The Economic Impact of Water Infrastructure Investments: Evaluating Alternatives

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BACKGROUND

Economic projects cannot be evaluated solely in terms of their primary products or effects. Other socioeconomic consequences inevitably follow and these may very well be as important as the primary products. Water generation projects, in addition to producing potable water, generate jobs, value added, sales and tax revenue. They also stimulate regional development, both directly and indirectly. While it is often difficult to disentangle primary effects from these other impacts, any proper assessment of the benefits versus costs of a particular project must go beyond the obvious primary products.

Demand side management (DSM) is now a major plank of most power programs in North America. The motivation is to encourage either a shift in electricity demand to off-peak periods or to a decrease in quantity demanded through efficiencies in end uses. Both BC Hydro and Ontario Hydro have recently initiated far reaching conservation programs. Power Smart of BC Hydro comprises over 25 programs specially designed "to encourage customers to use electricity efficiently, using a variety of means including financial incentives" (BC Hydro, 1990). Hydro Quebec has also drawn plans to conserve electricity. These programs are limited in scope and fall far short of potential conservation possibilities given current practices and technologies. Not all conservation schemes are feasible or desirable. Only those whose costs are below conventional electricity generation are usually considered. The common practice is to compare DSM programs against annualized life cycle costs of the utility's alternative generation projects. The presumption being that projects with lower costs are more socially efficient and should dominate other more costly alternatives. But alternative economic costs are not the only criterion for building or not building a large project. It is often the case that several other socioeconomic considerations are considered too. This is particularly the case with publicly owned and operated utilities such as is the case in Canada. These utilities are expected to serve as instruments of social and political policy. They are called upon to stimulate the economy, promote local control and mastery over domestic resources, build and sustain downstream investments and engender economic independence. While the economist may not be in a position to pass a judgement on the validity or desirability of all of these objectives, it is within his\her domain to enumerate and evaluate the economic trade-offs inherent in any particular choice.

Our objective here is to compare the economic impact of potential water conservation policies with those of water supply alternatives. Surely, a choice is open to society. It may opt to generate a given supply of water or it may elect to conserve (reduce) its demand for water. The issue is how best to evaluate the these two alternatives. For the environmentalist, it may seem that conservation is good for its own sake. Resources are limited and our wants far exceed our ability to satisfy them and where today's consumption may compromise the consumption capacity of future generations. Besides, large investments in small local economies could degrade and compromise the environment and the natural habitat of the local area. For these reasons alone the environmentalists would argue there are sufficient grounds to halt the encroachment on the environment and to promote a culture of frugality and conservation. These environmental imperatives can not be easily separated from economic concerns and realizing the economic potential of the economy. A more balanced approach would entail a simultaneous evaluation of both the environmental and economic impacts of alternatives. In what follows we intend to compare the employment and value added impacts of alternative water supply augmentation with simply not building the projects but instead devoting a comparable investment towards implementing a far reaching but realizable conservation program of equal cubic metre capacity.

Economic Impact Analysis: A Synopsis

Economic impact analysis is predicated on two fundamental principles. First, direct effects are poor measures of the total impact of an activity. Indirect and induced effects comprise a much larger impact than is suggested by examining direct effects only. Second, to the extent that different activities involve a differential use of scarce resources, impacts on income, employment, regional economic base, and taxes are likely to be differential. Thus, in evaluating various water generation and/or conservation options, it is not enough to look at their relative economic feasibility. It is also important to consider the magnitude, composition and location of the economic benefits that result from bringing that water supply to market or reducing demand at source.

A dollar spent on the provision of water from any of several alternatives (supply augmentation or demand management) circulates and recirculates within the economy, multiplying the effects of the original expenditure on overall economic activity. This process is often referred to as the *economic multiplier effect*. It operates at several levels. Initial investment expenditures on wages and materials are generally referred to as the direct costs of the program and their effects on the economy are referred to as the *initial (direct) effects*. Subsequent purchases by suppliers of materials and services to sustain the original and derivative expenditures are called *indirect effects*. *Induced effects* emerge when workers in the sectors stimulated by initial and indirect expenditures spend their additional incomes on consumer goods and services. The circulation and recirculation of impacts are contingent, however, on local sourcing of materials. Therefore, to the extent that imports are purchased by participants in this process, the local or domestic circulation process is diminished or truncated.

This process does not operate in a vacuum. If the economy is operating at full employment, additional expenditures in a particular sector or on a particular project will most likely push up prices and wages as additional workers are drawn from other jobs to the new employment opportunity. Only when the economy is operating at less than full capacity (with some degree of unemployment in critical sectors) and only when there are no apparent bottlenecks in the economy does it become possible to claim that the person-years associated with a project's expenditures represent additional or incremental employment.

Furthermore, economic impacts are not generated from thin air. Resources used in a particular project could have been used in other activities and projects. Perhaps more fundamental here is the fact that funds used today have to come from somewhere (other uses or users) and will have to be paid back, if not immediately, then at least at some future date. There is a general but unacceptable tendency on the part of economists using impact analysis to suspend the concern about paying back the original investment or about the negative effects associated with crowding out other investments. This is particularly a concern when the project under consideration is large and involves substantial borrowing to finance it. A failure to recognize countervailing impacts will result in an exaggeration of the positive gross impacts of the project and a misleading evaluation of its contribution to the economy. One way out of this difficulty is to scale down the various alternatives to some common measure of impact (e.g. per million cubic meters of installed capacity or per million dollar of initial investment).

Investment projects typically involve substantial outlays over a few years that abruptly decline thereafter. While these expenditures generally boost a region's employment level, the effect is usually temporary. Indeed, in less diversified and economically vulnerable regions, such large-scale injections of capital are often responsible for extenuating the boom-bust cycle, with considerable negative consequences. Small communities in such regions often suffer because they share in few of the gains from large-scale projects while sustaining most of the disruption, congestion and inflation costs that can result. Small local economies, in particular, tend to depend on a small subset of activities and are often incapable of sustaining large economic demands. Their economic bases are often limited and unbalanced, and their physical and social infrastructure is correspondingly constrained. Their non-traded (e.g. community serving) goods sectors display limited elasticity and lack the flexibility needed to cushion the economic shock-waves that come in the wake of massive investments grafted on economic systems with limited capacities. Potential gains from massive projects are therefore limited. Greater benefits for such communities will arise from relatively small-scale investments in projects which generate longer term, sustainable, income and employment effects—the kinds of impacts that conservation systems can provide.

Ultimately, the economic impacts of specific projects and programs are only meaningful when considered in the context of available alternatives. In other words, the evaluation of project A must account for the opportunities lost by *not* undertaking it, or by undertaking project B instead. A full consideration of all options in this context would, of course, include both the bulk supply options and demand management options.

Economic impact may be measured using a number of indicators, each measuring a different aspect of this impact. For example, *gross output* includes the total value of goods and services sold by businesses to sustain the project's operations. Direct sales include the value of goods and services bought for on-site operations but exclude taxes, depreciation, wages and salaries and net profits. Total sales represent the entire turnover of goods and services needed to sustain the activity. The limitation of this measure is that, by including the sales of both inputs and outputs, it double counts a certain amount of economic activity. For example, the sale of dressed wood to a furniture manufacturer is counted as is the selling of chairs that results.

