"SINK OR SWIM:
Water Pollution and Environmental Politics in Vancouver, 1889-1975,"[1]

ARN KEELING

ON A SUNNY DAY in June 1969, Vancouver Mayor Tom "Terrific" Campbell landed on the front page of the *Vancouver Sun* by taking a swim in English Bay. More than a publicity stunt, the morning dip was intended to assure Vancouverites that city beaches were uncontaminated by sewage pollution. The mayor's swim came in the wake of a media battle between provincial Liberal leader Pat McGeer and Gerald Bonham, Vancouver's medical health officer, over elevated coliform bacteria counts at popular bathing sites around the city.[2] Pro-environment *Sun* columnist Bob Hunter derided Campbell's "frolic in the fecal surf," writing that "if the mayor would spend less time wading in the water in front of the cameras and more time wading into the job of halting further pollution, we'd all be better off."[3]

This episode somewhat comically illustrates the seemingly intractable problem of sewage pollution in Vancouver, a concern that has endured since the nineteenth century. Like most other modernizing urban centres, Vancouver confronted the ever-growing difficulty of waste disposal as it developed by constructing sewerage and drainage systems. Early civic leaders extolled planned public utilities to avoid the pollution, disease, and environmental degradation that plagued older cities. However, the continuing contamination of local waters by sewage

[1] Research for this article was facilitated by a Social Sciences and Humanities Research Council of Canada doctoral fellowship. Aspects of this article were presented at conferences of the Association of American Geographers and the Canadian Association of Geographers. This article also benefited from comments from Graeme Wynn, Robert A.J. McDonald, and an anonymous referee.

[2] Peter Trask, "Mayor 'Proves' Beaches Safe with 15-Minute Dip at Kitsilano," *Vancouver Sun*, 13 June 1969, 1; "Some Beach Pollution Rated High," *Vancouver Province*, 16 June 1969, 1; "Another Battle in the Pollution War," *Vancouver Province*, 17 June 1969, 4; "City Pollution Study Team Named," *Vancouver Province*, 19 June 1969, 1.

[3] Bob Hunter, "Bob Hunter," *Vancouver Sun*, 14 June 1969, 19.

late into the twentieth century revealed the shortcomings of the city's pollution-control technologies and strategies.

As Mayor Campbell's swim suggests, the definition of pollution and proposals for its solution presented more than technical problems. Polluted urban waters were sites of political and social conflict as well as products of historic decisions about sewage disposal, changing social values, and environmental conditions. Definitions of pollution, while referring to environmental conditions, are suffused with social concepts such as purity and risk and are constructed through historical, anthropocentric, and socially created measures of environmental quality.[4] An environmental historical-geographical examination of pollution in Vancouver reveals how changing ideas of pollution and nature licensed certain approaches to urban domestic waste disposal. The use of the city's waterways as "sinks" for the absorption of wastes gained scientific credibility and popular acceptance through the concept of water's "assimilative capacity," or its ability, through natural chemical and biological processes, to neutralize harmful pollutants. In creating waste disposal systems that exploited this assimilative capacity, Vancouver sanitary engineers transformed regional waters into a kind of "organic machine" for the processing of human waste.[5] Thus, the question of polluted beaches and shorewaters turned on water's social utility as a medium of waste disposal, which was evaluated through changing and contested measures of quality and human safety.

Human waste disposal, water supply, and sanitation have posed basic challenges to urban development throughout human history. As historian Dale Porter writes, "Sewers and sewage have become such an integral part of modern urban infrastructures that it is difficult to imagine alternative ways of thinking about the disposal of excrement, industrial waste, and rainwater runoff."[6] Yet historical writing on sanitation in Canada remains relatively sparse and its historical-geographical dimensions virtually unexamined.[7] As historians elsewhere

[4] Adam W. Rome, "Coming to Terms with Pollution: The Language of Environmental Reform, 1865-1915," *Environmental History* 1, 3 (1996): 6-28; Ulrich Beck, *Risk Society: Towards a New Modernity*, trans. Mark Ritter (London: Sage, 1992), esp. chap. 2; Mary Douglas, *Purity and Danger: An Analysis of Concepts of Pollution and Taboo* (New York: Frederick A. Praeger, 1966); Mary Douglas and Aaron Wildavsky, *Risk and Culture: An Essay on the Selection of Technical and Environmental Dangers* (Berkeley: University of California Press, 1982); Neil Evernden, "Pollution," in *Conservation and Environmentalism: An Encyclopaedia*, ed. Robert Paehlke (New York: Garland, 1995), 525.

[5] The concept of water as an organic machine comes from Richard White, *The Organic Machine: The Remaking of the Columbia River* (New York: Hill and Wang, 1995).

[6] Dale H. Porter, *The Thames Embankment: Environment, Technology, and Society in Victorian London* (Akron: University of Akron Press, 1998), 50.

[7] Related literature on the history of Canadian public health and sanitation includes: Margaret W. Andrews, "The Best Advertisement a City Can Have: Public Health Services in Vancouver,

have documented, the history of sewerage development has been marked by changing ideas about disease, technological change, and social conflict over pollution. The development of public services to combat urban pollution is an important aspect of environmental history – one that encompasses the history of science and technology, ideas of nature, structures of urban governance, and issues of environmental justice.[8] Geographical perspectives on urban technological networks emphasize how the modernization and the rationalization of space in the city through these networks entails both physical and discursive (re)constructions of nature. This process is dubbed "cyborg urbanization" by the geographer Erik Swyngedouw.[9] As historical geographer Matthew Gandy has written with regard to New York City, a distinctly "metropolitan nature" emerges from "the mutually constitutive relations between nature as biophysical fabric and the symbolic power of nature as a cultural representation of imaginary landscapes."[10]

1886-1888," *Urban History Review/Revue d'Histoire Urbaine* 12, 3 (1984): 19-27; Margaret W. Andrews, "Sanitary Conveniences and the Retreat of the Frontier: Vancouver, 1886-1926," *BC Studies* 87 (1990): 3-22; Logan Atkinson, "The Impact of Cholera on the Design and Implementation of Toronto's First Municipal By-Laws, 1834," *Urban History Review* 30, 2 (2002): 3-15; Douglas Baldwin, "Sewerage," in *Building Canada: A History of Public Works*, ed. Norman R. Ball (Toronto: University of Toronto Press, 1988), 221-244; Geoffrey Bilson, *A Darkened House: Cholera in Nineteenth-Century Canada* (Toronto: University of Toronto Press, 1980); Catherine Brace, "Public Works in the Canadian City: The Provision of Sewers in Toronto, 1870-1913," *Urban History Review/Revue d'Histoire Urbaine* 23, 2 (1995): 33-43; Bruce Curtis, "Social Investment in Medical Forms: The 1866 Cholera Scare and Beyond," *Canadian Historical Review* 81, 3 (2000): 347-79; Colleen McNaughton, "Promoting Clean Water in Nineteenth-Century Public Policy: Professors, Preachers, and Polliwogs in Kingston, Ontario," *Histoire Sociale/Social History* 34 (2001): 49-61.

[8] Important works on the history of urban pollution control include: Craig E. Colten, "Illinois River Pollution Control, 1900-1970," in *The American Environment: Interpretations of Past Geographies*, ed. Lary Dilsaver and Craig E. Colten (Lanham, MD: Rowman and Littlefield, 1992), 193-214; Craig E. Colten, "Basin Street Blues: Drainage and Environmental Equity in New Orleans, 1890-1930," *Journal of Historical Geography* 28, 2 (2002): 237-57; Christopher Hamlin, *A Science of Impurity: Water Analysis in Nineteenth Century Britain* (Berkeley: University of California Press, 1990); Suellen Hoy, *Chasing Dirt: The American Pursuit of Cleanliness* (New York: Oxford University Press, 1995); Martin V. Melosi, *The Sanitary City: Urban Infrastructure in America from Colonial Times to the Present* (Baltimore: Johns Hopkins University Press, 2000); Stanley K. Schultz, *Constructing Urban Culture: American Cities and City Planning, 1800-1920* (Philadelphia: Temple University Press, 1989); Joel A. Tarr, *The Search for the Ultimate Sink: Urban Pollution in Historical Perspective* (Akron: University of Akron Press, 1996).

[9] Maria Kaika and Erik Swyngedouw, "Fetishizing the Modern City: The Phantasmagoria of Urban Technological Networks," *International Journal of Urban and Regional Research* 24, 1 (2000): 120-38; Erik Swyngedouw, "The City as Hybrid: On Nature, Society and Cyborg Urbanization," *Culture, Nature and Society* 7, 2 (1996): 65-80.

[10] Matthew Gandy, *Concrete and Clay: Reworking Nature in New York City* (Cambridge, MA: MIT Press, 2002), 7. See also Matthew Gandy, "The Paris Sewers and the Rationalization of Urban Space," *Transactions of the Institute of British Geographers* (n.s.) 24, 1 (1999): 23-44.

This account of Vancouver's sanitary history draws from these perspectives to illuminate how sewer systems transformed the nature of cities. Here, as elsewhere, sanitary engineering not only offered "solutions to such physical problems as water and sewer supply, it also contributed comprehensive planning schemes that illustrated the interaction of technology with the social, economic, and political structure of cities."[11] Pollution problems shattered pre-existing political boundaries and imagined geographies, forcing city leaders to reconceptualize their territories as both natural and political. This led to the development of new structures of urban governance. Sanitary engineers were at the forefront of urban planning and regional governance initiatives that reshaped the spaces of the city as they sought to control a recalcitrant urban nature. By designating certain spaces and waters as "pure" or "polluted," planners incorporated the region's natural waterways into their networks, creating a rationalized hydrology to banish wastewater and stormwater to the edges of urban space. There, regional authorities enrolled surrounding waters as sinks for waste, based on their conceptions of assimilative capacity. Yet, as a consequence of its reliance on natural systems, the region remained plagued by recurrent episodes of beach contamination, disease outbreak, and political controversy over water pollution.

SANITATION AND NATURE IN THE PROGRESSIVE CITY

> An extended system of sewerage and a supply of pure water are absolutely essential; and when these are secured ... Vancouver will have utilized to the utmost the advantages of her position from a hygienic standpoint, and will owe still more to the teachings of sanitary science than she now does to the natural salubrity of her surroundings and her climate.[12]

This glowing assessment of Vancouver's natural amenities appeared in a promotional pamphlet published in 1889 by Mayor David Oppenheimer and reflected the sanitary preoccupations of late nineteenth-century municipal leaders. Particularly in older North American cities, disease, squalor, and disorder resulting from sewage contamination forced urban

[11] Schultz, *Constructing Urban Culture*, 190.

[12] Cited in David J. Oppenheimer, *Vancouver City: Its Progress and Industries, with Practical Hints for Capitalists and Intending Settlers* (Vancouver: News-Advertiser, 1889), 32. The "sanitary advantages" of Vancouver's geography are also highlighted in *The Financial, Professional, Manufacturing, Commercial, Railroad and Shipping Interests of Vancouver, BC* (Vancouver: Daily World, May 1891), 2.

governments to implement expensive and politically controversial solutions to pollution. In municipalities across Canada, restive publics, formerly resistant to the vast expenditures required to implement sewerage systems, began to demand improvements to civic sanitation. In addition to their environmental benefits, proper sewerage and drainage were regarded as important elements of the progressive social reform of the city, ensuring moral order, technological efficiency, and improved economy during what one historian has called "the age of light, soap, and water."[13] Likewise, Vancouver's boosters celebrated the "hygienic advantages" of the city's ample fresh water and seaside location as a key to its future development and prosperity.

