

Stewardship of Environment and Resources

Criteria 12: Core green and blue space areas are protected and maintained.

Descriptor 12a: The Green/Blue Spaces Strategy is implemented as approved, including linkages

Measure: Amount of green and blue spaces

Commentary:

No indicator was selected for this descriptor, as the base strategy and each of the options are designed to ensure implementation of the Green/Blue Spaces Strategy (GBSS). From this perspective, there would be no sensitivity amongst the options from a quantitative point of view.

From a qualitative perspective, however, it is important to consider that although most of the areas identified in the Parks Master Plan, new parks are identified as regionally significant green/blue space in the GBSS, there are a few exceptions. These exceptions, which include some areas around Mill Hill Regional Park and Mount Wells, can potentially be considered to be threatened by the those growth options which permit development to occur in these areas.

As well, there are private lands with high ecological value that could potentially be threatened by growth. Although it is proposed in *Growth Strategy Alternatives for the Capital Region* that 40% – 70% of these lands be protected through inter-municipal agreement, it is conceivable that less densified growth options could reduce the likelihood of success in this proposed initiative from being achieved.

In general, the preferred option from the point of view of Green/Blue Spaces Strategy is to direct growth into centres and to limit suburban development in areas that are currently undeveloped. Not all of the growth options achieve this. For example, as seen in “Map of Alternative 3” as contained in *Growth Strategy Alternatives for the Capital Region*, a significant number of neighbourhood villages are proposed on urban lands with unprotected core green space value.

It should be noted that *The Report on the Environment: Monitoring Trends in the CRD*, monitors indicators relevant to this descriptor, including “Amount of Greenspace in the CRD”.

Stewardship of Environment and Resources

Criteria 12: Core green and blue space areas are protected and maintained.

Descriptor 12b: Natural beauty of the Region is maintained

Measure: Amount of natural ecosystems lost

Quantitative Indicator: Hectares of Green/Blue Spaces Strategy land impacted by urbanization – #31 on Figure 5

Meaning: Lower is better

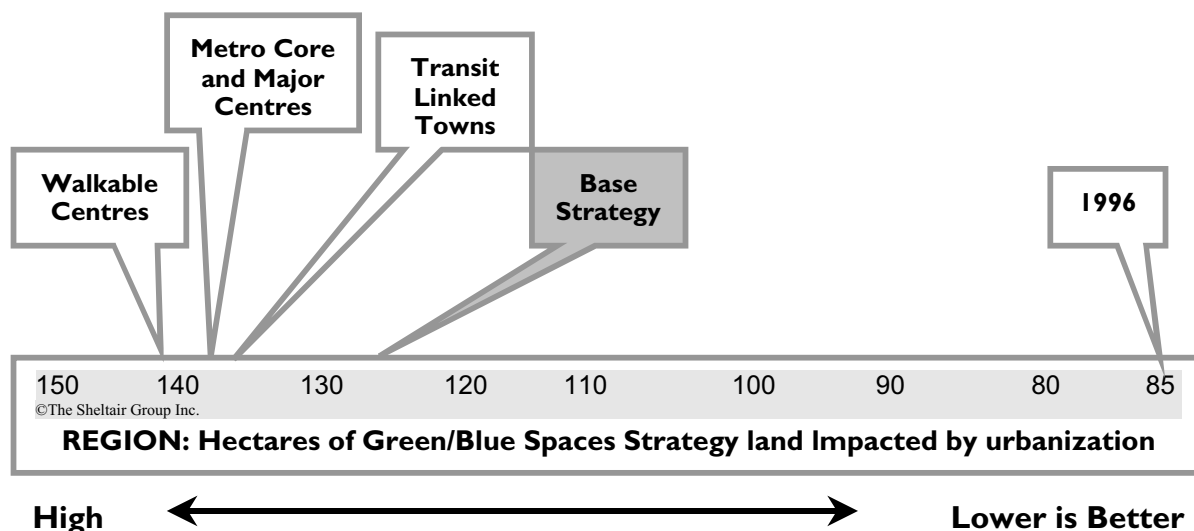
Commentary:

