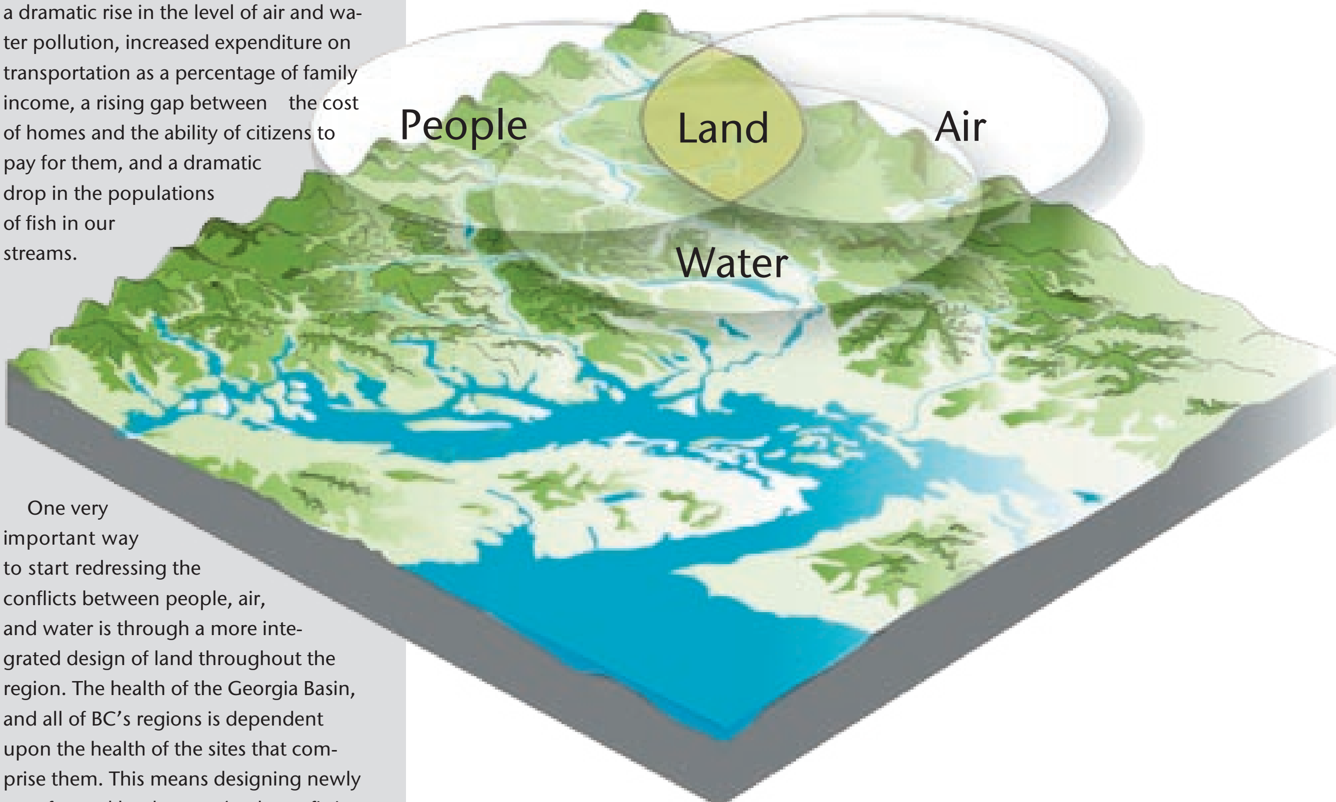
WATER, AIR, PEOPLE, LAND

The Georgia Basin is one of British Columbia's many unique and environmentally sensitive bioregions. The coastal bioregion is shaped by the dramatic peaks of the Olympic and Vancouver Island ranges on its south and west, and the Coast and Cascade ranges on its north and east. It is home to a rich diversity of ecological systems – systems that have supported human settlement for more than 10,000 years.

Unprecedented urban growth over recent decades has stressed the bioregion's natural systems, resulting in a dramatic rise in the level of air and water pollution, increased expenditure on transportation as a percentage of family income, a rising gap between the cost of homes and the ability of citizens to pay for them, and a dramatic drop in the populations of fish in our streams.



One very important way to start redressing the conflicts between people, air, and water is through a more integrated design of land throughout the region. The health of the Georgia Basin, and all of BC's regions is dependent upon the health of the sites that comprise them. This means designing newly transformed landscapes (and retrofitting existing ones) to respect and potentially enhance natural function and human quality of life. It means ensuring a healthy habitat for humans and other living things, ensuring a fair distribution of services and infrastructure among all communities, and providing quality affordable homes for citizens, while also preserving opportunities for future generations to enjoy these same benefits.

As the image above makes clear, we live on a dramatic but limited landbase. The interconnected systems of water, air and people – on the land – must first be seen and understood as an integrated whole before citizens and their elected leaders can act intelligently to protect them. This manual is intended to assist in building this understanding.

PART ONE
Setting a Context

Managing urban growth in British Columbia has become an increasing challenge. Over the past decade, British Columbia's population expanded by an average of about 65,000 persons per year. Over the next ten years, the population of our province is expected to grow from 3.9 million to beyond 4.7 million. This rapid growth has brought with it unprecedented demand for new homes, water, roads, shops, and places to work.

