CCME

Canadian Council of Ministers of the Environment | Le Conseil canadien des ministres de l'environnement

Technical Supplement 1

Canada-wide Strategy for the Management of Municipal Wastewater Effluent

Economic Plan Supporting the Canada-wide Strategy for the Management of Municipal Wastewater Effluent

April 2008

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1. Introduction

1.1 Economics and Funding Task Group

The Canadian Council of Ministers of the Environment (CCME) is developing a Canada-wide Strategy for the management of municipal wastewater effluent (hereafter, 'the Strategy'). A main feature of the Strategy will be a harmonized regulatory framework for the management of municipal wastewater effluent, including proposed National Performance Standards and a collectively agreed-to approach for implementation and timelines.

These new standards will require significant investments and upgrades to existing wastewater infrastructure. As a result, in May 2006 CCME's Deputy Ministers recognized the economic and funding issues associated with the implementation of the Strategy as key to its success. Consequently, Deputy Ministers established the Economics and Funding Task Group (hereafter the 'task group') to address the issues related to costs and options for funding.

The core purpose of the task group is to provide input to the developing Strategy to contribute to its achievement from an economic and funding standpoint. The work of the task group will complement the background economic work of the Development Committee developing the Strategy and contribute to the development of a feasible Strategy acceptable to ministers.

The task group has compiled information related to the costs associated with implementation of the Strategy. This information focuses on the incremental costs, the fiscal capacity of large versus small municipalities to deal with these costs, the costs associated with facilities with a higher environmental risk and the priority given to these projects within jurisdictions. This information is foundational and vital in order to identify efficient and effective funding mechanisms. The task group will use this information to identify potential funding options for various facility types to implement the Strategy within reasonable time frames.

1.2 Structure of the Economic Plan

In addition to the background above, section 1 outlines the funding principles upon which the Economic Plan was developed. Section 2 examines wastewater capital expenditures by federal, provincial, territorial and municipal governments since 2000. A look ahead and future funding in the context of federal programs is discussed. Section 3 focuses on the estimated capital and non-capital costs to jurisdictions to implement the Strategy. This section also addresses those costs which cannot be determined at this time. Section 4 highlights the funding considerations that must be taken into account in order to ensure that available funds are utilized in an efficient manner to implement the Strategy. The final section presents a summary and analysis of the information presented and the recommendations of the task group, given information presented.

1.3 Funding Principles

Funding and financing are two words often used interchangeably. For the purposes of the Economic Plan they will be defined separately. Funding is the act of providing the resources (funds) for a project, while financing is specifically defined as the use of financial instruments (e.g., loans, bonds, etc.) as a means to obtain immediate funding for a project. Financing is therefore a subset of funding. The term funding will be used throughout the Economic Plan to refer to the range of mechanisms that are used to pay for wastewater infrastructure investments.

Funding principles were established as a means of clarifying the overarching goals that the Economic Plan will facilitate. These serve as the framework within which the considerations of section 4 are taken into account. Options for funding should:

a) emphasize economic, environmental and social sustainability and be consistent with applicable community, regional or broader jurisdictional plans

    - Economic sustainability: Options that are economically sustainable support proper infrastructure asset management, with an emphasis on full cost accounting, full cost recovery and municipal accounting systems that ensure that funding for wastewater infrastructure is not directed to other municipal purposes;
    - Environmental sustainability: Options that are environmentally sustainable support stewardship of the resource, conservation, appropriate watershed management and source water protection;
    - Social sustainability: Options that are socially sustainable support protection of human health and well-being, and should not adversely impact one community or segment of a community more than another;

b) be flexible and take into consideration local, provincial and territorial factors, including the fiscal and human resource capacity of municipal wastewater services providers;

c) promote opportunities for municipalities to self-fund, including the implementation of innovative financing arrangements and schemes that may include private sector involvement; and

d) take into account risk to help inform the appropriateness of the options considered.

2. Wastewater Funding in Canada

2.1 Historic Funding

Wastewater infrastructure is one of many priorities competing for infrastructure funding. Municipalities own and are responsible for the operation of about 70% of wastewater infrastructure in Canada (including collection systems, wastewater facilities and combined sewers). The majority of funding for wastewater infrastructure is therefore provided directly by municipalities and recovered by revenues generated either through their rate base or from service charges. Supplemental funding for wastewater systems are often provided by federal, provincial and territorial governments.

Statistics Canada reports that approximately $14 billion has been spent in Canada on water and wastewater infrastructure by municipalities between 2000 and 2007, with $2.7 billion of this representing spending intentions for 2007; however, the breakdown between water and wastewater spending is unknown. Additionally, it is unclear whether municipalities have accurately reported funding that was also provided by federal and provincial/territorial governments.

Related to the above, actual spending on wastewater infrastructure on a national basis has proven very difficult to determine. While most provincial and territorial governments can provide accurate accounts of their spending in this sector, the capacity to account for spending at the municipal level – the single greatest funding source of wastewater infrastructure – varies greatly between jurisdictions. In addition, many municipalities do not report on wastewater infrastructure spending separately from drinking water infrastructure. Consequently, an accurate picture of annual or multi-year spending on wastewater infrastructure at a national level cannot be provided at this time, which makes it difficult to quantify the

gap between current spending and that needed to manage the added requirements proposed under the Strategy.

Anecdotal evidence from many municipalities and the Canadian Water and Wastewater Association indicates that funding for wastewater infrastructure is insufficient, indicating the existence of a deficit in funding for wastewater infrastructure, as with other infrastructure sectors. As a result, it can be reasonably assumed that, the infrastructure requirements imposed by the Strategy will be mostly in addition to existing levels of expenditure. Therefore, a substantial increase in the level of investment in wastewater infrastructure will probably be necessary to meet the requirements of the Strategy. It should be noted however, that this may be mitigated somewhat where normal course, planned municipal spending includes the construction of a new wastewater treatment facility or the replacement of an existing facility within the proposed timelines of the Strategy. Based on data from Statistics Canada[1], wastewater facilities in general, are one of the most advanced infrastructure sectors, in terms of age. In 2003, the average age of municipally owned wastewater treatment facilities was 16.9 years, with 58% of existing municipal stock nearing the end of its useful life of 29 years. While it is impossible to verify with any accuracy the impact that this will have on the costs of the overall Strategy, it does indicate that in a significant number of municipalities the cost of the requirements to upgrade to the new proposed standards may be incremental to the cost the municipality would be incurring in any event to replace or renew their existing stock.

Between 2000 and 2007, the federal government has instituted a number of cost shared contribution programs for infrastructure. Funding provided under these programs has focused on addressing a number of municipal infrastructure priorities; however, a significant amount has been committed to wastewater infrastructure – both collection and treatment systems. In total, just under $960 million in federal funding has been provided to wastewater infrastructure between 2000 and 2007. This funding is generally matched by provincial, territorial and municipal governments resulting in investments of $2.88 billion in wastewater infrastructure over the past seven years leveraged from federal-provincial programs alone. Federal infrastructure program funding figures represent only a portion of actual investments in wastewater infrastructure, as provinces, territories and most significantly, municipalities make many more investments that are not reflected through an analysis of federal infrastructure programs. This does not include funding provided under the federal Gas Tax Fund, provincial funding programs and other funding mechanisms used by municipalities which may also be used to support wastewater infrastructure. As a result, these figures should represent only small portion of overall expenditures in the wastewater infrastructure sector since 2000. In addition, it should be noted that Statistics Canada data indicates that in the early to mid-1990s there was significant investment in wastewater infrastructure, which may explain the seeming lack of emphasis in funding relative to other infrastructure sectors in more recent expenditure data.

2.2 Potential Future Funding

In response to the request for stable long-term funding, the Government of Canada announced in Budget 2008 that the Gas Tax Fund is to be extended at $2 billion per year beyond 2013-14 to become a permanent measure. As will be noted in Section 3, over half of the capital costs of upgrades will be incurred in the first 10 years of the Strategy. As a result, there is significant overlap between the required capital spending and the implementation of this new infrastructure funding. Through the $33 billion Building Canada plan announced in Budget 2007, the Government of Canada is making strategic investments in infrastructure that contribute to a growing economy; a cleaner environment and strong and prosperous communities. The Building Canada plan provides $33 billion over a seven year period until 2014, and includes both base funding initiatives for municipalities as well as program funding for

[1] Reference - *The Age of Public Infrastructure in Canada*, Statistics Canada Analysis in Brief Series, January 30, 2006

provinces and territories. Of note, under the $8.8 billion Building Canada Fund, wastewater infrastructure is one of the five categories of investment designated as a "National Priority." While it is expected a significant portion of funding under the Building Canada Fund will be targeted towards projects within these priority categories, specific funds have not been set aside to respond directly to the requirements of the strategy. In addition, the Government of Canada announced in Budget 2008 that the Gas Tax Fund is to be extended at $2 billion per year beyond 2013/14 thereby becoming a permanent measure.

With respect to wastewater infrastructure a few aspects are particularly notable:

- $8.8 billion for the Building Canada Fund with spending allocated among provinces and territories on an equal per capita basis. This funding will be used to support investments in the core national highway system, large-scale projects such as public transit and sewage treatment infrastructure, and small-scale municipal projects such as cultural and recreational facilities.
- $2.275 billion over seven years in equal per jurisdiction funding. Pursuant to this commitment, each province and territory will be provided an additional $25 million per year to support investments in national priorities throughout the country.

