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The making of a regulatory crisis: restructuring New York City's water supply

Matthew Gandy

Much practically orientated environmental research is marked by a polarity between functionalist abstraction and ahistorical normative discourse. This paper seeks to bridge the divide between theoretical and empirical research through a case study of New York City's water supply. Current processes of socio-economic restructuring are leading to negative environmental consequences obscured by a failure to extend analysis beyond limited temporal, spatial or sectoral scales. Insights from regulationist theory show that a combination of fiscal, political and other developments are bringing about a wide-ranging reformulation of existing patterns of environmental regulation and service provision in the city. The power of the state is being radically diminished in relation to the power of capital and a plethora of different interest groups. A relatively simple centralized model of environmental regulation is being transformed into a complex decentralized pattern involving the emergence of new approaches to urban governance. Further research is needed on the contradictions between capitalist accumulation and environmental regulation at different spatial scales in order to link New York's changing role within the global economy to the declining political legitimacy and fiscal capability of the state to play an extensive role in environmental management.

key words water quality environmental policy post-Fordism
regulation theory urban governance urban infrastructure capital switching

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Introduction

Practically orientated environmental research is severely hampered by its lack of theoretical sophistication. Behind the plethora of normative policy discourse, there is little analysis of the causes of environmental degradation and the interrelationships between environmental issues and broader socio-economic developments in society.

Environmental research has given insufficient attention to the historical emergence and contemporary dissolution of the role of the state in the provision of environmental services such as water supply, waste management, food inspection and the enforcement of health and safety regulations. Whilst the national state in developed economies

has been pivotal in pushing through postwar environmental legislation, the responsibility for implementation has fallen largely to sub-national tiers of state authority. Yet the local state has been embroiled in an increasingly intense fiscal and political crisis since the 1970s, throwing the long-term efficacy of environmental regulation into doubt. Over the last ten years a growing body of literature has explored the restructuring of the local state in advanced capitalist societies and the emergence of new patterns of governance.¹ In addition to the growing emphasis on state–economy–society relations at different spatial scales, there has been a parallel research effort devoted to understanding the ecological dimensions of socio-economic restructuring.² An important gap in our current

knowledge, however, is the impact of socio-economic restructuring on the prospects for the maintenance of environmental quality and public health in large metropolitan areas.

In this paper I explore how the social and economic development of New York City since the 1970s led to a sudden crisis in the city's water supply system in the 1990s. A long-established pattern of policy-making, which I term 'municipal managerialism', has been shattered in the space of a few years. The speed and complexity of these developments undoubtedly make the city an extraordinary case but the underlying processes have far wider implications for urban governance and environmental quality. The structures and relationships which have underpinned the successful development of New York City's water supply have started to unravel through a combination of fiscal, ideological and social shifts ranging from new patterns of political mobilization at the grass-roots level to the impact of global processes of economic restructuring which have fundamentally altered both the scope and rationale of urban governance. The city provides us with an opportunity to explore how a series of different processes at different spatial and temporal scales have led in combination to a public policy crisis which has overwhelmed existing political and administrative structures.

Urban life is intolerable without water. Water forms part of the complex web of relations between society and nature which has enabled the emergence of great cities and sweeping transformations in human history. Yet water is a multiple entity: it possesses its own biophysical laws and properties but is simultaneously the focus of political, cultural and scientific discourses surrounding its interaction with human societies. To trace the flow of water and examine the discourses surrounding its use, distribution and quality is to illuminate the functioning of urban space in all its complexity and contradictions. In the case of New York City, the provision of water has been one of the most elaborate undertakings in the history of North American urbanization. From the 1840s onwards, New Yorkers prided themselves on one of the highest quality water supplies of any major city in the western world. Since the early 1990s, however, the future of the city's water has become the focus of protracted and bitter debate. In order to understand the contemporary crisis in environmental regulation in the city, we need to examine how

changes in developed economies underway since the 1970s have led to an increase in the power of capital to determine public policy. We need to develop an analytical framework capable of integrating the specific and contextual experience of this local regulatory crisis within a broader set of social and economic developments.³