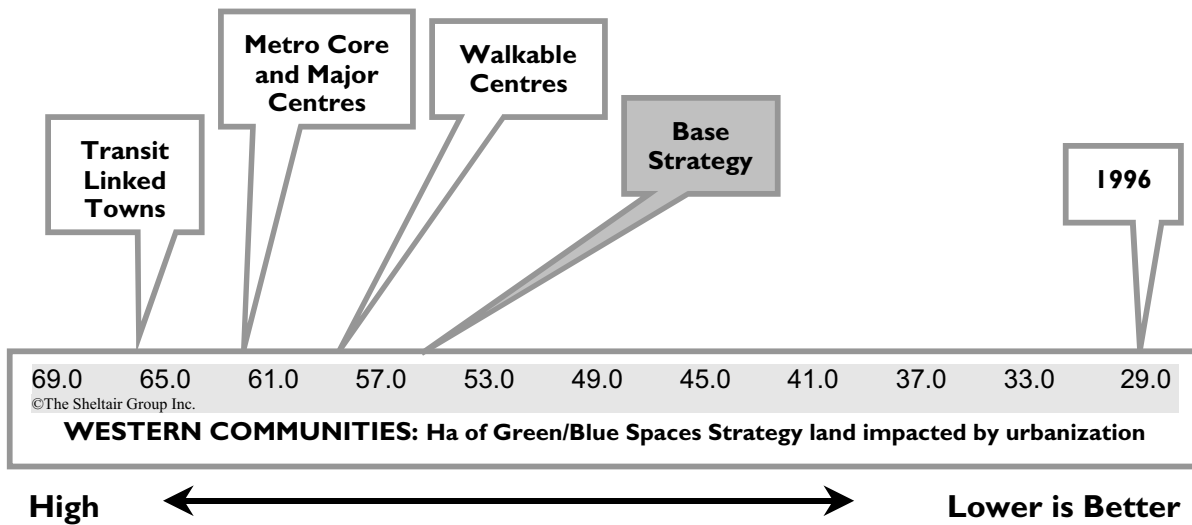
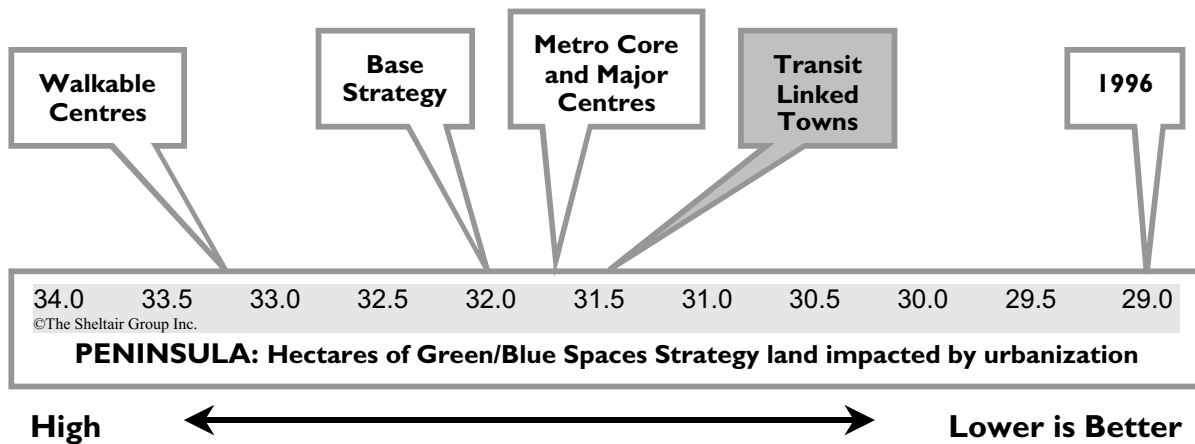
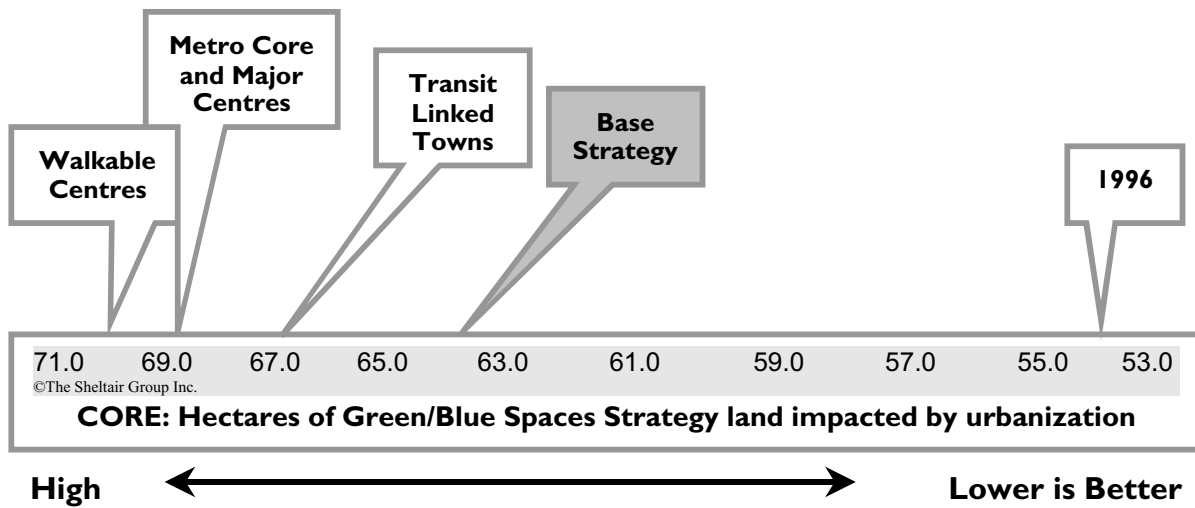
Although all of the growth options incorporate the Green/Blue Spaces Strategy, this indicator seeks to measure whether existing natural ecosystems might potentially be indirectly impacted by any of the growth options.

To this end, this indicator measures areas in which high-density development (30 dwelling units/hectare or higher) is proposed within 400m of GBSS land. Densities of this amount within such a proximity to natural habitat are considered to represent a threshold at which the integrity of the surrounding natural habitat is threatened.

The measurement of this indicator was based on a spatial identification of all potential parks, Green/Blue Spaces unprotected areas, and other Green/Blue Spaces areas, excluding schools, golf courses and institutional areas. Also identified were all high-density areas, which are land areas with a population density of 30 dwelling units per hectare or more. These high-density areas were then circled with a 400m buffer, representing a 5-minute walking distance to the GBSS lands. GBSS lands that were “captured” within these high density areas (plus buffer zones) were calculated and assumed to represent natural lands on which negative impacts of development can potentially be experienced.

It should be noted that no differentiation was made amongst the different types of Green/Blue Spaces; an urban park was considered equal to an ecological reserve. Thus, this indicator does not measure the impact of the growth options on specific types of Green/Blue Spaces, but rather their respective impacts on any “Green Lands”. This simple relationship obscures an important trade-off: in order to minimize





the impact on the most sensitive and ecologically significant land, it is important to use urban park land more intensively. A potential indicator for the future could be one in which there are refinements to accommodate the different classifications of GBSS lands.

Stewardship of Environment and Resources

Criteria 12: Core green and blue space areas are protected and maintained

Descriptor 12c: The healthy ecological functioning of natural systems is maintained, enhanced and remediated if necessary

Measure: Amount of environmentally sensitive land that is maintained

Commentary:

None of the growth options propose to reduce the amount of environmentally sensitive land. As with other descriptors similar to this one, it is conceivable that less compact development patterns can result in unintentional negative impacts on natural ecosystems and environmentally sensitive land.

The Report on the Environment: Monitoring Trends in the CRD contains indicators that are relevant to this descriptor, including:

- Intact riparian vegetation;
- Winter wetlands in the CRD; and
- Area of remnant natural terrestrial ecosystems in the summer months.

Stewardship of Environment and Resources

Criteria 13: Risks to life and property associated with natural hazards are minimized.

Descriptor 13a: Development on hazard lands (including floodplains and hillsides) is limited

Measure: Amount of development on hazard lands

Commentary:

This descriptor was not in the CRD's original evaluation framework but has been added by the consulting team.

The intent of this descriptor is to ensure that development on land located in seismic zones, floodplains, on steep slopes or hillsides, and so on, is limited. These lands are considered as hazardous for reasons relevant to each specific kind of land.

For example, homes and businesses built in low-lying floodplains are more likely to be devastated when a flood occurs. Likewise, development in seismic zones is more likely to be devastated in the eventuality of an earthquake. Development on steep slopes and hillsides can raise public safety concerns due to landslides, mudslides and erosion and can also be extremely damaging to surrounding ecosystems.

The BC Ministry of Environment Lands and Parks has recently released seismic hazard maps that could be used to calculate values for this indicator in relation to development in seismic zones. These maps were not available at the time this analysis was undertaken.

Stewardship of Environment and Resources

Criteria 14: The quality and quantity of water resources are protected – ground water, surface fresh water, watershed and marine waters are included.