Historically, projects funded under the federal cost shared programs have been identified jointly with provinces, territories and municipalities, in accordance with priorities established in each jurisdiction. It is important that all jurisdictions look carefully at the funds available through these programs and the amounts that will have to be spent in the coming years to upgrade wastewater systems as agreed to under the new Strategy (as outlined in section 3). Each jurisdiction will then have to assess their priorities for federal infrastructure funding given that there will be competing demands for these funds.

3. Jurisdictional Costs

All orders of government – federal, provincial, territorial and municipal – will need to bear the costs of implementation of the Strategy. These costs include both the capital costs to upgrade wastewater facilities to meet the proposed national performance standards, as well as non-capital costs (e.g. studies, monitoring) that would be required to implement the Strategy.

There are both capital and non-capital costs that have not been considered in the Economic Plan, although they are within the scope of the Strategy. These costs will be discussed in more detail later in this section:

- Some costs are related to site-specific conditions that cannot be predicted with any certainty (e.g., collection systems).
- Costs which are are expected to arise as the Strategy evolves in future years (e.g., combined sewer overflows, additional treatment).

The Strategy is limited in scope and therefore the costs are estimated and discussed only for facilities that are subject to the Strategy. Some costs are therefore beyond the scope of this document.

- The Strategy does not apply to facilities other than those discharging to surface water; therefore there are no costs presented for systems discharging to the subsurface or via evaporation.
- Costs that are related to the operation and maintenance of wastewater facilities (aside from directly related non-capital costs, such as monitoring costs, as indicated above) are not included.
- Administrative costs for federal, provincial territorial and municipal governments are also outside the scope of both the Strategy and the Economic Plan.

3.1 Capital Costs to Meet the Proposed National Performance Standards

The Strategy proposes that wastewater facilities meet proposed National Performance Standards of 25 mg/L for 5-day carbonaceous biochemical oxygen demand, 25 mg/L for total suspended solids, and 0.02

mg/L for total residual chlorine. There are a significant number of facilities across Canada which will require upgrading to meet these standards. Those wastewater facilities which currently do not meet the proposed National Performance Standards or do not meet the proposed standards consistently due to physical deterioration of the wastewater facility, facility capacity or original facility design, will require upgrading to achieve these standards consistently.

Where a wastewater facility is located in a municipality where combined sewer overflows are an issue, a decision will be made as to which is the higher environmental priority: ensuring the facility meets the proposed National Performance Standards within the identified timeframe, or addressing the environmental impact of the combined sewer overflows. Where it is determined that addressing the combined sewer overflows are the higher priority, funding may need to be directed towards combined sewer overflows prior to developing or upgrading wastewater facilities to meet the proposed National Performance Standards. Similary, where work to achieve the Effluent Discharge Objectives established for a facility is a priority, this may take precedence over meeting the National Performance Standards. In either case, an action plan must be prepared by the facility owner and submitted for approval.

Upgrading a wastewater facility to meet the proposed National Performance Standards will likely create a concurrent need to increase the biosolids management capacity of the facility; therefore, the capital costs presented for meeting the proposed national performance standards for carbonaceous biochemical oxygen demand and total suspended solids includes a biosolids component. In addition, there are systems currently employing chlorination for disinfection of effluent which would need to retrofit either dechlorination or ultraviolet irradiation equipment to meet the proposed national performance standard for total residual chlorine. The capital costs identified in tables 3.1 and 3.2 below are based on either a CCME costing template and/or actual jurisdictional cost estimates.

Ranking of capital projects is necessary in order to apportion available funds to cover capital costs over the implementation timeframe of the Strategy. A national level preliminary ranking of need to meet the proposed National Performance Standards based on level of treatment and broad environmental risk was used to rank upgrades in order of priority (see Appendix A). For example, under this methodology, a wastewater facility with primary treatment discharging to a sensitive receiving environment would receive “high priority” for upgrading whereas a secondary wastewater facility discharging to a large receiving environment with little sensitivity would receive “low priority” for upgrading. This preliminary ranking was used to estimate the required capital funding flow over the implementation period of the Strategy.

3.2 Non-Capital Costs to Implement the Strategy

An important component of the Strategy is an initial characterization of effluent and an environmental risk assessment which are used to ultimately establish site-specific effluent discharge objectives for harmful substances. High-risk facilities will be required to complete the initial characterization and environmental risk assessment first. Based on the results of the initial characterization and environmental risk assessments for these facilities, a refined method/program for both initial characterization and environmental risk assessments will be developed for all medium and low risk facilities. These one-time costs will be incurred during years 1-7 of the Strategy and are estimated to total (real costs) $113 million for the effluent characterization and $63 million for the environmental risk assessments. Some municipalities may have completed an environmental risk assessment which will be considered equivalent to the requirements of the environmental risk assessment under the Strategy which would reduce the overall costs in this area.

Monitoring is an important part of the Strategy. Estimated annual costs (real costs) for compliance monitoring and toxicity testing are estimated at $59 million for all facilities.

Environmental monitoring at a watershed level will be required in all jurisdictions. The process for environmental monitoring will be determined in years 1-5 under the Strategy. Environmental monitoring costs will begin to be incurred in years 6-10. It is estimated that the costs for environmental monitoring will be $185 million over every five years.

3.3 Summary of Costs

The estimated total capital costs (including inflation) to achieve compliance with the proposed National Performance Standards across Canada have been identified for both a 30 year implementation timeframe and a 20 year implementation timeframe.

Over 30 years, depending on inflation, the estimated capital costs range from $7.5 billion to $ 9.3 billion, and the non-capital costs range from $2.8 billion to $3.8 billion. In total, the range of capital and non-capital costs over 30 years ranges from $10.3 billion to $13.1 billion.

Over 20 years, depending on inflation, the estimated capital costs range from $7.3 billion to $8.8 billion, and the non-capital costs range from $2.3 billion to $2.8 billion. In total, the range of capital and non-capital costs over 20 years ranges from $9.9 billion to $12.1 billion.

Table 3.1. Summary of Estimated Costs over a 30 Year Implementation Period at 2% and 4% Inflation

30-Year Implementation (nominal – 2% inflation)	**Years 1-5**	**Years 6-10**	**Years 11-20**	**Years 21-30**
Capital Investment	$0 (a)	$3,760,000,000	$3,727,000,000	$22,000,000
Non Capital Investment (b)				
Initial Characterization (c, d)	$118,000,000	$0	$0	$0
ERA (e)	$66,000,000	$0	$0	$0
Annual Monitoring (f)	$307,000,000	$339,000,000	$788,000,000	$960,000,000
Environmental Monitoring (g)	$0	$32,000,000	$75,000,000	$91,000,000
Sub total Non Capital Investment	$491,000,000	$371,000,000	$863,000,000	$1,051,000,000
Totals	$491,000,000	$4,131,000,000	$4,590,000,000	$1,073,000,000
30-year Total	**$10,285,000,000**			

See table notes below

30-Year Implementation (nominal – 4% inflation)	**Years 1-5**	**Years 6-10**	**Years 11-20**	**Years 21-30**
Capital Investment	$0 (a)	$4,313,000,000	$4,962,000,000	$36,000,000
Non Capital Investment (b)				
Initial Characterization (c, d)	$122,000,000	$0	$0	$0
ERA (d)	$68,000,000	$0	$0	$0
Annual Monitoring (f)	$320,000,000	$389,000,000	$1,049,000,000	$1,552,000,000
Environmental Monitoring (g)	$0	$37,000,000	$100,000,000	$147,000,000
Sub total Non Capital Investment	$510,000,000	$426,000,000	$1,149,000,000	$1,699,000,000

Totals	$510,000,000	$4,739,000,000	$6,111,000,000	$1,735,000,000
30-year Total	**$13,095,000,000**			

Table Notes
a. Some facilities will build or upgrade in the first five years of the strategy. These costs would then be reduced from subsequent time periods within the Strategy.
b. For the purposes of cost estimation for the non-capital costs, it is assumed there are a total of 3500 wastewater facilities in Canada, of which approximately 80% are small (2800) and 20% are large (700).
c. Initial characterization is linked to the ERA. Some facilities have completed an assessment equivalent to the environmental risk assessment; therefore they will not be required to complete this work again.
d. Initial characterization is a one time cost [(2800 *$16,000) + (700*$98,000) + inflation]
e. ERA is a one time cost [(2800 *$3,500) + (700*$14,000) + inflation].
f. Annual monitoring costs are $57,000,000 per year [(2800 *$4,000/year) + (700*$69,000/year) + inflation]
g. Costs for environmental monitoring will be incurred once every 5 years starting at year 6 of implementation [(2800 *$3,500/5 years) + (700*$250,000/5 years) + inflation]

Table 3.2. Summary of Estimated Costs over a 20 Year Implementation Period at 2% and 4% Inflation