In contrast, *value added* avoids double counting of products sold during the accounting period by including only final goods. For instance, only chairs are included, whereas the wood that goes into making them does not appear separately. Total value added is the equivalent of gross provincial income (GPI). It may be calculated by adding wages, interest, rent and profits or by subtracting the total cost of purchased inputs from revenues.

Since there is no reason to expect a one-to-one correspondence between value added and jobs, employment measures become a necessary addition. Different industries exhibit different labour intensities and employ different grades of labour; hence they generate different employment impacts per unit of output. Further, because compensation levels (wage rates) vary by sector and from place to place, it is important to include as measures both *person-years of employment* and *employment income*.

Another measure of impact is the amount of *tax revenue* generated as a result of investment in a project. Tax revenues associated with different activity levels measure of the relationship of government to the economy. Since more than one level of government collects taxes (and each level collects an assortment of different taxes[1]), federal, provincial and local tax impacts are itemized separately.

Not all of the impacts generated are retained by the local economy. Some fraction will also leak to neighbouring economies. The volume of *imports* provides a

[1]The model includes a number of taxes; each is linked directly with the level of government receiving it. For example tariffs on imports are received only by the federal government, whereas business and property taxes are received solely by local (municipal) governments. On the other hand, corporate profit taxes and personal income taxes are shared between the federal and provincial governments.

good indicator of the magnitude of these leakages. And since imports from other provinces are different from out-of-country imports, the import measures in this study are separated into these two components.

Typically, a project passes through two phases, a construction phase and an operations phase. Construction activity is relatively concentrated in space and time and the employment generation that occurs during this phase is temporary and often non-sustainable. It is necessary, therefore, to distinguish between permanent *jobs* and *person-years of employment* when assessing employment impacts. Translating person-years into jobs (and vice-versa) involves making assumptions about the number of repeated person-years that constitute a "job". While there are a number of popular, though *ad hoc*, conversion rates in use by government departments and consulting houses[2], our preference is to avoid using any arbitrary conversion and instead simply to distinguish between construction and operating employment, the former being temporary and non-sustainable, whereas the latter is more likely to be recurrent and sustainable. Under the operating phase it is not difficult to claim that the person years associated with operating expenditures can be translated directly into jobs. The same cannot be said for the construction phase, particularly when the construction expenditures are lumpy and bunched together.

When comparing the impacts associated with different options, a number of equivalency measures can be employed to compensate for scale effects. The two measures that make sense in this context are impacts (e.g. labour income) per thousand (million) cubic meters of economically feasible generating capacity and impacts per dollar (or million dollars) of investment needed to realize that economic potential. In any comparison of relative impacts, differences in the results revealed by these two measures will, of course, reflect differences in the investment cost of the various alternatives. That is, different water supply (demand) options have different capital and operational investment requirements —impacts measured on a per thousand cubic meter basis will reflect this while impacts measured per million dollars of initial expenditure will not. Both measures will be used throughout the analysis.

Research in the energy sector indicates that energy supply options are often less efficient in generating value added, employment or even taxes than conservation options that involve the production and use of many small instruments and products. Much of the differential impacts come from respending of savings by consumers and businesses. It is also the case that conservation impacts result in better jobs, more permanent and better distributed over the regions of the economy (Charles River Associates, 1984; Kubursi, 1992; Marbek, 1993).

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[2]For example, in some federal government departments (e.g., ISTC) it is common to use 5 person-years to represent one job.

OBJECTIVES

The study envisages the following objectives:

- Evaluating the quantitative economic impact of alternative Water Supply Projects in Waterloo and Halton counties by considering both construction and operating expenditure impacts.

- Evaluating and quantifying the economic impacts of several conservation measures adopted or potentially feasible in both counties.

-Comparing, on a common basis (physical units or fixed investment dollars) the relative impacts of supply augmentation strategies versus demand management strategies.

-Extrapolating the alternative impacts on a province wide basis.

The Impact Model

Following Margolick (1984), Jaccard and Sims (1991), Kubursi (1992) and Marbek (1993), we identify five possible impacts of new conservation investments. First there are the traditional direct, indirect and induced impacts associated with the multiplier process. The first two arise from the interindustrial relationships governing the economy while the last emerges from the macroeconomic consumption function. To this a fourth countervailing impact is added to take into consideration the displacement impacts that result from switching away from large investments. Investments in conservation will reduce the need for investments in supply augmentation and will therefore displace all the economic impacts that were likely to follow from undertaking the water generation investment. The displacement impact must be fixed at either the original volume of the intended investment or at the volume of the new investment whichever is highest. In the energy field it is possible to argue that "...For example, although extra insulation on an electric water heater and a hydroelectric project differ dramatically in nature and scale, they are alternative investments. Both are intended to provide the same level of energy service, one by reducing heat loss, the other by providing additional electric resistance heat to supplant the heat lost by a water heater with less insulation. These investments can be compared in terms of life cycle cost, one measuring the cost per kwh of electricity generated, the other measuring cost per kwh of electricity conserved."(Jaccard and Sims, 1991,p.36). To the extent that society is capable of producing one alternative more cheaply than the other, it frees resources to be spent by the economic agents. This effect is referred to as the respending effect. This applies as much to water conservation as it applies to energy conservation.

Adding all these five impacts together and adjusting Margolick , Jaccard and Sims equation to reflect the fact that not all the savings are spent on consumption and fixing the alternatives at a fixed volumetric constraint instead of a dollar value, we arrive at the following equation:

$$N_{ec} = (D_c + I_c + J_c) - (D_w + I_w + J_w)\left(\frac{E_c}{E_w}\right) \times \beta \times \alpha (C_c - C_w) \times E_c \times Z_c + (1 - \alpha)(C_c - C_w) \times E_c \times Z_i$$

Where

N_e = net employment effect (person-years)
D = direct employment (on site)
I = indirect employment
J = induced employment
E = cumulative discounted water, energy, chemicals savings (generation)
C = life cycle cost of water savings (conservation)
β = marginal propensity to consume
α = share of households in water demand
Z = implicit total direct, indirect and induced employment generated by 10 million MIGD conservation expenditures
c = conservation
w = other water supply augmenting projects

The conservation programs here represent incremental programs in excess of those already in existence and implemented by the regions. The results are organized along two perspectives. One that emphasizes the actual investment spending needed to operationalize these programs and the other details the savings in water and energy that are likely to emerge from the implementation of these investments. Our calculations suggest that enormous savings are potentially available to Ontario if it were to choose the conservation option. The array of products needed to sustain the conservation programs is extensive. Their production may provide Ontario with the opportunity to enter the realm of environmental biased technology industrialization in products whose demand can only increase.