To meet this demand, many communities endlessly replicate the "status quo" suburban development pattern of large-lot, single-family homes located in car-oriented districts far from jobs and services. Although the typical suburban pattern successfully met post-war housing demands, it did so at a cost and now needs changing. It is clear that uncontrolled suburban sprawl has wasted precious land, cost our families more money than it should, increased the tax burden for succeeding generations, and doubled the per capita production of greenhouse gases (as compared to that produced by the inhabitants of pre-Second World War developments). It is now clear that standard post-war development patterns are at odds with provincial policies aimed at increasing regional sustainability. It is also clear that the replication of this pattern has far-reaching implications for the purity of our water and air, for our standard of living, and for the quality of our lives.

Who Is This Manual For?

This manual is intended for people interested in making better communities: citizens, elected officials, government regulators, NGOs, and those who plan and build new homes and communities. Unlike traditional design and engineering manuals whose treatments of site development, environmental protection, and drainage guidelines are presented separately and often in language exclusive to their intended audience, this manual tries to keep all of the pieces of the urban design puzzle together. We do this in order to avoid problems that have arisen when issues have been "dis-integrated"; that is, when transportation planning has been discussed without reference to land-use; when storm drainage engineering has been discussed without reference to stream habitat protection; and when engineering and subdivision standards have been discussed without reference to economics.

This manual "re-integrates" these pieces of the sustainable urban region. As many of us now know, a sustainable community is one that balances ecology, economy, and equity. We have tried to maintain this balance in the way we have developed and organized this manual.

Organization

Part One begins with a review of current development trends and their effects on the interrelated components of our regional landscapes: water, air, and people. This is followed by a brief overview of the emerging policy and legislative context for sustainability within British Columbia. Part One ends with a discussion of four projects in the Lower Mainland where a design charrette was used to vision and plan a new community according to sustainable development principles. We feature the design charrette because it is one particularly effective model for overcoming the institutional barriers and regulatory gaps that impede the adoption of more sustainable local policy. While each project used the charrette differently, all were guided by very specific institutional and regulatory frameworks that supported sustainability.

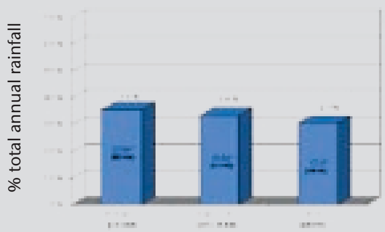
Part Two documents the methodology for developing the Design Guidelines (featured in Part Three). In culling the scores of design ideas emerging from the four charrettes, we developed a **Taxonomy of Urban Sites**, which became the means for first organizing, and then communicating, the various components that make a sustainable community. The Taxonomy is informed by four tenets of sustainability – **green infrastructure, social infrastructure, movement, and cost** – and by four scales of urban design – **district, corridor, block, and parcel.** The design ideas that emerged from each of the charrettes in Part One are categorized according to the Taxonomy in the form of **Strategies**.

Together, the charrette Strategies and Taxonomy provide the methodological basis for **Six Overarching Principles** of sustainable community design, outlined in Part Three. These Principles were reverse engineered from the charrette Strategies and the years of policy development and research that preceded them. Together, they constitute a valid and defensible "first set" of principles for rethinking how our communities are designed.

Flowing from this process of sifting, sorting, and reverse engineering, and organized under Six Overarching Principles, are the **Design Guidelines**. It is important to emphasize that in order to achieve the highest degree of balance between ecological and urban systems, the Design Guidelines are not presented as fixed, prescriptive sets of instructions, but rather as a menu of options for adapting to each distinct site type and situation at the scales of the district, corridor, block, and parcel.

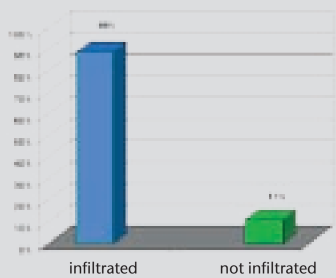
The manual concludes with a research and action framework for continuing our collective progress toward more liveable, affordable, and ecologically sound communities.

Percentage of Total Annual Rainfall Attributable to Minor, Moderate and Substantial Rainfall Events.



In many areas of the Greater Vancouver Region, the majority of annual rainfall on a site is from minor and moderate (i.e., less than 1”/24 mm) rainfall events. Source: Kwantlen Park Raingauge data from Jan 1, 1962 - May 1, 1995. Surrey, BC, 1995.

Annual Rainfall Potentially Captured with a System that can Absorb 1”/24mm every 24 Hours.



Stormwater management systems designed to absorb 24mm (1 inch) per day, such as the East Clayton Infiltration System, will absorb almost 90% of all the rain that falls on a site. Infiltrating rain water ensures stream base flows are supported, stream peak flows are reduced, and flooding downstream is eliminated. Infiltration systems maintain the hydrological cycle of the soil and ensure that groundwater is recharged at pre-development rates. Infiltration is the single best way to protect most aquifers from depletion (and streams from degradation).
Source: City of Surrey Department of Planning and Development et al., East Clayton Neighbourhood Concept Plan, Section 6.

Right – Lost Streams of Vancouver
In many of our older urban environments, natural stream systems no longer exist. In the map of Vancouver on the near right, dashed lines represent the streams that used to flow overland. Today, over 95% of Vancouver’s original stream systems flow through pipes buried beneath sidewalks and streets.
Source: Fisheries and Oceans Canada, Fraser River Action Plan.