20-Year Implementation (nominal – 2% inflation)	**Years 1-5**	**Years 6-10**	**Years 11-15**	**Years 16-20**
Capital Investment	$0 (a)	$3,760,000,000	$3,542,000,000	$19,000,000
Non-Capital Investment (b)				
Initial Characterization (c, d)	$118,000,000	$0	$0	$0
ERA (e)	$66,000,000	$0	$0	$0
Annual Monitoring (f)	$307,000,000	$339,000,000	$374,000,000	$413,000,000
Environmental Monitoring (g)	$0	$212,000,000	$234,000,000	$259,000,000
Sub total Non Capital Investment	$491,000,000	$551,000,000	$608,000,000	$672,000,000
Totals	$491,000,000	$4,311,000,000	$4,150,000,000	$950,000,000
20-year Total	**$9,902,000,000**			

See table notes below

20-Year Implementation (nominal – 4% inflation)	**Years 1-5**	**Years 6-10**	**Years 11-15**	**Years 16-20**
Capital Investment	$0 (a)	$4,313,000,000	$4,477,000,000	$27,000,000
Non Capital Investment (b)				
Initial Characterization (c, d)	$122,000,000	$0	$0	$0
ERA (e)	$68,000,000	$0	$0	$0
Annual Monitoring (f)	$320,000,000	$389,000,000	$473,000,000	$576,000,000
Environmental Monitoring (g)	$0	$244,000,000	$269,000,000	$361,000,000
Sub total Non Capital Investment	$510,000,000	$633,000,000	$742,000,000	$937,000,000
Totals	$510,000,000	$4,946,000,000	$5,704,000,000	$973,000,000
20-year Total	**$12,133,000,000**			

Table Notes
a. Some facilities will build or upgrade in the first five years of the strategy. These costs would then be reduced from subsequent time periods within the Strategy.
b. For the purposes of cost estimation for the non-capital costs, it is assumed there are a total of 3500 wastewater facilities in Canada, of which approximately 80% are small (2800) and 20% are large (700).
c. Initial characterization is linked to the ERA. Some facilities have completed an assessment equivalent to the environmental risk assessment; therefore they will not be required to complete this work again.
d. Initial characterization is a one time cost [(2800 *$16,000) + (700*$98,000) + inflation]
e. ERA is a one time cost [(2800 *$3,500) + (700*$14,000) + inflation].
f. Annual monitoring costs are $57,000,000 per year [(2800 *$4,000/year) + (700*$69,000/year) + inflation]
g. Costs for environmental monitoring will be incurred once every 5 years starting at year 6 of implementation [(2800 *$3,500/5 years) + (700*$250,000/5 years) + inflation]

Note that actual implementation costs will likely be higher than the estimated costs in Tables 3.1 and 3.2 above due to site specific factors and the accuracy of the available information.

In addition to the above costs, it is estimated an additional $225 million in capital investment costs will be incurred for First Nation on reserve and federal (e.g. prisons, national parks) wastewater facilities. These costs are not incorporated into the tables above as they are monies which will be incurred solely by the federal government.

3.4 Additional Considerations

There are a number of costs which may arise during the implementation of the Strategy which may be subject to significant variation as the Strategy is implemented. These include site-specific treatment costs, combined sewer overflows and sewage collection systems.

Site-Specific Treatment Costs

The purpose of the environmental risk assessment component of the Strategy is to identify the presence of harmful substances in municipal wastewater effluent and determine whether or not the wastewater facility will need to take action to reduce substance levels in effluent to protect the receiving environment. It is not possible to accurately forecast in advance how many facilities will need to take action, which substances will be detected at levels of concern and the exact nature of the actions needed to reduce the substances levels at affected facilities. This makes it difficult at this time to estimate with any certainty the costs that would arise from full implementation of effluent discharge objectives at affected facilities across Canada. It is anticipated that the environmental risk assessment-related costs will be clearer after the first five to seven years of implementation.

What can be expressed in a general sense at this time is that the overall costs across Canada could be significant. If a harmful substance is present in effluent at levels above the effluent discharge objectives, the Strategy requires the wastewater facility to take action to meet its effluent discharge objectives by either controlling the source of the substance or by upgrading the sewage treatment process.

Source control is the preferred method to address the majority of substances. This could involve imposition of sewer use controls through a municipal sewer use bylaw and/or targeted best management practices which could be used by industrial, commercial and institutional users who discharge to the sewer system. There are costs to the municipality associated with imposing sewer use controls including enforcement. There are also costs which would need to be borne by users, including on-site treatment, to pre-treat their effluent to a level prescribed in the sewer use bylaw.

For specific harmful substances, treatment is the only viable option for reducing levels in effluent to meet effluent discharge objectives. The most significant substance in this regard is ammonia, which is

generated naturally by the breakdown of sewage. Upgrading wastewater facilities to allow for nitrification to reduce ammonia content is a major cost. For example, estimated costs for a medium-sized facility to upgrade to nitrification could range from $6 to $20 million. These costs will be better known after the first five years of implementation of the Strategy. It is difficult to predict how many facilities will need to upgrade to nitrification across Canada at this time.

Combined Sewer Overflows

Many major cities in Canada have older portions of their city serviced by combined sewers which carry both sewage and storm water. Combined sewers are widely recognized as being major contributors to water pollution in all provinces as heavy storm water flows exceed the capacity of the combined sewer and the sewer overflows into the environment, dumping untreated sewage at many locations, some of which are close to recreational and other sensitive areas. The Strategy proposes requirements which will initiate action to address the impact of combined sewer overflows across Canada. While these requirements include the completion of a pollution control plan, monitoring of overflow events and floatables control where feasible, if a municipality determines that the impact of a combined sewer overflow is a greater environmental risk than the current quality of the treated effluent, it may propose actions to address the impacts of the combined sewer overflow first, prior to meeting the proposed national performance standards. This could include a capital investment in managing its combined sewers before it upgrades its wastewater facility. Estimates of the costs to meet these requirements have not been completed. While the monitoring costs associated with combined sewer overflows are significantly less than the capital costs, it is likely that the capital cost of meeting a reasonably protective control standard for combined sewer overflows across Canada in the future will be several billions of dollars.

Sewage Collection Systems

The collection systems which convey sewage to wastewater facilities are outside the scope of the Strategy; however, inflow and infiltration into sewer mains can contribute significantly to sanitary sewer flow during storm events and play a significant role in sanitary sewer overflows and bypasses. The general commitment in the Strategy to eliminate bypassing of raw sewage may lead to the need for capital spending on sewer system upgrades, which cannot be predicted at this point of the Strategy's development. This would need to be addressed in a future update of the Strategy.

4. Funding Considerations

Based on sections 2 and 3, above, a number of conclusions can be drawn that will assist in the determination of the availability of funding options. From section 2 it is apparent that although there has been significant expenditure in respect of wastewater infrastructure, an accurate amount of spending by all levels of government cannot be provided, primarily because of the lack of a consistent reporting mechanism for expenditures at the municipal level, separate from that of drinking water infrastructure. Section 3 indicates that costs will vary depending on the timeline of implementation and the inflation rate over that period of time; however, under both options it is clear that regardless of the timeline, the costs over the first 10 years will be the same and over 50% of the total capital costs will likely be incurred within the 6-10 year timeframe, based on a preliminary risk ranking assessment performed by the task group. As a result, the estimated capital costs of upgrading the higher risk facilities for during years 6 to 10 of the implementation of the strategy are between $5.26 and $6.14 billion. Of the remaining capital funding, practically all of it is required in years 11-15 (under a 20 year implementation period), or 11-20 (under a 30 year implementation period). Only a very small proportion of funding will be required in the last years of the implementation of the Strategy (less than 1% under all scenarios). This indicates that the capital costs of the Strategy will be loaded towards the early and mid periods of implementation.

With respect to the mid-period of implementation of the Strategy (years 11-15 for 20 years and 11-20 for 30 years), funding would likely be assisted by the 30 year implementation period. Although the overall costs are higher over a 30 year implementation period, the year over year costs may be more manageable for all orders of government over the 30 year implementation period ($459-611 million per year over 10 years, as opposed to $830 million-$1.2 billion per year over five years). As the highest risk facilities will be dealt with in years 6-10 of the strategy, the economic considerations of a longer implementation period for medium risk facilities may outweigh the environmental benefits.

The success of the Strategy clearly depends to a large extent upon the availability of suitable funding options for municipalities for the implementation of the provisions for the Strategy. It is clear that not all options are applicable or practical in all situations and for all municipalities. Many of the options can or should be combined; however, to reduce the financial burden on a municipality and each may represent a partial solution to issue of funding for capital projects.

4.1 Jurisdictional Considerations

Federal

The federal government is, generally speaking, the smallest player in respect of direct responsibility for the construction and operation of wastewater infrastructure. The federal government has direct responsibility only in limited circumstances: (1) on federally owned lands (such as military facilities owned by the Department of National Defence); and, (2) on First Nations reserves. Despite this relatively limited direct responsibility, federal actions can have implications regarding the wastewater effluent requirements in all jurisdictions, primarily through regulations under the *Fisheries Act*, which limit the deposit of deleterious substances in waters.

Provincial/Territorial

Like the federal government, provincial and territorial governments also do not own the majority of wastewater facilities. They are directly responsible, however for licensing these facilities and setting the effluent treatment levels.

