BROCKVILLE
CITY OF THE 1000 ISLANDS

BROCKVILLE WATER POLLUTION CONTROL CENTRE UPGRADE

CLASS ENVIRONMENTAL
ASSESSMENT REPORT

Technical Memorandum No. 4
Septage Receiving Considerations

Prepared By:

Simcoe
SIMCOE ENGINEERING GROUP LIMITED
Consulting Engineers

in association with

Hydromantis, Inc.
Consulting Engineers

161.03
January 2005

Technical Memorandum No. 4: Septage Receiving Considerations

1. Introduction

The City of Brockville is proceeding to complete a Class Environmental Assessment to assess alternative solutions for a proposed Brockville Water Pollution Control Plant (WPCC) Upgrade.

The upgrade works, as a minimum, are to provide the current "normal" level of treatment prescribed by the Ministry of Environment (MOE), which is considered as being secondary treatment or equal and consistent with the Provincial Guideline F-5.

This Technical Memorandum (TM#4) has been prepared to consider the effects of implementing septage receiving at the Brockville WPCC and asses the desirability of including capacity and facilities for septage receiving as part of the proposed WPCC upgrade or a future plant upgrade.

2. General

TM#4 presents considerations for four main scenarios of septage receiving:

1. Residential septage from within the City of Brockville
2. Residential septage from within the Township of Elizabethtown-Kitley
3. Residential septage from within the County of Leeds and Grenville
4. Commercial haulage (relatively local).

Septage volumes and plant loading contributions are estimated for current conditions (2004) and twenty year future conditions (2024) for each of the scenarios.

3. Assumptions and Data

For purposes of this technical memorandum, septage is assumed to be characterized by three main parameters: 1) Biochemical Oxygen Demand (BOD_5), 2) Total Suspended Solids (TSS), and 3) Total Phosphorus (TP). **Table 1** presents estimated residential and commercial septage strength based on published literature and historical records.

TABLE 1:
Assumed Septage Characteristics

Parameter	Residential Septage[1]	Commercial haulage[2]
BOD_5 (mg/L)	5,000	2,500
TSS (mg/L)	15,000	3,300
TP (mg/L)	200	60

Notes:
1. Adopted from EPA references.
2. Average concentrations based on historical records of previous septage receiving from various local commercial sources.

Residential Septage volumes are estimated based upon published records of the number of housing "units", assuming each has a septic tank with an average volume of 4 m^3. Units are assumed to be emptied an average of once every 5 years. Hauling from the City, Township, and County Units is assumed to occur seasonally; over 8 months of the year with no hauling in winter months. To allow for distance considerations and other disposal destinations, the estimated residential septage volume for the County scenario is assumed to be from 50% of the number of units in the County.

The commercial haulage volume is estimated from historical records of a previously operated receiving station in the City. Haulage is assumed to be distributed over the full calendar year.

Table 2 presents the basic septage volume generation assumptions for current and future sources:

TABLE 2:
Septage Sources and Growth

	City Residential	Eliz. Twp. Residential	County Residential [1]	Commercial Haulage
Current Sources (2004)	100 units	3,779 units	14,411 units	92,000 m^3
Future Sources (2024)	103 units	4,252 units	16,214 units	126,950 m^3
Growth – Overall Increase	3% [2]	12.5 % [3])	12.5 % [3]	37.5 % [4]

Notes:
1. Half of recorded units in County assumed to be in service area
2. Growth based on projected City Population increase.
3. Growth based on projected County Population increase of 10.4% with average occupancy of 2.8 people per unit.
4. Growth based on County residential growth plus additional 25% for commercial haulage.

It is assumed for the commercial scenario that a septage receiving facility located in Brockville will generate additional commercial interest and use. Currently there are significant distances and costs for commercial haulers using Kingston or Ottawa waste water treatment facilities for disposal. For this reason the future growth includes an additional increase of 25 % for commercial haulage.

Design populations, plant flows, and plant loadings for BOD, TSS, and TP used in loading calculations summarized below are taken from Technical Memorandum No. 1, “Planning and Design Basis Information”, developed as part of this study.

4. Additional Plant Flow and Influent Loadings

Table 3 and **Table 4** present the calculated effect of septage receiving on design plant hydraulic and influent loadings for current and future conditions, respectively, for the four source scenarios of City residential septage, Township residential septage, County residential septage, and commercial haulage. Additionally, the combination of both County residential and commercial haulage scenarios is shown to illustrate a high-use projection of additional septage volumes and influent loadings.