The economic impacts of the conservation option involves several components. First, there are the impacts arising from the investments in producing the products and running the programs. Second, there are the respending impacts that arise from the savings implicit in conservation versus generation. Thirdly, there are the displacement effects that are likely to result from shelving other water generating projects. The first two impacts add up to what we will refer to as the gross impacts of conservation. When the displacement impacts are subtracted from the gross impacts we arrive at net impacts.

Water Demand Functions for Halton and Kitchener-Waterloo

Water demand functions describe the response of water use to water price and other relevant factors. In the context of this project they are of interest for two reasons. First, these functions can help identify the degree to which water use can be affected by changes in water prices or other factors which can be manipulated by policy makers. Second, these functions can be used to evaluate the economic benefits and costs of changes in water supply or demand which may result from public policy decisions.

Water demand functions have typically been estimated using cross-section data, in which differences in water use across different municipalities or households during the same time period are explained by differences in water pricing, income, weather and other factors. However, it is potentially misleading to assume that the responses indicated by this type of data are the same as the responses of water use over time to changes in these same factors. Thus it is important to use time-series data, in which changes in water use over time are explained by changes in these explanatory factors. Finally, water demand functions can be estimated using pooled cross-section time-series data, in which both types of data are used together. The advantage of using pooled-data is to increase the number of observations (data points), but care must be taken to disentangle the time-series and cross-section effects. In both Halton and Kitchener-Waterloo, there is a potential to use pooled data insofar as monthly water use data is available by municipality.

Water demand has unique characteristics which must be taken into account when estimating demand functions. Water demand follows strong seasonal patterns, with peak use occurring in the summer, but being highly sensitive to summer weather. Thus weather variable must be included as explanatory variables in the demand equations. A second important characteristic is the prevalence of block pricing, where different quantities of water used by the same customer are billed at different rates. For example, in Halton sewer charges are based on water use, so that in effect they are included in the price paid for water. When sewer and water charges are combined, Halton has a five block water rate schedule. In this schedule, water rates increase in the second and third blocks but then decline in the fourth and fifth blocks. As a result, the marginal water price (the price paid for the last unit of water used) depends on the usage of water. When combined with seasonal patterns in water use this block structure can lead to spurious price effects in the estimated demand functions. For example, a customer consuming on the declining block portion of the schedule may be pushed onto a higher block (lower marginal price) by the normal summer increase in water use. This customer will have higher water use at the same time that the marginal price is lower, suggesting the erroneous conclusion that lower water prices led to the increased use. For a customer on the increasing block portion of the schedule, increased summer use would push the marginal price higher, suggesting the erroneous conclusion that a higher price led to more water use. Great care must be used to correctly incorporate seasonal and weather effects, in order to avoid biasing the estimates of price response.

Another implication of the block pricing structure is that when aggregate water use data is used for a community, different customers will be paying prices on different portions of the rate schedule. Thus the average marginal water price should be a weighted average of the prices for different blocks, with the weights corresponding to the proportions of customers on each block. Ideally, it would be desirable to have this information when using aggregate data. However, it is unlikely that this data will be available for Halton or Kitchener-Waterloo. This distribution could be estimated from knowledge of the distribution of the number of persons serves per water meter. This in turn, may be inferred from the distribution of water meters by size, together with knowledge of the number of households in different types of housing (apartments, single-family homes, etc.), and average household size.

A third important feature of water use is its dependence on equipment used by the customer. This dependence may lead to either more water use if water-using equipment is present, or less water use if water-saving equipment is present. For this reason it is important to have measures of the prevalence of water-using and water-saving equipment in residential households and commercial/industrial establishments.

For Halton , monthly water-billing totals for residential and commercial/industrial users are available by municipality. An alternative set of data gives water pumped in each month. This data also contains estimates of water losses (water pumped but not billed. Since the billing lags pumping and actual water use some shifting in time of data is necessary in order to make the timing of the weather, water pumped and water billing data consistent.

A variety of functional forms can be used for water demand equations. Regardless of the form chosen, the demand function for residential water use will have the following general structure:

$$WU_{it} = F(Y_{it}, C_{it}, D_{it}, P_{it}, W_{it}, H_{it}, POP_{it}, E_{it})$$

where WU_{it} is the average water use per customer (water meter),
Y_{it} is the average real (deflated by the consumer price index) income per customer,
C_{it} is the average real meter charge per customer,
D_{it} is the average real difference variable (representing the effects of the block pricing structure),
P_{it} is the average marginal water price per customer,
W_{it} is a set of weather variables,
H_{it} is the average number of households per water meter,
POP_{it} is the average number of people per household,
and E_{it} is a set of indicators of the presence of water-using or water-saving equipment.

These equations will be estimated using pooled municipal time series data.

The equations for commercial/industrial water use will be based on commercial and industrial employment measures for the region as a whole, in order to indicate the general intensity and composition of commercial/industrial activity. This data will be supplemented by information on the presence of particular large users in each municipality. Weather data will also be included to test for any seasonal factors in commercial/industrial water use. The water price will also be used as an explanatory variable in these equations, together with fixed meter charges and difference variables to account for the block pricing structure.

The Water Supply Augmentation Programs In Waterloo and Halton

The Water Conservation Programs in Waterloo and Halton

The Impact Results

Table presents the results of the gross and net impact analysis of the conservation option. A large employment impact of over thousand person years is associated with the gross conservation expenditures on devices (almost thousand person years) and with respending the savings realized on conservation of electricity use (thousand person years). In a way it may not be legitimate to add these two impacts together. Spending on conservation devices may be once for all expenditure whereas the respending of savings realized on not consuming electricity is a recurrent expenditure. Abstracting from this difficulty, which incidentally improves the advantages of conservation in comparison with the generation option, and deducting the full impact of implementing other projects with similar outlays involved in investments in conservation devices, we arrive at positive net impacts of substantial magnitudes. A net figure of thousand person years remains as well as $ billion in sales and about $ billion in value added. Figures and display these findings.