Generally speaking, the effectiveness of the various funding mechanisms at the provincial and territorial level is influenced by a variety of factors. The geography of the province or territory, particularly the presence of sensitive watersheds such as those in Alberta and Saskatchewan which do not drain to the sea, or may be at risk because of multiple user demands and somewhat limited resources, can influence the level of treatment required and thus the scale and cost of a municipal wastewater project. As well, the size of municipalities within the province and territory has an effect as small, scattered population centres tend to have limited tax bases, making the large-scale funding that may be required by municipal wastewater effluent challenging. Such conditions also do not lend themselves to the regionalization of services and the limited tax base may make debt financing and public-private-partnership arrangements less attractive to potential investors than those in larger centres. Finally, the fiscal means of a particular provincial or territorial government may dictate its ability to offer grants, contributions or other transfers to the municipal and regional levels of government.

Municipal

Municipalities own and are responsible for the maintenance of the vast majority (70%) of wastewater facilities in Canada. They are subject to federal, provincial and territorial legislation and standards in respect of the operation of the infrastructure.

The suitability or appropriateness of different funding mechanisms varies most according to the characteristics of the municipality involved. When determining whether a particular mechanism for

funding or financing of wastewater treatment upgrades required under the Strategy is applicable, a number of characteristics have been identified. These relate to the ability of the municipality to self-fund or finance a project, as well as the impact environmental risk assessment has on the timeline within which a municipality has to implement changes to their wastewater treatment systems. The key six factors identified are: (1) size of the community; (2) potential to increase the existing rate base; (3) whether sustainable asset management practices are in place; (4) financial position of the municipality; (5) the growth prospects within the community; and, (6) the environmental risk assessment ranking of the municipality.

Size of Community

The Strategy indicates that very large and large communities are likely to receive a higher risk ranking as a result of the volume of municipal wastewater effluent produced. From a financial perspective, these same communities can generally also be expected to have greater ability to raise revenues from within their own constituency. This ability may be reduced when looking at medium, small or very small communities. This factor can be influenced by the timelines within which the community is operating, as well as the asset management practices that are in place, both of which are discussed below.

Flexibility of Rate Base

The wastewater rate structures within individual municipalities vary widely across the country. Those that have rate structures do not often support the full life cycle cost of operation, maintenance, rehabilitation, potential expansion and eventual capital replacement of the municipalities wastewater infrastructure system. Indeed, many Canadians pay less for wastewater services than they do for other utilities such as cable, phone, electricity or heating. As a result, the rate base may be artificially low in many municipalities with a corresponding flexibility to be increased. These increases in rate bases can be used to generate additional financial revenues that can, in turn, be used to create reserves or to service debt to cover the cost of wastewater treatment upgrades.

Sustainable Asset Management

Sustainable asset management focuses on ensuring that the real costs of the infrastructure asset are accounted for and are used as the foundation on which to base cost recovery and to establish user rates. This helps reduce life-cycle costs and improve system performance. In order to establish sustainable asset management practices in respect of their wastewater infrastructure, municipalities must have a reliable inventory of their wastewater assets, including the age, expected life span and current state of repair of the asset. Sustainable asset management should include long term capital planning that reflects expected growth, as well as recognition of the eventual need to substantively rehabilitate or replace the asset. This must be accompanied by financial planning practices that ensure that the costs of the long-term capital plan are identified and that there is a mechanism in place to address these costs.

Municipal Financial Position

The financial situation of the individual municipality is critical to its ability to access external financing opportunities. Municipalities with strong balance sheets, high bond ratings and low borrowing charges have greater flexibility to access financial markets for loans or other debt financing mechanisms. The ability of municipalities to access debt financing mechanisms is also impacted by provincial and territorial legislation, which may set limits on the amount of debt that an individual municipality can carry. This is often established as a ratio to municipal revenues or reserves.

Community Growth Prospects

Communities that are growing or that have stable populations have more flexibility in terms of their capacity to raise revenues through own-sources. In growing communities in particular, this can include development charges as well as other mechanisms discussed above. Growing communities, as with all communities, also have a particular responsibility to implement demand side management and system

optimization mechanisms to increase conservation and reduce the costs associated with infrastructure expansion and upgrades. Communities that are declining will have a correspondingly reduced capacity to raise own-source revenues as they are faced with a declining rate base. In addition, senior governments (senior governments include federal, provincial and territorial governments) may be less inclined to prioritize investments in infrastructure assets that the community cannot afford to operate or maintain over the long term.

Environmental Risk Ranking and Timelines

The Strategy will establish clear criteria by which each facility will be able to asses its level of risk and hence, the priority and the timelines within which a particular municipality must implement upgrades to their wastewater treatment system to meet the proposed national performance standards. Municipalities that are identified as having a high environmental risk will be required to meet the proposed National Performance Standards set out in the Strategy within 10 years from the start of implementation. As one of the factors in determining risk is the volume of municipal wastewater effluent produced, it is expected that many large facilities may have a higher risk ranking. As a result, these facilities will likely have less time to plan, and raise their own source revenues, and because of the size of the facility, may have higher costs. Facilities that are identified as medium risk will have up to 20 years to meet the proposed national performance standards, and low risk facilities will have up to 30 years to meet the proposed national performance standards. The lower risk communities will have longer timeframes to plan for the infrastructure upgrades required, this may provide them with additional flexibility to develop and implement strategies to address associated costs.

4.2 Funding Sources and Mechanisms

Innovative Transportation Revenues/Incentives (i.e., Gas Tax Fund)

This type of funding involves a portion of provincial fuel taxes or other revenues (i.e., tolls, license fees) being redistributed to municipalities for the funding or maintenance of road infrastructure. The federal government's Gas Tax Fund is an example of this type of mechanism, although it is important to clarify that the amount of the Fund is a notional amount that has been established in advance and is not directly linked to the gas tax revenues collected by the federal government in a particular year. In Budget 2008, the federal government announced that the Gas Tax Fund is to be extended at $2 billion per year beyond 2013-14 to become a permanent measure. Important features of the Gas Tax Fund include that it is "bankable" and can be used as a mechanism to create a reserve or as a mechanism to repay loans or leverage additional financing. The Gas Tax Fund encourages small municipalities to pool funding and could be used as a mechanism to support regional schemes.

One of the major drawbacks, however, of this form of funding, generally speaking, is that depending on how funding is allocated, small municipalities may not receive enough money individually to fund larger scale projects such as wastewater facilities. Additionally, although this form of funding provides a sustainable source of funds to municipalities, it does so only so long as the federal or provincial partner continues to maintain the program.

Depending on allocation amount received by municipalities, this mechanism will work best in situations where there are longer time horizons for creating a reserve. While it will be most effective in larger communities because of the expected higher allocation amounts, it can also be applicable to smaller communities particularly if regional schemes are initiated.

Government Service Partnerships

Also referred to as "regionalization of services," these arrangements encourage governmental partnerships particularly between neighbouring municipalities to achieve economies of scale to lower capital and administrative costs and/or ongoing maintenance and operational costs. This would be an effective

mechanism for medium and small communities within reasonable proximity of each other. Regionalization schemes are quite adaptive; for example, municipalities could save money by sharing their human resources, thereby saving money to put toward a wastewater facility. There are, however, significant initial costs to organizing Government Service Partnerships. In addition, they are only applicable where geography and location make them a possibility.

Regionalization of services can assist smaller communities in relatively close geographic proximity by allowing them to realize savings and pool risk. Over the short term it can help improve access to financing and over the long term can improve the sustainability of the asset. Regionalization will likely not be of assistance for high risk situations where upgrades are mandated within the 5 years.

Strategic Budget Allocations

This arrangement involves a portion of a tax bill or rate bill being set aside in a special fund. These monies are invested and interest reinvested in order to create a dedicated fund for certain types of capital needs. This type of fund could be created by most municipalities regardless of size, although it is limited by the length of time required to accumulate sufficient funds for a major project such as a wastewater facility. However, to shorten this lag time, the funds in a Strategic Budget Allocation could be combined with a bankable transfer such as the Gas Tax Fund.

This framework can be applicable to municipalities in many situations; however, it is best suited to longer timeframes to allow for the capital fund to be built up. It will work better if associated with life cycle cost accounting to ensure adequate amounts are being set aside but will often face skepticism from members of the public regarding the need for such allocations.

Full Cost Recovery

Full cost recovery can be achieved through a “cash needs basis” or a “utility model,” approach that identifies the cost of providing drinking water to consumers and recouping the full cost of delivery of the service, including operation, maintenance, and eventual replacement. The “utility model,” full cost recovery involves charging rates to users of the utility that reflect the full cost of delivery of the service, including operation, maintenance, rehabilitation and eventual replacement. Full cost accounting is a necessary precursor to full cost recovery. Full cost recovery requires full life cycle cost or accrual accounting for the particular infrastructure as a precursor. It is notable that the Public Sector Accounting Board announced on March 6, 2007 that it would be instituting a new standard for the government sector in terms of the accounting for tangible capital assets. This new standard for full cost or accrual accounting is required to be in place for all local governments for fiscal years starting on or after January 1, 2009.

Full cost recovery, may be viewed as fair as it is the users of the utility who pay in proportional to the amount of the service that they consume. Although full cost recovery has been implemented in Canada previously for municipal wastewater (Kelowna, British Columbia, Saskatoon, Saskatchewan and Edmonton, Alberta all have full cost recovery sewer utility charges), organizing such a funding system can be complicated and may have substantial initial costs.