Retrospective assessments of Vancouver's early infrastructure development largely echo the optimism of city founders. Historians Margaret Andrews, Douglas Baldwin, and Louis Cain each praised the foresight of early Vancouver leaders in providing modern water and sanitary services.[14] Likewise, Graeme Wynn and Patricia Roy noted the attention given sanitation by early twentieth-century civic administrations.[15] Echoing early civic leaders, these observers have remarked how favourable topographical, environmental, and historical circumstances influenced the expeditious provision of public amenities. After all, in this same period, civic leaders in Toronto, Charlottetown, Hamilton, and Winnipeg, among other cities, grappled with the pollution of water supplies and the difficulty of convincing penny-pinching populations to approve spending bylaws for coordinated sewerage development.[16] In 1912 a Canadian Commission of Conservation study revealed that Canadians suffered the second-worst rate of typhoid among nine in-

[13] Mariana Valverde, *The Age of Light, Soap, and Water: Moral Reform in English Canada, 1885-1925* (Toronto: McClelland and Stewart, 1991). In addition to note 9, see also Douglas O. Baldwin, "The Campaign against Odors: Sanitarians and the Genesis of Public Health in Charlottetown, Prince Edward Island, 1855-1900," *Scientia Canadensis* 10, 1 (1986): 72-82; and Tom Davey, *Recollections of Water Pollution Control in Ontario* (Aurora, ON: Pollution Control Association of Ontario, 1985), chap. 5.

[14] Andrews, "Best Advertisement"; Margaret W. Andrews, "The Emergence of Bureaucracy: The Vancouver Health Department, 1886-1914," *Journal of Urban History* 12, 2 (1986): 131-55 ; Baldwin, "Sewerage"; Louis P. Cain, "Water and Sanitation Services in Vancouver: An Historical Perspective," *BC Studies* 30 (1976): 27-43.

[15] Patricia E. Roy, *Vancouver: An Illustrated History* (Toronto: James Lorimer and Co., 1980), 32, 73; Graeme Wynn, "The Rise of Vancouver," in *Vancouver and Its Region*, ed. Graeme Wynn and Timothy Oke, 116-8 (Vancouver: UBC Press, 1992).

[16] Baldwin, "Campaign against Odors"; Baldwin, "Sewerage"; Atkinson, "Impact of Cholera"; Brace, "Public Works"; Davey, *Recollections of Water Pollution Control*; Heather A. MacDougall, "The Genesis of Public Health Reform in Toronto, 1869-1890," *Urban History Review/Revue d'Histoire Urbaine* 10, 3 (1982): 1-9.

dustrialized nations, and it called for an immediate investment in urban infrastructure as well as federal anti-pollution legislation.[17] Vancouver's enthusiasm for sanitary improvements, along with a lower incidence of the slum crowding that was characteristic of eastern cities, allowed the city to avoid the worst ravages of water-borne contagious disease. However, long-term, recurrent environmental problems emerged in spite of – and as a result of – early sewerage initiatives.

Vancouver made sanitary regulation and infrastructure development early priorities. The city's first health bylaw, which included clauses for the sanitary regulation of privies, cesspools, and house drains, was passed within a year of the city's incorporation in 1886. Vancouver's municipally run fresh-water system, supplied by reservoirs in the North Shore mountains, was connected in 1889.[18] By 1890 a modest sewerage system already served the central business district and neighbouring residential areas. Reporting to the Canadian Society of Civil Engineers in 1888, the system's designer, Edward Mohun, described the central city's site, atop small "eminences" with salt water on all sides, as ideal for the "rapid and economical removal of surface water" from the region's abundant rainfall. Separate sanitary sewers, flushed by the gravity-fed water supply, likewise ensured the easy conveyance of sewage to marine waters. Mohun, like most sanitarians at this time, assumed that the rapid removal of wastes and their adequate dilution was the main goal of sewerage and drainage works – even though the "self-purifying" properties of water were poorly understood. In any case, the protection of public health from dangerous bacteria and sewer gases overrode concern for environmental degradation. Indeed, Mohun even considered the prospect that sewage disposal might benefit fisheries by enriching local waters with nutrients.[19]

However, the fast-growing city quickly overwhelmed Mohun's system. The primitive wooden box sewers discharged to outfalls just below low water mark, resulting in widespread shoreline pollution. The location of these outfalls near residential and recreational areas encountered fierce opposition from citizens who were revolted at the

[17] T. Aird Murray, *The Prevention of the Pollution of Canadian Surface Waters* (Ottawa: Commission of Conservation, 1912).

[18] Andrews, "Best Advertisement"; Cain, "Water and Sanitation." Cain notes that the waterworks systems of Vancouver and New Westminster were initially privately built and operated but were quickly bought out by the cities they supplied.

[19] Edward Mohun, "The Sewerage System of Vancouver, BC," *Transactions of Canadian Society of Civil Engineers* 2 (1888): 243-67. Based on the commentaries following this paper, Mohun's design was relatively well received, though he was criticized for using wood (which he claimed was necessitated by the expense of Portland cement). See also the approving assessment of engineer T.C. Keefer in the *Daily News-Advertiser*, 30 October 1887, reprinted in Canadian Institute for Historical Microreproductions no. 15658.

prospect of swimming in sewage-laden waters. In 1900 a group of prominent West End residents, led by H.O. Bell-Irving and Sir Charles Hibbert Tupper, petitioned against an outfall near the popular English Bay bathing beach. Tupper told city council that "a natural prejudice would exist against the place if it were made a receptacle for sewage; the bay would become a place to be avoided, parents would not let their children go there, [and] property would depreciate."[20] In addition, the shoreside "septic tanks" (really just settling chambers) at the sewer outlets often backed up at high tide, fouling the surrounding air with noxious fumes.[21]

Rates of typhoid and other waterborne communicable diseases in Vancouver fluctuated in the prewar years; a spike in the number of cases and deaths in 1910 and 1911 probably reflected both population growth and deteriorating sanitary conditions (see Table 1). City health inspectors pointed to the sewage pollution of city streams and surrounding waters as a major contributor to disease outbreaks, particularly in the crowded districts surrounding the east end of False Creek, the rapidly industrializing but poorly flushed inlet and tidal flats at the heart of the city. The Mohun plan had called for the protection of False Creek waters, but the inlet received sewage anyway, as well as garbage, manure, slaughterhouse wastes, and other city offal. The False Creek area became a focus of sanitary concern as a flashpoint for typhoid outbreaks, particularly among immigrant and squatter settlements.[22]

TABLE 1
Reported cases of typhoid, 1909-12

Year	Total Cases	Total Deaths
1909	142	7
1910	265	27
1911	212	23
1912	163 (39 imported)	21

Source: CVA, PDS 11, Vancouver Health Department, *Annual Report* (1912), 43. Vancouver's population in 1911 was 100, 401.

[20] "Skeptics on Septics," *Vancouver Province*, 3 August 1900, 2; "The Bay Threatened," *Vancouver Province*, 23 July 1900, 7.

[21] "Will Remedy Septic Nuisance," *Vancouver Province*, 31 July 1906, 1; "More Complaints of Septic Tank," *Vancouver Province*, 25 August 1906, 1; "City's Sewerage System Inadequate," *Vancouver Province*, 22 January 1907, 1; "Complaint about Another Septic Tank," *Vancouver Province*, 27 May 1907, 1.

[22] On prewar sanitary conditions and infectious disease rates, see City of Vancouver Archives (CVA), PDS 11, Vancouver Health Department, *Annual Report*, 1910-12; and CVA, MCR 38, W.A.

In spite of improvements and extensions to the sewer system, Vancouver's rapid expansion before the First World War outstripped the modest network (see Figure 1). Particularly problematic was the widespread use of septic tanks in areas beyond the reach of city sewers. Health and plumbing inspector Robert Marrion noted in 1912 that "nearly every householder demands an up-to-date water closet and every water closet requires a septic tank, this needs an overflow which usually discharges the excrement in solution into the channel of the nearest street or lane, thus causing complaints to be made from the people in the locality who are generally creating nuisances themselves."[23] The growing popularity of indoor plumbing also meant that older, land-based disposal methods such as privy vaults and cesspools were overwhelmed by the increasing volume of wastewater, and their overflow carried into surface ditches and local creeks.[24]

ENGINEERING NATURE IN THE CITY: THE LEA PLAN

Despite growing annual expenditures for sewer construction, pollution from sewage threatened the progressive self-image of Vancouver's boosters. Civic leaders responded, as did many other North American jurisdictions in this period: they sought a regional solution to waste disposal problems. In 1911 leaders from the four Burrard Peninsula municipalities – Point Grey, Vancouver, South Vancouver, and Burnaby – formed the Burrard Peninsula Joint Sewerage and Drainage Committee to investigate cooperative solutions to the problem.[25] The committee hired eminent sanitary engineer R.S. Lea of Montreal to study

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Clement, *City Engineer's Report*, 21 January 1908. Vancouver's typhoid death rates were below the shocking national average of 35.5/100,000 reported by the Canadian Commission of Conservation, though they still lingered above the 20/100,000 rate that indicated water pollution by sewage. Comapre Murray, *Prevention of Pollution*, and the report on the Dominion Health Conference in Canadian Commission of Conservation, *Second Annual Report* (Montreal: John Lovell and Son, 1911), 125-8. Before the tidal flats at the head of False Creek were drained in the 1910s to create the Canadian Northern terminus and railyards, the area was used as a garbage dump and a receptacle for manure, slaughterhouse wastes, and other city offal. On this and the growth of industry in the area, see Robert K. Burkinshaw, *False Creek: History, Images, and Research Sources* (Vancouver: City of Vancouver Archives, 1984), 21-5, 32-5.

[23] CVA, PDS 11, Dr. F.T. Underhill, "Medical Health Officer Annual Report," in Vancouver Health Department, *Annual Report*, 1911, 2-3; "Septic Tanks," *Vancouver Province*, 26 October 1909, 6.

[24] "Fairview Streams Badly Polluted," *Vancouver Province*, 25 August 1906, 2; "Cesspool Must Be Done Away With," *Vancouver Province*, 27 October 1906, 2.

[25] CVA, Add. MSS 1257, 63-A-2, file 1, Burrard Peninsula Joint Sewerage and Drainage Committee, *Minutes*, 1911-13. The committee was chaired by Vancouver alderman and reformer H.H. Stevens.

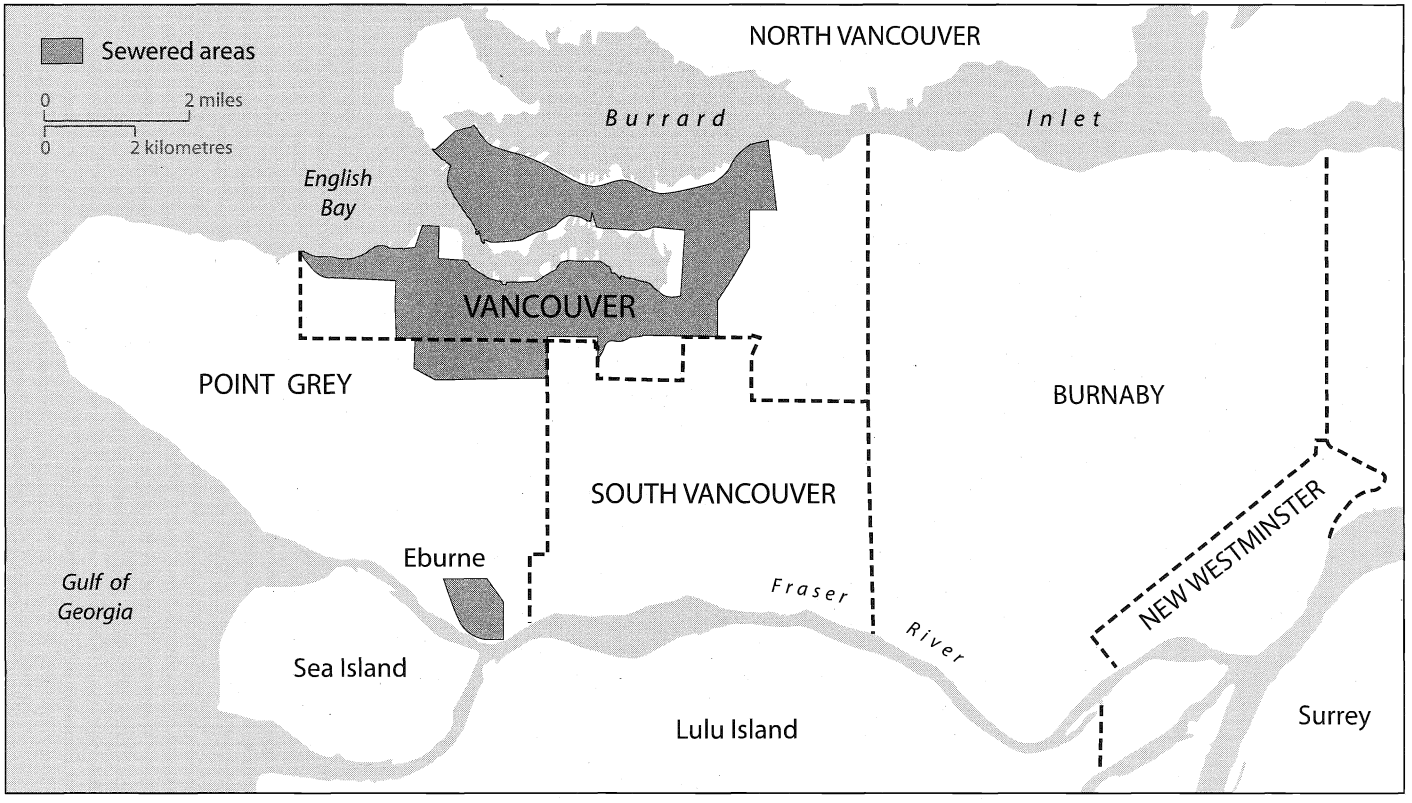

Figure 1: Vancouver and neighbouring municipalities sewered and unsewered areas of Vancouver, 1912. Although Vancouver neighbouring municipalities were rapidly expanding south- and eastwards, sewerage facilities were confined to the central city areas. Map by Eric Leinberger. Source: Based on R.S. Lea, *Report by R.S. Lea to the Burrard Peninsula Joint Sewerage Committee* (Vancouver: Vancouver and Districts Joint Sewerage and Drainage Board, 1913 [1917]), Plate 10.