Water

Urbanization causes significant changes to natural stream channels and hydrological function. Even on the “RainCoast” of British Columbia, the piping and channelling of stormwater runoff creates desert-like conditions in urban environments. Conventional stormwater management techniques disrupt surface flow and eliminate the opportunity for groundwater recharge. As a result, aquifer levels drop and streams dry up. When large rainfall events do occur in this artificially arid zone, severe flooding results, scouring what streams remain with up to a twentyfold increase in stormwater volume during storm events.

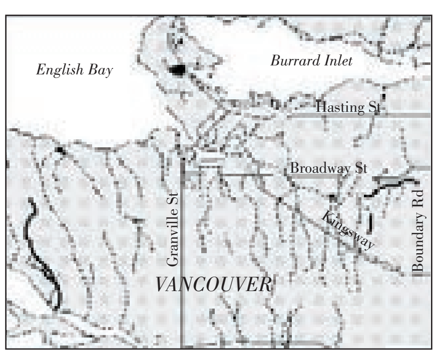
Water Quantity

It is only recently that we have learned that fish are more susceptible to water quantity changes than to water quality changes. As a consequence of the disruption to urbanized watersheds, the fish-bearing capability of virtually all of our urbanized stream systems has been destroyed. In the City of Vancouver alone, only six of the original sixty salmon-bearing streams still provide habitat.[1]

But it does not have to be this way. If we simply change the instructions we give to our engineers and ask them to infiltrate rain into the soil rather than to send it to streams through pipes, we could protect our urban streams, protect fish, and save money. For instance, the vast majority of rain that falls in many parts of the Greater Vancouver Regional District (GVRD) is in the form of frequent but small storm events (i.e., storms that deliver less than twenty-five millimetres of rain within twenty-four hours). These events also dominate in most other parts of the province. Systems that aim to capture and infiltrate this rainfall can reduce the amount of stormwater runoff from the site by nearly 90%. Infiltration systems, wherein rainwater is absorbed naturally into the ground, ensure that stream base flows are supported, reduce stream peak flows, and reduce flooding downstream. Such systems maintain the hydrological cycle of the soil and ensure that groundwater is recharged at pre-development rates. Infiltration is the single best way to protect most aquifers from depletion and streams from degradation.

Streamside vegetation also plays an important role in preserving soils, retaining nutrients, protecting in-stream habitat, and ensuring food supply for fish. Some studies indicate that thirty metres of streamside vegetation on both sides of any given watercourse is required in order to maintain a healthy riparian corridor. Such a canopy cover of riparian vegetation shades streams and helps to moderate water temperatures. Insects that reside in this vegetation also provide a constant source of food for fish. Fallen trees and branches provide cool resting places for fish as well as protection from predators. Roots and fallen trees reduce the energy of flowing water, which in turn helps to secure stream flow and to stabilize streambanks. Riparian plants bind soils in place and trap moving sediment, actually replenishing healthy soil and reducing erosion. During times of rising floodwater, vegetation filters surface runoff and slows overland flow. Slow-moving water then has more time to soak into the soil.

In healthy, well managed watersheds, stored groundwater is released back into the stream during periods of dry weather. If this hydrograph – which is dependent upon a healthy riparian corridor, interflow, and ground water recharge – is not maintained, then the stream channel will wash away or dry up. Even the riparian vegetation of non-fish-bearing parts of a stream plays a role in fish habitat. Upstream areas provide important food and nutrient sources, and they help to maintain the quality and quantity



of water flow downstream. These intermittent portions of streams are extensive throughout our regions, which makes them very difficult to protect when development occurs.

Water Quality

Non-point source (NPS) pollution – which includes pathogens, oxygen-depleting substances, nutrients, sediments, and toxins – has been identified as the major cause of water quality degradation. Urban land use and development plays a significant role in NPS pollution. Sprawling suburban development not only increases this pollution through erosion and sedimentation from land clearing and excavation, but also from related land-use activities; impermeable surfaces (i.e., roads, driveways, and parking lots that prevent the infiltration of water into the soil) generate large amounts of stormwater runoff and with it a host of NPS pollutants.

Our vehicles are largely responsible for such contaminants as oil, paint, lead, and organic compounds, not to mention toxic gases and particulates that are released into the atmosphere. Currently, the amount of petroleum residues washed off streets, highways, parking lots, and industrial sites each year exceeds the total worldwide spillage from oil tankers and barges.[2]

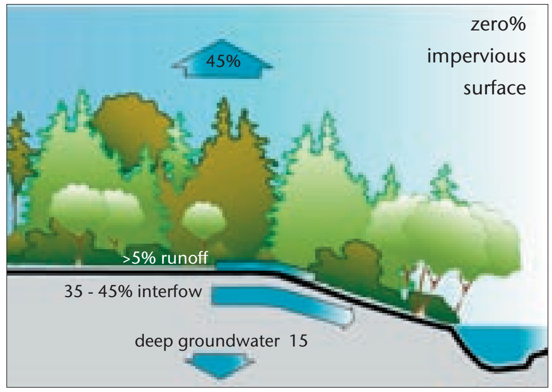
Nonetheless, per capita car use and per capita pavement allocation continues to rise, leading to even higher per capita pollution. Furthermore, low-density sprawl means that water quality is impacted over ever wider areas.