This can be applied to many municipalities; however, for some small systems it may be prohibitive to implement full cost recovery due to the inability of a small tax base to support the potentially high full cost of wastewater infrastructure. It is generally best suited to longer timeframes. Ultimately, full cost recovery is the most desirable option of funding most wastewater infrastructure as it is open, transparent, accountable and sustainable.

Debt Financing - Bonds, Loans, State Revolving Loan Funds, Securitization Funds

Bonds or loans can be used to finance infrastructure. In both cases the financial situation of the municipality is the main factor regarding the success of the instrument; if a municipality is not rated or has a poor bond rating, bonds may be unavailable and/or interest rates on loans may be very high. As there can be full cost recovery associated with many municipal wastewater systems the rates charged to users can be adjusted to include the cost of borrowing through the bond or loan, providing a guaranteed source of revenue to repay the bond or loan.

A revolving loan fund involves an initial grant from either the federal or provincial government, along with a percentage match contributed by the municipal government. The municipality controls the fund and the federal or provincial partner contributes an ongoing yearly grant that decreases in amount over time. State established revolving loan funds have the advantage of lower rates of interest (as the municipality controls the flow of money into and out of the fund) and can have broad applicability to both small and large municipalities. This type of funding is sustainable and flexible with respect to the conditions of repayment, refinancing, and type of project funded. Indeed, the existence of a potentially dedicated revenue stream through municipal wastewater rates can be utilized to repay funding. The federal Green Municipal Funds are an example of a revolving loan fund that currently exists for municipal infrastructure.

Securitization funds use repackaged loans to sell securities which entitle the owner of the securities to repay a portion or the total amount of a loan. The loans are pooled and the cash flow from the loans is used to pay the interest and principle on the securities. Under this type of funding mechanism, individual municipalities or regional districts may borrow money together and guarantee each other's debt. However, despite the fact that securitization funds can provide long-term financing at low rates, small municipalities may not be able to handle the financial burden. In addition, securitization funds may not be applicable in the wastewater sector since investors may not feel that their investments are diversified in a securitization fund which provides funds to only one type of project.

These mechanisms can be good options for shorter timeframes and where the financial status of the municipality will support lower interest and/or bond rates. This is more often the case for larger municipalities. A poor municipal financial position can also be somewhat offset through the provision of loan guarantees by higher orders of government. The existence of a potentially dedicated revenue stream through municipal wastewater rates can be utilized to repay funding and this could also potentially be combined with revenues through the Gas Tax Fund.

Public Private Partnerships

There are different types of public private partnership arrangements: public-private partnerships; build, own and operate; build, operate and transfer; and private finance initiatives. Some of these arrangements involve private sector financing only, while others focus on the building and operating of the asset, with some of those including maintenance and replacement. Most public private partnership arrangements include provisions that the asset reverts to public ownership at the end of the contract. Public private partnership arrangements have numerous advantages: creativity and the level of expertise and innovation will be increased, costs to governments can be lessened, the private sector is better able to handle more debt than most municipalities, and the arrangement can involve a maintenance phase for which total life cycle costs will be considered. However, this type of mechanism may present some risks to the public that must be appropriately managed. In addition, it is usually only successful if a fair, open and transparent selection process is used in the development of the public-private partnership and in the selection of the private sector partners.

These are generally applicable to very large facilities in large communities, but smaller communities may also benefit from different public private partnership arrangements, particularly under regionalization

schemes. Public private partnerships can also be utilized to address high risk facilities that have a shorter timeframe for implementation. Public private partnerships will work best if accompanied by appropriate life cycle accounting and full cost recovery, as the cost recovery allows a dedicated revenue stream, which particularly enables public private partnership arrangements in respect of wastewater treatment.

Grants and/or Contributions

Grants and contributions from federal or provincial governments are non-repayable and can have different levels of conditionality and different eligibility criteria. Grants have been used extensively in Canada to fund services but tend to have significant costs associated with the application process and are an unpredictable funding resources as the priorities of the federal or provincial governments dictate the amount of funds devoted to grant programs. At the federal level, grants are generally not used to support infrastructure development.

Contributions are normally associated with higher levels of conditionality and are cost shared with other orders of government, as they are usually a "contribution" to a specific project or for a specific reason. Existing federal infrastructure programs are contribution programs such as the *Canada Strategic Infrastructure Fund* and the *Municipal Rural Infrastructure Fund*. Funding is subject to the terms of the Contribution Agreement signed and funding is normally audited to ensure all funding conditions are met. In addition, funding under federal contribution agreements are normally made in the form of reimbursements for eligible costs that the project proponent has incurred.

Grants and contributions could be used for all types of municipalities. They would be particularly applicable to the high- risk facilities that are faced with shorter timeframes, or small municipalities that are unable to fund or finance capital works projects on their own. In order to avoid the funding becoming viewed as an ongoing subsidy and a reward for poorer asset management practices, funding would have to be accompanied by appropriate conditionality (i.e. full life cycle cost accounting and, preferably, recovery).

Additional information on these funding sources and mechanisms is found in Appendix B.

5. Summary and Recommendations

It is difficult to ascertain an accurate estimate of total expenditure on wastewater infrastructure as spending for water and wastewater is usually reported together, especially by municipalities. Between 2000 and 2007, at least $2.88 billion[2] has been spent by federal, provincial, territorial and municipal governments on wastewater infrastructure through federal-provincial programs alone, although it is anticipated that this number is much higher. Statistics Canada figures show $14 billion[3] has been invested on water and wastewater infrastructure in Canada between 2000 and 2007, although neither the breakdown between water and wastewater investments nor the source of the funding is indicated.

There will be costs to all jurisdictions to implement the strategy. Over 30 years, depending on inflation, the estimated capital costs range from $7.5 billion to $ 9.3 billion, and the non-capital costs range from $2.8 billion to $3.8 billion. In total, the range of capital and non-capital costs over 30 years ranges from $10.3 billion to $13.1 billion. Over 20 years, depending on inflation, the estimated capital costs range from $7.3 billion to $8.8 billion, and the non-capital costs range from $2.3 billion to $2.8 billion. In total, the range of capital and non-capital costs over 20 years ranges from $9.9 billion to $12.1 billion.

[2] In federal-provincial-municipal programs cost-share, each committed $960 million towards wastewater infrastructure investment.
[3] Reference – *Capital and Repair Expenditures, Actual, Preliminary Actual and Intentions – 2803*, Table 029-0008, Statistics Canada

It is recognized that these costs are incomplete due to the lack of site specific details regarding infrastructure upgrades and that additional costs will arise as the Strategy is implemented (e.g., the above estimates do not include financing costs). In addition, while the difference between current expenditures in wastewater and the cost of implementation of the Strategy cannot be estimated accurately, based on limited information, existing spending on wastewater infrastructure is not enough to cover the cost of maintenance, replacement and expansion of existing stock at current treatment standards. As a result, it would appear that the large proportion of the estimated capital costs of implementation of the Strategy are additional to existing expenditure levels. This may be mitigated somewhat, as a result of the normal lifecycle replacement of existing wastewater treatment infrastructure assets. As noted in Section 2, based on Statistics Canada data, a significant portion of existing municipal wastewater infrastructure stock is nearing the end of its expected lifespan and will need to be replaced within the timelines of the Strategy. This indicates that for a significant number of municipalities the costs of treatment to the new proposed standards would be incremental to the costs that would have been incurred anyway in the replacement of their existing facilities. It is impossible, however, to estimate with any accuracy the actual impact this will have on the costs of the Strategy.

Funding for capital infrastructure projects will be one of the most significant factors in the success of the Strategy. There are a number of considerations for each jurisdiction when considering funding of wastewater infrastructure that may impact the effectiveness of certain funding options in particular regions. The success of the Strategy also depends upon the availability of suitable funding to municipalities to implement the provisions for the Strategy. While it is clear that not all options are applicable or practical in all situations and for all municipalities, many of the options can or should be combined to reduce the financial burden on a municipality and each may represent a partial solution to issue of funding for capital projects.

Implementation of the Strategy will require a higher level of financial commitment to wastewater infrastructure compared with historic levels. Wastewater infrastructure is just one of many sectors competing for infrastructure funding and all orders of government will be required to prioritize wastewater infrastructure if the Strategy is to be implemented successfully. The funding announced through the Building Canada Fund, which will establish new cost-shared contribution programs for infrastructure and in Budget 2008 which makes the Gas Tax Fund a permanent measure, provides an opportunity for governments to do this.

Based on the economic considerations, both the 20 and 30 year timeframes are feasible, provided all orders of government make funding of wastewater a high priority. The funding committed by the federal government through its Building Canada Fund will be implemented in the coming years and, for most programs and transfers outlines, can be used to fund wastewater treatment infrastructure. The federal funding commitment overlaps significantly with the planned first 10 years of the Strategy, and it is notable that is during this timeframe that the majority of the capital costs will be incurred. As a result, if wastewater infrastructure is appropriately prioritized over this timeframe, there should be sufficient funding, assuming appropriate cost-matching by provincial, territorial and municipal governments, to address the capital costs of upgrades to the high risk facilities.