Descriptor 14a: Demand management strategies are enacted for water and sewage discharge

Measure: Amount of seasonal increase in water use

Quantitative Indicator: Litres/capita/day of treated water consumed by residents – #32 on Figure 5

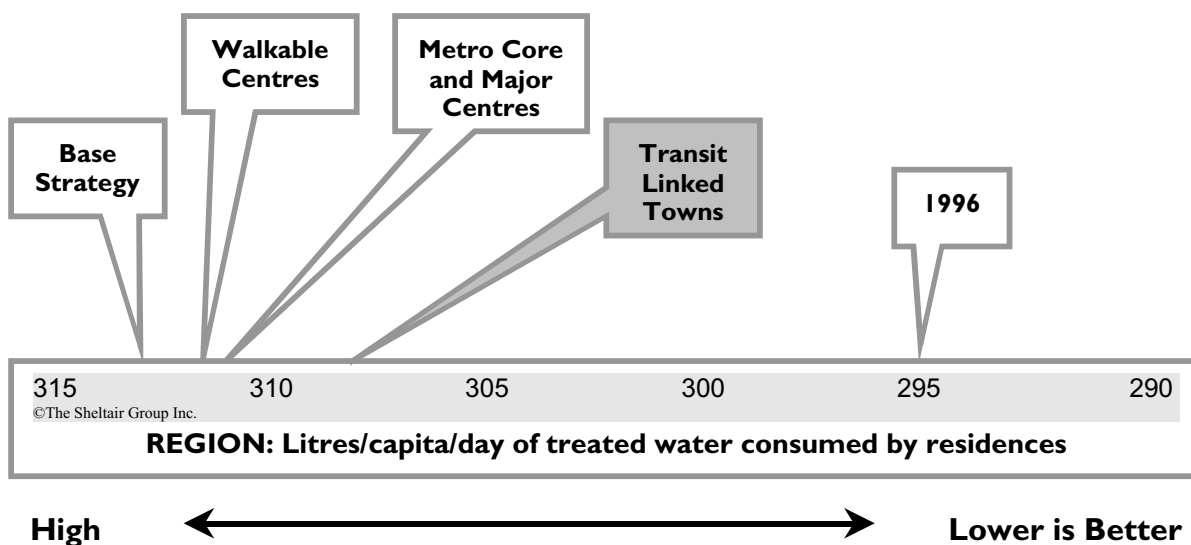
Meaning: Lower is better

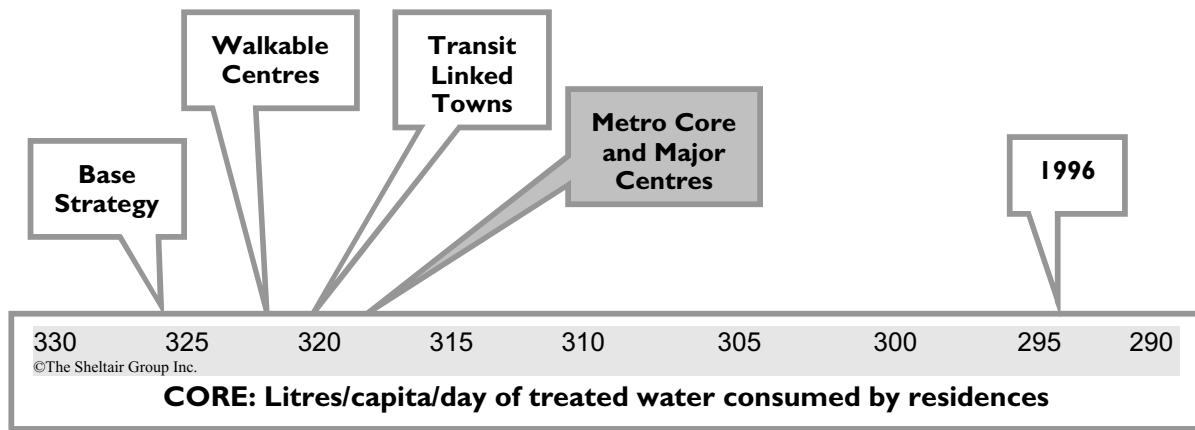
Commentary:

Although demand management is a policy issue that is dealt with separately from this analysis, general trends in water consumption associated with the different housing types permit some analysis of which growth option will best achieve the criteria. Seasonal increases in water use are related to this descriptor to the extent that big increases in summer water use reflect an increase in outdoor water usage, which is one area of consumption that can be effectively addressed through demand management strategies.

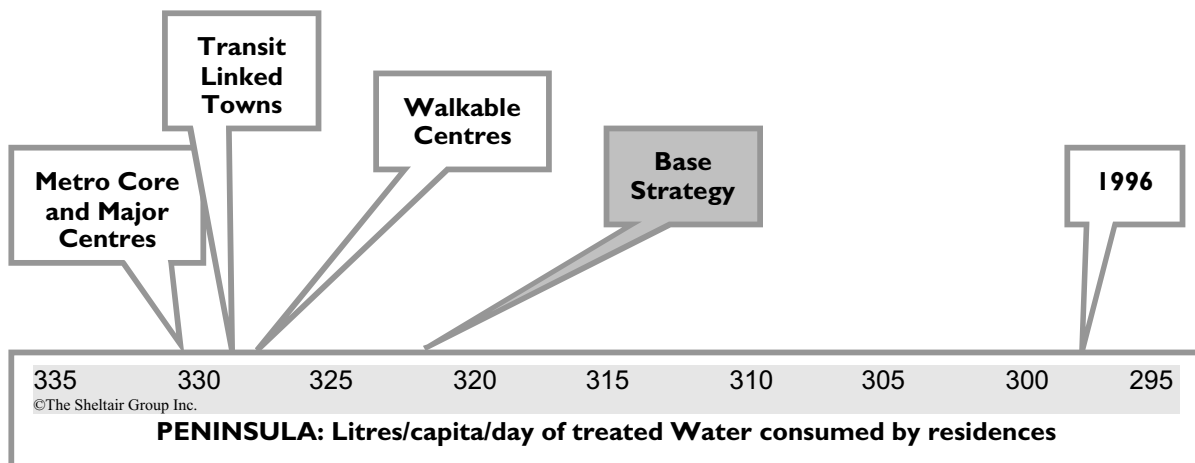
This indicator is intended to measure daily water consumption – seasonal increases in water use are subsumed within this calculation in order to reflect all housing types within each option. Because higher density housing types typically use less water for outdoor purposes, they typically have less of a seasonal variation in water consumption, and less water consumption overall. This is reflected in this indicator, where the Transit Linked Towns option (the option with the most multi-unit residential housing) performs the best at the regional level.

This indicator is similar to the one developed for Descriptor 2b, except that the units of measurement are different. It has been included, however, as it provides a more focused identification of the impact of housing type, and growth settlement options, on daily water consumption patterns. The measurement of this indicator is based on calculations generated for Descriptor 2b. In this case, however, the total consumption is divided by the population in order to identify daily per capita water usage.