Thankfully, considerable research shows that integrated infiltration and evaporation/transpiration practices provide a cost effective alternative to conventional stormwater infrastructure. The benefits of these practices are that they:

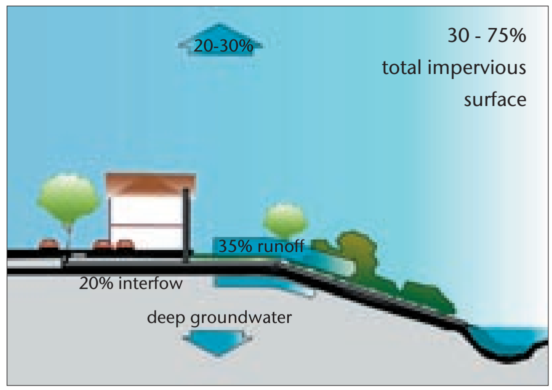
- capture "first flush" pollution (which comes from small storms after long dry periods and contains the greatest number of pollutants)
- maintain "pre-development" peak rates of infiltration and evapotranspiration (as well as total water volume discharged into streams)
- protect existing dry-season base flows

Such practices can also greatly reduce the pollution from urban stormwater and are typically more cost-effective over the long term than conventional infrastructure. In addition, they can increase habitat quality, add to the natural amenity of a community, and serve such multiple purposes as passive recreation and community education.[3]

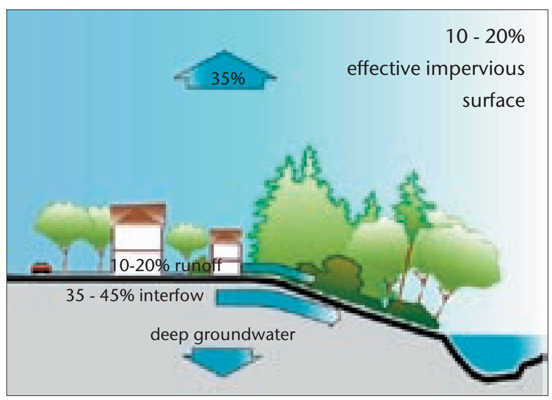
The Hyrdological Effects of Urbanization[4]



Pre-development hydrology
Streams are simply the manifestation of the infiltration performance of the soils in the watershed and the evapotranspiration performance of its vegetation. In a naturally functioning hydrological cycle, the majority of the rain that hits the site infiltrates the soil. Most of this infiltrated rainwater replenishes streams (through subsurface interflow), and some replenishes the deeper groundwater aquifer. Less than 5% actually flows across the surface as runoff. Maintaining predevelopment rates of infiltration (and thus virtually eliminating runoff) after development is essential if streams are to continue to survive.



Post-development (Conventional)
In conventional development, rainwater falling on a typical street cross-section is trapped between street curbs and cannot pass to the roadside soil. From the inlet grate on the street, almost all stormwater that falls moves via pipes that get progressively bigger until it is finally discharged into a stream, usually at velocities and volumes many times greater than those to which the stream has adjusted. The cumulative effects of this concentrated and artificial flow of water include increased flood potential, destabilized stream banks, increased water pollution, and reduced groundwater levels.



Post Development (Alternative)
Alternative development that limits impervious surface area achieves a much higher rate of infiltration than conventional development. Narrower streets, smaller building footprints, and riparian vegetation with continuous tree cover work together to mimic the natural hydrology of the site. Urbanizing an area without destroying streams, and the habitat necessary for fish survival, requires virtually all of the infiltration naturally occurring in the watershed to be maintained.

Notes:

1 Ministry of Environment, Lands and Parks, *Tackling Non-point Source Water Pollution in British Columbia*: An Action Plan (Victoria, BC: Ministry of Environment, Lands and Parks, 1998), 10.

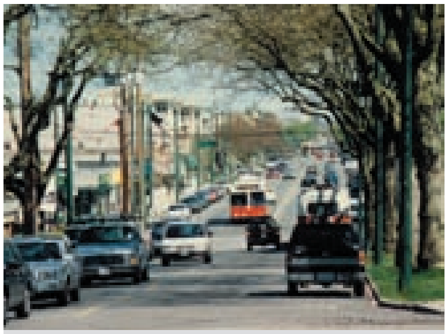
2 William Marsh, *Landscape Planning: Environmental Applications* (New York: Wiley, 1998).

3 A Pacific Northwest example of an open drainage infiltration system that has been successfully implemented is found in Bellevue, Washington. Implemented in the mid-1980s to mitigate the effects of flooding, the system cost a fraction of what a conventional piped-system would have cost and has successfully managed storms in excess of 100 year levels. In addition, the infiltration technologies have assisted in the protection of riparian areas, which continue to support salmonid fish populations. See C.L. Girling and K.L. Helphand, "Retrofitting Suburbia: Open Space in Bellevue, Washington, USA," *Landscape and Urban Planning 36* (1997): 301-33.