Concluding Remarks

Appendices

Data
Model
Estimation

DATA

Regional Municipality of Waterloo
Long Term Water Strategy

Engineering Options Summary

Engineering Option:	GROUNDWATER
Option Capacity	10 MIGD
Supply Source:	Additional groundwater from new and existing well fields
Supply Consumer:	RMW
Project Cost(1993 dollars)	61.3 M
O&M Cost	2.4 M/year, based on supplying 10 MIGD
Engineering Option:	AQUIFER RECHARGE
Option Capacity	20 MIGD, based on deep bedrock aquifer
Supply Source:	Grand River(Mannheim)
Supply Consumer:	RMW
Project Cost(1993 dollars)	8.6 M (10 MIGD, traditional) $17.0M (20 MIGD, security)
O&M Cost	5.9M/year (10 MIGD), $8.8M/year (20 MIGD)
Engineering Option:	GRAND RIVER INCREASED LOW FLOW ABSTRACTION
Option Capacity	5 MIGD
Supply Source:	Mannheim (Grand River)
Supply Consumer:	RMW
Project Cost(1993 dollars)	Not applicable
O&M Cost	Not applicable
Engineering Option:	GRAND RIVER LOW FLOW AUGMENTATION
Option Capacity	10 MIGD
Supply Source:	West Montrose reservoir/dam
Supply Consumer:	RMW
Project Cost(1993 dollars)	112.0M
O&M Cost	$6.2m/year, based on supplying 10 MIGD
Engineering Option:	GRAND RIVER LOW FLOW AUGMENTATION
Option Capacity	10 MIGD
Supply Source:	Pipeline: Georgian Bay to Lake Belwood
Supply Consumer:	RMW
Project Cost(1993 dollars)	123.6M, most expensive of the Grand River Engineering Options
O&M Cost	$6.6M/year, based on supplying 10 MIGD
Engineering Option:	GRAND RIVER LOW FLOW AUGMENTATION
Option Capacity	10 MIGD
Supply Source:	Pipeline: Lake Huron to Conestogo Lake
Supply Consumer:	RMW
Project Cost(1993 dollars)	$111.25
O&M Cost	$6.7M/year, based on supplying 10 MIGD
Engineering Option:	GREAT LAKES PIPELINE
Option Capacity	10 MIGD and 20 MIGD
Supply Source:	Hamilton-Wentworth System (lake Ontario, Hamilton)
Supply Consumer:	RMW + communities along route
Project Cost(1993 dollars)	$71.4 M (Traditional), $120.4 M (Security)
O&M Cost	$1.3M/year (Traditional - 10 MIGD), $4.2M/year (Security - 4 MIGD)

Regional Municipality of Waterloo
Long Term Water Strategy

Engineering Options Summary

Engineering Option:	GREAT LAKES PIPELINE
Option Capacity	20 MIGD
Supply Source:	Hamilton-Wentworth System (lake Ontario, Hamilton)
Supply Consumer:	RMW + Halton(Milton)
Project Cost(1993 dollars)	$118.5M (Traditional - 10 MIGD), $102.7M (Security - 4 MIGD))
O&M Cost	$1.5M/year average (Traditional - 10 MIGD), $4.2M/year (Security - 4 MIGD)
Engineering Option:	GREAT LAKES PIPELINE
Option Capacity	10 MIGD and 20 MIGD
Supply Source:	OCWA Nanticoke System (Lake Erie, Nanticoke)
Supply Consumer:	RMW + communities along route
Project Cost(1993 dollars)	$89.4M (Traditional - 10 MIGD), $126.0M (Security - 4 MIGD)
O&M Cost	$1.1M/year (Traditional - 10 MIGD), $3.4M/year (Security - 4 MIGD)
Engineering Option:	GREAT LAKES PIPELINE
Option Capacity	10 MIGD and 20 MIGD
Supply Source:	Lake Huron (Goderich)
Supply Consumer:	RMW + communities along route
Project Cost(1993 dollars)	$126.7M (Traditional), $181.4M (Security)
O&M Cost	$2.3M/year (Traditional - 10 MIGD), $1.3M/year (Security - 4 MIGD)
Engineering Option:	GREAT LAKES PIPELINE
Option Capacity	10 MIGD and 20 MIGD
Supply Source:	Lake Huron (Bayfield)
Supply Consumer:	RMW + communities along route
Project Cost(1993 dollars)	$125.3M (Traditional), $181.3M (Security)
O&M Cost	$2.3M/year (Traditional - 10 MIGD), $1.3M/year (Security - 4 MIGD)
Engineering Option:	GREAT LAKES PIPELINE
Option Capacity	10 MIGD, 20 MIGD, and 70 MIGD
Supply Source:	OCWA London System (Lake Huron, Mount Carmel)
Supply Consumer:	RMW + communities along route
Project Cost(1993 dollars)	$110.0M (Traditional), $154.3M (Security), $428.2M (Displacement)
O&M Cost	$0.9M/year (Traditional - 10 MIGD), $2.1M/year (Security - 4 MIGD),
Engineering Option:	GREAT LAKES PIPELINE
Option Capacity	10 MIGD and 20 MIGD
Supply Source:	Georgian Bay (Thornbury)
Supply Consumer:	RMW + communities along route
Project Cost(1993 dollars)	$181.3M (Traditional), $222.2M (Security)
O&M Cost	$2.5M/year (Traditional - 10 MIGD), $1.9M/year (Security - 4 MIGD),
Engineering Option:	GREAT LAKES PIPELINE
Option Capacity	20 MIGD
Supply Source:	Private system - TransCanada Pipelines Ltd. (Georgian Bay, Collingwood)
Supply Consumer:	RMW + York Region
Project Cost(1993 dollars)	$193.5M (Security)
O&M Cost	$4.8M/year (Security - 4 MIGD)
Engineering Option:	GREAT LAKES PIPELINE
Option Capacity	
Supply Source:	Lake Ontario (Halton Regional Headquarters)
Supply Consumer:	RMW + Halton (Milton)
Project Cost(1993 dollars)	$145.8M (Security)
O&M Cost	$1.4M/year (Security - 4 MIGD)

City Of Cambridge

Tune Up Customers Potential Annual Energy Savings

Total Tune-Ups 1903

	KWHRS	Dollars
Insulating Blanket	552,384	$34,990
Pipe Wrap	149,073	$9,443
Temperature Reductions	228,220	$14,393
Showerheads	655,622	$41,530
Total Electrical Savings	1,585,299	$100,356

Potential Annual Customer Water Savings

Total Kits delivered 1903

	Installation Rated(%)	M3	Dollars
Toilet Dams	74.3	39,590	$47,263
Areators	67.6	6,432	$7,679
Showerheads	63.8	41,280	$49,280
Total Water Savings		87,302	$104,222
Total Water & Electrical Savings			$204,578

Savings From Customer Account Data

Period in Months	5
Electrical Accounts	1,082
Water Accounts	560
Energy Savings(KWHR)	110,644
Water Savings(M3)	3,805

Projected Annual Savings Based On Account Data

Based on a total of 1903

# of customers		Dollars
Energy Savings (KWHR)	486,496	$30,817
Water Savings(M3)	32,236	$38,590
TOTAL		$69,407

HOUSEHOLD & WATER USE DATA

AUTOMATICALLY READ METER GROUP

	ULF Toilet	Retrofit	Combination	Control
Total No. Households	17	5	12	16
Total No. Persons	55	17	38	54
Persons/Household Avg.	3.24	3.40	3.17	3.38
Before (Avg. in Litres/Day)	790	620	770	720
After (Avg. in Litres/Day)	550	620	630	680
Percent Std. Deviation	24	9	21	18
Water Reduction (Avg. in Litres/Day)	240	0	140	40
Water Reduction	0.304	0.000	0.182	0.056

MANUALLY READ METER GROUP

	ULF Toilet	Retrofit	Combination	Control
Total No. Households	141	37	34	100
Total No. Persons	439	106	100	275
Persons/Household Avg.	3.11	2.86	2.94	2.75
Before (Avg. in Litres/Day)	650	670	710	600
After (Avg. in Litres/Day)	520	610	590	570
Percent Std. Deviation	25	18	23	23
Water Reduction (Avg. in Litres/Day)	130	60	120	30
Water Reduction	0.200	0.090	0.169	0.050