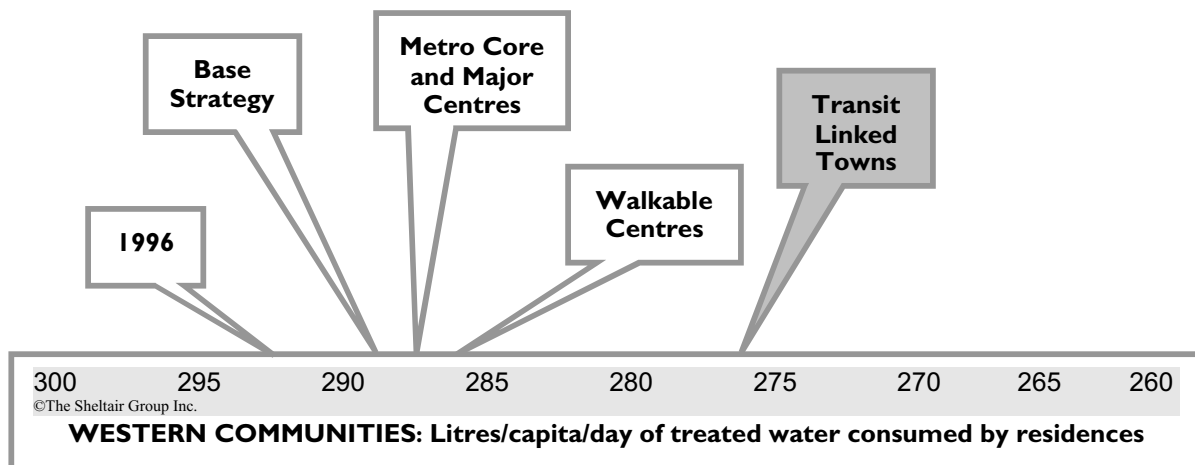




High ←————→ Lower is Better



High ←————→ Lower is Better



High ←————→ Lower is Better

Stewardship of Environment and Resources

Criteria 14: The quality and quantity of water resources are protected – ground water, surface fresh water, watershed and marine waters are included.

Descriptor 14b: Cost effective and efficient waste management is practised

Measure: Cost of wastewater treatment

Commentary:

The costs associated with wastewater treatment are partly a function of water demand, as well as of capacity thresholds of the infrastructure, and of the location of demand. Descriptors 2a (Peak day demand as a percentage of treatment capacity), 2b (Cubic metres per year of treated water consumed by residences), and 14a (litres per capita per day of treated water consumed by residences), all provide an analysis of the growth options in terms of the first two of these issues. Costs associated with the growth options and wastewater treatment in terms of location of demand could not be calculated due to insufficient data on which to base an analysis.

Stewardship of Environment and Resources

Criteria 15: Renewable and non-renewable natural resources are conserved and stewarded.

Descriptor 15a: Productive land reserves are secured and maintained (ALR, FLR) to foster a secure supply of food and agricultural products

Measure: Amount of agricultural land lost to development

Commentary:

Possible indicators for this descriptor include “percent of agricultural land available for agricultural use” and “hectares of land under active agriculture”. Developing indicators such as these would assume that some change might result from proposed settlement patterns. Because all of the growth options assume consistent amounts of ALR land, however, there would be no sensitivity of the options to these indicators.

It is important to note, however, that there are indirect impacts associated with different settlement patterns. For example, threats to ALR land increase with less dense forms of development. The less dense the development form, the more quickly that land is used up, and the greater the pressure for resource lands to be released for urban uses. Thus, although ALR lands are intended to remain in a productive capacity, it is possible that the longer term ramifications of the less dense growth options might threaten this status.

Another dimension is the potential for rural/urban conflict that arises when a lot of townfolk are placed immediately adjacent to farms, raising complaints about manure spreading, spray drift, night harvesting and cultivation, and so on. In this respect, there can be a “sterilizing” effect on farmland that becomes too difficult to farm due to these factors. Growth options that result in increased settlement in currently undeveloped or rural areas would perform poorly in this regard.

Stewardship of Environment and Resources

Criteria 15: Renewable and non-renewable natural resources are conserved and stewarded.

Descriptor 15b: Regional self-reliance for food and energy supply is improved

Measure: Amount of land appropriate for individual food production

Commentary:

A possible indicator for this descriptor is “hectares of land dedicated to community gardens”. Because this relates to an issue that is not dealt with by the growth options, the indicator was not developed. In theory, however, community gardening programs would be possible under all of the options.

Another dimension is that many people choose to live in single detached houses so that they can garden. Thus, growth options with a higher proportion of detached housing might potentially result in higher household food production.

Stewardship of Environment and Resources

Criteria 15: Renewable and non-renewable natural resources are conserved and stewarded.

Descriptor 15c: Recycling of energy, materials and nutrients is enhanced

Measure: Amount of energy, materials and nutrients recycled

Quantitative Indicator: Annual residential recycled material diverted from landfill (tonnes) – **#33 on Figure 5**

