

Settlement Pattern and Form with Service Cost Analysis

April 2005

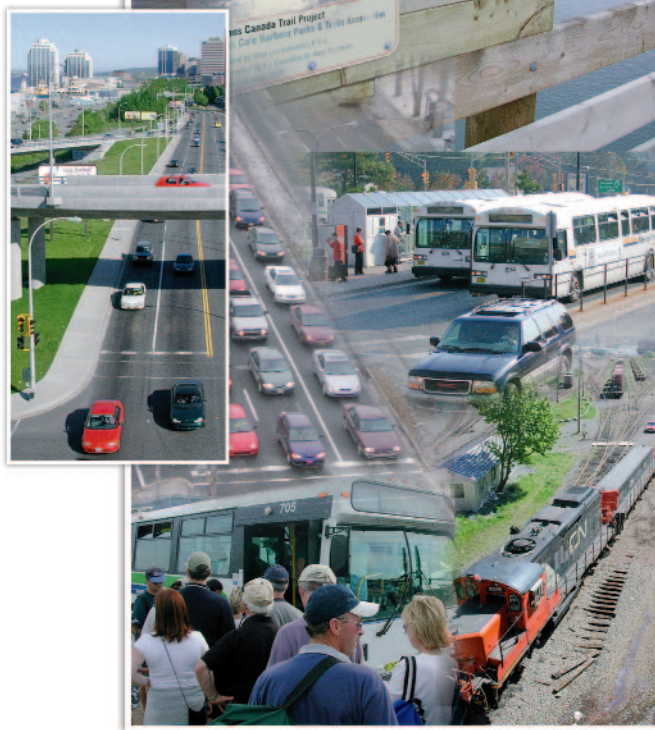


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Introduction

SUMMARY

Halifax Regional Municipality is in the process of developing a 25-year Regional Plan and is proposing specific policies on how and where it should grow. In a sense, one might think of HRM as a growing "family" looking at options for its future "home". And when looking for a new home, it is important to know that the one you're looking at, or thinking of building, is affordable. HRM's Cost of Servicing study allows us to better understand the cost implications of different patterns of growth.

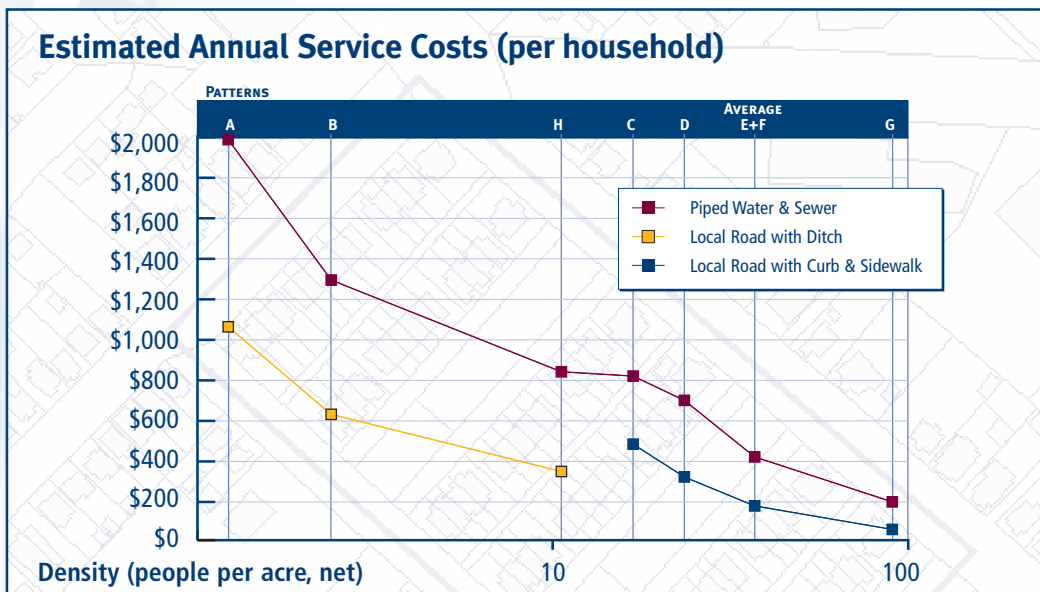
This booklet will show the findings of the Cost of Servicing study applied to sample settlement patterns that are typical to HRM. Although, not all of the factors influencing costs, such as the effects of specific locations, have been included, trends are emerging that should support discussions of the relative, incremental costs of the different styles of "rooms" (neighbourhoods) that make up HRM's "home".

This type of analysis could be very complex, since many factors affect HRM costs, from the age of our residents (i.e. demographics) to our weather. This study looks to identify cost trends due to the "form" of our neighbourhoods. The first step in doing this is to see how density affects local costs of services.



Although this document does provide an overall cost for each pattern, there should not be a rush to consider this the absolute "bottom line." As described in the methodology section which follows, several of these costs are included using an average HRM-wide cost per household. The specific location of the pattern has not been analyzed – only to an urban, suburban and rural level. (In support of the Regional Planning project, location-specific cost estimates of regional major infrastructure were done separately.) Nonetheless, some trends – like the influence of density on service costs – can be seen.

The chart below, showing three services very closely linked to land use - roads, water and sewer - illustrates the link between density and costs.



Introduction

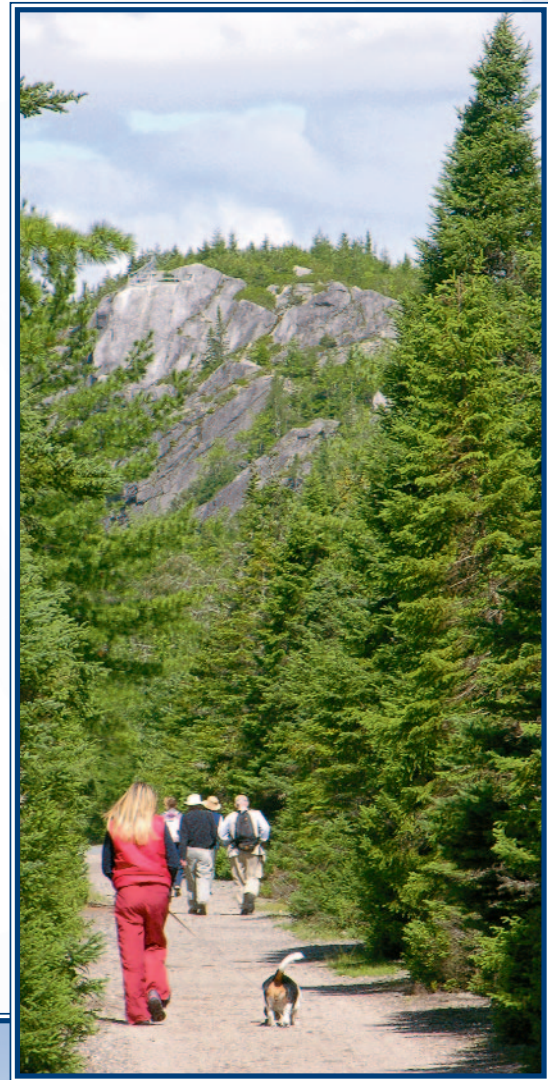
Although, many larger lots developed with on-site services may never have the need for piped services, for a variety of reasons – geological, environmental, failure of technology, public health concerns and public desire for increased services – recent trends have shown that there is significant financial risk that on-site systems will be replaced with municipal systems. With this as a possibility, water and sewer costs are shown for even the low density patterns on the chart (on the previous page). It can be seen, clearly, as neighbourhoods become more dense service costs decrease.

