Building	Gross Floor Area (m^2)[1]	CS2
	814	Specialty Retail	Gross Floor Area (m^2)[1]	CS3, CR1-3, CR5-7, CR9-13
	441	Live Theatre	# seats	CR2A
	936	Coffee Shop, No Drive Thru Window	Gross Floor Area (m^2)[1]	CR4
	931	Quality Restaurant	Gross Floor Area (m^2)[1]	CR8
	412	County Park	Acreage	CS5
5	412	County Park	Acreage	CS6-9

1. ITE values reflect gross floor area in square feet. All Concept Plan information has been converted from square meters to square feet.

The trips generated for each land use in each zone are summarized in ***Figure 11.***

Figure 11
Projected Morning and Afternoon Peak Hour Trip Generation (Building-Out)

Description			Units	AM Peak Hour			PM Peak Hour		
				Total	In	Out	Total	In	Out
Traffic Zone 1	HA 1	Library/Public Meeting Space (m^2)	784	43	21	22	68	35	33
	HA 2	Heritage Attraction/Museum (m^2)	311	17	8	9	27	14	13
	HA 3	North Hastings Museum (m^2)	200	11	5	6	17	9	8
	HA 4	Train Station Existing (m^2)	242	13	6	7	21	11	10
		Sub Total - Traffic Zone 1	**Total**	**84**	**40**	**44**	**133**	**69**	**64**
Traffic Zone 2	M1	Motel (# rooms)	60	32	12	20	42	23	19
	CS 1	Community Facilities (m2)	1,017	29	15	14	26	10	16
		Sub Total - Traffic Zone 2	**Total**	**61**	**27**	**34**	**68**	**33**	**35**
Traffic Zone 3	RE1	Residential Condominium (# units)	20	14	3	11	43	29	14
	CS10	Shelter (m2)	24	0	0	0	0	0	0
		Sub Total - Traffic Zone 3	**Total**	**14**	**3**	**11**	**43**	**29**	**14**
Traffic Zone 4	CS 2	Medical Clinic (m2)	487	24	16	8	24	10	14
	CS 3	Liquor Store (m2)	372	42	24	18	20	11	9
	CS 4	Post Office (m2)	438	57	28	29	69	35	34
	CS 5	Gazebo/Shelter (m2)	222	1	1	0	2	0	1
	CR 1	Commercial/Retail (m2)	195	22	12	10	11	6	5
	CR 2	Commercial/Retail (m2)	200	23	13	10	11	6	5
	CR 2A	Commercial/Theatre (# seats)	300	0	0	0	6	3	3
	CR 3	Commercial/Retail (m2)	120	14	8	6	6	3	3
	CR 4	Commercial/Café (m2)	130	90	46	44	36	18	18
	CR 5	Commercial/Retail (m2	140	16	9	7	8	4	4
	CR 6	Commercial/Retail (m2)	90	10	6	4	5	3	2
	CR 7	Commercial/Retail (m2)	113	13	7	6	6	3	3
	CR 8	Commercial/Restaurant (m2)	321	19	16	3	31	19	12
	CR 9	Commercial/Retail (m2)	400	45	25	20	22	12	10
	CR 10	Commercial/Retail (m2)	26	3	2	1	1	1	0
	CR 11	Commercial/Retail (m2)	133	15	8	7	7	4	3
	CR 12	Commercial/Retail (m2)	106	12	7	5	6	3	3
	CR 13	Commercial/Retail (m2)	40	5	3	2	2	1	1
		Sub Total - Traffic Zone 4	**Total**	**411**	**229**	**182**	**273**	**144**	**128**
Traffic Zone 5	CS 6	Picnic Pavillion (m2)	93	1	1	0	1	0	1
	CS 7	Picnic Pavillion (m2)	153	1	1	0	1	0	1
	CS 8	Gazebo (m2)	29	0	0	0	0	0	0
	CS 5	Gazebo (m2)	29	0	0	0	0	0	0
		Sub Total -Traffic Zone 5	**Total**	**2**	**1**	**1**	**2**	**1**	**1**
		Grand Total -Traffic Zones 1 to 5	***Total***	***572***	***300***	***272***	***519***	***276***	***242***

Based on the above analysis, it is estimated that the **Building Bancroft** development will generate 572 vehicle trips (total 2-Way trips) in the critical morning peak hour and 519 vehicle trips (total 2-Way trips) in the afternoon peak hour.