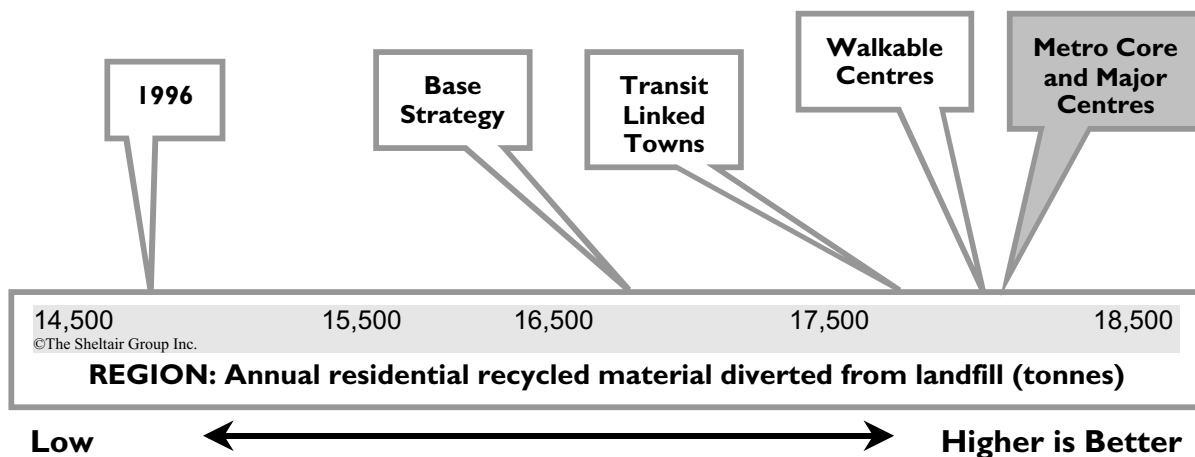
Meaning: Higher is better

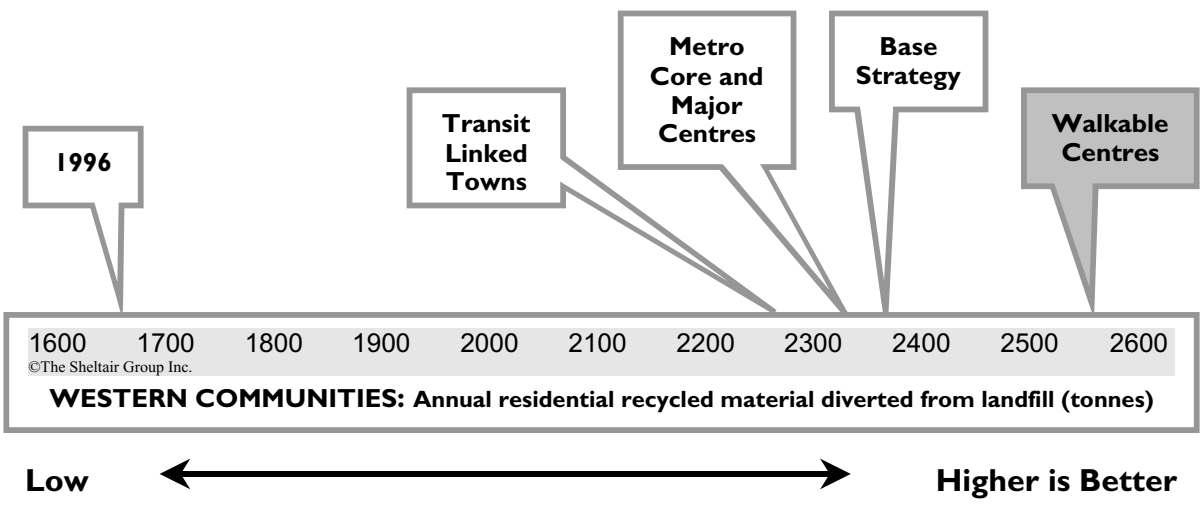
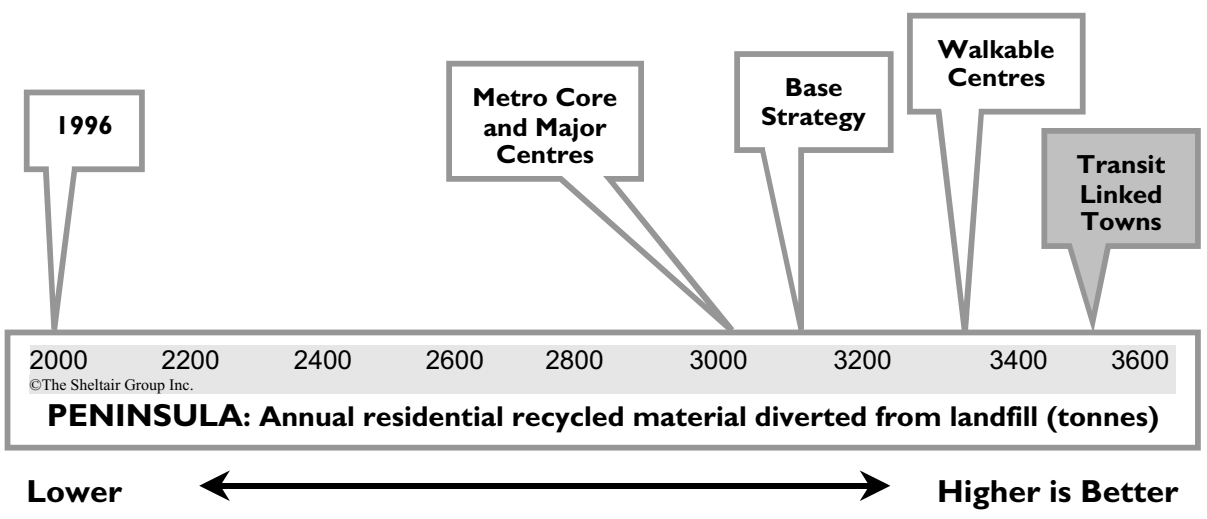
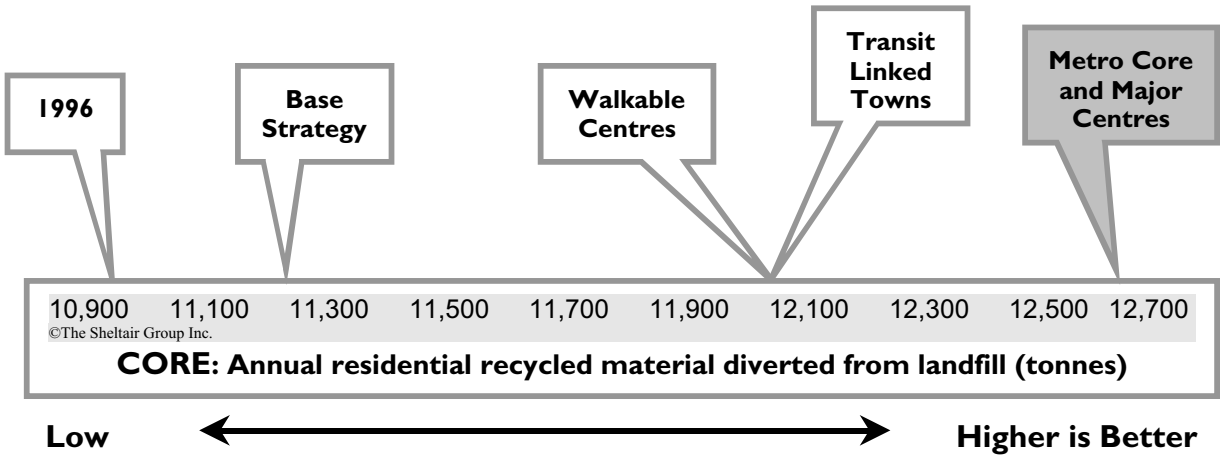
Commentary:

This indicator measures performance in terms of the descriptor by identifying how much solid waste could potentially be diverted from the landfill according to each growth option. While this typically represents more of a policy issue, as opposed to a growth settlement issue, the indicator is somewhat sensitive to the options, although based on differentiation in the location of population settlement at a municipal level. In other words, differences amongst the options can not be attributed within this analysis to different housing types, but rather to existing municipal policies and programs with respect to waste disposal.

The calculation of this indicator was based on residential recycling rates, aggregated at a municipal level. Using 1996 baseline data, a value for tonnes per capita was generated for each municipality. This value was then correlated to proposed population growth for each municipality for each of the growth options, and then aggregated again to an annual amount at both a regional and sub-regional level.

This indicator was calculated based on current trends, and thus in many ways does not reflect the situation that may occur over the next 26 years. The estimates reflect the fact that some municipalities in 1996 performed better than others in terms of recycling rates, which was translated to the modelled 2026 figures. No forecasts have been made in terms of how policy decisions might alter these rates.