the area and to design a sewerage and drainage system. Lea, a McGill University professor of civil engineering, had assisted in designing sewerage projects in Massachusetts, Prince Edward Island, Nova Scotia, and Quebec. He was among a growing cadre of professional municipal engineers dedicated to improving the health and efficiency of cities through the planned construction of technological systems for waste disposal, water supply, and other urban amenities.[26]

To plan and develop a waste disposal system for Burrard Peninsula, Lea was forced to overcome a paucity of data on this large, lightly developed area. There were few accurate precipitation records; detailed topographical investigations of the region, only recently begun by the Joint Sewerage Committee, remained incomplete. As Walter Van Nus has noted, sewerage developments often spurred the earliest topographical surveys of Canadian cities.[27] In 1913, after two intensive data-gathering visits, Lea produced an extensive survey of the physical and, to a lesser extent, social geography of the region, which included population forecasts, observations on urban growth, and recommendations for urban governance.[28] Hydrological investigations examined the suitability of surrounding waters to receive wastes. Lea documented a rugged, spottily developed peninsula riven by dozens of short, low-volume streams flowing north to the surrounding ocean and south to the massive Fraser River (Figure 2). Some of these streams crossed municipal boundaries and discharged to waters shared by every municipality in the region, including those not represented on the Sewerage Committee.

As Lea later reflected, these geographical and hydrological conditions provided the basis for his sewerage plan. Since much of the peninsula drained downslope to salt water or the Fraser River, nearly the entire system could be operated on a gravity-flow basis. Lea divided the region into separate "sewerage areas" based on the natural watersheds

[26] "Lea, Richard Smith," in *The Canadian Men and Women of the Time*, 2nd ed., ed. Henry James Morgan (Toronto: William Briggs, 1912), 645; on sanitary engineers in Canada, see Baldwin, "Sewerage," 225; B. Sinclair, N.R. Ball, and J.O. Petersen, *Let Us Be Honest and Modest: Technology and Society in Canadian History* (Toronto: Oxford University Press, 1974), 244-9. For the profession in the United States and generally, see Martin V. Melosi, "Sanitary Engineers in American Cities: Changing Roles from the Age of Miasmas to the Age of Ecology," in Martin V. Melosi, *Effluent America: Cities, Industry, Energy, and the Environment*, 225-37 (Pittsburgh: University of Pittsburgh Press, 2001); Schultz, *Constructing Urban Culture*, esp. chap. 8; Joel A. Tarr, "Water and Wastes: A Retrospective Assessment of Wastewater Technology in the United States, 1800-1932," in Tarr, *Search for the Ultimate Sink*.

[27] Walter Van Nus, "The Plan-Makers and the City: Architects, Engineers, Surveyors and Urban Planning in Canada, 1870-1939" (PhD diss., University of Toronto, 1975), 270.

[28] R.S. Lea, *Report by R.S. Lea to the Burrard Peninsula Joint Sewerage Committee* (Vancouver: Vancouver and Districts Joint Sewerage and Drainage Board, 1917 [1913]).

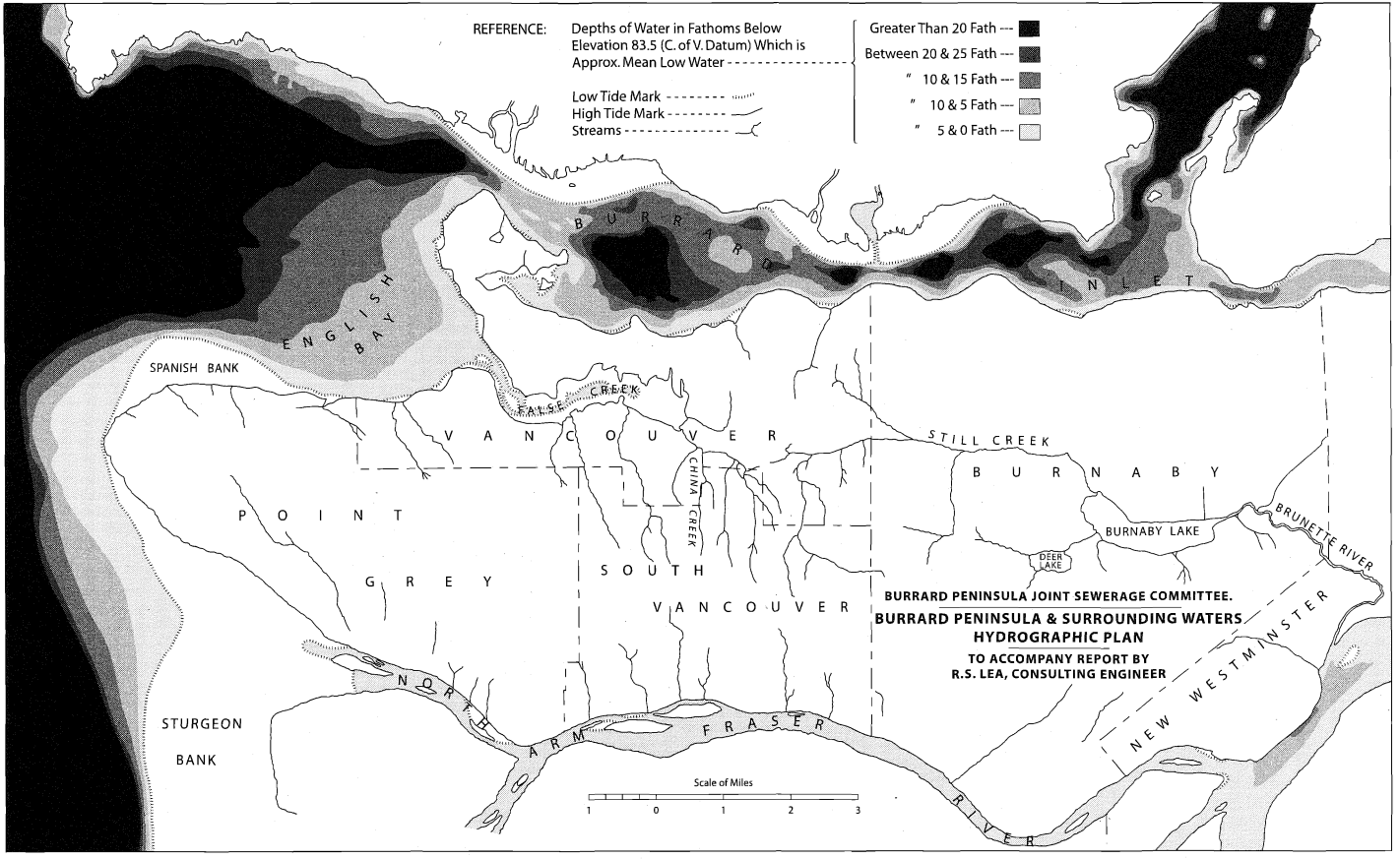

Figure 2: Lea map of the original hydrology of Burrard Peninsula. Map by Eric Leinberger. Source: Based on R.S. Lea, *Report by R.S. Lea to the Burrard Peninsula Joint Sewerage Committee* (Vancouver: Vancouver and Districts Joint Sewerage and Drainage Board, 1913 [1917]), Plate 10.

for administrative, planning, and construction purposes. Reflecting contemporary thought on water and pollution, Lea proposed to use the assimilative capacity of the waters surrounding the city to neutralize and absorb dangerous wastes, while diverting surface runoff along natural drainage courses. He wrote: "Obviously, in order that the fullest advantage may be taken of the purifying agencies and properties inherent in the diluting water, the sewage must be brought under the influence of these agencies. That is to say, it must be discharged where it will be subject of such action of the currents, winds and other allied factors, as will affect its adequate dilution in the surrounding water."[29] To this end, Lea estimated the diluting capacities of surrounding tidewaters and the Fraser River, based on their ability to absorb the oxygen-depleting and bacterial components of fresh sewage.[30]

The risk in Lea's strategy was that the receiving waters would be irredeemably fouled by this process. Lea's relativist definition of pollution, however, reflected the anthropocentric bias that sustained the idea of nature as a sink for human wastes:

> The degree to which [these conditions] can be said to constitute a nuisance depends on the uses to which the waters and shores are put, and on the density of, and proximity thereto, of human habitations. For instance, to cite an extreme case: a river might be intensely polluted by the sewage from a community without causing a nuisance, provided it flowed away to the sea through an uninhabited country, was not navigable, nor suitable for purposes of recreation, and was not, in its natural state, frequented by fish.[31]

Lea's definition of pollution weighed hygienic, aesthetic, and economic considerations, not environmental quality per se. Guided by utilitarian conservation ideology, which proposed the maximum efficient use of natural resources, he held that waste disposal was a legitimate use of water that was not employed for other, higher purposes. The reliance

[29] Lea, *Report*, 12.

[30] Changing views of disease etiology and its relationship to water pollution by sewage are discussed in Melosi, *Sanitary City*; Hoy, *Chasing Dirt*, 61-80; Joel A. Tarr, "Decisions about Wastewater Technology, 1850-1932," in Tarr, *Search for the Ultimate Sink*, 111-30; Hamlin, *Science of Impurity*; Charles E. Rosenberg, *The Cholera Years: The United States in 1832, 1849, and 1866* (Chicago: University of Chicago Press, 1962); John T. Cumbler, *Reasonable Use: The People, the Environment, and the State: New England, 1790-1930* (Oxford: Oxford University Press, 2001), 149-50. As these authors point out, even once, by the end of the nineteenth century, bacteriological theory replaced miasmatic, or environmental, theory as the accepted cause of communicable diseases, widely used tests and standards for water quality were slow to develop.

[31] Lea, *Report*, 16.

on dilution was also sustained by the widely held assertion that flowing water purified itself through natural biochemical action.[32]

The Lea plan projected a rationalized hydrology onto the landscape and incorporated local waterways into a capital-intensive, technological waste-disposal network. Lea proposed an integrated regional sewerage system designed to serve the Vancouver area until at least 1950 (Figure 3). His plan outlined a network of underground trunk sewers that would collect sewage (not stormwater) from houses via laterals. These would feed into larger "interceptor" sewers that would transport wastewaters and deposit them at sea or into the Fraser River via deep-water outfalls.[33] Stormwater would be diverted through separate pipes enclosing the peninsula's natural streams. Lea advised that the construction and finance of works of "common interest, which [include] interceptors, purification works, and all works designed for the prevention of pollution of natural bodies of water," be undertaken by a joint board. Individual municipalities would remain responsible for maintenance of laterals and regular trunk sewers.[34] The scheme would be managed by a sewerage and drainage board, which would raise funds through levies of member municipalities as well as from bond issues, a widely used method of raising capital for infrastructure works.