In all cases septage contributions to hydraulic loading are relatively minimal as would be expected, but additional influent loadings can be very significant.

TABLE 3:
Septage Receiving Scenario Contributions to Plant Flow and Influent Loadings – Current (2004)

	Plant		Septage Receiving Scenario				
Parameter	Current Conditions	Design	1 - City Residential	2 - Eliz. Twp. Residential	3 - County Residential	4 - Commercial Haulage	5 - Commercial + County
Plant Flow:							
Septage Volume (m^3/d)			0.3	13	48	252	300
Total Plant Flow (ADF m^3/d)	17,783	21,800	17,783	17,796	17,831	18,035	18,083
Influent Loadings:							
Septage BOD_5 (kg/d)			2	63	240	617	857
Total influent BOD_5 (kg/d)	1,988	2,616	1,990	2,051	2,228	2,605	2,845
Total influent BOD_5 (mg/L)	112	120	112	115	125	144	157
Septage TSS (kg/d)			5	189	721	830	1551
Total influent TSS (kg/d)	2,543	3,488	2,544	2,728	3,260	3,369	4,090
Total influent TSS (mg/L)	143	160	143	153	183	187	226
Septage TP (kg/d)			0.1	2.5	9.6	14.9	24.5
Total influent TP (kg/d)	53	87	53	56	63	68	78
Total influent TP (mg/L)	3	4	3	3	4	4	4

Notes:
1. BOD_5 – biochemical oxygen demand (5 day), TSS – total suspended solids, TP – total phosphorus.
2. Total influent concentrations presented as influent loading divided by average day plant flow (current condition plus septage volume).

TABLE 4:
Septage Receiving Scenario Contributions to Plant Flow and Influent Loadings – Future (2024)

	Plant		Septage Receiving Scenario				
Parameter	Current Conditions	Design	1 - City Residential	2 - Eliz. Twp. Residential	3 - County Residential	4 - Commercial Haulage	5 - Commercial + County
Plant Flow:							
Septage Volume (m^3/d)			0.3	14	54	348	402
Average Day Plant Flow (m^3/d)	17,783	21,800	17,783	17,797	17,837	18,131	18,185
Influent Loadings:							
Septage BOD_5 (kg/d)			2	70	270	852	1,122
Total influent BOD_5 (kg/d)	1,988	2,616	1,990	2,058	2,258	2,840	3,110
Total influent BOD_5 (mg/L)	112	120	112	116	127	157	171
Septage TSS (kg/d)			5	213	811	1,146	1,957
Total influent TSS (kg/d)	2,543	3,488	2,544	2,752	3,350	3,685	4,496
Total influent TSS (mg/L)	143	160	143	155	188	203	247
Septage TP (kg/d)			0	3	11	21	32
Total influent TP (kg/d)	53	87	53	56	64	74	85
Total influent TP (mg/L)	3	4	3	3	4	4	5

Notes:
1. BOD_5 – biochemical oxygen demand (5 day), TSS – total suspended solids, TP – total phosphorus.
2. Total influent concentrations presented as influent loading divided by average day plant flow (current condition plus septage volume).

Septage contributions as additional plant flow and influent loadings for both City residential, and the City plus Elizabethtown-Kitley Township residential septage scenarios (Scenarios 1, 2 and 1+2) are relatively minor compared to the design flows and loadings. As such the upgraded plant should be able to receive septage from the City and Elizabethtown-Kitley Township with minimal impact. However, the current condition estimate of additional BOD_5 loading of the City and Township residential septage (65 kg/d), does represent an equivalent serviced population of 722, based on the historical per capita loading for BOD_5 of 90 g/cap/day.

Additional plant flow from septage volumes associated with the County residential septage, commercial haulage, and from the combination of both scenarios is relatively minor (i.e. Scenarios 3, 4, and 5 have a small hydraulic impact). However the BOD_5 and TSS influent loadings from the same scenarios are significant additional contributions to the plant influent loadings (i.e. significant increase in wastewater strength). The resulting wastewater strength from the County residential, commercial haulage, or from the combination of the both scenarios is in the range of what is generally considered representative of a “medium” strength wastewater. The influent loadings from these scenarios (both current and future conditions) are not excessive but design loadings (average day, and peak month) should be adjusted to accommodate the increase in estimated influent loadings.