METHODOLOGY

The focus of this study is on the relative cost of services delivered by HRM. Costs of services provided by the Province or homeowner are considered, when appropriate, to give a more-balanced picture of overall costs. For example, private well and septic operations, maintenance and replacement costs are included for the three rural patterns. Most private costs, such as the initial development costs or the costs to operate a "second car" are not included.

The following nine HRM services, delivered directly to the public, have been considered:

- Roads
- Transit
- Water
- Wastewater & Stormwater
- Solid Waste
- Parks & Recreation
- Libraries
- Police
- Fire



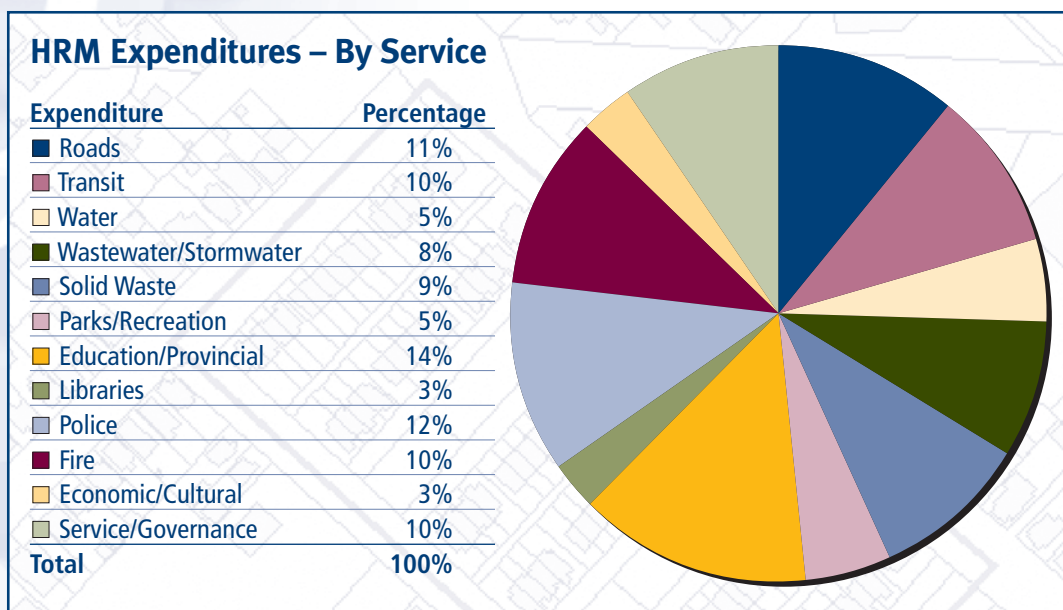
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In addition, implications of settlement pattern on school costs are being assessed, since schools are an important element in planning of residential areas.

The following three HRM service/expenditure areas are also shown for completeness, but will not be assessed for each settlement pattern:

- Economic and cultural programs (includes Planning & Development)
- Governance and shared services (includes HR, Finance and Legal)
- Transfers to the Province (88% to School Board)

The following chart shows the relative annual expenditures by HRM in each of these areas. This includes both capital and operational costs, for the 2003-04 fiscal year.



The Patterns

Eight residential patterns are included in this booklet. They are typical of residential layouts and densities seen within HRM. The focus here is on residential patterns – rather than commercial or industrial – the primary focus is on residential because one of the main issues in considering HRM's growth is where people will live and what form these new neighbourhoods will take. Of course, the form may be mixed-use-residential and commercial together, as is Patterns G, but the focus of this study will remain on the residential component and its costs.

The residential patterns are considered to be location independent although they are defined to be rural, suburban or urban. They are also considered to be neutral with respect to demographics, although smaller household sizes in middle and higher density areas were recognized.

The Costs

The costs of most of HRM's services are not budgeted or tracked on a neighbourhood-by-neighbourhood basis and, likely, never will be. To do so would be complex and expensive. So the challenge is, how do we estimate the cost of providing various services for various settlement patterns?

Introduction

Research by CMHC¹ and others have shown four factors, related to settlement pattern, that affect the costs of services. We refer to these as the "Four Ds":

- Density
- Distance
- Dispersion/Discontinuity
- Diversity (Mix of Use)

As well, there are other factors that affect costs that are not directly related to settlement pattern. Two key ones are:

- Demographics
- Delivery Standard (Service Levels)

For each service, the above factors were considered and "cost drivers" were identified. Where possible, depending on the detail and the way in which cost data was compiled at source, unit costs were found for each relevant cost driver. For example, length of road is a cost driver for roads, and consumption (amount used) is a cost driver for water treatment.

The study considers both the operational and capital replacement costs required for each service. In most cases, HRM budget amounts were used to determine the costs of a service. However, in many cases, this approach did not provide enough detail, so costs were assessed using engineering estimates. The average annual "life-cycle" costs were estimated, if possible. [Life-cycle costs are the total costs spent to operate, maintain and repair the item over its entire useful life. For example, in the study, the useful life of a road was estimated to be 70 years, but many repairs are required over that time.] Where engineering life-cycle estimates weren't practical to develop, typical annual operating and capital costs were identified for a group of assets and the average annual cost was estimated for each service.

How these costs were determined and what cost drivers were used is summarized on the following pages, by service.

¹ May 2003 draft report CMHC Costing Mechanism to Facilitate Sustainable Community Planning, Phase 1 – Background Research and Costing Framework



Research has shown that increased residential density is one of several key factors in decreasing the cost of municipal services.

The question we want to answer for HRM : "How much of a decrease in cost?"