The main body of the paper is divided into four sections. First, some of the main theoretical debates concerning the socio-economic restructuring of western societies since the early 1970s are reviewed and potential areas of engagement with environmental discourse identified. I set out the historical development of New York's water supply system and outline the emergence of a specific approach to urban water supply which I have termed 'municipal managerialism'. The origins of this approach may be traced to the processes of rapid urbanization in the nineteenth century and it reached its zenith in the era of the Fordist New Deal. Thirdly, the contemporary breakdown in established patterns of policy-making is explored by focusing on three interrelated areas: the impact of changing modes of water supply and consumption; the fiscal crisis of the state; and the inability of existing patterns of environmental regulation to protect water quality. In the concluding discussion, I re-evaluate the potential usefulness of the restructuring literature for exploring the ecological dimensions to socio-economic change since the early 1970s.

Socio-economic transitions and ecological transformations

Much scholarly attention has been devoted to establishing what kind of social and economic structures are emerging from the ashes of the relatively stable Fordist era. One of the most ubiquitous themes in this socio-economic restructuring debate is the putative existence of a distinctive 'post-Fordist' set of social and economic developments.⁴ The use of the term 'post-Fordism' ranges from restricted analysis of the labour process to the full range of political, economic and cultural changes that have transformed capitalist societies since the early 1970s (though few scholars would now use the term in anything other than a descriptive or heuristic sense).⁵ The more enthusiastic readings of post-Fordism have tended to focus on developments in the labour process as a

solution to the increasing rigidities and contradictions of Fordism and as a means both to revitalize saturated consumer markets and alleviate the drudgery of the Taylorist workplace. The concept of post-Fordism is therefore directed at examples of improved quality and flexibility with highly skilled autonomous workers. Within the sphere of production new relationships have been identified between computerized technologies, work organization, skills formation and industrial relations, and distinctions have been drawn between restructuring for labour as opposed to neo-Taylorist restructuring for capital (Mathews 1989). In an environmental context, the technological variants of the post-Fordist literature have become closely associated with the 'ecological modernization' thesis and the application of clean technologies. There is a degree of congruence here between the theories of 'ecological modernization' and the positivist application of technological solutions to what are complex policy issues stemming from wider structural contradictions well beyond the confines of science and technology policy. Consequently, much of this technologically orientated literature is marked by a separation of policy debate from wider political and ideological developments.⁶

Other commentators have been much more circumspect in their interpretation of socio-economic restructuring and especially cautious of the neo-Schumpeterian technological determinism of Freeman, Perez and others. Alain Lipietz (1987, 1992), for example, initially welcomed post-Fordism as a form of labour empowerment accompanied by the decline of Taylorism but has since modified his stance substantially. In the more critical literature, there is scepticism towards the idea that a coherent 'post-Fordist regime' has solved or transcended the limitations of Fordism and a rejection of binary and functionalist explanations of socio-economic change (Peck and Tickell 1994; Sayer 1989; Sayer and Walker 1992).

Theories of regulation have broadened analyses to encompass politically contested processes of historical change in capitalist societies, thereby transcending the more simplistic teleological or determinist accounts. The focus of analysis in regulation theory is the ability of capitalism to sustain itself, despite its contradictions, through various permutations in the relationships between economic and social structures. A prominent theme is the degree to which the development of a new regime of accumulation, variously referred to as

'flexible accumulation' or 'flexible specialization', has not yet found a clearly defined counterpart in terms of its accompanying mode of regulation and the social and institutional arrangements necessary to facilitate capital accumulation. This is nowhere more apparent than in the field of environmental policy where competing regulatory discourses ranging from free-market environmentalism to extensive interventionist models vie to demonstrate their effectiveness in handling the escalating scale of environmental degradation.

