"We must all work together to protect water sources, manage water demands, modernize water systems and infrastructure, and live water smart."

Living Water Smart, British Columbia's Water Plan

Water

Sustainability by Design Research Roundtable

by Sheryl Webster

Introduction

The theme of water is broad. It encompasses water storage and supply, treatment and distribution, consumption, wastewater treatment and conveyance, and stormwater management.

The Sustainability by Design research roundtable working group on water will investigate water infrastructure and the impacts that climate change and increased population will have on water in the Metro Vancouver region over the coming years. The group will identify trends and drivers and explore key indicators that help to define the relationship between water, infrastructure and urban form. The group will also set a baseline for water in the region.

History

The need to preserve and sustain future water supply for the region first became apparent in 1920 when Dr. Ernest A. Cleaveland pressed for a 999-year lease for the three North Shore Watersheds – Capilano, Seymour, and Coquitlam (Design Centre for Sustainability 2006). This lease drove the need for regional water management. In 1924, the Greater Vancouver Water District (GVWD) was established to provide water services to the member municipalities (Design Centre for Sustainability 2006). This long-range regional plan was effective for decades.

In 1993, Metro Vancouver (formerly Greater Vancouver Regional District) created the Water Response Plan and imposed water restrictions in an effort to reduce peak summer usage. The result was an immediate and significant reduction in water use. In 1997, the region halted logging in the three watersheds to ensure water quality.

The City of Vancouver began replacing the combined sewer system in 1996 to address the issue of stormwater overflows and untreated sewage entering river and ocean water through sewer outfalls. In 2001, Metro Vancouver approved the Liquid Waste Management Plan, which included a key strategy and shift in thinking of stormwater as a resource, not a waste.

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Water

Long-range water planning is a key priority for Metro Vancouver and critical to regional sustainability. The 2005 Drinking Water Management, and Watershed Management plans ensure long–term protection of the region's three watersheds and a clean supply of water to the residents. The new Seymour-Capilano Water Filtration Plant scheduled to begin operations in 2009 will improve regional drinking water by removing turbidity and ensuring safer, cleaner drinking water.

Current Context

Water Supply for the region comes from surface water originating from the three North Shore watersheds. These watersheds occupy five hundred eighty-five square kilometres of land and supply 94% of the region's water (Metro Vancouver 2009). The remaining 6% of water consumed in the region originates as groundwater (Hallsworth 2002). Metro Vancouver has a total reservoir storage capacity of 322 million cubic meters (Bonin 2007).

Water Distribution from the three watersheds to municipalities occurs through thousands of kilometres of pipes and water mains' (Metro Vancouver 2009). Four Metro Vancouver municipalities have their own water supply and are not members of the Metro Vancouver distribution system: White Rock and Belcarra utilize groundwater, Bowen Island uses both groundwater and rainwater, and Lions Bay uses surface water. In addition, private systems such as groundwater wells are found in parts of Maple Ridge and elsewhere (Hallsworth 2002).

Water Treatment is a comprehensive process. The new Seymour-Capilano Drinking Water Filtration Plant (SCFP) filters approximately 1.8 billion litres per day to address turbidity. Currently, a primary treatment of chlorine disinfects drinking water at both Seymour and Capilano. Coquitlam utilizes both ozone and ultraviolet light for primary disinfection. Chlorine, sodium carbonate and carbon dioxide act as a secondary disinfection and to prevent copper and lead leaching from pipes into the water supply as it travels through the distribution system to end users (Metro Vancouver 2009, Hallsworth 2002). To maintain water supply safety, the GVWD flushes and clears water mains periodically. Water quality is maintained through daily testing; more than 25,000 drinking water samples are taken every year (Metro Vancouver 2009). To prevent reservoir contamination and ensure safe drinking water, Metro Vancouver closes watersheds to the public.

Water Consumption is a growing issue. Despite its temperate rainforest location and high average rainfall (1200mm – 4000mm/year), the region is not immune to summer water shortages (Design Centre for Sustainability 2006). Full reservoirs are frequently insufficient to meet meet peak summer water demands of the current population. To reduce summer use, Metro Vancouver introduced sprinkling regulations in 1993, resulting in a substantial decline in peak use (Metro Vancouver 2009). Using this type of management technique, along with new design strategies, Metro Vancouver aims to delay expansion of water supply infrastructure until 2050 (Metro Vancouver 2009).

"Less than 3% of municipally-treated water is actually used for drinking" (BC Ministry of Evironment 2008). On average, the daily regional water consumption is approximately one billion litres (See Table 1). The residential sector represents the largest consumer of water in the region, using approximately 56% of water supply. Less than 16% of water that enters a house is actually used for drinking and cooking. Toilets, dishwashers, and washing machines consume almost half of the water used within the home, which could be offset with non-potable water (Hallsworth 2002).

Wastewater Conveyance and Treatment is carried out through over 7,000 kilometres of pipes managed by the private sector, Metro Vancouver, and member municipalities. The region has three sewer types – storm sewers, sanitary sewers, and combined sewers. Storm sewers collect and drain rainwater runoff, Sanitary sewers collect liquid waste from residential, industrial and commercial sources. Combined sewers located in older municipalities – Vancouver, New Westminster and parts of Burnaby – comprise about 15% of the sewage systems. The combined sewer system is problematic during high rain events when the system becomes overloaded and discharges untreated sewage into rivers and oceans through sanitary outfalls.