In proposing a regional-scale solution to the sewerage problem, Lea favoured technologies and scales of organization developed during this period to deal with the increasing complexity of cities and their infrastructure problems. In Vancouver, as elsewhere, regional cooperation emerged from the conjunction of social forces, such as economics and technology, and natural circumstances. Lea's report illustrates how ideas about town planning, urban governance, and environmental management coalesced in infrastructure development.[35] The administration and finance of such extensive technological networks required a larger scale of organization in order to function effectively. As historian

[32] Melosi, *Sanitary City*, 162. On waste disposal as a conservation measure, see Cumbler, *Reasonable Use*.

[33] "Lateral" sewers run along streets to collect wastewaters from house connections; these in turn feed larger "trunk" sewers, which collect these flows. "Interceptors," such as the Clark Drive Interceptor or the False Creek Interceptor, are larger still, and they divert the flow towards the ultimate discharge and/or treatment point.

[34] Lea, *Report*, 43.

[35] On the connections between early environmental management and urban planning in Canada, see van Nus, "Plan-Makers and the City"; Alan F.J. Artibise and Gilbert A. Stelter, "Conservation Planning and Urban Planning: The Canadian Commission of Conservation in Historical Perspective," in *Consuming Canada: Readings in Environmental History*, ed. Chad Gaffield and Pam Gaffield, 152-69 (Toronto: Copp Clark, 1995); Michel F. Girard, "The Canadian Commission of Conservation: Urban planning," in *The Atlas of US and Canadian Environmental History*, ed. Char Miller, 108-9 (New York: Routledge, 2003).

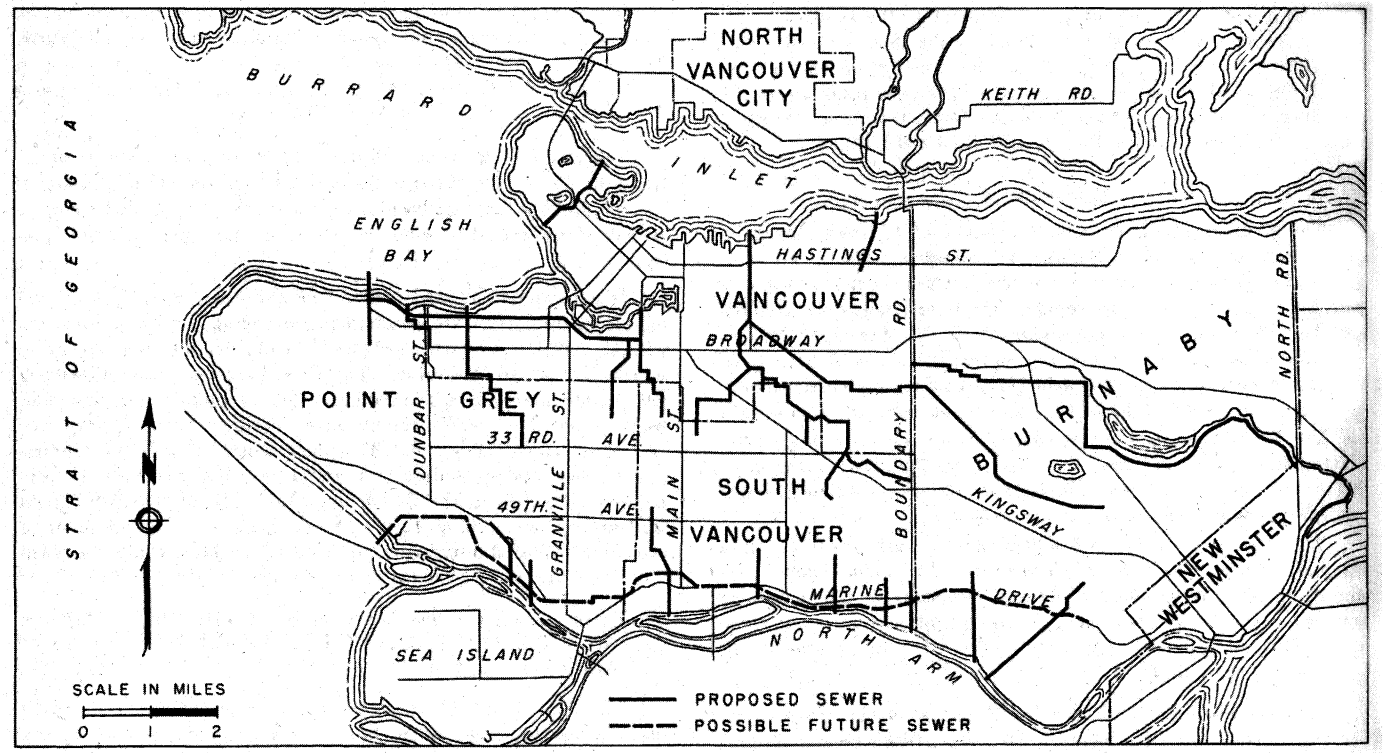

Figure 3: R.S. Lea's design for the trunk sewer system of Burrard Peninsula. Lea recommended that separate sewage and storm-water pipes be laid along this network, and that interceptors carry sewage away from False Creek and, if necessary, the North Arm of the Fraser River. This map was reproduced in Greater Vancouver Sewerage and Drainage Survey, *Sewerage and Drainage of the Greater Vancouver Area, British Columbia,* A.M. Rawn, Charles Gilman Hyde, and John Oliver, Board of Engineers (Vancouver: Vancouver and Districts Joint Sewerage and Drainage Board, 1953), 264.

Sarah Elkind has noted, "The transfer of responsibility for water supply and sewerage from the individual to the public and from small to ever larger physical and governmental structures illustrates the expanding awareness of interconnection, first between one household and the next, then between neighbourhoods, cities and watersheds, and finally between adjacent drainage basins, bays, and states."[36] In the Vancouver setting, streams crossed municipal boundaries and discharged to waters shared by every municipality in the region, including those unrepresented on the sewerage committee. Thus, the need for coordinated construction and finance, driven by economic and political imperatives, was also predicated on the natural systems of the region.

The Lea plan was quickly adopted after a government review by two consulting engineers. The province passed enabling legislation in 1913 (and amendments in 1914) chartering the Vancouver and Districts Joint Sewerage and Drainage Board (VDJSDB). Made up of elected officials from member municipalities, the board oversaw the gradual extension of the sewerage system. It eventually purchased portions of existing municipal systems from individual cities, thereby concentrating its control over metropolitan nature. But the board had difficulty convincing outlying municipalities to join the regional plan. After the board's first half-dozen years of operation, a VDJSDB report lamented that "water supply, sewerage and drainage problems cannot be solved within man-made political boundaries alone, but must be treated as watershed problems." Pointing to regional boards elsewhere, it noted that "many of them [came] into being because of the fact 'that as no man liveth unto himself' neither can one community be entirely independent of another whose political boundary lines interfere with its natural boundaries."[37] In spite of these appeals, cities such as New Westminster joined the scheme only reluctantly, while North Shore municipalities remained outside the regional plan entirely.

[36] Sarah S. Elkind, *Bay Cities and Water Politics: The Battle for Resources in Boston and Oakland* (Lawrence, KA: University Press of Kansas, 1998), 3. Of course, special districts and commissions were created for a variety of purposes; however, infrastructure development was among the most common and important. On the development of metropolitan-scale municipal organization for sewerage, see also Melosi, *Sanitary City*, chap. 7; Schultz, *Constructing Urban Culture*, chap. 4; Tarr, "Water and Wastes," 199-201; and Angus N. MacKay, "Metropolitan Organization and Water Pollution Control," in *Pollution and Our Environment Background Papers*, vol. 2, ed. Christian De Laet, 1-12 (note: page numbers of papers in this collection are non-sequential and each paper starts with p. 1 (Ottawa: Canadian Council of Resource Ministers, 1966).

[37] Vancouver and Districts Joint Sewerage and Drainage Board, *Sixth Annual Report* (Vancouver: VDJSDB, 1919), 15-6.

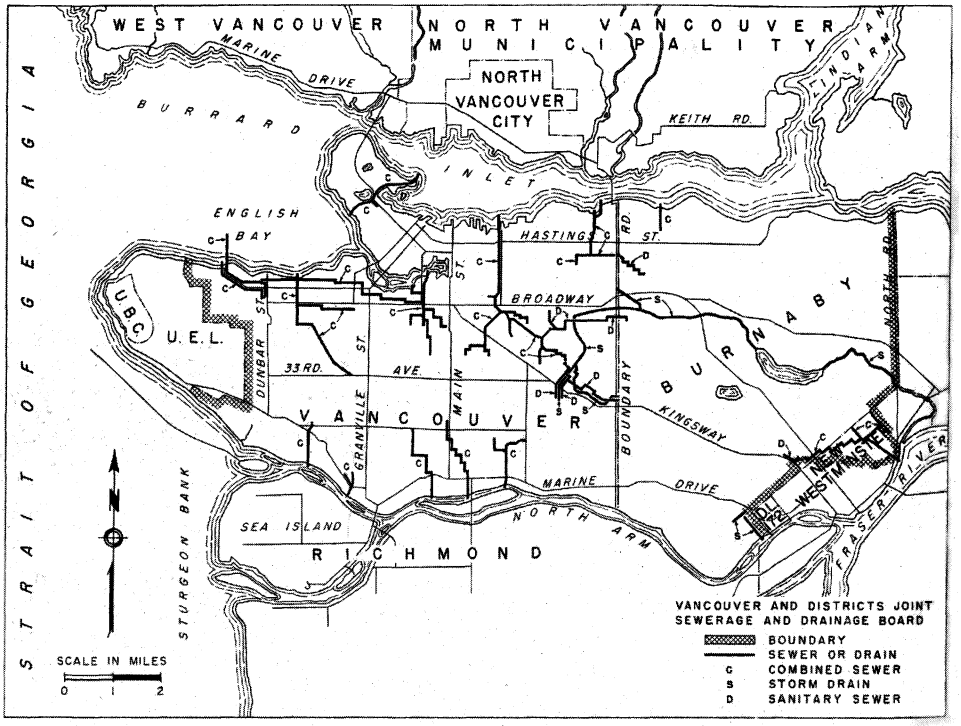

Figure 4: Sewerage and drainage of Burrard Peninsula, circa 1950. Instead of the separate system proposed by both Mohun and Lea, combined sewers (marked "c") discharge sanitary wastes and stormwaters some or all of the time to Burrard Inlet and False Creek. Source: Greater Vancouver Sewerage and Drainage Survey, *Sewerage and Drainage of the Greater Vancouver Area, British Columbia,* A.M. Rawn, Charles Gilman Hyde, and John Oliver, Board of Engineers (Vancouver: Vancouver and Districts Joint Sewerage and Drainage Board, 1953), 78.

Over the next thirty-five years, due to financial constraints, the Depression, and war, Lea's key recommendation for separate stormwater and sanitary pipes was largely neglected; instead, sewage was channelled through combined collector sewers (Figure 4). This produced a hybrid system that enrolled area streams for waste-disposal purposes. Unfortunately for local residents, this practice ensured that sewage continued to flow along with storm runoff into shallow or inappropriate receiving waters. The worst pollution resulted from the failure to eliminate outfalls in False Creek, as both Lea and Mohun had urged. A 1927 town planning commission report on False Creek described the air around the inlet as "considerably tainted" by the smell of sewage from sixteen outfalls.[38] By 1943, 1,524 acres of Vancouver's most densely

[38] CVA, Town Planning Commission Operational Files, 61-C-5 file 2, A.R. Mackenzie, *Report on False Creek,* 14 July 1927, 1-2.

populated areas drained raw sewage some or all of the time into this "filthy ditch."[39] Typhoid reappeared in the False Creek area in 1937 and 1938.[40] Although city engineers contended that tidal action was usually sufficient to disperse the wastes, the presence of rank, polluted waters at the geographical heart of the city proved a public health menace and a constant, unwelcome reminder of the failure to master the urban environment.