Yet regulation theory is permeated by a series of weaknesses which limit its potential role in environmental research. A pervasive problem is a tendency towards an overly abstract and functionalist account based at a national level of analysis far removed from the complexities and contingencies of 'real' regulation (see Clark 1992; Lake and Disch 1992; Marden 1992; Tickell and Peck 1992). There has been little application of regulation theory to the different spatial scales of state activity or to localized empirical transformations in social and economic structures (Goodwin and Painter 1996; Jessop 1995; Painter and Goodwin 1995). Furthermore, there is little engagement with the discursive and ideological dimensions to the perception of crisis which herald far-reaching changes in regulatory institutions and patterns of governance (Hay 1995). This can be related to the weak interdisciplinary lineage of regulation theory across a swathe of cultural and philosophical discourses ranging from Foucauldian concerns with the very possibilities for regulating society to the degree of intersection between modernist technological and epistemological discourses and specific 'modes of social regulation'.⁷ Above all, regulation theory has been driven primarily by concern with the economic contradictions of capital accumulation to the relative neglect of the problematic relationship between capital and nature. In its classic theoretical formulation, the mode of social regulation does not include an ecological dimension: its primary elements are restricted to the macro-economic regulation of the wage relation, the money form, competition, the state and international regimes (Jessop 1995). As a consequence, there is a lack of theoretically and historically grounded approaches to the study of environmental regulation in the context of shifting relationships between state, capital and society. By focusing here on the transformation of environmental discourse at the local level, I am seeking to extend

knowledge of the applicability of regulation theory in three key areas: the local manifestations (and geographical variations) in socio-economic restructuring; the understanding of the ecological dimensions to regulatory crisis; and the need for a greater focus on the changing role of the state in processes of socio-economic restructuring.

The creation of New York City's water supply system

The development of urban water supply systems is integral to the institutional basis of the modern state. It marks a collective endeavour in the control and management of nature in order to facilitate urban growth and development. For over two centuries since the founding of the city in 1625, the growing settlement relied on polluted local water sources such as wells and ponds. These inadequate arrangements led to repeated epidemics of infectious diseases and uncontrollable fires which devastated parts of the city (Baker 1949; Wegmann 1896). By the early nineteenth century, there was an increasingly intense public debate over the future of the city's water supply in the face of rapid population growth. Early attempts by private entrepreneurs to build a piped water supply system had only managed to provide poor quality water to a minority of homes. Eventually, after decades of public debate, the New York State Legislature passed an act in 1834 that gave the city the right to construct its first municipally owned waterworks (Blake 1956). The city then began a programme of aqueduct and dam construction beginning with the Croton Aqueduct which linked the city to plentiful supplies of unpolluted water diverted from the Croton watershed in up-state New York (Jervis 1842). When completed in 1842, the first supplies of water reaching Manhattan Island were greeted by the biggest public celebrations in the city since American independence (Tuckerman 1889). In subsequent decades, the Croton system was extensively enlarged with the building of a new aqueduct and more up-state reservoirs and was finally completed in 1911 (Fig. 1).

In the late nineteenth century, the emphasis on the engineering and supply side dimensions of water policy was supplemented by the new bacteriological discourses of public health and water purification which led to the chlorination of

the city's water supply (Baker 1949; Duffy 1968; Hale 1921). With the growing status of engineering, planning and other new public service professions, urban governance became increasingly influenced by a technical élite devoted to the rationalization of urban space and the extension of centralized control over large-scale urban systems.⁸ The development of a comprehensive water supply system in nineteenth-century New York marked a decisive shift from a *laissez-faire* water policy to an extensive municipal system integrated into a powerful local state structure mirroring developments elsewhere in Europe and the United States.