The development plan is conceptual and due to the limitations of the land uses in the ITE Trip Generation Manual, a number of assumptions were made concerning the values for the **Building Bancroft** site, as follows:

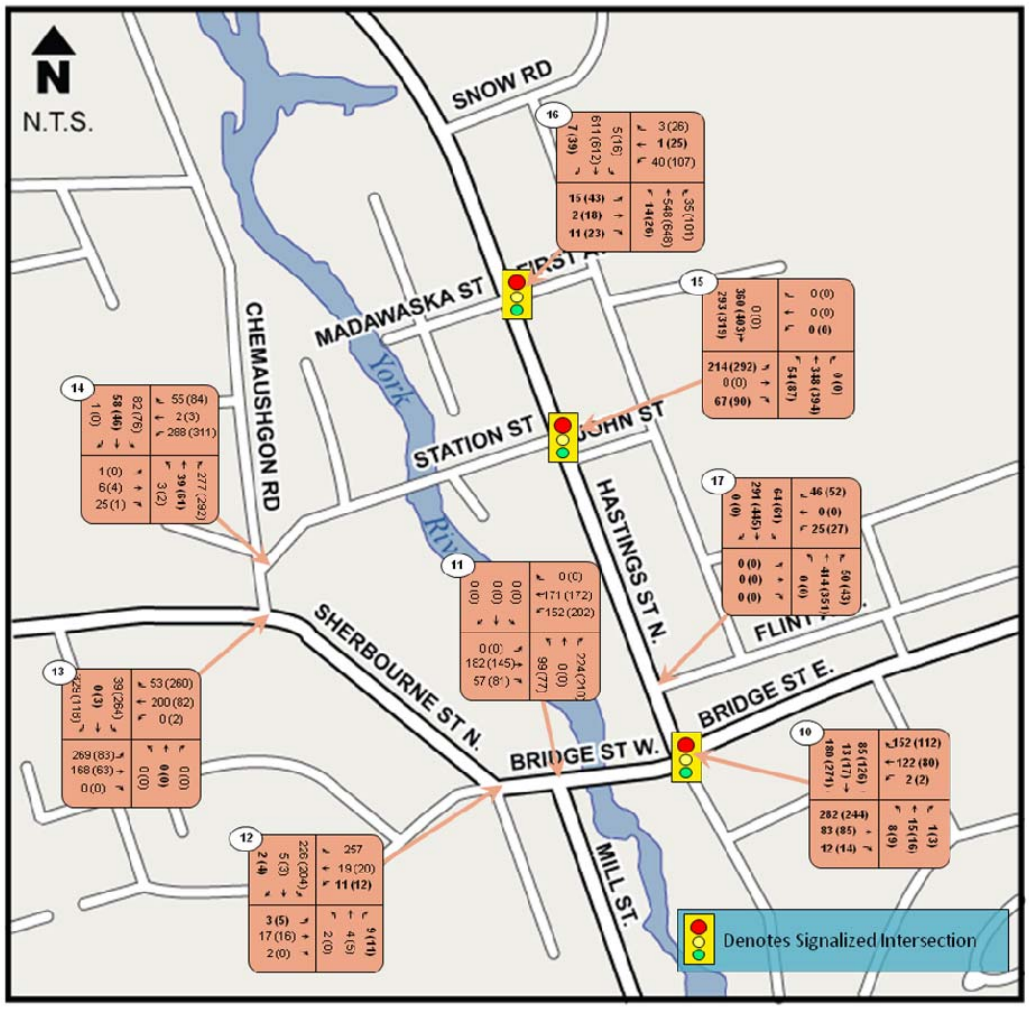
1. "Library" was used, in addition to the proposed library, for the museums (HA2 & HA3), and Train Station (HA4) land uses. Both provide an estimate of somewhat similar institutional uses;
2. The residential condominium was estimated to include 1 unit per 100 m^2 of gross floor area (GFA);
3. All gazebos/picnic areas were assumed to be somewhat similar to a "County Park" style land use. Since this land use incorporates acreage, it was assumed that the area of the park surrounding the gazebo/shelters was 50 times the area of the shelters themselves;
4. Due to the early stages of the process, a number of the areas slated for commercial/retail development are not known. As such, the "Specialty Retail" land use was selected; and
5. The live theatre land use is based on the number of seats. The number of seats was estimated 1 seat for every 2 m^2 of floor area, resulting in an estimate of approximately 300 seats.