Continuing pollution problems after the Second World War, coupled with rapid population and geographical expansion, led to widespread calls for an update of the Lea Report. Periodic beach contamination threatened popular English Bay and Kitsilano bathing spots.[41] As in the 1910s, rapid urban growth prompted the use of domestic septic tanks in suburban areas such as Kitsilano, West Vancouver, South Vancouver, and Burnaby. These created a nuisance through overflows and inadequate drainage. Septic tanks operate by allowing solid matter to settle in the tanks, while wastewater diffuses through a system of pipes into surrounding soil, or septic field, which filters impurities from the water as it percolates through the ground. However, many parts of the region are situated on poorly draining sites or steep areas where wastewater seeps rapidly through the ground to contaminate groundwater, streams, or low-lying areas. These factors, combined with the region's high rainfall, meant that septic-tank effluent often discharged at or near ground level, prompting complaints about septic waters running in ditches.[42] By 1948 the problem had become so acute that the city considered restricting development or asking developers to bear the cost of building sewers

[39] CVA, Add. MSS 1257, 64-A-3, file 4, "Vancouver and Districts Joint Sewerage and Drainage Board Memo on Drainage Areas Flowing into False Creek and English Bay," 19 May 1943. This problem persisted in spite of the belated construction of interceptor sewers along the south shore of False Creek in 1929-30 to divert sewage to the English Bay outfall. Quote is from a 1950 Vancouver mayoralty candidate, cited in Burkinshaw, *False Creek*, 46.

[40] "Typhoid Germs Infest Creek, Probe Reveals," *Vancouver Province*, 8 January 1938, 1; "Sewer Change Mooted Here," *Vancouver Province*, 10 January 1938, 2; "Health Head Would Evict 500," *Vancouver Province*, 11 January 1938, 1; "Special Committee to Battle Typhoid," *Vancouver Province*, 13 January 1938, 1; "False Creek and Typhoid," *Vancouver Province*, 20 January 1938, 6.

[41] See, for instance, Erwin Kreutzweiser, "City to Eliminate Polluted Beaches," *Vancouver News-Herald*, 18 August 1949, 11; Erwin Kreutzweiser, "Controversy Rages over Beach Pollution," *Vancouver News-Herald*, 19 August 1949, 1; Erwin Kreutzweiser, "City's Beaches Disease-Free," *Vancouver News-Herald*, 22 August 1949, 2.

[42] "Sewage Conditions Protested," *Vancouver Province*, 16 April 1947, 3; Bill Lamb, "Twenty Years, $24 Million to End Septic Tank Problem," *Vancouver Sun*, 14 September 1951, 3; "We Can't Shrug This Off," *Vancouver Province*, 8 September 1951, 4; "Don't Encourage Septic Tanks," *Vancouver Province*, 22 September 1951, 4. See also CVA, PDS 11, Health Department, *Annual Report*, 1948. Adam Rome amply documents the environmental perils of the profusion of septic tanks in postwar American suburbs in *The Bulldozer in the Countryside: Suburban Sprawl and the Rise of American Environmentalism* (Cambridge: Cambridge University Press, 2001), chap. 3.

themselves until the city could reimburse them later.[43] An estimated 25 percent of the city used septic tanks, and, although the problem was greatest in south and southeastern sections of the city, pockets of unsewered areas could be found throughout the Burrard Peninsula area. In 1952 an outbreak of polio in a Point Grey neighbourhood near a bog polluted by septic tanks prompted angry demands for sewerage, even as the city struggled with ballooning sewerage budgets and natural sinks that were nearing their capacity.[44]

RE-ENGINEERING NATURE IN THE CITY: THE RAWN REPORT

As if in response to the "polio boy" episode, the first draft of a new sewerage and drainage plan appeared in the fall of 1952. It emerged from a comprehensive review of the regional sewerage system launched by the VDJSDB in 1950 and conducted by a committee that included board chairman E.A. Cleveland and two well-known California sanitary engineers, A.M. Rawn and Charles Gilman Hyde.[45] Typically referred to as the Rawn Report,[46] this plan may be seen as an enlargement and extension of the Lea Report's basic strategies and assumptions. It, too, included detailed surveys of the region's physical and social geography, pollution problems, climatic conditions, and economic development. It also acknowledged the threat – indeed, the fact – of pollution of inland waterways and shore waters by sewage. The investigators started from the premise that beach pollution, not environmental degradation, was the major threat posed by sewage, so that

[43] "Sewer Development at Promoters' Risk," *Vancouver Province*, 9 July 1948, 2. See also CVA, Vancouver Health Department fonds, 103-A-3 file 1, minutes of Metropolitan Health Committee, 20 October 1948, which contains a report by city engineer J.C. Oliver highlighting septic tank problems.

[44] "Council Tackles Problem of Point Grey Swamp," *Vancouver Province*, 6 June 1952, 19; "Clean-Up of Swamp Promised," *Vancouver Province*, 11 June 1952, 2; "Third Polio Case Here Reported," *Vancouver Province*, 17 June 1952, 1; "Action Urged on Disease-Ridden Swamp," *Vancouver Province*, 18 June 1952, 21; "Demand Sewerage System," *Vancouver Province*, 21 June 1952, 21; "Early Start Likely on 'Polio Boy' Sewer," *Vancouver Sun*, 18 July 1952, 5; "Residents Demanding New Sewers," *Vancouver Sun*, 19 July 1952, 21.

[45] Rawn was Los Angeles County's chief sanitary engineer and, later, chairman of the State Water Pollution Control Board of California, while Hyde was an emeritus professor of engineering at the University of California. Cleveland, also the head of the Greater Vancouver Water Board, served on the committee until his death in 1952, when his place was taken by Vancouver city engineer John Oliver.

[46] Greater Vancouver Sewerage and Drainage Survey, *Sewerage and Drainage of the Greater Vancouver Area, British Columbia* (Vancouver: Vancouver and Districts Joint Sewerage and Drainage Board, 1953).

the basic strategy of waste disposal – dilution – remained intact. As California's top pollution control official, Rawn averred that, "Because it can act as a natural treatment system, [the ocean] should be used for this purpose with respect to sewage."[47] Like Lea, the Rawn team approached the problem of sewerage as a fundamentally geographical one: given certain oceanographic, topographical, geological, climatic, and land-use considerations, how might wastewaters be safely transported through space to a location where they could be discharged efficiently? They also confronted the inadequate scale of the VDJSDB by expanding regional planning to include municipalities to the north, east, and south of Burrard Peninsula (although areas south of Richmond were not included in the original plan).

The final Rawn Report in 1953 proposed a technological solution to accommodate regional population growth while preserving water quality. It envisioned a system that incorporated, yet almost completely reversed, the natural hydrology of the area (Figure 5). Responding to the overriding need to prevent further pollution of Burrard Inlet, Vancouver harbour, and English Bay, the report proposed the interception of all north-bound combined sewage and stormwater from Vancouver and parts of neighbouring Burnaby, and its diversion southward through a deep tunnel to a treatment plant on Iona Island at the mouth of the Fraser River near Richmond. Much of the wastewater draining southward to the Fraser River was also to be processed at Iona. There, wastewaters would receive primary treatment (essentially comminution – or "chopping" – settling and removal of solids, and chlorination) before flowing through an open channel across Sturgeon Bank into the Strait of Georgia. The Rawn plan incorporated the existing combined sewer system since the cost of rebuilding the entire system was too great. This meant that, during heavy rains, when the volume of runoff exceeded the capacity of the interceptors, diluted combined runoff would continue to discharge through old outfalls into Burrard Inlet, English Bay, and False Creek.[48]

Another sewage treatment facility, Lions Gate, was proposed for the North Shore of Burrard Inlet at First Narrows, to be built on

[47] Quoted in Michael Waldichuk, *Sewage Pollution in British Columbia in Perspective*, Canadian Industry Report of Fisheries and Aquatic Sciences No. 153 (Ottawa: Department of Fisheries and Oceans, 1984), 6.

[48] This arrangement is the source of the combined sewer overflows that continue to plague older parts of the regional sewerage system, particularly in the City of Vancouver. In addition, during heavy rainfall events, the volume of water reaching the sewage treatment plant exceeded the plant's capacity, so the diluted wastewater bypassed the plant and was discharged untreated into Sturgeon Bank waters.

the Capilano Indian Reserve. Where raw sewage disposal was still permitted (notably, into the main arm of the Fraser from New Westminster, Richmond, and parts of Burnaby), outfalls were planned to take advantage of the river's tremendous flow. The report called for an eventual end to all direct disposal into the north arm of the river since oceanographic investigations had revealed that the sewage-laden discharge of this part of the river was swept around Point Grey and into English Bay by tidal action. Unlike Lea, whose report had considered the presence of river water in Burrard Inlet a boon to pollution control, Rawn concluded that the north arm was the source of at least some of the contamination plaguing English Bay beaches.

The Rawn plan, then, plotted the diversion of wastewaters from numerous dispersed outfalls to concentrate them at fewer treatment and discharge points that were considered most advantageous from a sanitary viewpoint. This configuration of the region's liminal spaces delineated shores and shorewaters that were to be preserved for aesthetic and recreational purposes (such as English Bay) and others that were to serve as sinks for waste (such as the Fraser River and Sturgeon Bank). These sinks were chosen for their capacity to assimilate wastes and because of their relative unsuitability for other purposes. Beyond this, environmental quality considerations were nearly totally absent from the Rawn Report, save for a nascent concern with toxic chemicals that might pose a threat to fish and wildlife. Rawn discounted the impact on fish life of sewage discharge to the Fraser, figuring that the river's high levels of dissolved oxygen would more than compensate for the oxygen-depleting characteristics of wastewaters.[49]

To administer and finance this plan, the Rawn Report recommended the continuation of the VDJSDB and the sharing among municipalities of the cost of works of common benefit, including the treatment plants. City newspapers hailed the plan, but it encountered stiff resistance from several municipalities that balked at the cost of constructing expensive infrastructure to benefit (they argued) Vancouver beach-goers. Richmond residents protested at their municipality being chosen as the site for an "oversized outhouse" at Iona Island.[50] From 1953 onwards, Richmond reeve Ray Parsons, along with municipal leaders from New Westminster and North Vancouver, worked to block provincial legislation enabling implementation of the report. "The only excuse for

[49] Ibid., 101.

[50] The comment came from Lou Blanchard, "Richmond Would Lose," letter, *Vancouver Sun*, 16 October 1953, 4. See also "City's Sewerage Plan Bitterly Opposed," *Vancouver Sun*, 19 September 1953, 13; Roy W. Brown, "Beaches Safe," *Vancouver Sun*, 2 October 1953, 4.