Introduction

Road Costs

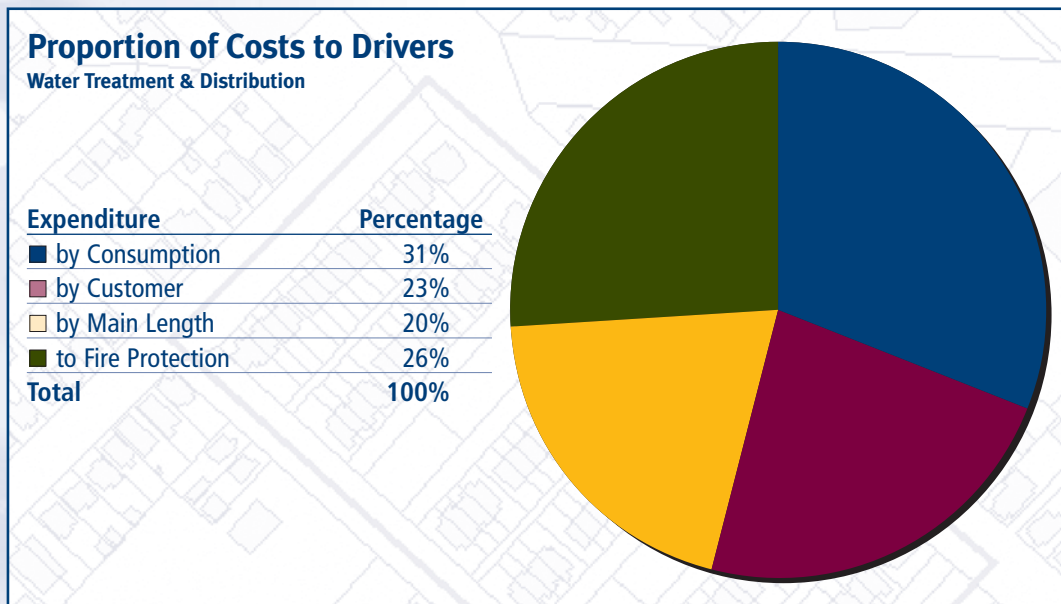
Road maintenance costs were determined based on design standards and recommended engineering repair and maintenance schedules. These theoretical costs were proportionately reduced to reconcile with current road expenditures. To improve the condition of our roadways, higher expenditures – closer to the theoretical or “optimal” costs – would need to be made. These optimal road costs are shown in Appendix C.

Operational costs, such as snow removal and street cleaning, were based on budget expenditures for specific operations or services, weighted by service level requirements, e.g. collector roads would be plowed more frequently than local roads. Different patterns may have different delivery standards, for example, urban and suburban patterns have curbs and sidewalks (on both sides for high density patterns) while rural patterns do not.

Costs for larger arterial and collector roads have not been fully allocated to each pattern. Cost allocations are based on the number of people commuting assuming equal travel distances. This will tend to underestimate the impact of rural commuters on roadways.

Water Costs

Water costs were assessed by reviewing the level of effort (expenditures) for different activities of the Halifax Regional Water Commission. Primary “cost drivers” were identified for each activity. e.g. the number of customers is a cost driver for quarterly billing and fire hydrant coverage (length) is a cost driver for fire suppression. [Note: Hydrant costs are included as part of Fire service cost.] The four cost drivers and their relative allocation of expenditures are shown on the pie chart (below). According to this allocation, about 46% of the expenditures - ensuring adequate flow to hydrants and maintaining and repairing water mains - are density influenced.



Wastewater & Stormwater Costs

Wastewater costs were assessed similar to Water, in that costs for specific activities were allocated to their primary costs drivers. For example, the number of connections to the sewer main is a cost driver for sewer lateral replacement costs. Cost drivers that are characteristic of a specific location, such as age or material of pipes, were not included. For the “mains” and “laterals”, engineering life-cycle cost

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estimates were developed. Their costs drivers are main (road) length and number of connections, respectively. "Trunk" costs have been preliminarily allocated on a per capita basis, rather than by distance (to treatment or outfall). Costs shown for this service include (projected) operating costs at the completion of the Harbour Solutions project.

Solid Waste

Solid Waste costs were assessed based on the costs per customer in each of the eight solid waste collection contract areas, as developed for the tender process. To these collection costs, the disposal cost of the Solid Waste Management Facility was added. For this service, it became clear that the "distance" to HRMs one landfill was a significant factor, with service in the western part of HRM significantly less expensive than in the eastern. It appears that "density" was also a significant factor but, it is difficult to separate the impacts of density from distance.

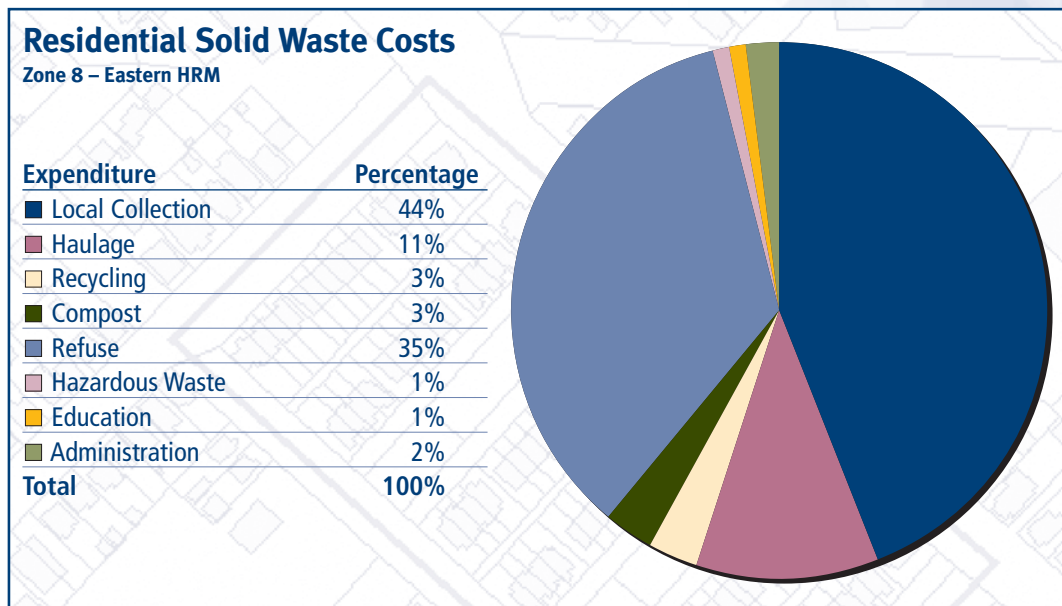


Across HRM, collection costs - the portion of costs most influenced by density and distance - represented 37% of total solid waste costs. Treatment costs for refuse, recycling and compost represented nearly 60% of total service costs.