By the early twentieth century, the Croton system was no longer capable of meeting the needs of the rapidly growing city. As a result, the water supply system was extended through the far larger and more distant Catskill–Delaware system (Fig. 1) constructed between 1907 and 1967 using state-of-the-art technologies and further entrenching the role of engineers in the technical management of urban space (Clark 1950; Van Burkaw 1959; Weidner 1974). During this period, the administrative arrangements for the construction of water supply infrastructure were extensively centralized with the creation of semi-autonomous state structures fiscally and politically insulated from directly elected local government (Weidner 1974). This marked a smaller-scale precursor to the powerful regionally based federal agencies of the New Deal era, such as the Tennessee Valley Authority which emerged to play a significant role in water resources planning across much of the United States during the twentieth century (Feldman 1991; Peters 1996). There was a peak in construction activity during the New Deal with the channelling of federal funding under the La Guardia administration into the completion of the city's second water tunnel and the on-going construction of the Catskill–Delaware system, as well as bridges, tunnels, roads and the beginning of comprehensive urban redevelopment (Kessner 1989; Weidner 1974). The New Deal era of the 1930s and 1940s not only led to a radical reconfiguration of the extent and regulatory scope of state structures but also set in place the basis of a Fordist postwar era of public policy through which centralized state structures played a leading role in the transformation of urban space within regional industrial systems linked into a US-dominated global economic arena (Sunstein 1990).

When finally completed in 1967, the New York water supply system consisted of the largest

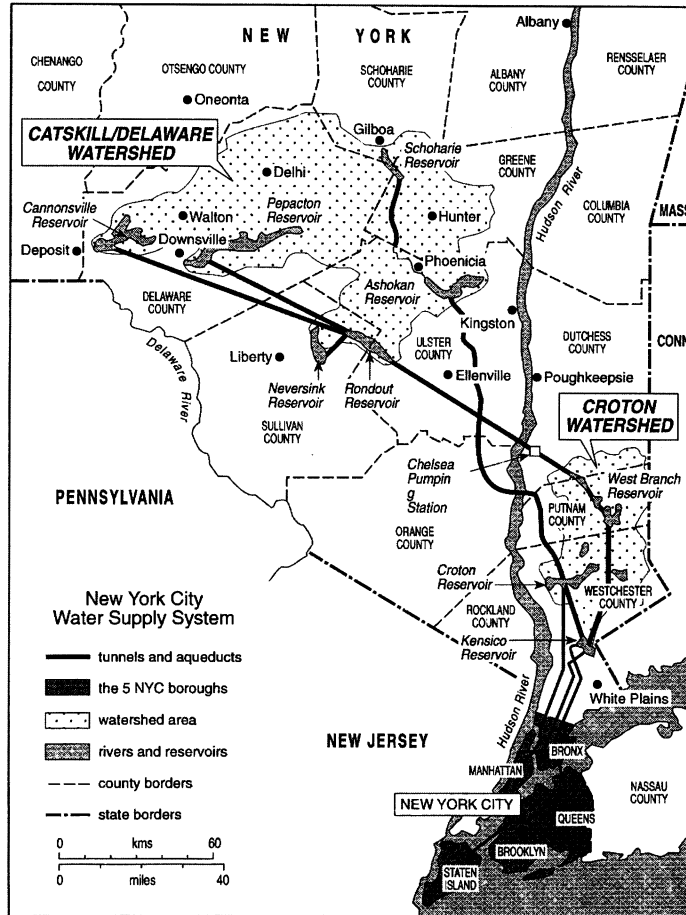


Figure 1 The New York City watershed
 Source: New York City Department of Environmental Protection

watershed in the US, spanning nearly 2000 square miles and serving nineteen up-state reservoirs, two down-state balancing reservoirs, two city water tunnels, two in-city balancing reservoirs, the world’s largest storage tanks and 5773 miles of gravity-fed water mains delivering 1.5 billion gallons of water a day to the 8 million residents of New York City and six up-state counties (Figs 1 and 2).⁹ The water distribution system is in turn connected to a vast waste water treatment network of some 6200 miles of sewers and fourteen sewage treatment plants, also owned and operated by the city. The current operation and maintenance of the water supply system remains the responsibility of the city, although there are growing fiscal and ideological pressures to sell off the whole system to

the private sector (see below). The regulation of water quality also remains the responsibility of the state but is now shared between three different tiers of authority: the city’s Department of Environmental Protection (for water quality and watershed protection); the New York State Department of Environmental Conservation (for watershed protection); and the federal Environmental Protection Agency (for setting water quality standards).