Environment and Resource Stewardship

Criteria 16: Air, land and water pollution is reduced and remediated.

Descriptor 16a: Air pollution is reduced

Measure: Emissions based on total travel, level of congestion and vehicle fleet composition

Quantitative Indicator: Annual regional vehicle emissions (1000 tonnes) – #36 on Figure 5

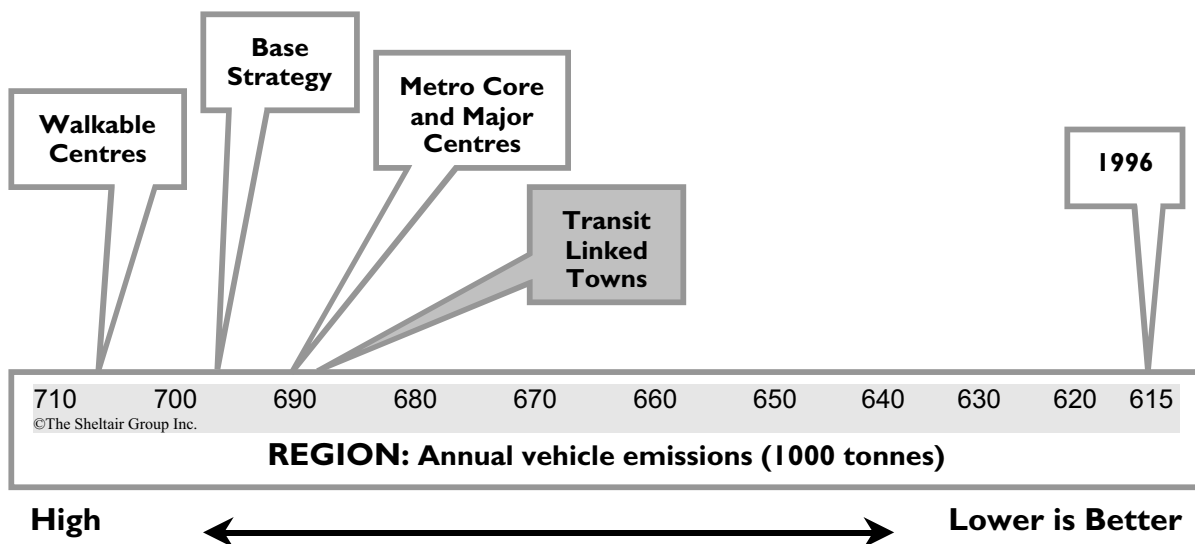
Meaning: Lower is better

Commentary:

The peak hour estimates of emission components based on total travel, level of congestion and vehicle fleet composition as produced by the regional transportation model have been converted to annual totals with some adjustment to the 1996 values to allow for trends in vehicle emission levels – there are small variations in the 2026 totals with the Transit Linked Towns option marginally in the lead over the Metro Core and Major Centres option. The change in estimated total annual emissions follows the 36% growth in total kilometres of travel shown in descriptor 1e.

The model results were tabulated in terms of vehicle kilometres of travel by speed range. Vehicle fleet composition and emission characteristics were applied using data and procedures developed by the Greater Vancouver Regional District to produce estimates of hourly and annual totals of various vehicle emissions and pollutants. Total annual emissions were used as the comparison between options.

The ongoing trend in reduced emissions per vehicle is reflected in the results because of anticipated technological improvements to the vehicle fleet. Although total trips increase about 30%, emissions increase in the range of 12-15%.



Stewardship of Environment and Resources

Criteria 16: Air, land and water pollution is reduced and remediated.

Descriptor 16a: Air pollution is reduced

Measure: Amount of air pollution

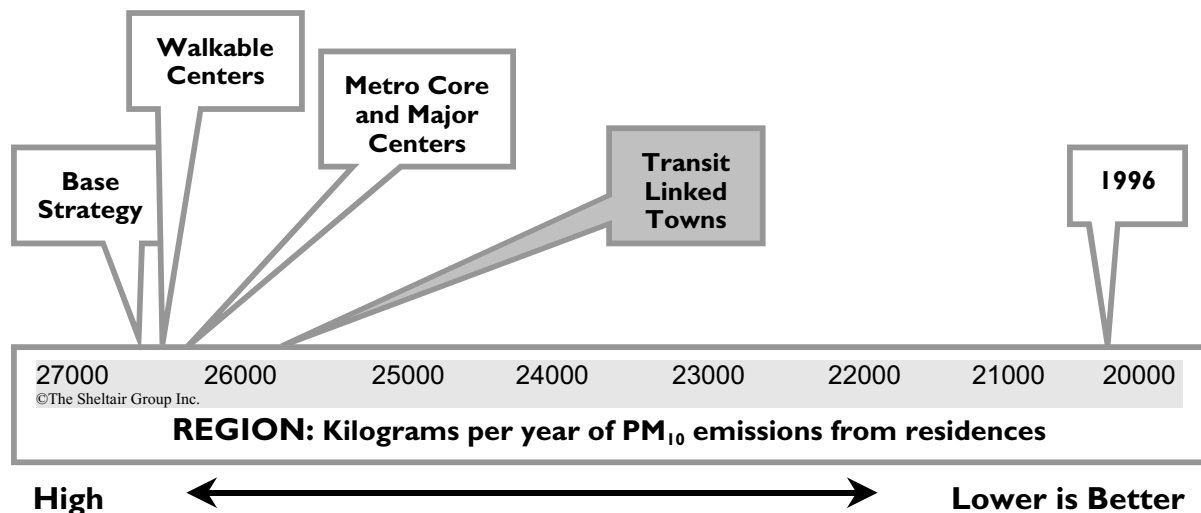
Quantitative Indicator: Kilograms per year of PM₁₀ from residences – #34 on Figure 5

Meaning: Lower is better

Commentary:

This indicator measures the emission into the atmosphere of PM₁₀ particulates associated with natural gas and oil used by residential buildings. PM₁₀ refers to particulate matter that is less than 10 micrometres in diameter and is considered to be a pollutant that can reduce the quality of the air, with negative impacts more commonly being experienced at the human health level. It also plays a major role in causing the “brown clouds” that reduce visibility. Differentiation amongst the options is due to the type of housing, and the associated energy consumption patterns and fuel mix factors; transportation and other contributors to PM₁₀ have not been factored in to the calculation.

This indicator was calculated based on residential energy consumption values generated for Descriptor 2b. These values were then correlated with associated air emission factors, and translated into an aggregated value for PM₁₀ emissions.



Stewardship of Environment and Resources

Criteria 16: Air, land and water pollution is reduced and remediated.