Why was this study conducted?

To provide HRM staff and citizens with a better understanding of how different settlement patterns affect cost.

For one of the Solid Waste service zones, Eastern HRM, costs for local collection and "haulage" from the local transfer station to the central waste management facility were available separately. In the chart below, the "distance" factor is separated from the haulage cost. Since Zone 8 would have the most significant distance component to its overall collection costs, we can expect that "density" is a significant factor in overall collection costs. Other cost factors would include waste volumes and traffic congestion.



Fire Service

The two main service drivers for fire services are distance (travel times) and population (numbers of calls). A third factor is the nature and quantity of buildings. Density and dispersion are key factors in the cost-effectiveness of fire services. Compact, close, well-connected neighbourhoods can be most-effectively serviced. Because of this, a suburban or urban service in HRM with crews on hand "24-7" is no more expensive per capita, for its service area, than a mostly volunteer service in the rural area.

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Other Service Costs

Other costs in this report, including costs for Transit, Police, Recreation and Library are shown as average costs (per person) across HRM.

Settlement pattern significantly impacts the cost-effectiveness of public transit service. Transit-oriented development is being encouraged through the Regional Plan. The focus will be on developing communities that are better suited for transit, as well as providing commuting options that can be used by those from less dense residential areas, including park and ride locations, rapid buses and fast ferries.

Police service costs are influenced by a multitude of factors, many of which are socio-economic. However, some demands for police may be affected by land use. For example, more than 15% of police response time (2003-04) was spent on car or traffic-related calls. Reduced car-dependency could have a positive affect. However, increased urban and suburban settlement could create increases in noise complaints or similar issues. The Regional Plan includes policies that address urban design, including issues of redevelopment of existing neighbourhoods and the mix of commercial and residential uses.

Transit, Recreation and Library costs are shown "net" of fees for these services. Transit has the potential to self-fund, given the right conditions. At present, six of HRM's transit routes are more than 80% self-funded.

Many of the HRM's provincial payments are driven by a legislated formula that includes assessment values, however they are shown in this document simply on a per capita basis.



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Other Cost Estimates

This study analyzes the impact of local density. However to more fully understand the costs of Regional Planning, the larger-scale "distance" and "dispersion" factors need to be understood. These were taken into account, in the Regional Plan costs through several other studies that looked at the impact of variations in growth patterns.

The 2003 Greenfield Study conducted by Regional Planning looked at potential new suburban growth areas near existing suburban areas. The cost of regional "trunk" infrastructure was identified for ten different future development areas. These costs are being used to estimate the costs of major new sewer and water infrastructure needed for growth.

Future traffic demands were modeled (estimated) with the assistance of Delphi-MRC. Based on projected traffic volumes and existing road capacities, it was determined where new major roadways, or existing road expansions, would be needed and major growth-related project costs were estimated.

Transit ridership for the Regional Plan's proposed enhanced transit system was estimated by LEA Consultants. The new buses needed to create this increased transit system, and the related incremental operating costs, were estimated with the assistance of ENTRA Consultants.

The on-going service costs (based on these patterns) and the specific, one-time costs identified in the consulting studies, above, were combined to provide an estimate of the future costs of growth.



How does this work support HRM's Regional Plan?

This work can inform discussion on how HRM should plan for more-affordable residential land use.

It helps HRM staff, residents and Regional Council understand the future cost implications of land use policy.

Residential Patterns

Samples of different residential patterns that may be seen in HRM are shown on the following eight pages. On each page, you will find two diagrams, to give a sense of the style of neighbourhood, along with a description of lot size and density. As well, estimates of service costs are included.

On the following page is a summary of the costs for each of the eight sample patterns. It is clear when looking at the services such as roads and bussing, that density is a significant factor affecting costs. As you look across the table from left to right, density increases from lower to higher, as costs are decreasing.

In the table, under the heading Common Services one can see the costs across different density patterns for comparable levels of service. For example, road costs show that the estimated lifecycle cost of roads in Pattern A is \$1,053/year vs. \$26/year in Pattern G. In itself, this is not surprising. In Pattern A, there are more than 400 feet of total frontage for each household, while the frontage is less than 6 feet per household in Pattern G, which includes apartment buildings.

Of those services that are commonly available, Pattern A is nearly three times as expensive as Pattern G. From the perspective of public services, the higher levels of service available in more urbanized areas, such as sidewalks and central water and wastewater services, will offset some of this differential. However, this is only true to the extent that 1) these services are never extended to the low density areas and 2) the costs of private water and sewage treatment, as well as other private, social and environmental costs, are excluded.

For the rural patterns – A, B and H – two cost scenarios are shown for "Water" and "Wastewater". Under "Other Services", the private costs for a well and on-site wastewater treatment are included. Below that, "extended water/wastewater" identifies the additional local costs, if piped water and wastewater services were extended.

Comparison to Average Residential Tax Payment

The costs presented here are estimates for the typical patterns being analyzed. They are meant to allow comparisons between patterns, to allow for a better understanding of how municipal costs may be impacted by various settlement forms, and other, factors. These costs cannot be readily applied to an individual household, since too many local variations would exist.

As a broad comparison, it may be interesting to note that the average residential property tax (per dwelling) in 2003-04 was about \$1,200, less than the estimated costs for any of the eight settlement patterns. In part this may be because commercial tax rates are 2.55 times the residential tax rate. Although the residential and commercial demand on services is difficult to separate, it is likely that commercial properties are subsidizing residential, as well as exempt classes of properties (such as churches, hospitals, universities and some other government properties).

Residential Patterns

SUMMARY ESTIMATED ANNUAL COSTS PER HOUSEHOLD (LISTED ACCORDING TO DENSITY)