Without septage receiving contributions, the upgraded plant remaining/available capacity, based on current plant conditions relative to the ADF design basis conditions is:

- Flow (21,800 – 17,783) = 4,017 m^3/d (18%)
- BOD_5 Loading (2,616 – 1,992) = 624 kg/d (24%)
- TSS Loading (3,488 – 2,543) = 945 kg/d (27%)

5. Septage Receiving Budget Costs and Revenue Potential

Implementation of septage receiving would result in capital and operating costs that could be offset by revenue from users. Proper consideration for the management and treatment of septage is especially important for small to medium size plants, as the septage forms a larger contribution and component to plant loadings. Typical considerations for a septage receiving facility include vehicle access and unloading, septage quantity and quality monitoring, screening, grit removal, grinding, mixing, flow equalization/storage, pumping system, odour treatment, and other user and operator requirements.

A representative range of budget construction costs for a larger scale on-site septage receiving facility is $0.7 to $1.5 million. Costs vary depending upon facility scope.

Potential revenues from septage receiving users are shown in **Table 5**, assuming that all forecast septage volumes as defined above are received and accounted for.

TABLE 5:
Septage Receiving - Potential Annual Revenue

	1 - City Residential	2 - Eliz. Twp. Residential	3 - County Residential	4 - Commercial Haulage	5 - Commercial + County
Current Sources (2004)	$ 700	$ 26,600	$ 101,500	$ 809,500	$ 911,000
Future Sources (2024)	$ 720	$ 29,900	$ 114,150	$ 1,117,200	$ 1,231,350

Notes:
1. Potential annual revenues are based on a septage volumetric rate of $8.80 / m^3.

6. Observations and Findings

The estimated septage volume contributions from all scenarios are relatively small in comparison to the plant's design flows. There is minimal hydraulic impact expected with the lower volume scenarios, and with some form of storage and/or flow equalization, there is minimal hydraulic impact expected with the larger volume scenarios.

Servicing the City and Elizabethtown-Kitley Township residential septage sources, on average would involve approximately one to two tanker truck loads per day. This volume may not require or warrant the larger scale septage receiving facilities as described above.

The septage receiving scenario offering the most significant potential source of annual revenue is commercial haulage. It is unlikely that this scenario would be practiced without also receiving septage from the County area. Septage receiving from both commercial haulage and County residential sources (Scenario 5), offers the highest annual revenue potential, and is best able to recover capital and operating costs associated with a septage receiving facility. The combination of the commercial and County sources however also has the most significant impact on solids and organic loadings to the plant.

Table 6 includes the estimated average day septage flow, and estimated influent loadings in terms of total influent concentration for average day flow conditions and a suggested maximum month condition for Scenario 5 septage receiving.

TABLE 6:
Future Influent Characteristics and Loadings

	Influent (No Septage)	Influent - Scenario 5 Septage Receiving	
Parameter	Average Day	Average Day	Maximum Month
Estimated septage volume (ADF) – (additional m^3/d)	NA	400	500
Total influent BOD_5 (mg/L)	120	170	200
Total influent TSS (mg/L)	160	250	300
Total influent TP (mg/L)	4	5	6
Total influent TKN (mg/L)	15	18.5	20

Notes:
1. Total influent concentrations based on Scenario 5 – future conditions.
2. Additional influent Total Kjeldhal Nitrogen (TKN) based on estimated concentrations of 700 mg/L for septage and 100 mg/L for commercial haulage.

The forecast future organic loadings (influent characteristics) with receiving both the commercial haulage and County residential septage although significant increased, are still considered representative of a medium, or medium-strong strength domestic sewage. It should be noted that the characteristics of septage and commercial haulage can vary dramatically, and the use of suggested design values is expected to provide conservative allowances. The most apparent relatively elevated parameters in **Table 6** are the influent BOD_5 and TSS. The additional treatment process upgrade capital and annual O&M costs associated with the increased Scenario 5 septage receiving loadings are estimated as approximately $1.0 million, and $250,000 to $300,000 respectively. The increased O&M cost estimate includes an allowance for the operating and maintenance costs of the septage receiving facility as part of the overall treatment plant operations.

The identified preferred secondary treatment options are suitable to co-treat septage with the characteristics being considered. To accommodate receiving septage from Scenario 1 or 2 sources, minimal works are required as the forecast future loadings fall within the current design basis conditions. To accommodate receiving septage from the Scenario 3, 4 or 5 sources, the forecast future loadings should be considered in the design basis in the biological treatment processes of the Brockville WPCC upgrade. The design of the upgrade works should account for:

- Current and future influent characteristics
- Septage receiving facilities
- Increased treatment processes loadings (e.g. increased aeration requirements)
- Additional sludge and biosolids production

TM4_Septage