Descriptor 16a: Air pollution is reduced

Measure: Amount of air pollution

Quantitative Indicator: Kilotonnes CO₂ per year generated by residences– #35 on Figure 5

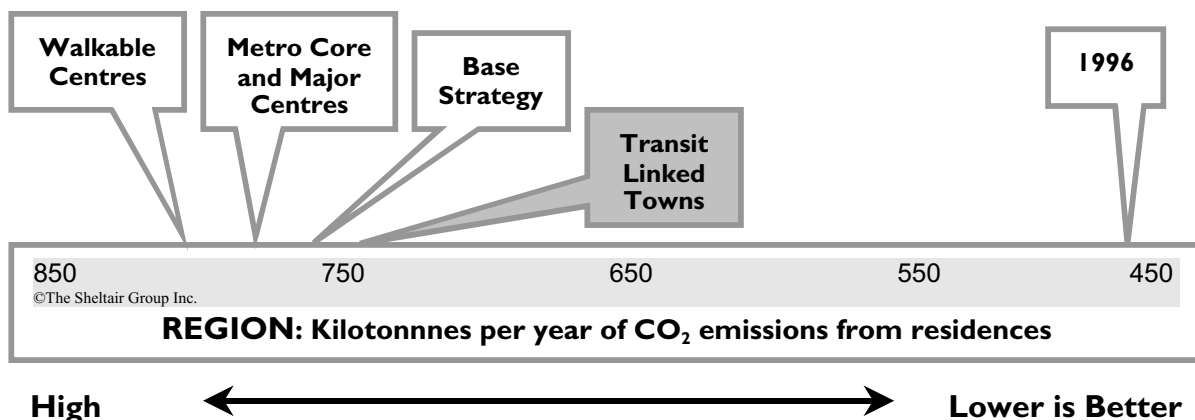
Meaning: Lower is better

Commentary:

One of the most significant negative environmental impacts associated with the burning of fossil fuels as a source of energy is the addition of CO₂ to the atmosphere. Carbon dioxide from residential energy use is a key source of greenhouse gas emissions, and thus of air pollution. This indicator measures performance in this area for each of the growth options, and demonstrates a small range of variability. This variability is due to variations in housing type, and the associated energy use and fuel mix for each option. For example, the large increase in CO₂ emissions from the 1996 baseline can be attributed not only to the overall increase in quantities of residential units, but also to the increase in multi-unit residential buildings. Because these buildings typically rely more on electricity as a source of heating energy, and because electricity represents the energy source with the greatest associate CO₂ emission rate, a non-linear increase in overall CO₂ emissions occurs*. In terms of housing stock, because, for example, the Walkable Centres option results in the largest increase in number of residential units, performs poorly.

This indicator was calculated using the same energy consumption method as used for Descriptor 2b. To this consumption data, emissions factors were correlated in order to produce a value for CO₂ emissions. It should be noted that electricity results in the most CO₂ emissions, followed by oil and then natural gas. While a future natural gas burning co-gen facility may be developed on the Island, altering this relationship amongst the fuel types, an eventuality such as this has not been incorporated into the assumptions made to model this indicator.

Emission factors attributed to residential sector space heating were used to calculate CO₂ emissions (as per information from “Emission Factors for Greenhouse and Other Gases by Fuel Type”, Ad Hoc Committee on Emissions Factors, Energy Mines and Resources, 1990). For the Base Strategy and the three options, future marginal capacity electrical demand is assumed to be supplied by natural gas.



*Electricity produces a higher emission rate than natural gas-fired home heating because there is a more efficient energy conversion heating directly from a burner in your home than through conversion to electricity and heating with electricity. To illustrate: one unit of natural gas provides one gigajoule of energy in a home furnace; whereas, three units of natural gas are needed to give one gigajoule of equivalent electrical energy.

Stewardship of Environment and Resources

Criteria 16: Air, land, and water pollution is reduced and remediated.

Descriptor 16b: Land pollution is reduced and remediated

Measure: Amount of waste going to landfill

Quantitative Indicator: Annual solid waste going to landfill (tonnes) – #37 on Figure 5

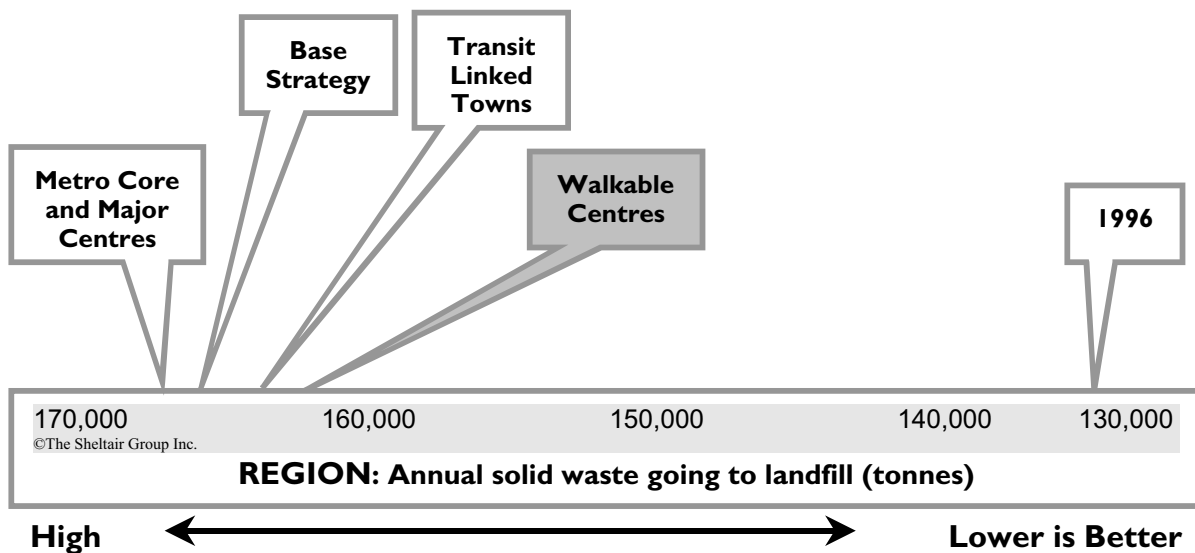
Meaning: Lower is better

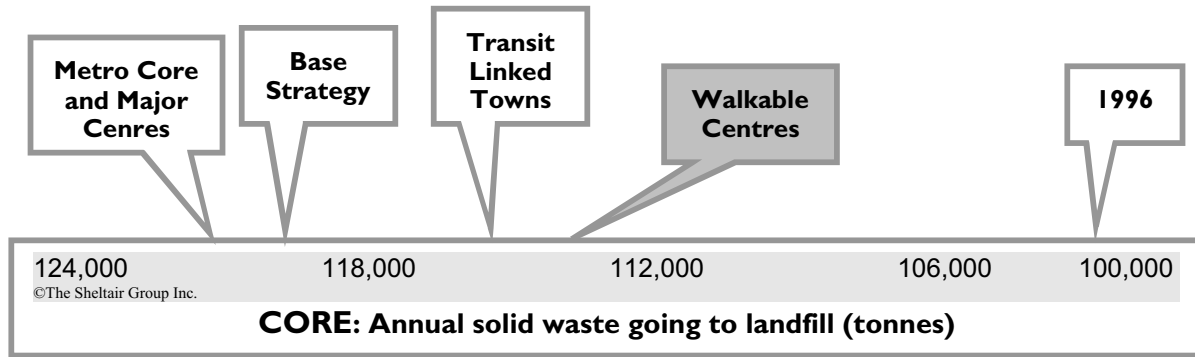
Commentary:

Solid waste going to landfill is not only a form of pollution from a visual perspective, there are also serious ramifications associated with leachates which enter the soil and groundwater aquifers. This indicator therefore measures the potential for such pollution to occur.