As indicated above, the majority of the costs will be incurred within the first 10 years of implementing the Strategy, regardless of the timeframe chosen. It should also be noted that because of the predicted cash flow requirements over the 11-15 versus the 11-20 year timeframe for upgrades to medium risk facilities, the 30 year timeframe may be more easily accommodated from a fiscal perspective. In addition, the longer timeframe will have the added benefit of increasing the availability of funding options, many of which can be more easily accessed over a longer timeframe. At a minimum, within 20 years, both high and medium risk facilities are required to meet the proposed national performance standards. Should a

30-year implementation period be chosen, the last 10 years would address the low risk facilities. Based on the small amount of estimated capital costs for these facilities, they are few in number. In addition, where a municipality will address issues with its combined sewer overflows prior to meeting the national performance standards, funding for combined sewer overflows will likely be required. A 30-year implementation timeframe would provide these municipalities with greater financial and planning flexibility to address combined sewer overflow issues and still meet the proposed national performance standards within the 30 years.

Balancing the above considerations, inflation will result in higher overall costs over a 30 year time frame and the environmental benefits will be realized at a slower pace (ten years later), which may be considered by Canadians to be too long a timeframe for realization of the environmental benefits.

There is no consensus within the task group on a recommendation for a particular implementation timeframe. Both timelines are feasible and there are advantages and disadvantages associated with both 20- or 30-year implementation timeframes.

5.1 Recommendations

The following recommendations will assist in making the Strategy more economically achievable:

Funding Principles

1. The following funding principles should inform funding programs and decisions.

a) emphasize economic, environmental and social sustainability and be consistent with applicable community, regional or broader jurisdictional plans

- Economic sustainability: Options that are economically sustainable support proper infrastructure asset management, with an emphasis on full cost accounting, full cost recovery and municipal accounting systems that ensure that funding for wastewater infrastructure is not directed to other municipal purposes;
- Environmental sustainability: Options that are environmentally sustainable support stewardship of the resource, conservation, appropriate watershed management and source water protection;
- Social sustainability: Options that are socially sustainable support protection of human health and well-being, and should not adversely impact one community or segment of a community more than another;

b) be flexible and take into consideration local, provincial and territorial factors, including the fiscal and human resource capacity of municipal wastewater services providers;

c) promote opportunities for municipalities to self-fund, including the implementation of innovative financing arrangements and schemes that may include private sector involvement; and

d) take into account risk to help inform the appropriateness of the options considered.

Current Expenditure on Wastewater Infrastructure

1. All orders of government need to place a high priority on wastewater infrastructure in order to ensure access to funding programs.

Costs of the Strategy

1. The initial effluent characterization and environmental risk assessment are required in years 1-5 are an imperative part of the Strategy. A phased approach – high risk facilities will complete the initial characterization and environmental risk assessment first – may be taken to carrying out the initial characterization and the environmental risk assessment. Senior governments should consider establishing a specific short-term funding mechanism for this initial part of the Strategy.

2. During the first 6 years, as a part of implementation plan development, municipalities must estimate the actual costs of implementation of the Strategy, based on site-specific factors and the proposed national guidelines for the implementation of the Strategy.

3. Jurisdictions should continue to examine the on-going costs of implementing the Strategy. For example, administrative costs, CSOs, upgrades, etc.

4. Each jurisdiction should complete a jurisdictional implementation plan, including a capacity and resource assessment on the ability of municipalities to undertake full cost accounting, join a regional system to mitigate cost increases and identify other challenges. This will allow all jurisdictions to prioritize investments based on more complete information.

Funding Mechanisms

Municipal-based Approaches

1. Own-source revenues should be used to the maximum extent possible.

2. Wastewater utilities should be managed so they are sustainable economically, environmentally, and socially.

3. Municipalities should be encouraged to use best management practices and existing tools (e.g. Infraguide) in order to implement proper infrastructure management (e.g. up-to-date asset inventories, state of good repair, focus on lifecycle approach, etc.).

4. Full cost accounting should be implemented by all municipalities as required by the Public Sector Accounting Board.

5. Full cost recovery should be implemented to the extent that funding at local levels makes it possible. Where not possible to fully fund the necessary capital investment, rates should be maximized keeping in mind affordability and sustainability. To assist all jurisdictions in assessing affordability, a model is available at www.ccme.ca.

6. Alternative finance and service delivery mechanisms should be explored to the extent possible.

7. Municipalities should be encouraged to make wastewater infrastructure a high priority and utilize existing and future funding programs including the federal Gas Tax Fund and provincial equivalents.

Senior Governments Assistance (federal, provincial and territorial governments)

1. Senior government assistance should consider and encourage best management practices, full cost accounting, full cost recovery and municipal sewer use by laws.

2. Funding should consider the financial capacity and fiscal constraints faced by small and very small municipalities.

3. Senior governments should also consider other means of assistance to small and very small municipalities (e.g., planning, capacity building).

4. Senior governments should make wastewater infrastructure a high priority under existing and future infrastructure funding programs as a means to implement the Strategy.

5. Senior governments should consider establishing financing mechanisms to assist municipalities in accessing low cost financing, thereby potentially increasing the number of municipalities that will have

the capacity to borrow, and enabling those municipalities that have the capacity to fund investments to spread the investment cost over a number of years (e.g., the use of revolving funds like the Green Municipal Funds).

Economic Information Management

1. Better tracking, monitoring reporting of costs and funds committed to wastewater treatment are needed by municipalities. Municipalities should report accurately (and publicly) their current level of wastewater expenditure, the value of their wastewater asset base, and the multi-year investment needed in their wastewater system.

2. The possible establishment of a mechanism to collect and/or act as a repository of information on the value of the wastewater infrastructure asset base and associated infrastructure expenditures on a national basis (e.g., Statistics Canada) should be considered. Information collected should include separate statistics on the level of water versus wastewater utility expenditures by private, municipal, provincial, territorial and federal sources. Economic information should be included in the overall approach to one-window reporting under the Strategy.

Implementation

1. Implementation of these recommendations should include:
   a. Initial Characterization and an environmental risk assessment will be completed for high risk facilities first, with all remaining facilities to follow.
   b. Identify the municipal-financial capacity: the capacity of a municipality to address the problems, if any).
   c. Jurisdiction implementation plan based on a and b.
   d. Formation of a national municipal wastewater effluent management committee to provide guidance on the various elements of the Strategy during its implementation, to coordinate future work, to review the Strategy, to report on progress in implementing the Strategy and to manage emerging wastewater issues.

Appendix A National Ranking for Capital Funding Priorities for Wastewater Systems Template

Municipality	**Population**	**Level of Treatment**	***Value***	**Receiving Environment**		***Value***	**Overall Value***	***Estimated Cost of Upgrading - per facility ($,000)***	***Number of Similar Facilities***	**Total Estimated Cost ($,000)**
				Proximity to higher risk uses	*Receiving Watercourse Concern*					Includes biosolids
		Preliminary Treatment Primary Treatment Secondary Treatment Sewage Lagoons			Proportion of flow and location of discharge					

This preliminary ranking was used to estimate the required capital funding flow over the implementation period of the Strategy: 1-5 years, 6-10 years, 11-20 years and 21-30 years. Each jurisdiction filled in the template for those facilities which would require upgrading as a result of the Strategy or for those municipalities which would require a wastewater facility as a result of the Strategy. A value, based on current information, was estimated for all categories above for each facility and a total identified. Priority to rank capital projects was based on the following values:

- High Priority – those facilities with an overall value greater than 25.
- Medium Priority – those facilities with an overall value between 11 and 24.
- Low Priority – those facilities with an overall value 10 and less.

Overview

The purpose of this template, that can be applied to all Canadian wastewater facilities, is to develop a national level preliminary ranking of need, based on the level of treatment and the receiving environment. The template is developed in response to the proposed National Performance Standards for 25mg/L five-day carbonaceous biochemical oxygen demand ($CBOD_5$) and total suspended solids (TSS) of 25mg/L, and 0.02 mg/L for total residual chlorine (TRC). Other discharge options, such as the 50 - 50mg/L $CBOD_5$ and TSS, are not being considered in this ranking method.

The template does not address risk from acute toxicity due to ammonia and the related need for upgrades to nitrification, as the strategy does not mandate action to eliminate acute toxicity at the end of pipe associated with ammonia. Nor does the template address risk associated with other harmful pollutants, as these are site specific contaminants whose occurrence cannot be assessed in all systems at this time, and which in any case are largely managed through source control activities (e.g. sewer use controls) rather than infrastructure upgrades.

The various levels of treatment are assigned a value or range of values based on the potential for that system to meet discharge standards. The poorest performance is achieved through preliminary treatment therefore it is assigned the highest number of 30. Primary treatment is that much more efficient that it is assigned a range of values from 24 to 27 depending on how well the system is operating. Secondary treatment produces considerably better results than primary, so it is assigned the weighting of 9 to 15 depending on the system operation. Tertiary treatment is assigned a 0 weighting as this level of treatment

is expected to meet the performance standards. The definitions of the various treatment levels, as well as the definitions applied to the risk to downstream users and watercourse sensitivity, are provided below.