As a final note, because of the very limited development that currently exists in the study area, no traffic reductions were assumed due to the removal of any existing developments.

6.4 Trip Distribution

The distribution of traffic (i.e. directions of approach and departure) for each traffic zone was oriented in a manner that is generally consistent with current patterns (i.e. previously illustrated in ***Figure 5***). The resulting 2014 volumes, which includes the projected traffic generated by the **Building Bancroft** development is summarized in ***Figure 12***.

Figure 12
Projected (2014) Morning and Afternoon Peak Hour Traffic Volumes
With Building Bancroft Development (Build-Out)



6.5 Traffic Impact Analysis

The traffic impact analysis involved an assessment of the transportation impacts for the future total traffic scenario, based on the current roadway configurations. As stated, in an urban environment, intersections typically represent the greatest capacity and operational constraints, because of the interruptions to traffic flow on all approaches. Typically, LOS "D" is the threshold for improvement; however, there are numerous locations that operate below this LOS.

The results of the capacity analyses based on **Synchro 7** software are summarized in ***Figure 13.*** The analysis assumes current roadway configurations (i.e. number of through lanes, turning lanes, intersection controls, etc.). As previously stated, the traffic signal timings have been adjusted to maximize efficiency. The effects and impacts of on-street parking movements have also been considered in the traffic modelling activities.

Figure 13
Projected (2014) Morning and Afternoon Peak Hour Intersection Performance
With Building Bancroft Development (Building-Out)

Intersection			AM Peak Hour *(PM Peak Hour)*			
			Volume-to-Capacity		Level of Service	
			Critical Ratio	Critical Movement	Overall Delay/LOS	Critical Movement
10		Hastings/Bridge	0.59 *(0.49)*	EBL *(SBR)*	9/A *(8/A)*	EBL *(SBT)*
11		Bridge/Mill	0.62 *(0.57)*	NBL/R *(NBL/R)*	9/C *(9/C)*	NBL/R *(NBL/R)*
12		Bridge/Sherbourne	N/A	N/A	N/A	N/A
13		Monck/Sherbourne/ Chemaushgon	0.43 *(0.46)*	SBR *(SBL)*	7/A *(7/A)*	SBL *(SBL)*
14		Chemaushgon/Station	0.71 *(0.86)*	SBL*(SBL)*	18/B *(22.5/B)*	SBL *(SBL)*
15		Station/Hastings	0.55 *(0.62)*	NBT *(NBT)*	10/A *(11/B)*	EBL *(EBL)*
16		Madawaska/Hastings	0.67 *(0.82)*	NBT/R *(NBT/R)*	10/B *(13/B)*	WBL/T/R *WBL)*
17		Flint/Hastings	0.30 *(0.25)*	NBT/R *(NBT/R)*	2/B *(2/C)*	WBL *(WBL)*

Notes: NB = Northbound/WB = Westbound/SB=Southbound/EB=Eastbound/R=Right Turn/T=Through/L=Left Turn

Signalized Intersection Unsignalized Intersection

A review of ***Figure 12*** indicates the following:

- Acceptable intersection operations are evident at all locations in both peak hours.
- All locations exhibit spare capacity in 2014, even with the addition of the traffic generated by the **Building Bancroft** development.
- At the Chemaushgon Road/Station Street intersection, the southbound left turn exhibits a poor LOS (i.e. LOS "E" and "F", respectively in the morning and afternoon peak hours). This is due to the current signing which gives the right of way to the westbound traffic movements while stopping northbound and southbound movements. However changes are not envisioned because of existing sightline concerns in this area. **This is an existing issue and not related to the Building Bancroft development.**

During the completion of the traffic review, it was indicated that operational issues currently exist at select locations in the summer months (due to the considerable increase in traffic generated by recreational and seasonal uses in this area). The most prominent location is the northbound movement at the Mill Street/Bridge Street intersection which exhibits lengthy queues that are primarily caused by the northbound left turn movements being delayed due to insufficient gaps available in the eastbound and westbound movements. Because an exclusive left turn lane is not provided, the northbound right turn movement (the dominant movement on the approach) experiences delays and

long queues result. In this regard, consideration should be given to constructing an exclusive left turn lane with sufficient storage to accommodate left turning vehicles.

It is also noted that this is an existing issue and not related to the Building Bancroft development. The operational needs of this intersection should be fully examined and mitigation measures should be explored independent of the Building Bancroft development.

7.0 CONCEPT PLAN – TRANSPORTATION REQUIREMENTS

The Conceptual Plan represents identifies the land use arrangements and supporting services (including transportation) for the **Building Bancroft** development. It is recognized that the plan will likely evolve as the development proceeds through the subsequent stages of the planning, design and approvals process. Depending upon the nature and magnitude of the changes, revisions/updates to these findings may also be required.

7.1 Pedestrians and Cyclists

The transportation network within the **Building Bancroft** development and the Bancroft downtown area should also include appropriate facilities for pedestrians and cyclists. Although the specific features will be developed as more detailed development plans are prepared, the following general guidelines should be considered as part of the planning process:

- Sidewalks should be provided on both sides of roadways where major pedestrian movements will occur. Minor pedestrian corridors should include a sidewalk on one side of the roadway.
- Consideration should be given to reduced pedestrian crossing distances at intersections though the use of narrowing or similar treatments.
- The internal transportation network should include bicycle-friendly features such as wider travel lanes, dedicated bicycle lanes, bicycle parking, etc;
- Consideration should be given to the provision of pedestrian and bicycle friendly features at signalized intersections including loop detectors, call buttons, etc.; and
- Consideration should be given to the provision of appropriate illumination in areas which serve pedestrians and cycling movements.

The use of pedestrian and cycling-supportive neighbourhood and streetscape design features will make these modes a more attractive choice for travel.

7.2 Roadways

As previously mentioned, the current road network/configuration is capable of accommodating the traffic generated by the **Building Bancroft** development. Notwithstanding the above, operational improvements should be explored at the Mill Street/Bridge Street Intersection – specifically the provision of an exclusive northbound left turn lane to reduce delays and queues during summer months. It is recognized that factors such as sightlines and horizontal and vertical geometry must also be considered in the review. **It should also be reiterated that this is an existing issue and not related to the Building Bancroft development.**

7.3 Traffic Controls

At this juncture, changes to the current traffic controls are not envisioned. The existing arrangement of traffic signals and STOP controls will function acceptably in the 2014 planning horizon with the **Building Bancroft** development. The need for and location of additional traffic control (i.e. signals and any other traffic control mechanisms) should be re-examined when design details are available.

7.4 Parking

The proposed development plan provides several internal (off street) parking areas which are dispersed throughout the site (see ***Figure 8***). The parking facilities include:

- **Parking Area 1:** 53 spaces (north of Station Street)
- **Parking Area 2:** 214 spaces (between Bridge Street and Station Street)
- **Parking Area 3:** 155 spaces (between Bridge Street and Station Street)

In total, 422 spaces are provided within the **Building Bancroft** site. The parking areas should address all Town bylaw requirements related to parking supply, space size, driving aisle dimensions, special needs parking, setbacks, etc. The on-street parking areas will also supplement the internal parking areas, if required.