HOUSEHOLD SAVINGS & PAYBACK PERIOD

	ULF Toilet	Retrofit
Avge cost(Inc. Taxes, in $)	575	230
Household annual Savings (minimum, in $)	65	N/A
Household annual Savings (maximum, in $)	135	30
Simple Payback (minimum, in Years)	4.3	7.7
Simple Payback (maximum, in Years)	8.8	N/A

Note: Average cost includes: Installation of a showerhead, 2 faucets aerators and 2 ULF Toilets OR 2 retofits

Water Usage By Area Municipalities
(Gallons)

1994	Kitchener	Cambridge	Waterloo	North Dumfries	Rate/1000 gals	Total/Month
January	457,390,560	263,325,000	194,610,460	4,245,140	1.99	919,571,160
February	400,251,280	281,998,000	189,384,960	4,722,000	1.99	876,356,240
March	422,602,840	311,837,120	188,645,360	4,916,220	1.99	928,001,540
April	438,838,180	281,821,680	191,396,040	4,786,980	1.99	916,842,880
May	449,025,940	309,319,000	189,138,180	5,697,340	1.99	953,180,460
Total	2,168,108,800	1,448,300,800	953,175,000	24,367,680		4,593,952,280
1993	**Kitchener**	**Cambridge**	**Waterloo**	**North Dumfries**	**Rate/1000 gals**	**Total/Month**
January	436,828,040	253,910,000	181,517,820	4,181,080	1.99	876,436,940
February	414,214,240	277,913,000	171,597,140	4,514,080	1.99	868,238,460
March	446,879,180	281,671,000	184,090,280	4,231,360	1.99	916,871,820
April	425,432,040	286,729,040	172,160,780	4,404,120	1.99	888,725,980
May	469,539,180	293,950,360	192,405,620	5,291,100	1.99	961,186,260
June	451,392,700	306,288,000	182,315,320	5,264,000	1.99	945,260,020
July	447,611,560	287,614,000	189,101,100	5,720,000	1.99	930,046,660
August	460,807,160	327,340,000	196,579,680	7,427,000	1.99	992,153,840
September	537,002,620	291,213,000	195,763,040	4,793,000	1.99	1,028,771,660
October	415,906,040	268,252,000	191,967,820	4,845,000	1.99	880,970,860
November	365,526,700	304,365,800	193,899,860	5,139,000	1.99	868,931,360
December	446,889,300	310,047,000	173,604,860	4,639,000	1.99	935,180,160
Total	5,318,028,760	3,489,293,200	2,225,003,320	60,448,740		11,092,774,020
1992	**Kitchener**	**Cambridge**	**Waterloo**	**North Dumfries**	**Rate/1000 gals**	**Total/Month**
January	479,391,000	279,945,000	198,766,940	3,730,000	1.95	961,832,940
February	461,505,000	295,753,000	212,770,820	3,751,000	1.95	973,779,820
March	411,838,000	294,125,000	210,417,500	3,570,000	1.95	919,950,500
April	443,174,000	289,835,000	212,487,480	4,080,000	1.99	949,576,480
May	450,594,000	291,740,000	216,477,600	4,555,000	1.99	963,366,600
June	531,730,000	335,120,000	266,336,720	5,590,000	1.99	1,138,776,720
July	422,415,000	275,540,000	214,718,900	4,100,000	1.99	916,773,900
August	426,505,000	264,100,000	200,592,240	3,720,000	1.99	894,917,240
September	405,822,000	258,708,000	206,193,020	3,849,000	1.99	874,572,020
October	442,867,920	286,705,000	211,446,400	4,725,980	1.99	945,745,300
November	416,927,500	285,310,000	192,395,040	4,587,000	1.99	899,219,540
December	430,880,780	251,171,800	192,981,360	4,458,220	1.99	879,492,160
Total	5,323,650,200	3,408,052,800	2,535,584,020	50,716,200		11,318,003,220
1991	**Kitchener**	**Cambridge**	**Waterloo**	**North Dumfries**		**Total/Month**
January	500,469,000	201,055,000	200,202,620	3,380,000		905,106,620
February	430,110,000	270,510,000	189,581,300	3,116,600		893,317,900
March	442,929,000	259,465,000	184,803,560	3,187,000		890,384,560
April	562,962,000	310,080,000	213,746,940	3,849,000		1,090,637,940
May	502,041,000	326,230,000	213,209,472	4,430,000		1,045,910,472
June	487,356,000	323,260,000	223,620,920	5,030,000		1,039,266,920
July	535,190,000	353,198,000	238,824,800	5,300,000		1,132,512,800
August	466,922,000	315,574,000	200,142,540	3,500,000		986,138,540
September	493,754,000	317,530,000	215,534,160	4,588,400		1,031,406,560
October	479,057,612	301,395,000	198,008,100	4,000,000		982,460,712
November	403,092,000	262,270,000	228,286,880	3,600,000		897,248,880
December	491,196,000	277,000,000	208,951,380	3,860,000		981,007,380
Total	5,795,078,612	3,517,567,000	2,514,912,672	47,841,000		11,875,399,284
1990	**Kitchener**	**Cambridge**	**Waterloo**	**North Dumfries**		**Total/Month**
January	504,269,000	336,290,000	226,431,000	3,100,000		1,070,090,000
February	437,408,000	289,505,000	188,147,000	3,259,000		918,319,000
March	466,926,000	307,405,000	205,146,000	3,190,000		982,667,000
April	480,292,000	313,880,000	205,196,000	3,600,000		1,002,968,000
May	517,644,000	322,950,000	222,233,000	3,900,000		1,066,727,000
June	504,928,000	331,155,000	219,343,000	4,465,000		1,059,891,000
July	517,925,000	326,455,000	224,538,000	4,125,000		1,073,043,000
August	493,521,000	325,885,000	204,255,000	3,630,000		1,027,291,000
September	429,327,000	307,435,000	193,602,000	3,622,000		933,986,000
October	495,070,800	306,145,000	224,363,000	3,607,000		1,029,185,800
November	479,138,000	295,150,000	200,293,500	3,342,000		977,923,500
December	462,006,000	260,565,000	187,380,180	3,478,000		913,429,180
Total	5,788,454,800	3,722,820,000	2,500,927,680	39,840,000		11,142,091,300

GENERAL	
Engineering Option:	**GROUNDWATER**
Option Code	GW1
Option Capacity	10 MIGD
Supply Source:	Additional groundwater from new and existing well fields
Supply Consumer:	RMW
STRATEGY CLASS	
Traditional	Yes, supply capable of meeting projected Regional demands in excess of existing Regional supply capacity.
Security	Not applicable
Displacement	Not applicable
COST	
Project Cost(1993 dollars)	61.3 M
O&M Cost	2.4 M/year, based on supplying 10 MIGD
ENGINEERING	
Water Quality	Finished water quality meets existing and projected Provincial drinking water standards.
Supply Capability	Additional perennial yields to be as high as 29.5 MIGD, but further investigation required.
Infrastructure Impact	Low to moderate
Operation Impact	Low
Construction Impact	Low
ENVIRONMENT	
ANSI/ESA	Confirmation of locations of new well fields must first be determined to provide more insight into the possible environmental interference by new well fields as well as assessment of the potential effect on fisheries and wetlands.
OTHER	
Public Acceptance	Finished water aesthetics would be unchanged from existing as new supply is from an already utilized source.
Regional Growth/Developmen	Dependent on perception of the Region's existing water quality and quantity. i.e.. raw water source and finished water quality.
Recreation	Not applicable
Miscellaneous	