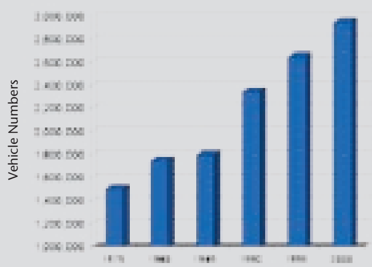
4 Various sources suggest a range of quantities for the performance of rainfall on forested and urbanized landscapes. The diagrams shown reflect the average, and most likely, performance expected on most landscapes within the lower mainland region and Georgia Basin. Please see: Environmental Protection Agency, "Guidance Specifying Management Measures for Sources of Nonpoint Source Pollution in Coastal Waters", #840-B-92-002 (Washington, DC: USEPA, 1993); Marx, Josh, et. al, *The Relationship Between Soil and Water: How Soil Amendments Aid in Salmon Recovery*, (Seattle, Washington: King County Department of Natural Resources, 1999); and CMH2Hill, *Provincial Stormwater Planning Guidebook* (Vancouver, BC: Department of Fisheries and Oceans, Ministry of Water, Land and Air Protection, Draft June, 2001): 6-22.

5 The increase in impervious surface cover results in detrimental effects towards stream ecosystems. Urban streams have become a gauge to the degree of disturbance by urbanization, facilitating better landscape management. See Michael J. Paul and Judy L. Meyer, "Streams in the Urban Landscape," *Annual Review of Ecological Systems 32* (2001): 333-65.

Air

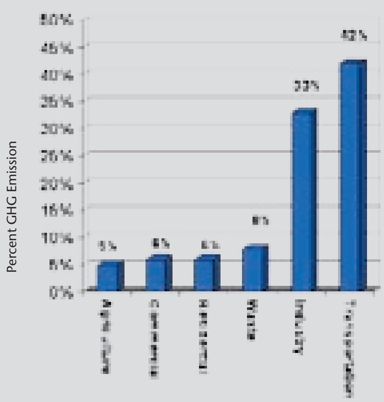


Passenger Vehicle Increase in Vancouver



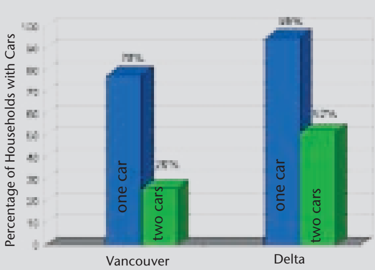
Vehicle numbers are based on the total ICBC Autoplan policies in effect. The steady growth in policies mirrors the increased traffic on Vancouver's roads.
Source: ICBC Statistics, 2000.

BC's Green House Gas (GHG) Emissions by Sector



Compared to other land use sectors, transportation is the largest and fastest growing source of GHG emissions in BC
Source: BC Ministry of Environment, Lands and Parks. Environmental Trends.

Car Ownership per Household



Car ownership per household is less in our urban communities, such as Vancouver, while in our suburban communities, such as Delta, almost all households rely on one or more cars.
Source: Statistics Canada. Canada Census 1996.

One of our region's major air quality challenges is photochemical smog, which forms mainly in the eastern portions of the GVRD and Lower Fraser Valley during hot summer days.[1] The primary unhealthy ingredient in smog is "ground-level ozone." Ground-level ozone is produced through a reaction in the atmosphere between sunlight, nitrogen oxides, and volatile organic compounds from industrial and vehicle emissions. Elevated levels of ozone can cause respiratory problems for people and can damage vegetation, including agricultural crops.[2]

A second major air quality challenge is the atmospheric concentration of greenhouse gases (GHG), the accumulation of which influences global climate.[3] For British Columbia, global climate change could lead to rising sea levels and flooding, more frequent and severe weather events, and further declines in fish populations.[4]

The increase in automobile use due to urban sprawl significantly influences smog and GHG emissions. In British Columbia, transportation is the largest and fastest-growing source of GHG emissions, accounting for 41% of the current provincial total.[5] Within the GVRD, passenger vehicles alone account for 40% of the ozone smog in the Lower Fraser Valley Airshed.[6] Conventional suburban development brings with it a deep dependence on the automobile and results in a doubling of per capita vehicle kilometres travelled (VKT) per person per day.[7] Yet research also shows that North Americans will leave their cars at home if services and frequent transit are available within a five-minute walking distance.[8]