	Pattern A¹ Rural Commutershed	Pattern B¹ Rural Commutershed	Pattern H¹ Rural Commutershed	Pattern C¹ Suburban	Pattern D¹ Urban	Pattern E² Suburban	Pattern F² Urban	Pattern G³ Urban
	Low Density 1.2 people/acre	Low Density 2.2 people/acre	Low Density 10.4 people/acre	Low Density 16 people/acre	Low Density 22 people/acre	Mid Density 36 people/acre	Mid Density 36 people/acre	High Density 92 people/acre
Common Services:								
Roads (no curbs)	\$1,053	\$621	\$339	\$280	\$184	\$76	\$124	\$26
Solid Waste	\$200	\$200	\$200	\$185	\$185	\$185	\$185	\$185
Libraries ⁴	\$72	\$72	\$72	\$72	\$72	\$48	\$48	\$38
Parks/Recreation ⁴	\$129	\$129	\$129	\$129	\$129	\$86	\$86	\$69
Police ⁴	\$360	\$360	\$360	\$360	\$360	\$240	\$240	\$192
Fire ⁴	\$324	\$324	\$324	\$406	\$379	\$231	\$248	\$177
School Bussing	\$186	\$186	\$186	\$87	\$25	\$58	\$17	\$13
Culture/Economy	\$36	\$36	\$36	\$36	\$36	\$24	\$24	\$19
Governance	\$297	\$297	\$297	\$297	\$297	\$198	\$198	\$158
HRM to Province	\$435	\$435	\$435	\$435	\$435	\$290	\$290	\$232
Subtotal	\$3,092	\$2,660	\$2,378	\$2,287	\$2,102	\$1,436	\$1,460	\$1,109
Other Services:								
Curbs&Sidewalks	\$0	\$0	\$0	\$194	\$128	\$52	\$86	\$27
Transit ⁴	\$171	\$171	\$171	\$171	\$171	\$114	\$114	\$91
Water	\$425	\$425	\$425	\$197	\$176	\$77	\$146	\$42
Waste/Stormwater	\$625	\$625	\$625	\$613	\$514	\$235	\$364	\$147
Subtotal	\$1,221	\$1,221	\$1,221	\$1,175	\$989	\$479	\$710	\$307
extended ⁵ Water/Wastewater	\$927	\$234	-\$219					
Total	\$5,240	\$4,115	\$3,380	\$3,462	\$3,091	\$1,914	\$2,170	\$1,416

1) Household size estimated at 3 people per household

2) Household size estimated at 2 people per household

3) Household size estimated at 1.6 people per household

4) Costs allocated simply on "per capita" basis

5) incremental on-going (annual) costs, only; does not include remediation/installation (capital) costs

Residential Patterns

PATTERN A RURAL ON-SITE SEPTIC, 2+ ACRES



Pattern A Estimated Annual Service Costs

Service	Per Dwelling
Roads	\$ 1,053
Transit	\$ –
Water	\$ –
Waste/Stormwater	\$ –
Solid Waste	\$ 200
Libraries	\$ 72
Parks/Recreation	\$ 129
Police	\$ 360
Fire	\$ 324
Culture/Economy	\$ 36
Governance	\$ 297
To the Province	\$ 435
School Bussing	\$ 186
Public Service Subtotal	\$ 3,092
Private Well/Septic	\$ 1,050
Service Subtotal	\$ 4,142
Potential Services ¹	\$ 1,098
Potential Service Total	\$ 5,240

¹ includes the additional annual costs of transit, piped water and wastewater/stormwater but not including remediation/installation (capital) costs.

PATTERN CHARACTERISTICS

Lot Size:

2.5 acres per dwelling unit
(108,000 sq. ft. per dwelling unit)

Road Frontage:

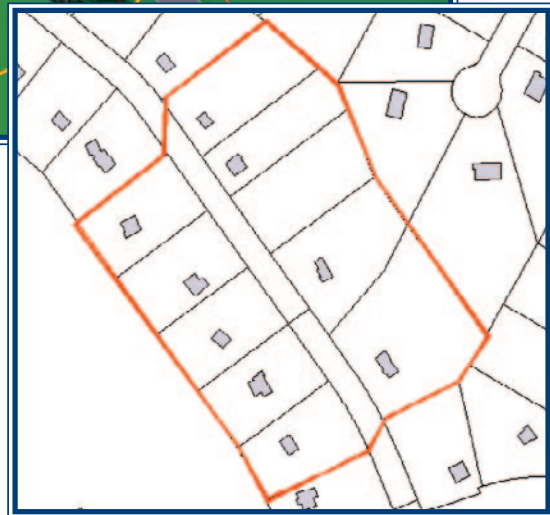
407 feet per dwelling

Residential Density:

1.2 people per (residential) acre

Residential Patterns

PATTERN B RURAL, ON-SITE SEPTIC, 1+ ACRE LOTS



Pattern B Estimated Annual Service Costs

Service	Per Dwelling
Roads	\$ 621
Transit	\$ -
Water	\$ -
Waste/Stormwater	\$ -
Solid Waste	\$ 200
Libraries	\$ 72
Parks/Recreation	\$ 129
Police	\$ 360
Fire	\$ 324
Culture/Economy	\$ 36
Governance	\$ 297
To the Province	\$ 435
School Bussing	\$ 186
Public Service Subtotal	\$ 2,660
Private Well/Septic	\$ 1,050
Service Subtotal	\$ 3,710
Potential Services ¹	\$ 405
Potential Service Total	\$ 4,115

¹ includes the additional annual costs of transit, piped water and wastewater/stormwater but not including remediation/installation (capital) costs.

PATTERN CHARACTERISTICS

Lot Size:

1.4 acres per dwelling unit
(59,000 sq. ft. per dwelling unit)

Road Frontage:

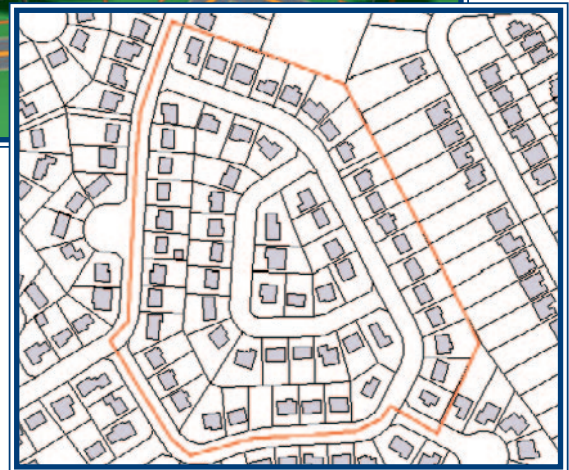
222 feet per dwelling

Residential Density:

2.2 people per (residential) acre

Residential Patterns

PATTERN C *SUBURBAN LOW DENSITY*



Pattern C

Estimated Annual Service Costs

Service	Per Dwelling
Roads	\$ 474
Transit	\$ 171
Water	\$ 171
Waste/Stormwater	\$ 555
Solid Waste	\$ 185
Libraries	\$ 72
Parks/Recreation	\$ 129
Police	\$ 360
Fire	\$ 406
Culture/Economy	\$ 36
Governance	\$ 297
To the Province	\$ 435
School Bussing	\$ 87
Public Service Subtotal	\$ 3,378
Private Water/Sewer	\$ 84
Service Total	\$ 3,462

PATTERN CHARACTERISTICS

Lot Size:

8,100 sq. ft. per dwelling unit

Road Frontage:

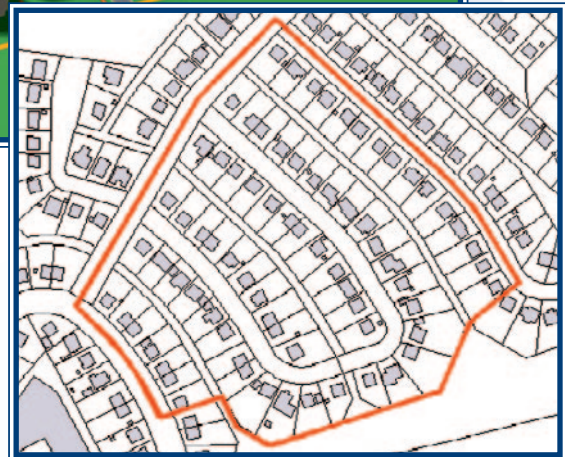
98 feet per dwelling

Residential Density:

16 people per (residential) acre

Residential Patterns

PATTERN D URBAN LOW DENSITY



Pattern D Estimated Annual Service Costs

Service	Per Dwelling
Roads	\$ 312
Transit	\$ 171
Water	\$ 150
Waste/Stormwater	\$ 456
Solid Waste	\$ 185
Libraries	\$ 72
Parks/Recreation	\$ 129
Police	\$ 360
Fire	\$ 379
Culture/Economy	\$ 36
Governance	\$ 297
To the Province	\$ 435
School Bussing	\$ 25
Public Service Subtotal	\$ 3,007
Private Water/Sewer	\$ 84
Service Total	\$ 3,091

PATTERN CHARACTERISTICS

Lot Size:

6,000 sq. ft. per dwelling unit

Road Frontage:

65 feet per dwelling

Residential Density:

22 people per (residential) acre

Residential Patterns

PATTERN E *SUBURBAN MID DENSITY*



Pattern E

Estimated Annual Service Costs

Service	Per Dwelling
Roads	\$ 128
Transit	\$ 114
Water	\$ 66
Waste/Stormwater	\$ 210
Solid Waste	\$ 185
Libraries	\$ 48
Parks/Recreation	\$ 86
Police	\$ 240
Fire	\$ 231
Culture/Economy	\$ 24
Governance	\$ 198
To the Province	\$ 290
School Bussing	\$ 58
Public Service Subtotal	\$ 1,878
Private Water/Sewer	\$ 36
Service Total	\$ 1,914



PATTERN CHARACTERISTICS

Lot Size:

2,400 sq. ft. per dwelling unit

Road Frontage:

18 feet per dwelling

Residential Density:

36 people per (residential) acre

Residential Patterns

PATTERN F *URBAN MID DENSITY*



Pattern F

Estimated Annual Service Costs

Service	Per Dwelling
Roads	\$ 210
Transit	\$ 114
Water	\$ 120
Waste/Stormwater	\$ 306
Solid Waste	\$ 185
Libraries	\$ 48
Parks/Recreation	\$ 86
Police	\$ 240
Fire	\$ 248
Culture/Economy	\$ 24
Governance	\$ 198
To the Province	\$ 290
School Bussing	\$ 17
Public Service Subtotal	\$ 2,086
Private Water/Sewer	\$ 84
Service Total	\$ 2,170

PATTERN CHARACTERISTICS

Lot Size:

2,400 sq. ft. per dwelling unit

Road Frontage:

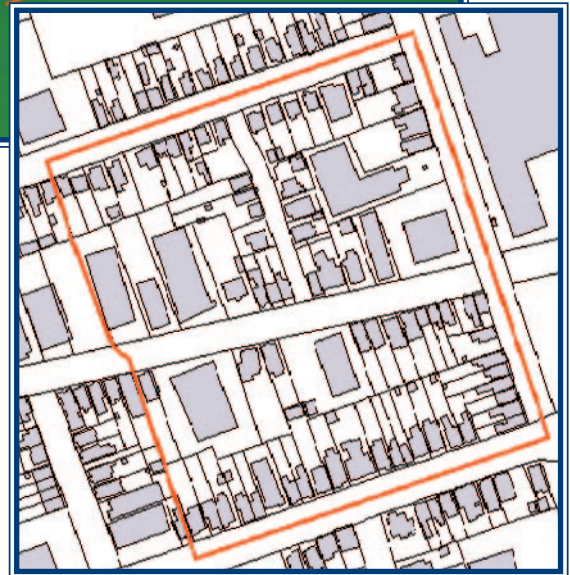
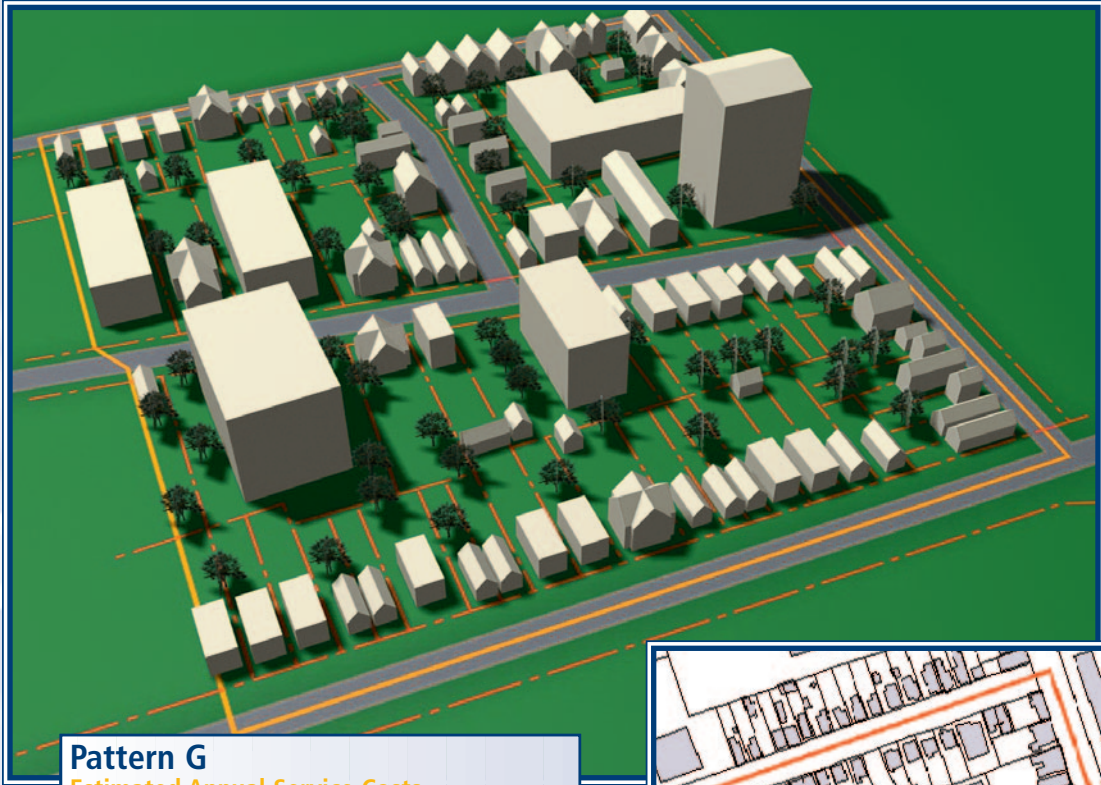
38 feet per dwelling