7.5 Trucks and Large Vehicles

Consideration should be given to truck and tour bus movements both along the municipal roadway system and within the **Building Bancroft** internal roadway network. Access locations for large vehicles should be planned and designed with appropriate design features including horizontal and vertical elements, clearances, turning radii and other features. The primary pedestrian and cycling

movements should not conflict with these large vehicles. Similar to the above, the selection and design of truck routes and loading areas should address all Town bylaw requirements.

8.0 NEXT STEPS

This **Transportation Impact Study** has completed a preliminary examination of the projected transportation needs and opportunities associated with the **Building Bancroft** development. This review reflects the preliminary nature of the planning activities and additional transportation analyses may be required as the development plan is further updated.

9.0 CONCLUSIONS

This **Transportation Impact Study** has examined the projected transportation needs and opportunities associated with the **Building Bancroft** development. The key findings follow:

- The **Building Bancroft** site is well serviced by a variety of roadway types.
- Sidewalks are provided on all streets in the immediate study area facilitating pedestrian travel. There are no dedicated bicycle facilities on any roadways in the Town of Bancroft.
- The counts used in the technical analysis reflect a relatively typical weekday and encompass “normal” traffic volumes experienced in the Town of Bancroft.
- The road network is currently performing well in the morning and afternoon peak travel hours.
- The only location which exhibits minor delays includes the movement turning left onto Monck Street from Chemaushgon Road (i.e. southbound left turn).
- It is our understanding that the current on-street parking supply in the downtown area is generally adequate – there is a sufficient supply of parking to meet current needs.
- In total, 422 spaces are provided within the **Building Bancroft** site. The parking areas should address all Town bylaw requirements related to parking supply, space size, driving aisle dimensions, special needs parking, setbacks, etc.
- It is estimated that the **Building Bancroft** development will generate 572 vehicle trips (2-Way trips) in the morning peak hour and 519 vehicle trips in the afternoon peak hour.
- The distribution of traffic (i.e. directions of approach and departure) was oriented in a manner that is generally consistent with current traffic patterns.

- Considering the 2014 horizon (i.e. Building-out of the **Building Bancroft** project), the road network will continue to perform well in the morning and afternoon peak travel hours. The transportation system in the area of the **Building Bancroft** development has sufficient spare capacity to accommodate the proposed uses based on the current roadway configuration.
- At the Chemaushgon Road/Station Street intersection, the southbound left turn exhibits a poor LOS (i.e. LOS "E" and "F", respectively in the morning and afternoon peak hours). This is due to the current signing which gives the right of way to the westbound traffic movements while stopping northbound and southbound movements. However changes are not envisioned because of existing sightline concerns in this area. **This is an existing issue and not related to the Building Bancroft development.**
- During the completion of this review, it was indicated that operational issues exist at the Mill Street/Bridge Street intersection in the summer months. Specifically, the northbound approach exhibits lengthy queues primarily caused by the northbound left turn movements being delayed due to insufficient gaps available in the eastbound/westbound movements. Because no exclusive left turn lane exists, northbound right turn movements (the dominant movement on the approach) experience significant delays and long queues result. Consideration should be given to constructing an exclusive left turn lane with sufficient storage to accommodate left turning vehicles. Although this may not significantly improve delays to northbound left turn movements, the overall delay on the northbound approach would be significantly reduced (i.e. allow the other northbound movements to move freely). **It is also noted that this is an existing issue and not related to the Building Bancroft development. The operational needs of this intersection should be fully examined and mitigation measures should be explored independent of the Building Bancroft development.**
- The selection/design of truck routes and loading areas should address all Town bylaw requirements.

In summary, the overall impact of the proposed **Building Bancroft** development upon the road network is minimal. The projected increase in traffic resulting from the development can easily be accommodated by the existing transportation system.