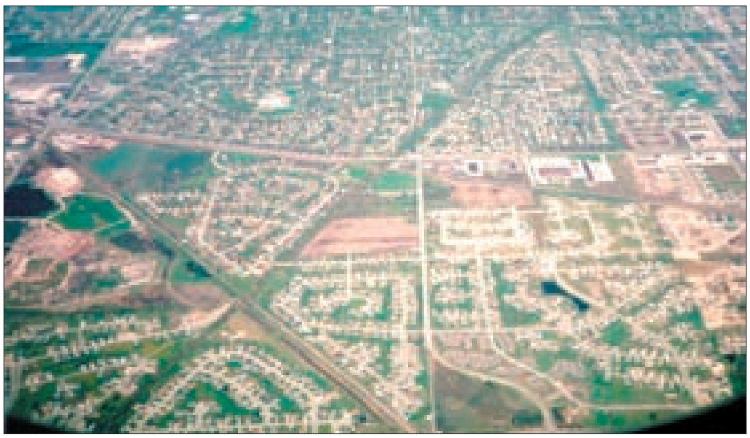
Mitigating Smog and GHG

In the metropolitan area of Vancouver, which has an average density of around forty units per hectare (sixteen units per acre), 22% of households do not own a car. The average car ownership per dwelling unit is approximately 1.2.[9] In Surrey and Delta – less dense areas of our region – the average car ownership per dwelling unit is approximately 1.8[10] and only 5% of households do not own a car. The number of households with two or more cars in Vancouver is 26%, while in Surrey and Delta it is 52%.[11] This is not simply a matter of residents of Surrey or Delta having more discretionary income than residents of Vancouver. The average annual income for a Vancouver resident is $40,354, while the average annual income for a Surrey resident is $34,598.[12] The dramatic difference in car ownership is explained by the fact that sprawling post-war communities such as Surrey and Delta are designed in such a way that one has no choice but to use a car. Conversely, residents of more compact pre-war urban communities such as Vancouver can meet many of their daily needs by walking or taking transit. Studies show that people living in communities with densities of twenty-five units per hectare (or ten units per acre), an interconnected street system, integrated land uses, and viable connections to local and regional transit contribute an average of 40% less GHG per capita on average than their suburban counterparts.[13]

Notes:

1 Greater Vancouver Regional District, Air Quality Management Plan (Burnaby, BC: Greater Vancouver Regional District, 1994).
2 Ibid.
3 Ministry of Environment, Lands and Parks, British Columbia Climate Change Business Plan (Victoria, BC: BC Ministry of Environment, Lands and Parks, 2000), 2.
4 Ibid.
5 Ibid.
6 Greater Vancouver Regional District, Air Quality Management Plan (Burnaby, BC: Greater Vancouver Regional District, 1994).
7 See Canadian Mortgage and Housing Corporation, Greenhouse Gas Emissions from Urban Travel: Tool for Evaluating Neighbourhood Sustainability (Ottawa: CMHC/SCHL in partnership with Natural Resources Canada, 2000); or ibid., CMHC Research Highlight #50 (Ottawa: CMHC/SCHL in partnership with Natural Resources Canada, 2000). Both available on-line at: <http://www.cmhc.ca/publications/en/rh-pr/index.html>
8 BC Transit, Transit and Land Use Planning (Vancouver: BC Transit Long Range Planning, 1994).
9 Statistics Canada, Census Data, 1996.
10 Ibid.
11 Greater Vancouver Regional District, Livable Region Strategic Plan (Vancouver: GVRD, 2000).
12 British Columbia Statistics, Income Profiles, 1996.
13 See Criterion Engineers, Planners, The Benefits of Neotraditional Community Development (Portland, OR: Criterion Engineers, Planners, 1996), 18.

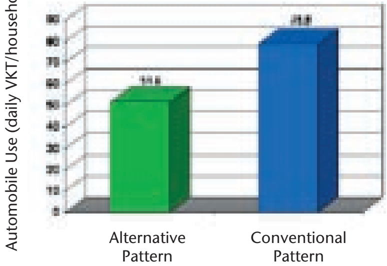
The Lower Fraser Valley Air Shed
The unique geographical features of the Lower Fraser Valley, along with the sea-to-shore breezes off the Strait of Georgia, restrict air-flow patterns and contribute to the region's ozone problem. Here, 80% of the smog is generated locally. Motor vehicles in the Vancouver area are the major source of NOx and VOC emissions.



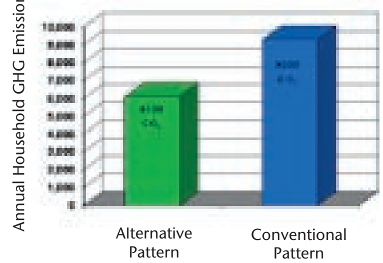
The Suburban Pattern
Conventional suburban development is characterized by single use development and is usually dominated by low-density housing, cull-de-sacs, and curvilinear streets connected to wide arterials. Its hierarchical street configuration means that even short trips are made by a car. Building more of the same kind of communities means building more (longer and wider) roads. Building more roads means more people are forced to drive, trips get longer, and air pollution increases.

The Alternative Pattern
Interconnected streets in a grid, or a modified grid pattern (as shown in this detail from the East Clayton Neighbourhood Concept Plan), provide multiple and alternative routes for moving through a community. Research shows that, in combination with higher than average household densities (i.e., above 25 units per hectare), a high degree of mixed land-use (including local employment opportunities), and access to frequent transit service, choice of travel mode increases and vehicle kilometres travelled can be significantly reduced.

Comparing Urban Travel Behaviour



Comparing GHG Emissions



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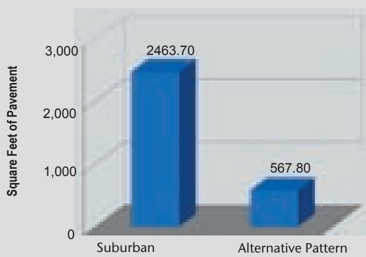
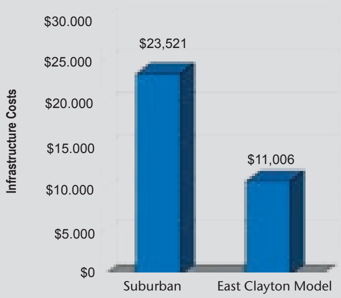
Using a software modelling tool, urban travel behaviour and GHG emissions are compared. As shown, average suburban weekday automobile use (in km/day) and GHG emissions are over 35% more than an equally sized alternative pattern. This is largely due to the alternative pattern's higher residential densities (approximately 25 units per hectare), higher employment densities, integrated streets, and frequent access to transit.
See Canadian Mortgage and Housing Corporation, Greenhouse Gas Emissions from Urban Travel: Tool for Evaluating Neighbourhood Sustainability or Research Highlight #50 under the same title.