GENERAL	
Engineering Option:	**AQUIFER RECHARGE**
Option Code	AR1
Option Capacity	20 MIGD, based on deep bedrock aquifer
Supply Source:	Grand River(Mannheim)
Supply Consumer:	RMW
STRATEGY CLASS	
Traditional	Yes, supply capable of meeting projected Regional demands in excess of existing Regional supply capacity.
Security	Yes, providing sufficient water is stored prior to loss of existing supply source.
Displacement	Not applicable
COST	
Project Cost(1993 dollars)	8.6 M (10 MIGD, traditional) $17.0M (20 MIGD, security)
O&M Cost	5.9M/year (10 MIGD), $8.8M/year (20 MIGD)
ENGINEERING	
Water Quality	Finished water quality could be expected to meet existing and projected Provincial drinking water standards.
Supply Capability	More than sufficient but subject to proving tests
Infrastructure Impact	Low to moderate
Operation Impact	Moderate
Construction Impact	Low
ENVIRONMENT	
ANSI/ESA	The ASR facility would be constructed almost entirely on lands already owned by the Region reducing the environmental impacts associated with the option. Assessment of increased withdrawal effect on Grand River fisheries.
OTHER	
Public Acceptance	Finished water aesthetics would be substantially unchanged from existing as new supply is from an already utilized source.
Regional Growth/Developmen	Dependent on perception of the Region's existing water quality and quantity. i.e.. raw water source and finished water quality-a period of uncertainty may exist.
Recreation	Not applicable
Miscellaneous	The option would require to be proven by on-site pilot and proto-type tests before being concluded as being the option of choice for the Study.

GENERAL

Engineering Option:	**GRAND RIVER INCREASED LOW FLOW ABSTRACTION**
Option Code	GR1
Option Capacity	5 MIGD
Supply Source:	Mannheim (Grand River)
Supply Consumer:	RMW

STRATEGY CLASS

Traditional	No, supply only marginally capable of increased low flow withdrawals.
Security	Not applicable
Displacement	Not applicable

COST

Project Cost(1993 dollars)	Not applicable
O&M Cost	Not applicable

ENGINEERING

Water Quality	Finished water quality meets existing and projected Provincial drinking water standards.
Supply Capability	Additional to existing-marginal
Infrastructure Impact	Low to moderate
Operation Impact	Low
Construction Impact	Low

ENVIRONMENT

ANSI/ESA	Possible risk of dissolved oxygen violations. Analysis of direct physical impact of reduced summer flows required as well as the impact of water quality on fish communities.

OTHER

Public Acceptance	Finished water aesthetics would be unchanged from existing as new supply is from an already utilized source.
Regional Growth/Development	Dependent on perception of the Region's existing water quality and quantity. i.e.. raw water source and finished water quality.
Recreation	Not applicable
Miscellaneous	

GENERAL	
Engineering Option:	**GRAND RIVER LOW FLOW AUGMENTATION**
Option Code	GR2
Option Capacity	10 MIGD
Supply Source:	West Montrose reservoir/dam
Supply Consumer:	RMW
STRATEGY CLASS	
Traditional	Yes, supply capable of meeting projected Regional demands in excess of existing Regional withdrawal (subject to MOEE approval)
Security	Not applicable
Displacement	Not applicable
COST	
Project Cost(1993 dollars)	112.0M
O&M Cost	$6.2m/year, based on supplying 10 MIGD
ENGINEERING	
Water Quality	Finished water quality meets existing and projected Provincial drinking water standards.
Supply Capability	Additional 50 MIGD could be abstracted for water supply purposes.
Infrastructure Impact	Low to moderate
Operation Impact	Moderate
Construction Impact	High
ENVIRONMENT	
ANSI/ESA	Permanent loss of existing ANSI's and ESA's located within the 3,000 acres to 4,500 acres of land required for the reservoir. Loss of animal habitats and wetlands in the area as well as downstream effects on fish and other aquatic organisms.
OTHER	
Public Acceptance	Finished water aesthetics would be unchanged from existing as new supply is from an already utilized source.
Regional Growth/Development	Dependent on perception of the Region's existing water quality and quantity. i.e.. raw water source and finished water quality.
Recreation	Intensive recreational uses similar to those existing in other reservoirs in the basin.
Miscellaneous	Opportunity for additional flood control and use as an aid to the assimilative capacity of the river for wastewater discharges.

GENERAL	
Engineering Option:	**GRAND RIVER LOW FLOW AUGMENTATION**
Option Code	GR3
Option Capacity	10 MIGD
Supply Source:	Pipeline: Georgian Bay to Lake Belwood
Supply Consumer:	RMW
STRATEGY CLASS	
Traditional	Yes, supply capable of meeting projected Regional demands in excess of existing Regional supply capacity.
Security	Not applicable
Displacement	Not applicable
COST	
Project Cost(1993 dollars)	123.6M, most expensive of the Grand River Engineering Options
O&M Cost	$6.6M/year, based on supplying 10 MIGD
ENGINEERING	
Water Quality	Finished water quality meets existing and projected Provincial drinking water standards.
Supply Capability	Unlimited, subject to International Joint Commission (IJC) review
Infrastructure Impact	Low to moderate
Operation Impact	Moderate
Construction Impact	Moderate to High
ENVIRONMENT	
ANSI/ESA	Environmental impacts of the pipeline portion of the supply option would largely occur during construction. The effect of increased river flows would require further investigation to gain insights into the environmental impacts of this option.
OTHER	
Public Acceptance	Finished water aesthetics could be changed as new supply is from Georgian Bay.
Regional Growth/Development	Interest in the Region may develop due to this unique supply facility
Recreation	Recreational use of Lake Belwood would be enhanced
Miscellaneous	Water from Georgian Bay would reach Lake Erie-would require IJC approval.