Sector	%	Total Volume (L/day)
Residential	56	680,000,000
Commercial	18	219, 000,000
Industrial	6	73, 000,000
Institutional	6	73, 000,000
Agricultural	1	12, 000,000
Other	13	158, 000,000
		1,200,000,000

Table 1: Metro Vancouver Water Consumption by Sector in 2000 (Hallsworth 2002)

The region produces approximately one billion litres of wastewater or liquid waste every day from residential, industrial, commercial, and stormwater sources (Metro Vancouver 2009). Five treatment plants process this liquid waste – Iona Island, Lions Gate, Lulu Island, Annacis Island and Northwest Langley – of which two have primary treatment and three have both primary and secondary treatment facilities. Primary treatment is a mechanical process that removes approximately 50% of biosolids while secondary treatment uses a biological process that removes up to 90% of biosolids. These wastewater treatment plants discharge directly to rivers and ocean where remaining biosolids deplete local oxygen levels in the aquatic environment as they as decompose. On-site disposal systems primarily service areas outside of the sewerage boundary (Hallsworth 2002).

Stormwater Management within Metro Vancouver is operated and maintained by member municipalities. In 2002, the Liquid Waste Management Plan became a key strategy to treat "stormwater as a resource." The strategy manages rainfall to restore and maintain fish-bearing streams and to recharge groundwater where appropriate and feasible (Metro Vancouver 2002).

Future Trends

Situated in a temperate rainforest, regional water resources are often taken for granted; however, with the population poised to double over the next fifty years, demands placed on our current water infrastructure systems will surely increase. At the same time, reservoir capacities will remain essentially the same, thus decreasing the amount of available water per capita.

British Columbia depends on water for a majority of its electricity supply. Increasing concern about greenhouse gas emissions has resulted in the replacement of fossil fuels with renewable energy sources, such as micro-hydro turbines. These systems may have detrimental impacts on water quality and volume downstream. Water consumers are also often unaware that inefficient use of water also results in increased consumption, both through water heating and treatment. Treating water to potable standards requires large amounts of energy (Hallsworth 2002).

In 1990 Metro Vancouver began recycling biosolid waste into Nutrifor soil products. This project keeps oxygen depleting wastes out of aquatic environments and restores depleted landscapes through mine reclamation, landfill and gravel pit reclamation, rangeland improvement, and silviculture enhancement (Hallsworth 2002).

Stormwater pollution generated by urban runoff is of major concern and difficult to manage. Pollutants from roadways, industrial sites, and illegal dumping enter the sewer system or local creeks and affect the aquatic ecosystem. Negative impacts of stormwater runoff begin when a watershed's impervious surface area exceeds 10%.

Bioswales and stream daylighting are two sustainable stormwater management options occurring in the region. Bioswales, such as Lost Lagoon in Stanley Park, filter urban runoff pollutants before entering the aquatic environment. Daylighting streams that are buried in pipes and culverts can ease congestion points along a sewer system and slow the downstream water velocity and minimize erosion. Still Creek in East Vancouver and projects by the Langley Environmental Partners Society are current daylighting examples.

Synergies with other themes

Energy
Hydroelectric sources generate the majority of Metro Vancouver's power. These systems may have detrimental impacts on water quality and regional climate. Increased water consumption may decrease the reliability of hydroelectric energy supply and result in unecessary energy consumption to heat and treat the water.

Food
Clean water is a necessity for crop irrigation and livestock. Agriculture contributes to runoff pollution of regional waterways.

Economy

Regional economic prosperity is tightly linked to water. The regions agriculture, industry, commerce and homes depend on hydro power and water as a resource. The Port of Vancouver – an international gateway and the fifth largest in North America – as well as other industries, rely on access to regional rivers and inlets. Biosolids from wastewater treatment can be a source of economic revenue, as is the case with Nutrifor.

Mobility

Metro Vancouver mobility systems cross numerous rivers and inlets. The Fraser River, Burrard Inlet, and False Creek are criss-crossed with bridge infrastructure that is expanding to accommodate the transportation needs of a growing and commuting Metro Vancouver. Ferries run regularly between downtown Vancouver and the North Shore, and private and public marinas facilitate heavy recreational boating traffic. This infrastructure disturbs shoreline and aquatic ecosystems and generates heavy water pollution.

Natural Habitat

The temperate rainforest/delta climate mean water quality and natural habitat are intrinsically linked. The natural habitat surrounding the three Metro Vancouver watersheds protects the drinking water quality by filtering rainwater through the vegetation and soil. Recreational activities in regional watersheds can adversely impact the habitat value and water quality of waterways.

Questions

How vulnerable is the region to changes in water supply resulting from climate change, and what would a more resilient region look like?

Are there optimal urban forms or patterns for efficiency throughout the water and wastewater systems, or for watershed preservation?

How do water and wastewater efficient forms of development conflict with or support other sustainability goals?

What water and wastewater efficiency technologies are most feasible for the region and what urban forms or patterns support or limit these technologies?

At what scale(s) should water and wastewater be collected, stored, treated and distributed?

What is the current baseline performance for water collection, storage, treatment, distribution, consumption, conveyance, and wastewater treatment in Metro Vancouver?

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Produced by the Design
Centre for Sustainability
March 2009