Water supply in an era of regulative crisis

The period from the 1840s until the 1970s can be characterized as one of ‘municipal managerialism’ marked by an increasingly centralized,

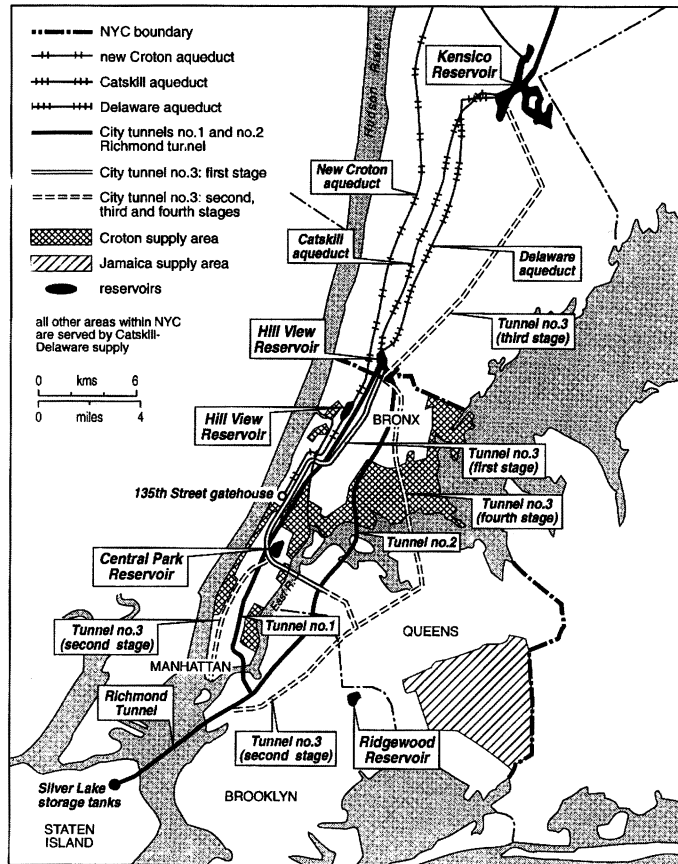


Figure 2 The New York City water supply system

Source: New York City Department of Environmental Protection

supply-orientated and state-coordinated approach to public policy, wherein the local state served the twin goals of facilitating capitalist urbanization and securing a degree of social cohesion through the protection of public health. Until the 1970s, the overriding concern of water policy was the meeting of ever-greater demands furnished by a well-financed centralized tier of state authority. There was little concern with threats to water quality, only temporary fiscal difficulties (during wartime, for example), and certainly little inclination to consult with people in the city or with up-state watershed communities. Yet this established pattern of 'municipal managerialism', as it has developed since the nineteenth century, is now unravelling in response to three main developments: first, up-state development and suburbanization during the postwar period have

seriously affected water quality, particularly in the older Croton system which supplies 10 per cent of the city's needs; secondly, fiscal pressures since the mid-1970s have undermined long-term investment in capital infrastructure and led to efforts by the city administration to relinquish control of capital assets to the private sector; and, thirdly, the decline in water quality in the 1990s, in combination with greater environmental awareness, has led to a pervasive sense of a public health crisis shaking the foundations of water policy and leading to despair and dissent over the future of the city's water.

Changing modes of water supply and consumption

The defining element in the socio-economic restructuring of western societies since the 1970s has been the crisis of the public sphere. This has

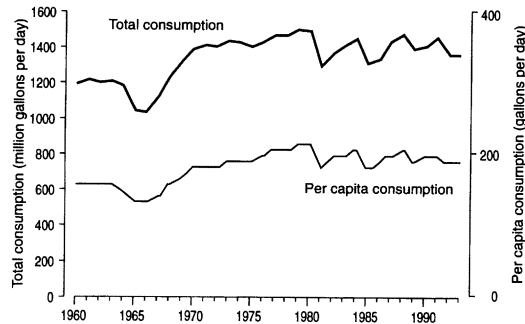


Figure 3 Changing levels of city-wide and per capita water consumption in New York, 1960–93