GENERAL	
Engineering Option:	**GRAND RIVER LOW FLOW AUGMENTATION**
Option Code	GR4
Option Capacity	10 MIGD
Supply Source:	Pipeline: Lake Huron to Conestogo Lake
Supply Consumer:	RMW
STRATEGY CLASS	
Traditional	Yes, supply capable of meeting projected Regional demands in excess of existing Regional supply capacity.
Security	Not applicable
Displacement	Not applicable
COST	
Project Cost(1993 dollars)	$111.25
O&M Cost	$6.7M/year, based on supplying 10 MIGD
ENGINEERING	
Water Quality	Finished water quality meets existing and projected Provincial drinking water standards.
Supply Capability	Unlimited, subject to International Joint Commission (IJC) review
Infrastructure Impact	Low to moderate
Operation Impact	Moderate
Construction Impact	Moderate to High
ENVIRONMENT	
ANSI/ESA	Environmental impacts of the pipeline portion of the supply option would largely occur during construction. The effect of increased river flows would require further investigation to gain insights into the environmental impacts of this option.
OTHER	
Public Acceptance	Finished water aesthetics could be changed as new supply is from Lake Huron.
Regional Growth/Development	Interest in the Region may develop due to this unique supply facility
Recreation	Recreational use of Conestogo Lake would be enhanced
Miscellaneous	Water from Lake Huron would reach Lake Erie-would require IJC approval. Question of conveyance from Conestogo Lake would require analysis.

GENERAL

Engineering Option:	**GREAT LAKES PIPELINE**
Option Code	GL1
Option Capacity	10 MIGD and 20 MIGD
Supply Source:	Hamilton-Wentworth System (lake Ontario, Hamilton)
Supply Consumer:	RMW + communities along route

STRATEGY CLASS

Traditional	Yes, supply capacity to meet Regional demands from 2018 to 2041 (10 MIGD)
Security	Yes, supply capacity to replace Regional largest single source of water supply, Mannheim (16 MIGD)
Displacement	Not considered although possible.

COST

Project Cost(1993 dollars)	$71.4 M (Traditional), $120.4 M (Security)
O&M Cost	$1.3M/year (Traditional - 10 MIGD), $4.2M/year (Security - 4 MIGD)

ENGINEERING

Water Quality	Finished water quality meets existing and projected Provincial drinking water standards.
Supply Capability	Unlimited, subject to International Joint Commission (IJC) review
Infrastructure Impact	Low to moderate
Operation Impact	Moderate
Construction Impact	Moderate to High

ENVIRONMENT

ANSI/ESA	Environmental impacts of the pipeline portion of the supply option would largely occur during construction, however with careful planning and construction practices they can be avoided or effectively mitigated.

OTHER

Public Acceptance	Finished water aesthetics could be changed as new supply is from Lake Ontario.
Regional Growth/Development	Interest in the Region may develop due to the confidence of a pipeline supply
Recreation	Not applicable
Miscellaneous	Introduces possible **partnership** between the Region and Hamilton-Wentworth

GENERAL	
Engineering Option:	**GREAT LAKES PIPELINE**
Option Code	GL1A
Option Capacity	20 MIGD
Supply Source:	Hamilton-Wentworth System (lake Ontario, Hamilton)
Supply Consumer:	RMW + Halton(Milton)
STRATEGY CLASS	
Traditional	Not, considered
Security	Yes, supply capacity to replace Regional largest single source of water supply, Mannheim (16 MIGD)
Displacement	Not considered although possible.
COST	
Project Cost(1993 dollars)	$118.5M (Traditional - 10 MIGD), $102.7M (Security - 4 MIGD))
O&M Cost	$1.5M/year average (Traditional - 10 MIGD), $4.2M/year (Security - 4 MIGD)
ENGINEERING	
Water Quality	Finished water quality meets existing and projected Provincial drinking water standards.
Supply Capability	Unlimited, subject to International Joint Commission (IJC) review
Infrastructure Impact	Low to moderate
Operation Impact	Moderate
Construction Impact	Moderate to High
ENVIRONMENT	
ANSI/ESA	Environmental impacts of the pipeline portion of the supply option would largely occur during construction, however with careful planning and construction practices they can be avoided or effectively mitigated.
OTHER	
Public Acceptance	Finished water aesthetics could be changed as new supply is from Lake Ontario.
Regional Growth/Development	Interest in the Region may develop due to the confidence of a pipeline supply
Recreation	Not applicable

GENERAL

Engineering Option:	**GREAT LAKES PIPELINE**
Option Code	GL2
Option Capacity	10 MIGD and 20 MIGD
Supply Source:	OCWA Nanticoke System (Lake Erie, Nanticoke)
Supply Consumer:	RMW + communities along route

STRATEGY CLASS

Traditional	Yes, supply capacity to meet Regional demands from 2018 to 2041 (10 MIGD)
Security	Yes, supply capacity to replace Regional largest single source of water supply, Mannheim (16 MIGD)
Displacement	Not considered although possible.

COST

Project Cost(1993 dollars)	$89.4M (Traditional - 10 MIGD), $126.0M (Security - 4 MIGD)
O&M Cost	$1.1M/year (Traditional - 10 MIGD), $3.4M/year (Security - 4 MIGD)

ENGINEERING

Water Quality	Finished water quality meets existing and projected Provincial drinking water standards.
Supply Capability	Unlimited, subject to International Joint Commission (IJC) review
Infrastructure Impact	Low to moderate
Operation Impact	Moderate
Construction Impact	Moderate to High

ENVIRONMENT

ANSI/ESA	Environmental impacts of the pipeline portion of the supply option would largely occur during construction, however with careful planning and construction practices they can be avoided or effectively mitigated.

OTHER

Public Acceptance	Finished water aesthetics could be changed as new supply is from Lake Erie
Regional Growth/Development	Interest in the Region may develop due to the confidence of a pipeline supply
Recreation	Not applicable
Miscellaneous	Introduces possible **partnership** between the Region and OCWA

GENERAL	
Engineering Option:	**GREAT LAKES PIPELINE**
Option Code	GL3
Option Capacity	10 MIGD and 20 MIGD
Supply Source:	Lake Huron (Goderich)
Supply Consumer:	RMW + communities along route
STRATEGY CLASS	
Traditional	Yes, supply capacity to meet Regional demands from 2018 to 2041 (10 MIGD)
Security	Yes, supply capacity to replace Regional largest single source of water supply, Mannheim (16 MIGD)
Displacement	Not considered although possible.
COST	
Project Cost(1993 dollars)	$126.7M (Traditional), $181.4M (Security)
O&M Cost	$2.3M/year (Traditional - 10 MIGD), $1.3M/year (Security - 4 MIGD)
ENGINEERING	
Water Quality	Finished water quality meets existing and projected Provincial drinking water standards.
Supply Capability	Unlimited, subject to International Joint Commission (IJC) review
Infrastructure Impact	Low to moderate
Operation Impact	Moderate
Construction Impact	Moderate to high
ENVIRONMENT	
ANSI/ESA	Environmental impacts of the pipeline portion of the supply option would largely occur during construction, however with careful planning and construction practices they can be avoided or effectively mitigated.
OTHER	
Public Acceptance	Finished water aesthetics could be changed as new supply is from Lake Huron
Regional Growth/Development	Interest in the Region may develop due to the confidence of a pipeline supply
Recreation	Not applicable
Miscellaneous	Could be an independent Region supply.