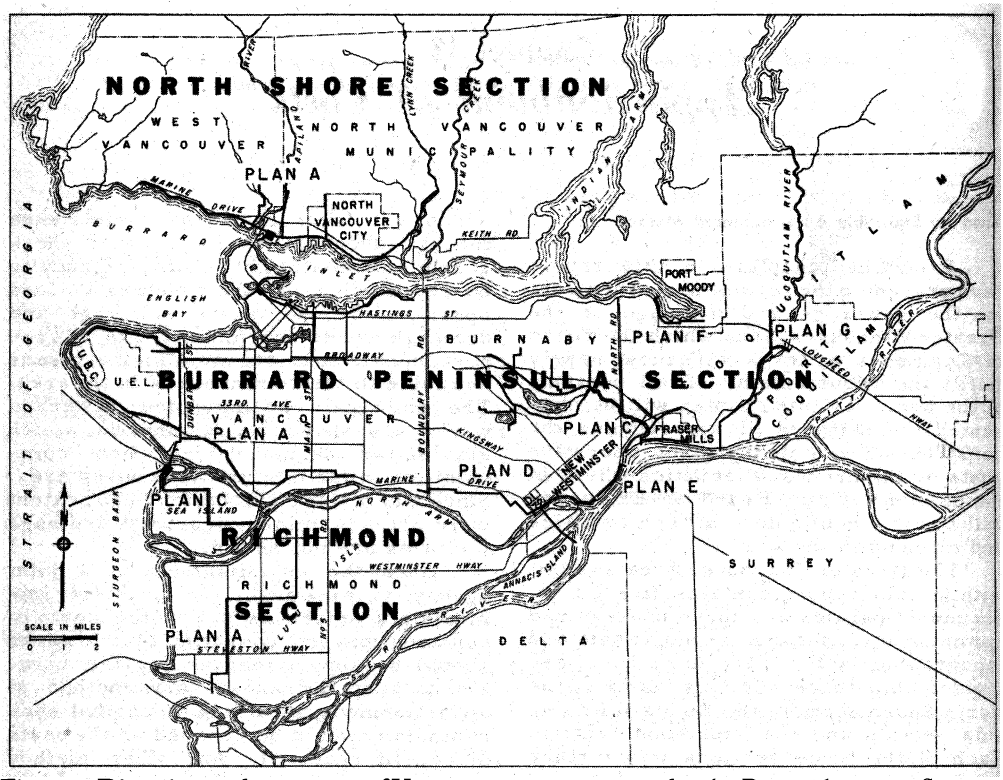

Figure 5: Diversion and treatment of Vancouver wastewater under the Rawn plan, 1953. Source: Greater Vancouver Sewerage and Drainage Survey, *Sewerage and Drainage of the Greater Vancouver Area, British Columbia,* A.M. Rawn, Charles Gilman Hyde, and John Oliver, Board of Engineers (Vancouver: Vancouver and Districts Joint Sewerage and Drainage Board, 1953), 208.

including us in this scheme is to provide an area in which to dump the effluent on our west shores and also to obtain our financial assistance," charged a 1955 Richmond brief to the province.[51] Facing such outcry, the provincial minister of municipal affairs, Wesley Black, refused to impose the Rawn plan on unwilling municipalities.

In response to the political deadlock, the region's Metropolitan Joint Committee and the VDJSDB each prepared reports promoting the benefits of metropolitan sewerage schemes. In his report to the minister of finance and Premier W.A.C. Bennett, VDJSDB chairman T.V. Berry lamented that "the communities ... outside the present Sewerage District, are not conscious of the metropolitan aspects of the problem nor are they willing to consider or concede their responsibilities to their

[51] "Gov't to Get Protest on Sewage Dump," *Vancouver Sun,* 13 December 1955, 2.

neighbours in matters of sewage disposal."[52] Rawn was recalled from Los Angeles to encourage the adoption of his plan. By 1955, with regional planning in disarray and sewage problems mounting, local editorialists demanded that the government either force municipalities to join a new scheme or dissolve the joint board, leaving each city responsible for the construction of its own facilities.[53] However, when the province created the new Greater Vancouver Sewerage and Drainage District (GVSDD) in 1956, its membership was essentially unchanged from that of the former board: it included only three members, Vancouver, Burnaby, and the University Endowment Lands.

Richmond continued to oppose the Rawn plan, and in 1957 it appealed a GVSDD application to the provincial Pollution Control Board (PCB) for a permit to build and operate the Iona sewage treatment plant. Created in 1956 with a mandate to control domestic waste discharges to the Fraser River below Hope, the PCB was intended to remove the pollution issue from its rancorous regional context and, indirectly, to compel participation in the Rawn plan.[54] It was also a recognition, however limited, of the growing scale of pollution problems in the region and the interconnected nature of the Fraser River-Georgia Strait aquatic environment.[55] Comprised of top bureaucrats from the departments of Health, Forestry, Water Resources, and Fish and Game (as well as two non-governmental members), the PCB aimed to coordinate and regulate the use of the assimilative capacity of regional waters through planning and permit processes.[56]

[52] CVA, Add MSS 1257, 63-F-5, file 4, T.V. Berry, "Memorandum to the Honourable Minister of Finance for the Province of British Columbia Relative to the Present Status of Planning of Sewerage and Drainage of the Lower Mainland," 3 August 1955, 9. See also CVA, PDS 492, Joseph E. Howes, "Sewerage and Sewage Treatment Facilities: A Report to the Metropolitan Joint Committee," 1959.

[53] "Sewer Plan Down the Drain," *Vancouver Province*, 25 February 1955, 4; "Scrap Sewer Board, Municipalities Urge," *Vancouver Province*, 22 October 1955, 19; "Leadership at Last," *Vancouver Sun*, 8 December 1955, 4.

[54] The Pollution Control Board was created to set up water quality regulations that would virtually compel local communities to join the GVSDD. Both bodies were created during the same session of the legislature. See "Board to Be Set Up on Sewage Problem," *Vancouver Sun*, 23 February 1956; "Shirking Responsibility," *Vancouver Sun*, 24 February 1956, 4. See also the sewerage board's file on the Rawn Report, CVA, Add. MSS 1257, 63-F-5, file 4.

[55] The provincial Department of Health and Welfare had previously monitored and approved the construction of sewerage works in communities across the province through the Department of Public Health Engineering. Indeed, it was officials within this department that recognized the need for a more comprehensive approach to pollution control and recommended the formation of a water-pollution control authority. See British Columbia Archives and Records Service (BCARS), GR-0132 Department of Health and Welfare, box 23, file 1.

[56] BCARS, Accession no. 88-0408 Environmental Appeal Board, box 79-02, file 1-2, Pollution Control Board minute book, 1956-62. Interestingly, in meetings with provincial and federal officials in 1952 to discuss his plan, Rawn himself suggested that such a body might become necessary to control pollution across the region: see "Minutes of Meeting of Government

Recognizing the controversial nature of the Iona application, the PCB held a two-day public hearing in September 1957. It was an unprecedented forum: never before had interest groups and the public in British Columbia been given access to pollution-control and sewage-disposal decisions beyond municipal bylaw-approval referendums. At the hearing, several Richmond groups offered technical and political objections to the Iona Island treatment plant. The municipality of Richmond brief asserted that "this scheme will merely transfer pollution from one area to another."[57] The brief contended that the Rawn team had failed to consider alternatives to the Iona Island site, and it announced the municipality's intention to develop this location as a recreational area. By contrast, testimony from the Vancouver Board of Trade accused Richmond of holding regional health and urban development hostage. Commercial fishery and fish and game advocates urged that the protection of fish life be considered, whatever plan was adopted. Along with other technical experts, Rawn testified that the Iona Island location was chosen as a site for sewage treatment in consultation with Richmond's own city engineer, based on the findings that area waters were already polluted by sewage outflow from the north and middle arms of the Fraser River.[58]

Satisfied with the testimony of the sewerage district's experts, the PCB approved a slightly amended form of the application in early 1958. Richmond immediately appealed the decision to the provincial Cabinet and launched a public relations campaign to discredit the Rawn plan. Meanwhile, Vancouver newspapers again called for the provincial government to compel participation in the scheme. Defending the Sturgeon Bank outfall channel, the GVSDD placed a newspaper advertisement urging Vancouverites to "think of the action of fresh water from the Fraser River on the south, the movement of currents and the out-going tide, and a channel cut three miles out to Sturgeon Bank, well away from the shore, as parts on a giant flushing machine."[59] To the GVSDD, the assimilative capacity of the Strait of Georgia provided an almost limitless hydrological resource for cheap and effective waste disposal.

As the provincial Cabinet delayed its decision through the summer of 1958, alarmingly high coliform counts at English Bay beaches prompted

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Officials with Representatives of Vancouver Sewerage and Drainage Board to Discuss Proposed Plans of Board," 10 December 1952, Greater Vancouver Regional District Library historical files, Burnaby, BC.

[57] *Transcript of Hearing before the Pollution-Control Board, September 5-6, 1957* (Victoria: PCB), 73.

[58] Ibid., 131-41.

[59] See display advertisements in: *Vancouver Sun*, 14 August 1958, 11; *Vancouver Sun*, 21 August 1958, 16, 21.

beach closures by the Vancouver Health Board. Public outcry over the return of beach pollution virtually guaranteed that Richmond's protests would be overridden.[60] The Iona application received Cabinet approval in September 1958, after additional monitoring conditions were imposed. The Rawn plan became the template for the sewerage and drainage network of Greater Vancouver for the next forty years.[61] Its implementation proceeded slowly and remained contentious; the Iona Island treatment plant was not brought on-line until 1963. However, public pressure for pollution control continued to build and, with some reluctance, seven other municipalities had joined the sewerage district by 1967. The slow pace of construction and the rapid growth of the metropolitan area strained existing infrastructure, but many came to believe that the Rawn plan would banish sewage pollution forever.

RE-DEFINING POLLUTION AND ASSIMILATIVE CAPACITY

In the mid-1960s it seemed that pollution was everywhere. Rachel Carson had written about the insidious effects of DDT pesticide on human and ecological health; citizen groups in eastern North America protested against phosphorous additives in detergents that left waste-receiving waters coated in foam; uncontrolled domestic and industrial wastes threatened to leave Ontario's Lake Erie "dead."[62] Pollution became the signal issue for what Samuel Hays has called the "second wave" of postwar environmentalism.[63] Historian Robert Gottlieb has observed that water pollution problems, which were assumed to have

[60] "Fast Action on Sewers Asked," *Vancouver Sun*, 22 August 1958, 29. The connection between the beach closures and the final decision was also alluded to in Greater Vancouver Sewerage and Drainage District, *Annual Report* (Vancouver: GVSDD, 1958), 14.

[61] The verbatim Cabinet decision can be found in BCARS, Accession no. 88-0408, Environmental Appeal Board, box 79-01, file 1, Pollution Control Board, Minutes of Meeting, 24 September 1958.

[62] On these issues, see Terence Kehoe, *Cleaning Up the Great Lakes: From Cooperation to Confrontation* (DeKalb, IL: Northern Illinois University Press, 1997); Samuel P. Hays, *Beauty, Health, and Permanence: Environmental Politics in the United States, 1955-1985* (New York: Cambridge University Press, 1987), 55-75; Christopher Sellers, "Body, Place and the State: The Makings of an 'Environmentalist' Imaginary in the Post-World War II US," *Radical History Review* 74 (1999): 31-64; Jennifer Read, "'Let Us Heed the Voice of Youth': Laundry Detergents, Phosphates and the Emergence of the Environmental Movement in Ontario," *Journal of the Canadian Historical Association* (n.s.) 7 (1996): 227-50; Rome, *Bulldozer in the Countryside.*

[63] On pollution and environmentalism, see Hays, *Beauty, Health, and Permanence*, 55; Scott Hamilton Dewey, *Don't Breathe the Air: Air Pollution and US Environmental Politics, 1945-1970* (College Station: Texas A&M University Press, 2000). Probably the best contemporary summary of pollution issues and their salience to environmentalism is Barry Commoner, *The Closing Circle: Nature, Man and Technology* (New York: Bantam, 1972 [1971]).

been overcome in the first era of urban environmental reform, dramatically reasserted themselves in the 1950s and 1960s as the long-term effects of inadequate waste-disposal practices became evident.[64] Postwar "effluent society" began to confront the unanticipated consequences of urbanization, mass consumption, and the alteration of the natural environment. The "voice of youth," raised against a variety of social and political institutions in the tumultuous cultural politics of the 1960s, railed against the bureaucratic mismanagement, consumer culture, and urban-industrial order that led to environmental degradation.[65] Even in British Columbia, with its comparatively low level of urban development and industrialization and ample tracts of wilderness, pollution became an outrage in search of a problem. Signalling the rise of this issue, an eight-part *Sun* series on pollution appeared in 1965. It opened with an ominous account of the province-wide problems of sewage pollution.[66] Appearing at a University of British Columbia conference on water pollution later that year, series author Arnie Myers urged the creation of a citizens' anti-pollution action group.[67] By the mid- to late 1960s, pollution was regularly identified in news stories and editorials as a "growing menace" to the unspoiled waters of the province, prompting demands for more effective government action.[68]

The impending elimination of outfalls in Vancouver harbour and English Bay shifted attention to the impact of sewage disposal on the Fraser River. Since the 1950s, anxieties about the possible eutrophication of the Fraser River and fears of damage to the fishery had prompted

[64] Robert Gottlieb, *Forcing the Spring: The Transformation of the American Environmental Movement* (Covelo, CA: Island Press, 1993), 78.