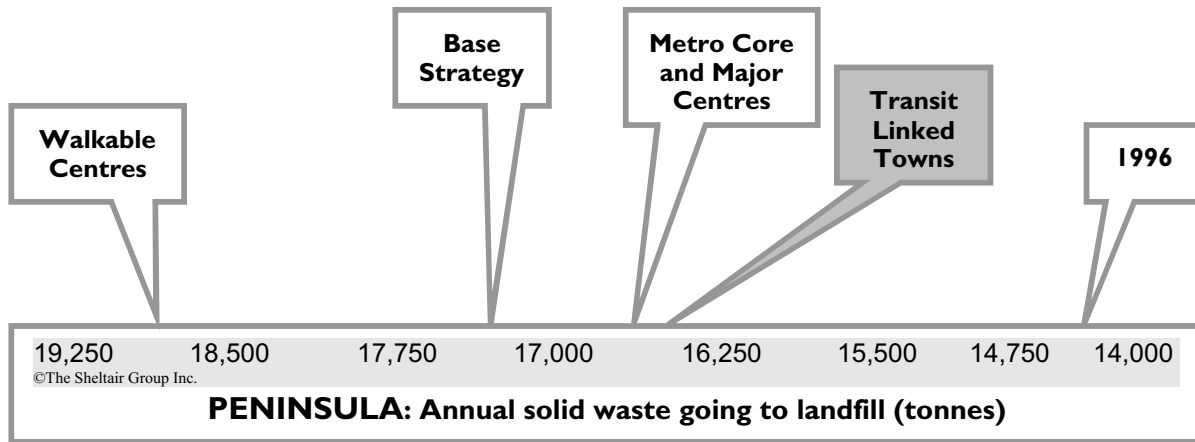
Again, the generation of solid waste is generally not considered to be closely related to *where* development occurs, but is more a function of strategic policies and programs along with housing types. For example, studies have found that detached residential units generate more waste due to yard clippings. In municipalities where yard clippings are collected separately and composted, however, such an observation would not hold true. There is, however, some variation amongst the growth options, based on current municipal disposal trends. It should be noted that these performances have not been correlated with housing type, but rather stem from municipal performance.

The calculation of this indicator was based on values provided by the CRD Solid Waste Division 1997 Annual Report. Data on total general refuse by source was correlated with population data contained in “Results of the Population, Dwelling Unit and Employment Projections for the Capital Region’s Growth Strategy Alternatives 1996 – 2026, Volume 1 – Results; Volume 2 - Methodology”. This correlation permitted the calculation of a value for the per capita solid waste generation for each municipality. This was then multiplied by the projected population for each of the growth options at a municipal level, and then aggregated to a regional and sub-regional level.

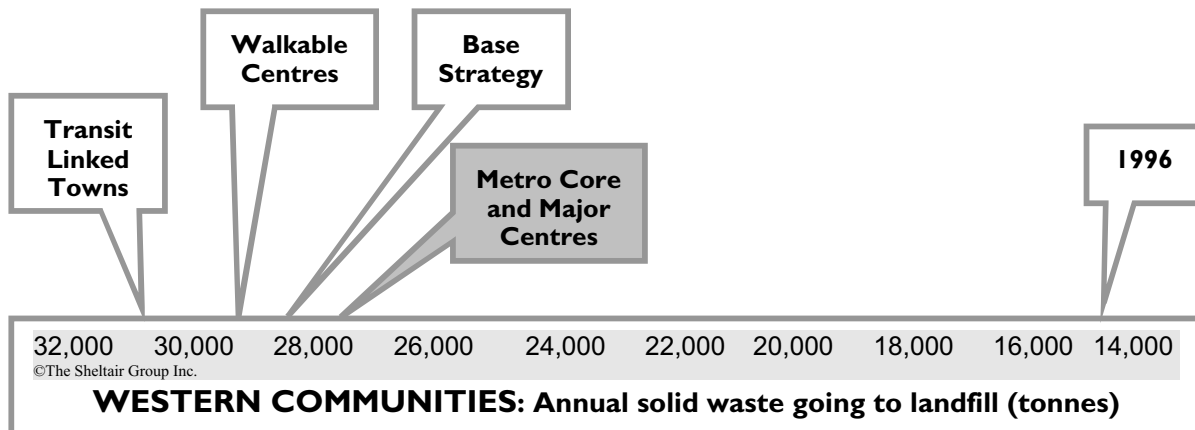




High ← Lower is Better



High ← Lower is Better



High ← Lower is Better

Stewardship of Environment and Resources

Criteria 16: Air, land and water pollution is reduced and remediated.

Descriptor 16c: Water pollution is reduced and remediated

Measure: Amount of runoff entering receiving bodies

Quantitative Indicator: Percent of land covered by impermeable surfaces – #38 on Figure 5

Meaning: Lower is better

Commentary:

One of the most significant sources of water pollution is from stormwater runoff, which in turn is very closely related to the amount of impermeable surfaces in a given land area.

This indicator measures the amount of impermeable surfaces associated with each growth option, based on archetypal values typically associated with different land uses. As is evident, the range in values is small, which reflects the fact that although to a certain extent impermeability is associated with settlement patterns, it is also a policy and design issue that can be addressed by any of the settlement patterns.

This indicator was calculated using land use area data from CRD Planning correlated with imperviousness values for land use types from “*Non-Point Source Pollution Prevention Recommendations*” (City of Santa Monica, 1992). This document assigns imperviousness ratings to each land use type, permitting values to be associated with each of the growth options. Included in this indicator calculation were all traffic zones in the CRD, including those outside the proposed UCB, with the exception of TZ 391 at the western extremity of the CRD. Traffic zone 391 was excluded as it is a very large area of forested land that diluted values in the more urbanized areas, and prevented an analysis from being conducted.

The impervious rating for the 1996 baseline was calculated as 80% of the Base Strategy, based on a survey of the percentage build-out already achieved for currently zoned areas in the municipalities of Saanich, North Saanich and Langford.