GENERAL	
Engineering Option:	**GREAT LAKES PIPELINE**
Option Code	GL4
Option Capacity	10 MIGD and 20 MIGD
Supply Source:	Lake Huron (Bayfield)
Supply Consumer:	RMW + communities along route
STRATEGY CLASS	
Traditional	Yes, supply capacity to meet Regional demands from 2018 to 2041 (10 MIGD)
Security	Yes, supply capacity to replace Regional largest single source of water supply, Mannheim (16 MIGD)
Displacement	Not considered although possible.
COST	
Project Cost(1993 dollars)	$125.3M (Traditional), $181.3M (Security)
O&M Cost	$2.3M/year (Traditional - 10 MIGD), $1.3M/year (Security - 4 MIGD)
ENGINEERING	
Water Quality	Finished water quality meets existing and projected Provincial drinking water standards.
Supply Capability	Unlimited, subject to International Joint Commission (IJC) review
Infrastructure Impact	Low to moderate
Operation Impact	Moderate
Construction Impact	Moderate to high
ENVIRONMENT	
ANSI/ESA	Environmental impacts of the pipeline portion of the supply option would largely occur during construction, however with careful planning and construction practices they can be avoided or effectively mitigated.
OTHER	
Public Acceptance	Finished water aesthetics could be changed as new supply is from Lake Huron
Regional Growth/Development	Interest in the Region may develop due to the confidence of a pipeline supply
Recreation	Not applicable
Miscellaneous	Could be an independent Region supply.

GENERAL

Engineering Option:	**GREAT LAKES PIPELINE**
Option Code	GL5
Option Capacity	10 MIGD, 20 MIGD, and 70 MIGD
Supply Source:	OCWA London System (Lake Huron, Mount Carmel)
Supply Consumer:	RMW + communities along route

STRATEGY CLASS

Traditional	Yes, supply capacity to meet Regional demands from 2018 to 2041 (10 MIGD)
Security	Yes, supply capacity to replace Regional largest single source of water supply, Mannheim (16 MIGD)
Displacement	Yes, supply capacity to totally replace existing Regional supply capacity (57 MIGD) and meet Regional demands up to the year 2041

COST

Project Cost(1993 dollars)	$110.0M (Traditional), $154.3M (Security), $428.2M (Displacement)
O&M Cost	$0.9M/year (Traditional - 10 MIGD), $2.1M/year (Security - 4 MIGD), $13.6M/year (Displacement - 67 MIGD)

ENGINEERING

Water Quality	Finished water quality meets existing and projected Provincial drinking water standards.
Supply Capability	Unlimited, subject to International Joint Commission (IJC) review
Infrastructure Impact	Low to moderate
Operation Impact	Moderate
Construction Impact	Moderate to high

ENVIRONMENT

ANSI/ESA	Environmental impacts of the pipeline portion of the supply option would largely occur during construction, however with careful planning and construction practices they can be avoided or effectively mitigated.

OTHER

Public Acceptance	Finished water aesthetics could be changed as new supply is from Lake Huron
Regional Growth/Development	Interest in the Region may develop due to the confidence of a pipeline supply
Recreation	Not applicable

GENERAL	
Engineering Option:	**GREAT LAKES PIPELINE**
Option Code	GL6
Option Capacity	10 MIGD and 20 MIGD
Supply Source:	Georgian Bay (Thornbury)
Supply Consumer:	RMW + communities along route
STRATEGY CLASS	
Traditional	Yes, supply capacity to meet Regional demands from 2018 to 2041 (10 MIGD)
Security	Yes, supply capacity to replace Regional largest single source of water supply, Mannheim (16 MIGD)
Displacement	Not considered although possible
COST	
Project Cost(1993 dollars)	$181.3M (Traditional), $222.2M (Security)
O&M Cost	$2.5M/year (Traditional - 10 MIGD), $1.9M/year (Security - 4 MIGD),
ENGINEERING	
Water Quality	Finished water quality meets existing and projected Provincial drinking water standards.
Supply Capability	Unlimited, subject to International Joint Commission (IJC) review
Infrastructure Impact	Low to moderate
Operation Impact	Moderate
Construction Impact	Moderate to high
ENVIRONMENT	
ANSI/ESA	Environmental impacts of the pipeline portion of the supply option would largely occur during construction, however with careful planning and construction practices they can be avoided or effectively mitigated.
OTHER	
Public Acceptance	Finished water aesthetics could be changed as new supply is from Georgian Bay
Regional Growth/Development	Interest in the Region may develop due to the confidence of a pipeline supply
Recreation	Not applicable
Miscellaneous	Could be an independent Region supply

GENERAL	
Engineering Option:	**GREAT LAKES PIPELINE**
Option Code	GL6A
Option Capacity	20 MIGD
Supply Source:	Private system - TransCanada Pipelines Ltd. (Georgian Bay, Collingwood)
Supply Consumer:	RMW + York Region
STRATEGY CLASS	
Traditional	Not considered
Security	Yes, supply capacity to replace Regional largest single source of water supply, Mannheim (16 MIGD)
Displacement	Not considered
COST	
Project Cost(1993 dollars)	$193.5M (Security)
O&M Cost	$4.8M/year (Security - 4 MIGD)
ENGINEERING	
Water Quality	Finished water quality meets existing and projected Provincial drinking water standards.
Supply Capability	Pipeline sized for 20 MIGD (Security)
Infrastructure Impact	Low to moderate
Operation Impact	Moderate
Construction Impact	Moderate to high
ENVIRONMENT	
ANSI/ESA	Environmental impacts of the pipeline portion of the supply option would largely occur during construction, however with careful planning and construction practices they can be avoided or effectively mitigated.
OTHER	
Public Acceptance	Finished water aesthetics could be changed as new supply is from Georgian Bay
Regional Growth/Development	Interest in the Region may develop due to the confidence of a pipeline supply
Recreation	Not applicable
Miscellaneous	Introduces purchasing water from a **private supplier**, TransCanada pipelines.

GENERAL

Engineering Option:	**GREAT LAKES PIPELINE**
Option Code	GL7
Option Capacity	
Supply Source:	Lake Ontario (Halton Regional Headquarters)
Supply Consumer:	RMW + Halton (Milton)

STRATEGY CLASS

Traditional	Not considered
Security	Yes, supply capacity to replace Regional largest single source of water supply, Mannheim (16 MIGD)
Disablement	Not considered although possible

COST

Project Cost(1993 dollars)	$145.8M (Security)
O&M Cost	$1.4M/year (Security - 4 MIGD)

ENGINEERING

Water Quality	Finished water quality meets existing and projected Provincial drinking water standards.
Supply Capability	Unlimited, subject to International Joint Commission (IJC) review
Infrastructure Impact	Low to moderate
Operation Impact	Moderate
Construction Impact	Moderate to high

ENVIRONMENT

ANSI/ESA	Environmental impacts of the pipeline portion of the supply option would largely occur during construction, however with careful planning and construction practices they can be avoided or effectively mitigated.

OTHER

Public Acceptance	Finished water aesthetics could be changed as new supply is from Lake Ontario
Regional Growth/Development	Interest in the Region may develop due to the confidence of a pipeline supply
Recreation	Not applicable
Miscellaneous	Introduces possible partnership between the Region and Halton.