[65] The phrase "effluent society" is adapted from a Canadian reader on pollution, Frank J. Taylor, Philip G. Kettle, and Robert G. Putnam, eds., *Pollution: The Effluence of Affluence* (Toronto, Methuen, 1971). On urban issues and environmentalism, see Samuel P. Hays, "The Role of Urbanization in Environmental History," in Samuel P. Hays, *Explorations in Environmental History* (Pittsburgh: University of Pittsburgh Press, 1998), 69-100. The growth of pollution concerns in Canada is discussed in Read, "Let Us Heed"; Donald A. Chant, ed., *Pollution Probe* (Toronto: New Press, 1970); and Robert Paehlke, "Eco-History: Two Waves in the Evolution of Environmentalism," *Alternatives* 19, 1 (1992): 18-23. On the connections between countercultural attitudes and environmentalism, see Gottlieb, *Forcing the Spring*, chap. 3; and Adam Rome, "'Give Earth a Chance': The Environmental Movement and the Sixties," *Journal of American History* 90, 2 (2003): 525-54.

[66] Arnie Myers, "Sewers Have No Sex Appeal: So Pollution Goes On," *Vancouver Sun*, 11 September 1965, 3; "Count Our Blessings," *Vancouver Sun*, 14 September 1965, 4.

[67] *Conference on Water Pollution Proceedings* (Vancouver: University of British Columbia, 1965); "Stronger Fight on Pollution Urged," *Vancouver Sun*, 4 December 1965, 3; Dave Laundy, "Charge Polluters with Cost of Controls, Says Loffmark," *Vancouver Sun*, 4 December 1965, 3; Arnie Myers, "Water Pollution Spreading," *Vancouver Sun*, 3 December 1965, 18.

[68] Two earlier examples include: "Count Our Blessings"; "Waste No One Can Afford," *Vancouver Sun*, 17 May 1966, 4.

numerous studies.[69] Arnie Myers's pollution stories emphasized threats to the Fraser River, into which over forty communities discharged raw or partially treated sewage as well as industrial wastes. When the sewerage and drainage district approved a plan for the dumping of Richmond's raw sewage into the Fraser in early 1967, public outrage ensued: "one thing is alarmingly clear: the future usefulness of the river – one of the world's great waterways – is in jeopardy," wrote one editorialist.[70] Fisheries workers launched a campaign to force the PCB to curb pollution in the Fraser, in spite of the board's assurances that dissolved oxygen levels in the river were unaffected by sewage.[71] Local fishers had long complained that polluted conditions in the north arm had virtually eliminated fish passage through its waters. "In a way, it is perhaps too bad we have a river and an ocean on our doorstep. If they weren't there we'd have to treat our sewage whether or not we could afford it," commented William Hourston, regional director of the federal fisheries department.[72]

The PCB responded to this controversy by issuing a report and holding a public hearing on water pollution in the Fraser. In his 1967 report, *Pollution and the Fraser*,[73] consulting engineer C.A. Goldie reported on bacteriological and chemical sampling data compiled since 1950. His report accepted the use of the river as a sink for wastes – so long as the practice did not impair other uses. Still, Goldie's conclusions were alarming. Many reaches of the Lower Fraser showed evidence of high

[69] Eutrophication is the process that occurs when water, "having been over-supplied with organic or mineral nutrients, promotes excessive growth of algae which draw on so much oxygen that little (or none in extreme cases) remains to support animal life." Audrey N. Clark, ed., *Penguin Dictionary of Geography*, 2nd ed. (London: Penguin, 1998), 138. Much of the Fraser research was undertaken by fisheries biologists. See BCARS, GR-1114 Fish and Wildlife Branch, box 62, file 41-00, R.G. McMynn, "Pulp Mill Pollution of North Arm of Fraser River" (1953); Michael Waldichuk, "Report on Pollution Studies Conducted in Western Canada" (1957), reprinted in Fisheries Research Board of Canada, *Aquatic Pollution Studies, 1902-1966* (Ottawa: National Research Council, 1966). Studies and surveys were also undertaken by the Dominion-Provincial Fraser River Board, established in 1949. See BCARS, GR-0132, Department of Health and Welfare, box 5, file 6; and British Columbia Research Council, *Fraser-Thompson River System Water Quality* (Vancouver, BCRC, 1952).

[70] "Deciding the Fraser River's Fate," *Vancouver Province*, 14 August 1967, 4. See also "Hands Off What?" *Vancouver Sun*, 28 November, 1967, 4; "How Much More Pollution for the Fraser?" *Vancouver Province*, 8 December 1967, 4; "A Little Bit Too Much," *Vancouver Sun*, 20 December 1967, 4.

[71] Norman Hacking, "Pollution Worries Fishermen," *Vancouver Province*, 7 April 1967, 21; Ron Rose, "I Won't Rinse My Dishes in That Slime Anymore," *Vancouver Sun*, 30 August 1967, 29. The United Fishermen and Allied Worker's Union was prominent in the fight over Fraser pollution. See "In this day and age?" *Vancouver Sun*, 16 February 1967, 4.

[72] Jack Ramsay, "Is Fraser Health Trap?," *Vancouver Sun*, 29 May 1967, 1.

[73] British Columbia, Pollution Control Board, *Pollution and the Fraser* (Victoria: Water Resources Service, 1967).

bacterial contamination, and he suggested that the combination of domestic and industrial waste inputs could eventually affect fish life in the river. The public hearing on the report showcased divergent views on pollution control. While fisheries and sporting groups demanded better water-quality standards, the GVSDD challenged the report's data and joined municipalities in lamenting the cost of sewage treatment.[74] Still, the hearing displayed the considerable political momentum building for pollution control. A mere two days after the hearing concluded, Municipal Affairs Minister Dan Campbell announced that all municipalities in the province would be required to treat their sewage before disposal. This created an uproar among BC municipal leaders.[75] The GVSDD revised and updated its regional sewerage design plan over the next two years. And in 1968 the PCB developed its first pollution-control objectives for the Fraser River; thereafter, the board remained the lead agency in developing municipal waste-disposal objectives.[76]

However, the board's authority to define and control pollution was soon challenged by new, non-governmental environmental advocacy organizations. In Richmond, disgust at the municipality's raw sewage dumping plan stimulated the formation of the Richmond Anti-Pollution Association (RAPA) in mid-1968. This group included members of the United Fishermen and Allied Workers' Union, area sport fishers, and local ratepayers.[77] Shortly after the creation of RAPA, the Society for Pollution and Environmental Control (SPEC) was founded in Burnaby and quickly became the largest environmental group in British Columbia. After the McGeer-Bonham controversy over beach pollution in the summer of 1969, the group launched an independent water sampling program in Vancouver to monitor pollution of the city's shorelines.[78] SPEC's 1970 *Fraser River Report*, completed by students, was an indictment of lax pollution control policies and generated a firestorm of controversy.[79] *Sun* columnist Bob Hunter declared that the report documented "a river in its death throes ... being killed by industry, by

[74] "Pollution Warning Sounded," *Vancouver Province*, 22 August 1967, 9; "Local Gov'ts Asked to Check Pollution," *Vancouver Province*, 23 August 1967, 2.

[75] "Sewage Hearing 'Just a Waste'," Vancouver Sun, 29 August 1967, 42.

[76] British Columbia, Pollution Control Board, *Control of Water Pollution in British Columbia* (Victoria: Water Resources Service, 1968).

[77] "Effluent Dye Tests Urged in Fraser Pollution Dispute," *Vancouver Sun*, 16 July 1968, 11; "Fraser Sewage Plan Protested," *Vancouver Sun*, 17 July 1968, 15; "Pollution Foes to Protest Richmond Sewage Dumping," *Vancouver Sun*, 23 July 1968, 23.

[78] "Beaches in City 'Approach Danger,'" *Vancouver Sun*, 5 August 1969, 15; "Now We Know – Don't We," *Vancouver Sun*, 6 August 1969, 4.

[79] Society for Pollution and Environmental Control, *Fraser River Report* (Vancouver: SPEC, 1970).

cheap treatment methods, by lack of foresight and concern, by governmental ignorance."[80] A *Sun* editorial on the report accused the GVSDD of being "wedded to studies of the Fraser's garbage-assimilation capacity which are hopelessly out of date."[81] These criticisms found a receptive audience in a public being bombarded with apocalyptic warnings of pollution and environmental collapse from across North America at the dawn of the "Age of Ecology."[82]

The dispute over the use of waterways as natural waste treatment facilities peaked in 1971, when the PCB approved the construction of a high-rate primary treatment plant at Annacis Island on the main arm of the Fraser to treat sewage from New Westminster and parts of Burnaby, Surrey, and several eastern communities. The ensuing "mighty sewage struggle" (as one *Sun* reporter called it) over treatment levels at the plant pitted "engineering technocrats" against an emerging "ecological consciousness."[83] Led by SPEC and RAPA, opponents of the plant contended that the Fraser River's current pollution load could not sustain the levels of organic materials remaining in primary-treated effluent. Although the project would result in the diversion of dozens of raw sewage outfalls from the river, these critics, including federal fisheries and environment minister Jack Davis, demanded advanced treatment and chlorination of sewage to remove bacterial and organic components before disposal.[84] Opponents forced an appeal hearing in 1971, but the PCB upheld the

[80] Bob Hunter, "Bob Hunter," *Vancouver Sun*, 28 May 1971, 31.

[81] "Is Half-Safe Safe Enough?" *Vancouver Sun*, 9 February 1971, 4.

[82] On perceptions of the "environmental crisis" in the late 1960s and early 1970s, see Lawrence Buell, *From Apocalypse to Way of Life: Environmental Crisis in the American Century* (New York: Routledge, 2003). For contemporary examples, see Gerald Leinwand, ed., *Air and Water Pollution* (New York: Pocket Books, 1969); and Barry Commoner, *The Closing Circle* (New York: Bantam, 1972 [1971]). Canadian books on pollution and the environmental crisis include: M. J. Dunbar, *Environment and Good Sense: An Introduction to Environmental Damage and Control in Canada* (Montreal: McGill-Queen's University Press, 1971); John Fisher, *What You Can Do about Pollution Now* (Don Mills, ON: Longman, 1971); P.A. Larkin, *Freshwater Pollution, Canadian Style* (Montreal: McGill-Queen's University Press, 1974); R.D. Lawrence, *The Poison Makers* (Canada: Thomas Nelson and Sons, 1969).

[83] Rod Morgan, "A Mighty Sewage Struggle," *Vancouver Sun*, 10 December 1970, 6.

[84] Ron Rose, "Sludge, Stench Clog Fraser Cruise," *Vancouver Sun*, 21 August 1970, 29. See also, Leonard Taylor, "Sorting Out Sewage Priorities," *Vancouver Province*, 3 March 1971, 4; "Ottawa's Stand: Them that Has, Gets," *Vancouver Sun*, 1 November 1971, 4; Steve Boyce, "Annacis Sewage Plant Facts withheld from Public," (letter) *Vancouver Sun*, 10 November 1972, 5. On the role of SPEC in this dispute, see the following files held at the offices of the current Society for Promoting Environmental Conservation in Vancouver: SPEC History files, box 994.02.03, file 6, "Report of the Executive Director to the SPEC Annual General Meeting," 17 April 1971; SPEC History files, box 994.02.05, file 1, Executive Committee minutes, 29 November 1972; and box 994.02.06, file 7, "Annacis Island Sewage Treatment Plant," brief to Pollution Control Board, July 1974. See also University of Victoria Archives, AR-372, Derek Mallard Papers, box 5, file 5.38; SPEC, "Annacis Island Primary Sewage Treatment Plant Notes," typescript, n.d. This was probably prepared for information purposes during the campaign.

permit issued to the Greater Vancouver Sewerage and Drainage District. With the election of the New Democratic Party in 1972, the issue came under review by an ad hoc committee of the legislature as well as by the new minister of forests and water resources, Bob Williams. As strident critics of the former Social Credit government's pollution policies, the New Democrats found themselves under intense political pressure to enforce higher standards of treatment. After the review, the PCB was forced to amend its original decision and now required secondary treatment at Annacis Island by 1977.[85] The GVSDD immediately appealed this decision (and a subsequent PCB "clarification" of its ruling), and the issue dragged on through 1973 with little movement.