Level of Treatment

The level of treatment will be assigned a value. Higher values will be assigned to treatment processes that are less effective in protecting the receiving watercourse. For example, a system that only provides primary treatment will receive a higher value than a system that provides secondary treatment. Values were determined in a manner that would create a distinct separation between the levels of protection provided to the receiving water course. Providing a range of values allows for consideration for a system's level of sophistication and its ability to reduce the impact of discharges to the receiving watercourse. More sophisticated systems would be assigned a lower score because of the extra level of protection afforded to the receiving watercourse.

Preliminary Treatment: Preliminary treatment involves screening, shredding or grinding for the purpose of removing coarse solids such as sticks, rags and other debris from the incoming wastewater. The purpose of preliminary treatment is to protect downstream treatment components such as pumps and reduce maintenance or operational problems. Preliminary treatment is a common first step to all wastewater facilities. These systems will not consistently meet the proposed National Performance Standards for $CBOD_5$ and TSS referred to above.

Primary Treatment: Primary treatment follows preliminary treatment and involves the use of primary devices that allow flows to be reduced and for solids to settle due to gravity. Commonly, sedimentation tanks that detain flows for 2 to 6 hours to allow settleable solids to settle and be drawn off for separate solids treatment. Typical BOD5 and TSS removal rates in primary treatment are 30% and 60%, respectively. On stand alone primary treatment, primary effluents can be treated with chemical disinfection prior to release. Primary treatment can also be enhanced using chemicals in which inorganic or organic flocculants are introduced into the wastewater to help improve the effluent quality over primary treatment alone. These systems will not consistently meet the proposed National Performance Standards for $CBOD_5$ and TSS referred to above.

Secondary Treatment: Secondary treatment follows primary treatment and is specifically designed for the removal of biodegradable organic matter (in solution or suspension) and the removal of suspended solids. Secondary treatment can include nutrient removal. Compliance standards are commonly set at 25 mg/L to allow for operational variations. The physical, chemical and biological processes in the process design may also fortuitously (not by design) remove other trace contaminants at unpredictable levels. The activated sludge treatment process is the most widely used form of secondary treatment in Canada and the world due to its versatility and relatively low cost. Properly designed and operated, these systems should consistently meet the proposed National Performance Standards for $CBOD_5$ and TSS referred to above.

Sewage lagoons: Sewage lagoons are a type of secondary treatment and one of the more common biological treatment processes used in Canada principally due to low cost and simplicity of operation. Effluent quality from lagoon systems varies depending on the type, size and configuration of the treatment cells (i.e. anaerobic cells, facultative cells and storage cells) and operational mode (i.e., seasonal or continuous discharge mode). A lagoon system with several months of storage capacity, such as systems with once a year discharge, can consistently produce very good effluent quality if the biological activity is not hindered. Recognizing that effluent quality varies with the size, type, configuration and retention time, a range of effluent quality can be achieved for $CBOD_5$ of 5 to 25 mg/L and for TSS of 10 to 30 mg/L. Compliance standards are commonly set higher to allow for operational variability.

While some lagoons consistently produce effluent with $CBOD_5$/TSS levels under 25 mg/l, not all lagoons across Canada are able to consistently meet the proposed limits (Comment: Unless one of the strategy's

proposed exceptions to the 25/25 limits for small and very small systems is adopted - this remains as an outstanding decision for the DC to make). This may be especially true for continuously discharging lagoons that would have to meet 25/25 based on a quarterly or monthly average of regular test results. Continuous or intermittent discharge lagoons not capable of consistently meeting a 25/25 limit would need upgrading consisting of a post-lagoon treatment step prior to discharge to remove excess $CBOD_5$ and TSS (e.g. roughing filters).

Tertiary Treatment: The additional treatment needed to remove suspended, colloidal, and dissolved constituents remaining after conventional secondary treatment. In Canada this term can refer to physical processes that further remove suspended solids, such as sand filtration. Tertiary treatment may include biological processes for removal of nutrients. Typical tertiary effluent $CBOD_5$ and TSS values are 5 and 5 mg/L, which meet the proposed National Performance Standards of 25mg/L for BOTH $CBOD_5$ and TSS.

Receiving Environment

This parameter considers the combination of the proximity of the outfall to higher risk uses, and the sensitivity of the receiving watercourse or waterbody. In terms of the location of the wastewater discharge to that of other activities in the watercourse, a higher rating would be assigned to a higher risk scenario where the discharge is just upstream from potential direct human contact, or a drinking water treatment plant or fishery. An example of a moderate risk is where a wastewater discharge is near a recreational use like canoeing, fishing or wading (no direct human contact or general aquatic consideration). A low risk would be an instance where there is little or no activity downstream where wastewater discharge would have an adverse affect on downstream users. Receiving watercourse concern considers the ability of that watercourse to assimilate the discharge from the wastewater treatment system. This is not a quantitative measure but is rather a subjective evaluation of impact of the discharge on the receiving watercourse.

Proximity to Higher Risk Uses:

Low Risk: Discharge located at such a distance whereby it is unlikely to have any impact on a highly sensitive downstream use (e.g. drinking water intake, aquaculture) at any time of the year.
No highly sensitive uses downstream.

Medium Risk: Discharge located at a distance where there is potential impact on a highly sensitive downstream use for at least part of the year. Discharge located in close enough proximity to a less sensitive uses (e.g. beach) where it is likely to have an impact for at least part of the year.

High Risk: Discharge located in close enough proximity to a highly sensitive use whereby it is likely to have an impact for at least part of the year.

Receiving Environment Sensitivity:

Low Risk: Discharge to rivers/streams where the discharge flow represents a minor proportion of the overall stream flow (at baseflow conditions) downstream of the discharge point. Discharge to off-shore areas of lakes or marine waters where presence of currents and/or distance of discharge from shore provides significant dispersion and dilution of effluent and a buffer for shallow aquatic environments.

Medium Risk: Discharge to rivers/streams where the discharge flow represents a moderate proportion of the overall stream flow (at baseflow conditions) downstream of the discharge point. Discharge to near-shore area of a lake or marine waters where there are significant currents present to promote dispersion and dilution of effluent. Discharge to off-shore area of a lake or marine waters where distance provides a buffer for shallow aquatic environments.

High Risk: Discharge to rivers/streams where the discharge flow represents a significant proportion of the overall stream flow (at baseflow conditions) downstream of the discharge point. Discharge to a lake at a near-shore location with no significant currents able to disperse and dilute effluent.

Receiving Environment Values

The values applied to the receiving environment category are dependent on the combination of the high, medium and low factors assigned to the receiving environment components of proximity to high risk users and watercourse sensitivity. The values are assigned as follows:

Proximity to higher risk uses	Watercourse Sensitivity	Value
High	High	10
High	Medium	8
High	Low	6
Medium	High	6
Medium	Medium	5
Medium	Low	3
Low	High	5
Low	Medium	2
Low	Low	1

Appendix B Funding Mechanisms for Municipal Wastewater Infrastructure Projects in Canada

FUNDING MECHANISM	GENERAL INFORMATION	SUSTAINABLE OR ONE TIME?	REPAYMENT REQUIRED? Y/N Why?	EXAMPLE OF LOCATION WHERE USED
ALTERNATIVE				
Sponsorships	Private contributor or group provides significant donations or strategic funding arrangements to a municipality in exchange for some form of public recognition through advertising, signage, or other. Not a very common form of funding.	One Time.	No repayment required, although the contributor must be acknowledged.	This type of funding has been used in Okotoks, Alberta in the development of open spaces and recreational areas, but does not seem to be very prevalent among Canadian municipalities. Winnipeg is pursuing corporate sponsorships for municipal parks to help cover O&M costs.
Innovative Transportation Revenues and Incentives	Generally involves an agreement in which a portion of provincial or federal fuel or gas taxes collected at gas pumps is redistributed to municipalities towards funding the construction or O&M associated with road infrastructure or other infrastructure projects. Other examples include road tolls, advertising fees along major routes or bus shelters and local road improvement with community funding partnerships. Refer also to "Special Levies" Funding Mechanism below. May be some difficulties in determining how to allocate funds to the municipalities. Those with smaller populations may not receive adequate funds for large projects. Municipalities may also have to follow terms and conditions set by provincial or federal levels of government, which could limit their control on how the funds are used.	Generally sustainable as long as the source of revenue or the incentive is maintained.	No.	Through the New Deal for Cities and Communities the federal government will flow the gas tax funds through the provinces and territories, which will in turn be allocated according to the municipalities as per federal-provincial and federal-territorial bilateral agreements. The funds will be directed towards projects involving public transit, water and wastewater management, solid waste and community energy systems. Calgary, Edmonton and Grande Prairie in Alberta also have a similar program that redistributes provincial fuel taxes.
Government Service Partnerships	Alternative form of service delivery which can take place in the form of inter-municipal, provincial-municipal, or federal-municipal partnerships. Also referred to as "regionalization" of services. Can be ideal for	Sustainable given that the partnership for the delivery of these services is ongoing.	N/A	Regionalized services have been used in Canada, including Annapolis County in Nova Scotia where a regionalized service agreement with other towns is used to manage solid waste