Residential Density:

36 people per (residential) acre

Residential Patterns

PATTERN G *URBAN HIGH DENSITY*



Pattern G

Estimated Annual Service Costs

Service	Per Dwelling
Roads	\$ 53
Transit	\$ 91
Water	\$ 35
Waste/Stormwater	\$ 131
Solid Waste	\$ 185
Libraries	\$ 38
Parks/Recreation	\$ 69
Police	\$ 192
Fire	\$ 177
Culture/Economy	\$ 19
Governance	\$ 158
To the Province	\$ 232
School Bussing	\$ 13
Public Service Subtotal	\$ 1,393
Private Water/Sewer	\$ 23
Service Total	\$ 1,416

PATTERN CHARACTERISTICS

Lot Size:

760 sq. ft. per dwelling unit

Road Frontage:

5.2 feet per dwelling

Residential Density:

92 people per (residential) acre

Residential Patterns

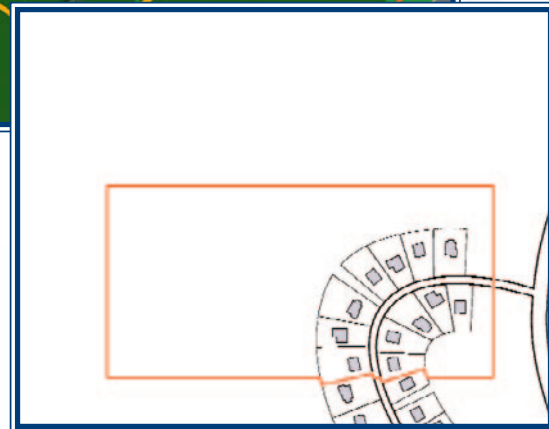
PATTERN H RURAL CLUSTER



Pattern H Estimated Annual Service Costs

Service	Per Dwelling
Roads	\$ 339
Transit	\$ -
Water	\$ -
Waste/Stormwater	\$ -
Solid Waste	\$ 200
Libraries	\$ 72
Parks/Recreation	\$ 129
Police	\$ 360
Fire	\$ 324
Culture/Economy	\$ 36
Governance	\$ 297
To the Province	\$ 435
School Bussing	\$ 186
Public Service Subtotal	\$ 2,378
Private Well/Septic	\$ 1,050
Service Subtotal	\$ 3,428
Potential Services ¹	- \$ 48
Potential Service Total	\$ 3,380

¹ includes the additional annual costs of transit, piped water and wastewater/stormwater but not including remediation/installation (capital) costs.
[For this pattern, the additional public operating and maintenance costs would be less than the private operating and maintenance savings.]



PATTERN CHARACTERISTICS

Lot Size:

0.3 acres per dwelling unit
(12,600 sq. ft. per dwelling unit)

Road Frontage:

103 feet per dwelling

Residential Density:

10.4 people per (residential) acre

Appendices

APPENDIX A

Pattern Attributes (Metric)

	Gross Study Area (hectares)	Road Length (metres)	Road ROW Width (metres)	Road ROW Area (hectares)	Commercial Area (hectares)	Parks in Study Area (hectares)	Parks outside Study Area ¹		Road Length Allocated to Resid'l (m)	Net Residential Area (hectares)
							(%)	(hectares)		
Pattern A	6.65	313.0	20.0	0.65	0	0	5%	0.35	372.0	6.00
Pattern B	6.00	284.0	20.0	0.55	0	0	5%	0.30	339.0	5.45
Pattern C	5.95	854.0	16.0	1.35	0	0	5%	0.30	909.0	4.60
Pattern D	5.20	677.0	16.0	1.10	0	0	5%	0.25	727.0	4.10
Pattern E	5.35	492.0	16.0	0.80	0	0	5%	0.25	542.0	4.55
Pattern F	3.45	567.5	16.0	0.90	0	0.35	0%	0.00	567.5	2.20
Pattern G	6.25	547.0	16.0	0.90	0.50	0	5%	0.30	545.5	4.85
Pattern H	6.00	187.5	20.0	0.40	0	4.20	0%	0.00	187.5	1.40

Pattern Attributes (Imperial)

	Gross Study Area (acres)	Road Length (feet)	Road ROW Width (feet)	Road ROW Area (acres)	Commercial Area (acres)	Parks in Study Area (acres)	Parks outside Study Area ¹		Road Length Allocated to Resid'l (ft)	Net Residential Area (acres)
							(%)	(acres)		
Pattern A	16.4	1,027	66	1.6	0	0	5%	0.9	1,220	14.8
Pattern B	14.8	932	66	1.4	0	0	5%	0.7	1,112	13.5
Pattern C	14.7	2,802	52	3.3	0	0	5%	0.7	2,982	11.4
Pattern D	12.9	2,221	52	2.7	0	0	5%	0.6	2,385	10.1
Pattern E	13.2	1,614	52	2.0	0	0	5%	0.6	1,778	11.2
Pattern F	8.5	1,862	52	2.2	0	0.9	0%	0.0	1,862	5.4
Pattern G	15.4	1,795	52	2.2	1.2	0	5%	0.7	1,790	12.0
Pattern H	14.8	615	66	1.0	0	10.4	0%	0.0	615	3.5

Other Pattern Attributes

	Sidewalks	Hydrants	Number of Utility Connections	Dwelling Units	Household Size	Number of People	% Children Bussed
Pattern A	No	No	6	6	3.0	18	75%
Pattern B	No	No	10	10	3.0	30	75%
Pattern C	1 side	Yes	61	61	3.0	183	35%
Pattern D	1 side	Yes	73	73	3.0	219	10%
Pattern E	1 side	Yes	87	202	2.0	404	35%
Pattern F	1 side	Yes	97	97	2.0	194	10%
Pattern G	2 sides	Yes	123	685	1.6	1,096	10%
Pattern H	No	No	12	12	3.0	36	75%

1) the proposed Regional Plan recommends 10% for park or open space, however some or all of this may be provided by "cash in lieu"

Conversions approx.:

1 hectare = 2.471 acres

1 metre = 3.281 feet

Appendices

APPENDIX B ANNUAL UNIT COSTS OF SERVICES

Roads Cost Driver	Local Road (sidewalk, 2 sides) \$31.80/metre	Local Road (sidewalk, 1 side) \$26.10/metre	Local Road (no curb/sidewalk) \$15.40/metre	
	Collector/Arterials Urban \$17.00/person	Collector/Arterials Suburban \$28.70/person	Collector/Arterials Rural Commutershed \$32.60/person	Collector/Arterials Rural \$11.70/person
Roads (optimal) Cost Driver	Local Road (sidewalk, 2 sides) \$63.00/metre	Local Road (sidewalk, 1 side) \$54.00/metre	Local Road (no curb/sidewalk) \$28.00/metre	
	Collector/Arterials Urban \$20.60/person	Collector/Arterials Suburban \$34.90/person	Collector/Arterials Rural Commutershed \$39.70/person	Collector/Arterials Rural \$14.30/person
Transit Cost Driver	Urban \$57/person	Suburban \$57/person	Rural Commutershed \$57/person	Rural \$57/person
Water Cost Driver	Consumption \$12.00/person	Customer (lateral) \$70.00/connection	Local Pipe Length \$4.45/meter (road)	
Wastewater Cost Driver	Consumption \$40.50/person	Customer (lateral) \$58.00/connection	Local Pipe Length \$9.80/meter (road)	Trunk Pipe \$24.40/person
Stormwater Cost Driver			Local Pipe Length \$10.50/meter (road)	
Solid Waste Cost Driver	Urban/Suburban \$185/dwelling	Rural Commutershed \$200/dwelling	Rural \$240/dwelling	
Libraries	\$24/person			
Parks/Recreation	\$43/person			
Police	\$120/person			
Fire	\$108/person			Fire Protection \$5.50/metre (road)
Culture/Economy	\$12/person			
Governance	\$99/person			
To the Province	\$145/person			
School Bussing	\$530/child, bussed			
Private Water/Sewer Cost Driver	Urban/Suburban \$84/connection	Rural Commutershed \$1,050/dwelling	Rural \$1,050/dwelling	
	Urban High Density \$126/connection			

Other numbers used in calculations:

15.6% of total population are school students

72,000 litres of water used / person / year

150 meter spacing between hydrants

Appendices

APPENDIX C (LISTED ACCORDING TO DENSITY)

SUMMARY - ESTIMATED ANNUAL COSTS PER HOUSEHOLD, WITH OPTIMAL ROAD MAINTENANCE

	Pattern A¹ Rural Commutershed	Pattern B¹ Rural Commutershed	Pattern H¹ Rural Commutershed	Pattern C¹ Suburban	Pattern D¹ Urban	Pattern E² Suburban	Pattern F² Urban	Pattern G³ Urban
	Low Density 1.2 people/acre	Low Density 2.2 people/acre	Low Density 10.4 people/acre	Low Density 16 people/acre	Low Density 22 people/acre	Mid Density 36 people/acre	Mid Density 36 people/acre	High Density 92 people/acre
Common Services:								
Roads (no curbs)	\$1,053	\$621	\$339	\$280	\$184	\$76	\$124	\$26
Solid Waste	\$200	\$200	\$200	\$185	\$185	\$185	\$185	\$185
Libraries ⁴	\$72	\$72	\$72	\$72	\$72	\$48	\$48	\$38
Parks/Recreation ⁴	\$129	\$129	\$129	\$129	\$129	\$86	\$86	\$69
Police ⁴	\$360	\$360	\$360	\$360	\$360	\$240	\$240	\$192
Fire ⁴	\$324	\$324	\$324	\$406	\$379	\$231	\$248	\$177
School Bussing	\$186	\$186	\$186	\$87	\$25	\$58	\$17	\$13
Culture/Economy	\$36	\$36	\$36	\$36	\$36	\$24	\$24	\$19
Governance	\$297	\$297	\$297	\$297	\$297	\$198	\$198	\$158
HRM to Province	\$435	\$435	\$435	\$435	\$435	\$290	\$290	\$232
Subtotal	\$3,092	\$2,660	\$2,378	\$2,287	\$2,102	\$1,436	\$1,460	\$1,109
Other Services:								
Curbs&Sidewalks	\$0	\$0	\$0	\$194	\$128	\$52	\$86	\$27
Transit ⁴	\$171	\$171	\$171	\$171	\$171	\$114	\$114	\$91
Water	\$425	\$425	\$425	\$197	\$176	\$77	\$146	\$42
Waste/Stormwater	\$625	\$625	\$625	\$613	\$514	\$235	\$364	\$147
Subtotal	\$1,221	\$1,221	\$1,221	\$1,175	\$989	\$479	\$710	\$307
extended public ⁵								
Water/Wastewater	\$1,977	\$1,284	\$831					
less private costs								
Water/Wastewater	-\$1,050	-\$1,050	-\$1,050					
Roads, Optimal ⁶	\$801	\$447	\$219	\$435	\$288	\$86	\$176	\$30
Total	\$6,041	\$4,562	\$3,599	\$3,897	\$3,379	\$2,000	\$2,346	\$1,446

1) Household size estimated at 3 people per household

2) Household size estimated at 2 people per household

3) Household size estimated at 1.6 people per household

4) Costs allocated simply on "per capita" basis

5) incremental on-going (annual) costs, only; does not include remediation/installation (capital) costs

6) incremental on-going (annual) costs for improved road maintenance and condition rating



Conclusions

- Densities of residential areas and their distance to commercial areas (and treatment plants) have a significant impact on the costs of "hard" infrastructure-based services such as water, wastewater (sewer) and roadways. Some residential patterns may have life-cycle costs ten times the cost of other patterns, for these types of services.
- Residential density and the distance between centres affects the viability and affordability of services such as: transit, 24-hour-staffed fire stations and larger library or recreational facilities.
- Often, the capital cost of a new road or facility is seen as the main financial barrier to service growth. However, most of the service costs occur after it is built. Across HRM services, on-going operations and maintenance make up 60% to 90% of the overall service costs.
- The right mix of densities and careful choice of growth centres can provide access to a fuller range of services by more HRM residents. The Regional Plan gives you the opportunity to say how you would like your community to grow. Please contact us to find out how to get more involved.



CONTACT INFORMATION:

Regional Planning

PO Box 1749
Halifax, NS
B3J 3A5

Website: www.halifax.ca/regionalplanning

For input on this document please contact:

Financial Planning

3rd floor Duke Tower
PO Box 1749
B3J 3A5

email: patterncost@halifax.ca

Phone: 490-4886

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