The GVSDD appeals sparked considerable public agitation for an ecological assessment of waste-disposal impacts on the Fraser River. RAPA urged local residents to become "Fraser Savers" and to support the fight for secondary treatment. Dozens of letters poured into PCB offices appealing to the "balance of nature" that was threatened by the continued degradation of the river. Fraser River dockworkers and fishers filed a petition with the PCB demanding secondary treatment, and in 1972 they held a floating protest on the river demanding a public hearing on the issue.[86] Citizens' groups challenged the PCB and the sewerage district's technical superiority by hiring their own experts and criticizing government data on water quality. One of these experts bluntly asked, "Should the [district] be allowed to make drastic changes in the amount of deleterious substances discharged into a short reach of estuarine water, without first being more sure of the degree of treatment required to maintain an 'acceptable' level of purity for all users?"[87] Other experts contended that high tides could trap waste in the river at Annacis Island for several days, then wash it upstream and thence into the much smaller and already highly polluted north arm channel. This debate also revealed a much stronger concern about the discharge into municipal sewers of toxic chemicals from urban industrial facilities – though no one knew how much or just which chemicals were released.

The GVSDD fell back upon its familiar claim that the river's assimilative capacity was more than adequate for the protection of human health

[85] BCARS, Accession no. 88-0407, box 18, BC Government News Release, "Re: Secondary Treatment for Annacis Island," 7 December 1972.

[86] "Sewage Treatment Plant Draws Angry Protests," *Vancouver Sun*, 4 December 1972, 13.

[87] The quote is from RAPA's consultant, University of British Columbia civil engineer, W.K. Oldham. BCARS, Accession no. 88-0407, box 18, Richmond Anti-Pollution Association, "Notice of Appeal," 15 March 1971. This box contains unnumbered files with correspondence, briefs, and other documents relating to the Annacis Island controversy, including the letters cited above.

and aquatic life. It also warned of the high cost of secondary treatment. In a letter to the PCB, GVSDD Commissioner Frank Bunnell presented technical information showing that the amount and quality of effluent discharged at Annacis Island would have a negligible effect on the river. "Really the most important consideration for the selection of a [treatment] process is the receiving water available for discharge. You can see from the foregoing on BOD [biological oxygen demand] that the size of the receiving river or body of water can determine the selection of the process. Also whether or not it is a recreational water is an essential factor and also whether it be salt or fresh water."[88] Such thinking was challenged by many fisheries scientists and ecologists. On behalf of the BC Environment Council, fisheries biologist Otto Langer wrote, "The Fraser Estuary cannot be viewed as a convenient medium into which we continually and indefinitely keep dumping our ever increasing amounts of municipal and industrial wastes. Even secondary treatment must not be mistaken as [an] indefinite safeguard for life in the Fraser River."[89] Unlike earlier appeals to "aesthetic considerations," these arguments were based on an ecological critique of the use of assimilative capacity.

After years of delay and wrangling, on 21 April 1975 the provincial Cabinet upheld the PCB requirement of secondary treatment at the Annacis Island plant. In addition, it established a special committee, under the direction of the provincial Environment and Land Use Committee Secretariat, to consider the cumulative ecological effects of sewage and toxic chemicals in the Fraser River.[90] While these issues lingered for years after this decision, the Annacis Island controversy represented a significant reversal for the doctrine of assimilative capacity that had ruled pollution control decision making in the Lower Mainland, and the province, for nearly a hundred years.[91] As much or more than technical considerations, environmental politics decisively

[88] BCARS, Accession no. 88-0407, box 18, F.R. Bunnell to W.N. Venables, 6 January 1971. This box also contains GVSDD, "Submission of the Greater Vancouver Sewerage and Drainage District in the Appeal Concerning the Annacis Island Treatment Plant," 1974.

[89] BCARS, Accession no. 88-0407, box 18, O.E. Langer, "BCEC Brief Supporting the Government of British Columbia Order to the Greater Vancouver Regional District to Provide Secondary Treatment at the Annacis Island Sewage Treatment Plant," 19 September 1974.

[90] BCARS, Accession no. 88-0407, box 18, Government of British Columbia, Lieutenant-Governor in Council, "In the Matter of the Appeal – Pollution Control Act. Greater Vancouver Regional District – Annacis Island Plant," 21 April 1975.

[91] The issue of sewage treatment and Fraser River pollution was the subject of another public inquiry in 1980. See Pollution Control Board, *Conclusions of the Board Regarding the Lower Fraser River Public Hearing on 18-22 February 1980*, (Victoria: PCB, 1980); and BCARS, Accession no. 88-0407, box 21. Due to continued wrangling over the cost and necessity of advanced treatment, the Annacis Island treatment plant was not upgraded to secondary treatment until the late 1990s.

influenced the government's decision. The Annacis controversy had galvanized regional environmental groups who advanced the notion that ecological factors, not merely technical, economic, public health, or aesthetic considerations, should guide waste disposal considerations.

CONCLUSION: CONSTRUCTING A MODERN SINK

Vancouver's longstanding sewage disposal problems illustrate the deep interconnections between urbanization, space, and nature as well as the social and cultural conceptions of pollution that underlie the policies, practices, and problems of sewage disposal. At its founding, the city seemed poised to capitalize on its "hygienic advantages" by constructing an adequate sewerage and drainage system before pollution could take root. In spite of a promising start, crucial choices about disposal and treatment methods resulted in the construction of a sewerage system that was reliant on dilution in regional waterways. This strategy constrained future choices when pollution loads increased with population growth.[92] Engineers and planners sought to use the region's surrounding waters as an organic machine for waste disposal by incorporating them into a capital-intensive, centrally administered sewerage system. The technocratic doctrine of assimilative capacity rested on the concept of natural systems as storehouses of resources or environmental services available for appropriation by or incorporation into modern technological systems. In this way, sewerage planning married water's biochemical properties to technology in constructing a modern sink for wastes. Jean-Pierre Goubert provocatively refers to this process as the cultural and technological "conquest of water."[93]

Vancouver's reliance on imported technical expertise connected the city to larger trends and approaches to sewerage and pollution control planning in twentieth-century North America. But this account also reflects the role of natural conditions and processes themselves in shaping pollution perceptions, problems, and solutions. Topographical and hydrological conditions in Vancouver influenced the design and construction of a particular type of sewerage system – one that recruited local streams and shorewaters into waste disposal processes. Engineers believed they could calculate and exploit the ability of water

[92] Melosi, in *Sanitary City*, introduction, refers to this phenomenon as "path dependency." The capital costs and organizational complexities of infrastructure are such that, once a certain technology or plan is adopted, it tends to shape and constrain future options.

[93] Jean-Pierre Goubert, *The Conquest of Water: The Advent of Health in the Industrial Age* (Oxford: Polity Press, 1989).

to disperse, dilute, and absorb pollutants in sewage. The technological rationalization of water overrode traditional concerns over water's purity but ultimately failed to control the currents, coliforms, and chemistry that co-produced degraded environmental conditions. The entrenched commitment to assimilative capacity and the high capital cost of these technological networks meant that technocratic experts and the systems they managed were slow to respond to the unintended consequences of waste disposal. These conditions in turn fuelled public outcry and environmental activism over the perceived pollution of beaches and threats to the ecological integrity of the Fraser River. Beginning in the late 1960s, changing attitudes towards nature and the rise of pollution as an environmental issue challenged the doctrine of assimilative capacity, resulting in political conflicts over sewage treatment and pollution. The catalytic effect of sewage pollution on environmental groups in Vancouver speaks to the oft-overlooked influence of urban issues on late-1960s environmentalism.[94]

Finally, the story of sewerage in Vancouver underlines the interaction of natural and cultural systems in shaping urban geographies. Pollution is a geographical problem: it transgresses the human boundaries superimposed on natural systems, entwining people and places across space through imagined and experienced geographies of environmental degradation. Vancouver, like cities elsewhere, attempted to account for this problem by rescaling environmental planning and governance first to intermunicipal and regional scales and, later, to the provincial scale. Sewerage planning was the direct forerunner of regional planning and metropolitan governance structures in the Lower Mainland.[95] New visions of a metropolitan region united by environmental circumstances shaped how residents of the Fraser River-Georgia Strait region understood their environment and governed themselves. As historian Sarah Elkind has described the situation in Boston and Oakland, "regionalism [and] political reforms were linked directly to the natural environment. Physical conditions, including urban pollution and resource shortages, played a crucial role in marshalling public support behind expensive and elaborate public works."[96] Clearly, the extension of state control over regional waters enabled the coordination of regional anti-pollution efforts.

[94] This point is made somewhat abstractly in Hays, "Role of Urbanization," 92-8.

[95] On the influence of sewerage and drainage development on regional planning and metropolitan governance in Greater Vancouver, see Christiana S. Crook, *Environment and Land Use Policies and Practices of the Province of British Columbia* (Victoria: BC Institute for Economic Policy Analysis, 1975), chap. 5; Paul Tennant and David Zirnhelt, "The Emergence of Metropolitan Government in Greater Vancouver," *BC Studies* 15 (1972): 3-28.

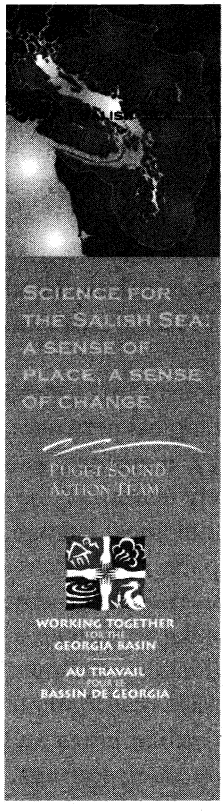
[96] Elkind, *Bay Cities and Water Politics*, 9.

In retrospect, however, it is also clear that the strategy of regionalization endorsed by sanitary engineers did not solve waste disposal problems but, rather, merely acted as a "longer pipe" for sewage.[97] The rationalization of regional waters into recreational and waste-disposal areas reinforced divisions among metropolitan residents, some of whom resented their location at the end of the pipe. Even the advent of provincial authority through the PCB simply rescaled the same old strategy of dilution and assimilative capacity, first encompassing the Lower Fraser Basin and, later, the entire watershed.

Historical-geographical studies of the "urban metabolism" of modern cities illustrate the critical links between urban technological networks, changing urban geographies, and the flows of energy, materials, and waste products that sustain cities.[98] More than a merely technical phenomenon, the urban metabolism is a product of technological change, environmental factors, and social conflict over space and nature. Vancouver's sewerage system, taken for granted by most residents today, produced a "metropolitan nature" of channelized creeks and polluted shorewaters. It also influenced urban morphology, regional governance, and urban environmental politics. In this sense, sewerage development provides insight into the historical geography of Canadian cities and the complex interaction of people and environment in urban settings.

[97] Ibid., 166.

[98] Gavin Bridge, "Everyday Ecologies: Cities, Nature, and Teaching Urban Ecology," *Journal of Geography* 100 (2001): 154-65; William Cronon, *Nature's Metropolis: Chicago and the Great West* (New York: W.W. Norton, 1991).



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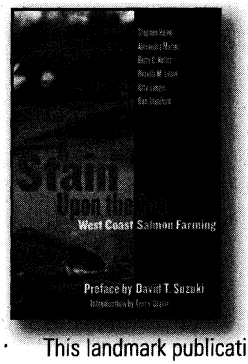

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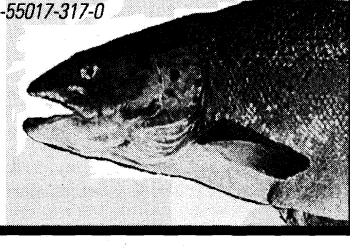

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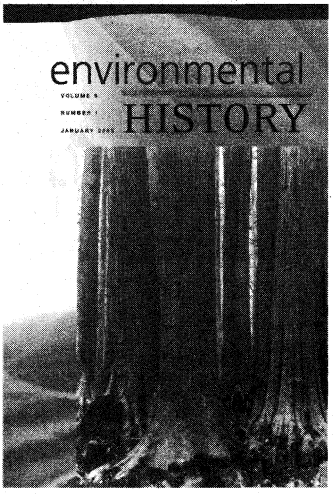

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