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	small, rural, neighboring communities. Advantage may include a savings in administrative costs and a higher level of service. May be some substantial start-up costs.			and transit.
Strategic Budget Allocations (Funds)	This method involves strategically setting aside certain monies collected from a portion of a tax bill or a portion of a rate bill into a special fund. The fund is then invested, and interest earned is re-invested, with the goal of having a special fund for certain types of capital for future needs. Can be applied to a diverse range of services, and can be appropriate for all sizes of communities. May encounter some skepticism from the public regarding the need for such allocations.	Sustainable.	No.	Reserve funds have been used in Surrey, BC., and Yellowknife, NWT. In Surrey a number of reserve funds have been used. In Yellowknife stabilization funds are used to maintain an adequate level of financial resources for infrastructure and to protect against reduced service levels or higher taxes.
Utility Models	Utility models are also known as "full-cost recovery models" and involve a charge and direct billing for system use and services. Typically, utility charges are charged for potable water, however since wastewater is a by-product of the use of water, the charge for wastewater can typically be collected with the water bill. This type of financing provides for full-cost recovery. This type of charge is normally dependent upon the amount of water used, and it should be considered that the amount of wastewater discharged to the system may not be equal to the amount of water used.	Sustainable.	N/A	In Kelowna, BC, the sewer utility charge for residential customers is made up of a monthly flat user rate and a parcel tax. Similar types of utility charges also exist in Saskatoon, and Edmonton.
BANK				
Bonds	In Canada, bonds can be sold for infrastructure at all three levels of government, although municipal bonds are less common. The borrower promises to repay the capital	One-Time financing.	Yes.	Bonds are commonly issued in both Canada and the United States. In the United States, bonds are more attractive as interest income is exempt from federal and/or state tax.

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	value of the bond along with interest at a specified date. With tax-exempt bonds, the borrower can borrow funds at lower interest rates than regular rates. Since bonds can be immediate, the up-front financial burden on the public is reduced. Some drawbacks are that bonds can create high long-term costs for the public. Not good for communities that are not rated or do not have a good bond rating.			
Loans	Loans include loan agreements, loan guarantees and capital access programs (CAPS). The lender is a private sector company and the borrower is a province or municipality. For CAPS, the borrower and the lender make a payment into a loss reserve fund, and the payment is matched by the federal government, thereby reducing the lender's risk. Loans can be immediate and the up-front cost to the public will be reduced. May not be applicable to small, rural communities. Can pose a significant financial burden, and may be unstable as political and fiscal demands change.	One-Time financing.	The borrower pays back the loan with interest over time to the lender. A federal or provincial government may offer a loan with no interest.	Very common in Canada and the United States.
Revolving Loan Funds/State Infrastructure Banks	A revolving loan fund is set up when a higher level, or central level government provides an initial grant, and lower jurisdictions provide a percent match and oversee the administration of the fund. The lower jurisdiction can then lend and re-lend funds. The central government provides a yearly grant that declines over time. The administration of the fund is paid using interest income. Small communities may have some difficulties with repaying due to limited financial,	This is a sustainable financing mechanism, that provides for one time-funding of infrastructure projects	Yes. As recipients pay back the loans to the revolving funds, the central level government can make new loans to other recipients.	In the United States these are referred to as "State Infrastructure Banks", and are a popular way to finance water infrastructure, including the "Drinking Water State Revolving Fund" and the "Clean Water Revolving Fund". May have potential for wider application in Canada than in the US.

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	technical, administrative and legal resources.			
Trust Funds	A percentage of tax revenues is dedicated to a specific investment area, thereby providing revenues for trust funds. Equitable if the source of revenue draws from users of the type of infrastructure that they support. (e.g. gas tax used to fund a highway infrastructure project.). Do not impose long-term costs on the public.	Sustainable.	No.	In the United States Trust Funds are useful for federal funding of highways and transit projects. In Canada, an example of a Trust Fund is the New Brunswick Environmental Trust Fund that supports projects in environmental conservation projects in New Brunswick.
Securitization Funds	Securitization is the process of repackaging loans and selling certificates, or securities, which entitle the owner to some or all of the repayment on the loans. The loans are pooled and the cash flows from the loans in the pool pay off the interest and principal on the securities. Allows municipalities to borrow together as a group and to guarantee each other's debts. May be beyond the capabilities of the poorest communities. Investors may want to diversify their portfolio and not provide loans for only one type of project.	One Time.	Yes.	Securitization loans have been used in the United States and Canada. For example the Toronto Atmospheric Fund to finance local initiatives related to global warming and to improve air quality in Toronto.
P3				
Public-Private Partnerships (P3s)	This financing arrangement increases the involvement of the private sector in public service delivery, and can range from minimal private-sector involvement to more comprehensive involvement. Can lower government costs. Private sector may be able to take on more debt. However, competitiveness of private companies may mean it is difficult to generate profit.	One-Time financing.	No repayment required, however, in return, the private partner receives payment according to certain standards of service as specified in the contract (i.e. fee, tariff or user charge).	Used in the United States, and becoming more common place in Canada and the world. Some examples of P3s used in Canada include: 1. The Town of Goderich, Ontario initiated a P3 for water and wastewater facilities, water distribution system and sewage collection system. 2. Construction of the Confederation Bridge in PEI 3. Ontario's 407 ETR toll highway
BOO (Build-	A type of P3 used in both	Refer to P3s	Refer to P3s	BOO mechanisms have been

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Operate and Own)	developed and developing nations. With this type of mechanism, a private company or consortium of companies receives a concession to finance, build and operate a facility for a fixed period of time, after which ownership reverts back to the public sector.	above.	above.	used to build wastewater facilities in Canada and the United States. The City of Moncton used a BOO to build a drinking water treatment facility for the Greater Moncton Area. A provate company designed, built and operates and maintains the facility, while it is owned by the City of Moncton.
BOT (Build-Operate and Transfer)	A type of P3 used in both developed and developing nations. The private sector designs, finances, constructs, and operates the revenue-producing public projects, and, at the end of the pay-back period, turns the project back over to the community.	Refer to P3s above.	Refer to P3s above.	The Ambassador Bridge connecting Detroit, Michigan and Windsor, Ontario was built and is owned by a private consortium, which accepts all the risks associated with the construction, ownership and operation of the bridge.
Private Finance Initiative (PFI)	United Kingdom funding mechanism. Refer to P3s above.	Refer to P3s above.	Refer to P3s above.	Used in Britain, called PFIs but can also be referred to as PPPs. Since January 2003 the London Underground has been operated as a Public-Private Partnership (PPP), where all the infrastructure is maintained by private companies although the Underground (the London subway) is still owned and operated by Transport for London.
PUBLIC				
Transfer Payments	In Canada, transfer payments are made from the federal or provincial government levels to the provincial and municipal government levels. Transfers may be non-specific and unconditional or specific and conditional. Provide equality between regions of Canada. However, those paying for the infrastructure are not necessarily the ones using it.	One-time or multi-year financing. Not considered self-sustainable.	Repayment is not expected in Canada.	Very common in Canada. The federal government commonly issues transfer equalization payments between the provinces and territories in Canada.
Grants	Unconditional transfer of funds from the federal or provincial	One Time.	No	Grants have been used in Canada and the United States

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	government levels to the provincial and municipal government levels, an individual or an organization which is not subject to being accounted for or audited but for which eligibility and entitlement may be verified or for which the recipient may need to meet pre-conditions. Can use grant funds to leverage additional funding. Grants limit the number of projects that can be supported.			
Contributions	Transfer of funds with conditions from the federal government to provincial and municipal governments, an individual or an organization. A contribution is a payment to an organization for specific purposes and costs meeting certain eligibility requirements and the terms of a Contribution Agreement. Contributions limit the number of projects that can be supported.	One Time.	No	At Infrastructure Canada, there are 4 funding programs: CSIF, ICP, MRIF and BIF.
Taxation	Taxes are used at all levels of governments to generate revenues. May not be sufficient and are not uniformly applied across all provinces. May be difficult to develop and set the appropriate rate.	Sustainable	No.	Very common in Canada and the United States.
USER BASED				
Special District Financing	Often used in combination with development charges to finance new infrastructure projects that will benefit directly those living in the area serviced by the new infrastructure. Primarily intended for financing of current operations and life-cycle renewal costs rather than for funding construction projects.	May be sustainable or one-time.	No.	Common in the United States.
Development Charges and Fees	In order to fund new infrastructure, municipalities will use a Development Charge instead of a property tax	May be sustainable or one-time.	No.	Canada has been using this financing mechanism for over 20 years. There are many examples included in the

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	increase. May be difficult to develop and set the appropriate rate.			Alternative Funding Mechanisms document as part of the Best Practice by the National Guide to Sustainable Municipal Infrastructure.
Special Levies	Economic Instruments that ensure a funding source exists to cover needs that are difficult to fund through user pay, and for which there is a benefit in explicitly identifying them separately from the general tax levy. Typically, this method is accompanied by a special fund established by the municipality to manage the special levy revenue. Costs for establishing the level may be considerable, and may be inappropriate for smaller communities.	May be sustainable or one-time depending on if the special Levy is set up for a specific time period or is set indefinitely.	N/A	Has been used in the United States (Portland transit system), Australia (watershed protection), and Alberta (infrastructure replacement), Winnipeg (sewer and water), etc.