Comparing Square Feet of Pavement



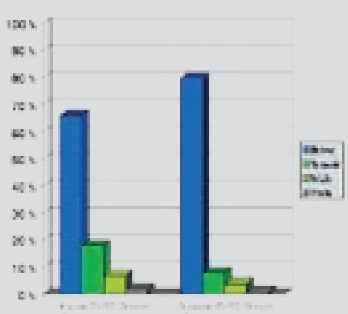
Conventional suburban development has four times more pavement per capita than the pre-war 'traditional' neighbourhood pattern.
Source: Condon and Teed, Alternative Development Standards.

Comparing Infrastructure Costs



The design of the neighbourhood can dramatically influence the cost of infrastructure. Because of their much more efficient use of land and higher densities, alternative development patterns can reduce infrastructure costs per dwelling unit by as much as $12,000 – less than half the cost per dwelling unit of a typical suburban development.
Source: Condon and Gonyea, "Status Quo Standards versus an Alternative Standard."

Comparing Modes of Travel



Within the Greater Vancouver Regional District (GVRD), people inside the Growth Concentration Area (GCA) drive less and walk, cycle, or use transit more than people outside the GCA. Source: Greater Vancouver Regional District, *Annual Report*.

People

Until recently, Canadian suburbs provided many people with a quality of life that they could not have afforded in urban centres. Suburbs offered young families ground-oriented homes at an affordable price, with easy access to schools and shops. In today's suburbs, jobs are increasingly available, with employment centres gradually going to where the people are located. As suburbs fill in, more and more public services are being provided, including improved transit services, shopping, schools, and important social amenities, such as parks and community centres. Many of our suburbs are socially and ethnically diverse and defy stereotypes of suburban homogeneity. In addition, our newer suburban communities still have the opportunity to protect and enhance habitat and the natural environment.

However, developable land in our region is in increasingly short supply, and the current suburban development pattern consumes three times more land per capita than did traditional pre-war neighbourhoods. This means that average suburban dwellers now have up to five times more pavement per capita than in more traditional urban neighbourhoods.[1] This has led to a corresponding increase in the impact, per person, on both the environment and the public purse. Automobile-centric communities and their associated separated land-uses create barriers to affordable housing (i.e., they result in suites and duplexes being illegal in most areas) and mean that one needs a car to satisfy even such minor needs as buying a loaf of bread or a litre of milk.

Infrastructure and Development Cost Charges: Affordability

The cost of building and maintaining the infrastructure of storm drains and arterial roads neccessary to support conventional suburban development is also reflected in the development cost charge (DCC) on new development and, in turn, in the cost of our new homes. DCCs are a one-time charge against single-family units or individual dwelling units in strata structures and can range up to almost $20,000 per dwelling unit.[2] The fees collected are used to pay for drainage, roads, and parks beyond the development site to serve new residents. The trend towards ever more expensive infrastructure, along with wider and more numerous roads to accommodate the near doubling of suburban per capita road use, has elevated DCCs and has had a significant impact on housing affordability. In addition, the replacement and upkeep costs of our overextended low-density infrastructure is consuming an increasing share of the municipal budget.[3] This scenario suggests that, over the long term, low-density sprawl is unsustainable without excessive new taxes. While favouring development within existing urban areas, where infrastructure costs are lower due to existing networks, DCCs currently act as a barrier to implementing more sustainable new communities. This is particularly the case in emerging urban areas outside the urban core — areas where the majority of our region's growth is occurring.[4]

Segregation of People by Income and Class

The rise of suburban car-dominated expansion also marks the rise of enforced segregation of land uses by activity (commercial versus residential), and residential density (low-density, single-family dwellings versus multi-family dwellings). Our cities have always contained areas dominated by people of means as well as areas dominated by people of much more modest resources. Currently, large areas of our cities are often zoned to eliminate housing diversity. Consequently, opportunities for social mixing are regulated out of existence within very large urban districts and even, in some extreme examples, within entire municipalities.

Providing different dwelling types (a mix of housing types, including a broad range of densities from single-family homes to apartment buildings) in the same neighbourhood, or even on the same street, can increase diversity and help to ensure a range of homes for a range of personal incomes. For example, a 3,000 square-foot lot might have a 6,000 square-foot lot on one side and a 4,000 square-foot lot on the other. One or more of these lots might have a duplex on it or include a secondary rental suite. This simple approach dramatically increases the affordability of homes on a given street and offers a socially diverse neighbour-hood that is capable of accommodating a variety of income levels. The value of this mixed parcel/mixed house approach has been amply demonstrated in older Vancouver neighbourhoods. Large areas of Vancouver contain wide ranges of house types within a one-minute walk from each other. People

Left
The automobile has provided British Columbians with freedom of motion and access to distant locations. Yet the unintended consequences of our car dependence are becoming painfully obvious. When all trips are by car, congestion is not just a nuisance, it is a curse. Yet, in too many suburban communities, daily needs can only be met in commercial districts that lie along busy arterials.

of various incomes mix casually and naturally during their daily routine.

The Automobile: Servant or Master?
The health of a community can be measured by the number of amenities located within walking distance. As one study notes, "when the necessities of daily life are located within walking distance, there will be community."[5] By this standard, the typical suburban community is far from well — largely because walking has become both unpleasant and dangerous. Recent studies indicate that the formation of social ties does not correlate to neighbourhood density but does correlate very strongly to the degree to which residents walk.[6] Sprawl and its associated automobile dependence decrease the opportunity for pedestrian traffic, resulting in less lively, less socially active streets. In addition, wide, curvilinear streets, which are typical of suburban communities, have a significant relationship to car-related injuries. In fact, as street width increases, there is an increase in accidents per kilometre per year.[7] As a result of unpleasant and unsafe streets, the number of adults and children walking to school and to work has declined dramatically since the 1970s. Although it used to be the most common way of getting around in cities and towns, today, only a small percentage of all trips are on foot.[8] Census information from 1996 indicates that only 6.6% of work trips within the GVRD's Growth Concentration Area (GCA) were on foot, while outside the GCA walking trips were even lower, garnering only 3.9% of the total mode split.[9]

Furthermore, in our suburbs driving and parenthood have become inextricably connected. Dispersed development causes parents to spend more than an hour a day driving. Whether they work or not, women with children now make an average of five car trips per day — 20% more than the average for all women and 21% more than the average for men.[10]

The proportion of people walking to work and taking transit is significantly higher in downtowns and regional centres than it is in less dense suburban areas. In the GVRD, 50% of work trips to downtown Vancouver are made by transit, walking, or cycling.[11] A study comparing automobile costs incurred in different cities close to shopping, jobs, and good public transportation spent from $2,000 to $4,000 less than the regional average for transportation of all kinds.[12] The study concluded that the savings were due to the availability of public transportation and city layouts that were amenable to walking.

Cars have clearly provided British Columbians with freedom of motion and access to distant locations — something that was not enjoyed by our grandparents. However, the unintended consequences of our car dependence are becoming painfully obvious. When all trips are by car, congestion is not just a nuisance, it is a curse. Between 1985 and 1996, GVRD rush-hour conditions worsened for regional commuters. On routes crossing the north and south arms of the Fraser River, peak hour travel increased by an average of almost 60%. In addition, the periods of rush-hour congestion are spreading over longer time periods, with hourly increases on the most congested routes of 60% to 80%.[13]

Car use is also endangering children in suburbs at rates four times greater than children in traditional communities. Transportation is now costing the average suburban family almost as much as housing, and this cost is continuing to grow.[15]

Yet, communities can be designed in such a way that the car is not the only option. Managing with one car rather than two, families can save up to $8,000 per year[16] – $8,000 that can be used for college education, a better home, or a more secure retirement.

Notes:

[1] Condon, Patrick, and Jacqueline Teed, Alternative Development Standards for Sustainable Communities (Vancouver: UBC James Taylor Chair in Landscape and Liveable Environments, 1997).
[2] In the GVRD, DCCs average about $10,000 per residential unit, with the City of Surrey having the highest rate, which is over $19,000 per unit.
[3] Patrick Mazza and Eben Fodor, Taking Its Toll: The Hidden Costs of Sprawl in Washington State (Seattle: Climate Solutions, 2000).
[4] Despite the often much lower DCC rates within higher-density areas of the GVRD, in 1999 43% of new urban residential development occurred in Surrey's emerging urban areas, which are located outside of the GVRD Growth Concentration Areas. See City of Surrey Corporate Report No. C014, 6 November 2000.
[5] Ray Oldenberg, quoted in Linda Baker, "Growing Pains/ Malling America: The Fast-Moving Fight to Stop Urban Sprawl," E Magazine 9 (3).
[6] Lance Freeman, "The Effects of Sprawl on Neighbourhood Social Ties," Journal of the American Planning Association 67 (1): 69-77.
[7] Peter Swift, Residential Street Typology and Injury Accident Frequency (Longmont, CO: Swift and Associates, 1998).
[8] The 1992 Greater Vancouver Region Travel survey indicates that an average of 14% of all trips are made by foot and/or bike. See Greater Vancouver Regional District, 1992 Travel and Demographic Characteristics (Burnaby, BC: GVRD, October 1997), 8-9.
[9] Greater Vancouver Regional District, 2000 Annual Report: Livable Region Strategic Plan, (Burnaby, BC: VRD, 2000), 29.
[10] Surface Transportation Policy Project, High Mileage Moms (Washington, DC: STPP, 1999).
[11] Greater Vancouver Regional District, 2000 Annual Report, 30.
[12] Barbara McCann, "Driven to Spend, Sprawl and Household Transportation Expenses," (Washington, DC: Surface Transportation Policy Project/Center for Neighborhood Technology, 2000), 10.
[13] Greater Vancouver Regional District, 1996 Vehicle Volumes, Classifications, and Occupancies (Burnaby, BC: 1997), 10-11.
[15] McCann, "Driven to Spend," 17; Patrick Mazza and Eben Fodor, Taking Its Toll: The Hidden Costs of Sprawl in Washington State (Seattle, Washington: Climate Solutions, 2000).
[16] Canadian Automotive Association, Driving Costs 2001 (Ottawa: CAA, 2001), 1.