Source: New York City Department of City Planning, with additional data adapted from Cropf (1989)

many facets, both practical and philosophical. Of principal concern here is the pervasive questioning of the 'public' interest and the emasculation of those institutions and structures that lie neither fully in the domain of capital nor within the reach of individual consumption. Environmental concerns are inseparable from these wider developments: individualism, consumerism and the new spatial configuration of postwar society have wide-ranging consequences for the consumption of energy and resources. Figure 3 shows how both total water consumption and per capita water consumption in New York have risen steadily over the postwar period but the long-term trend appears to have stabilized since the early 1980s, as a result in part of repeated drought emergencies and a new policy commitment to water conservation (Cropf 1989).¹⁰ The rise of postwar mass consumption has also engendered a specific socio-spatial form in the rise of suburbanized consumer society, referred to by Annemieke Roobeek (1987, 133) as the 'auto-house-electrical-appliance complex'. In the case of water supply, it has led not only to rising water consumption but also to the degradation of the city's watershed. This has involved a transformation in the spatial dimensions to US public policy, with a shift from the public works emphasis of the New Deal to the fostering of new patterns of urban development marked by the emergence of suburbanization and urban decline as two sides of the same process.¹¹ The declining water quality in the Croton system over the postwar period can be attributed to its close proximity to the city and to the experience of rapid suburbanization, with the population in

the Croton watershed increasing by 39 per cent between 1970 and 1990 (Gordon and Kennedy 1991).

In the more technologically orientated post-Fordist literature, there has been an emphasis on the identification of new 'techno-managerial paradigms' (Hoggett 1987, 221) contributing towards greater flexibility in both production and employment. In this respect, the city has been using computer-aided design (CAD) and computer-aided management (CAM) since the mid-1980s in order to facilitate the design, construction and operation of water supply infrastructure, notably the multi-billion dollar completion of the third water tunnel illustrated in Figure 2. The use of new technologies has also allowed more sophisticated data handling techniques, including the introduction of a computerized leak detection system and the expansion of the city's limnology programme to monitor reservoir water quality and sources of contamination in the city's water supply.¹² New managerial and technological changes also extend to changing labour practices.¹³ Since the 1980s, more and more operations and maintenance have been contracted out as city agencies seek to reduce their wage bills and subvert the power of organized labour in public-sector unions. Aglietta (1987) has shown how the flexibilization of labour markets in conjunction with privatization allows capital to take over services which previously only the state could provide. This change affects not only water but other environmental services such as waste management, public transit systems and parks services where labour power has been significantly diminished in recent years. If the restructuring of water supply in New York is contributing towards the resolution of the crisis of Fordism at the local state level, it reinforces the cogency of the idea of environmental deregulation and demunicipalization in developed economies seen as part of a wider process of socio-economic restructuring in response to declining levels of profitability and intensifying international competition.

The impact of the fiscal crisis of the state

Changes in water policy at a local level can be explicitly linked to national and international developments over the postwar period through the impact of the fiscal crisis of the state on environmental protection. This is not to suggest an economic reductionism wherein the transformation of New York's water supply can simply be

read off from the global crisis of postwar Fordism. Nonetheless, we can locate key elements in the city's water crisis within a wider geographical and historical context. There are important interconnections between the accelerated processes of economic globalization since the early 1970s and the concomitant decline in formerly prosperous urban and industrial regions across North America, including the New Jersey–New York metropolitan corridor.

The first major fiscal crisis to hit postwar New York was in 1975, when a combination of rapid depopulation and deindustrialization led to a shrinking local tax base in the face of spiralling demands for higher social expenditure in order to mitigate the devastating social and economic impact of urban decline.¹⁴ As a result, the city was shut out of the municipal bond market and, in the late 1970s, was completely reliant on federal and state grants, the only source of borrowed funds being municipal employee pension funds (Grossman 1982; Hartman 1985). After the mid-1970s fiscal crisis, an immediate concern was that city services with a relatively low political profile, such as water and sewerage, would be especially badly hit by lack of funds (Lang *et al.* 1976). The period between 1975 and 1990 effectively represented a disinvestment in infrastructure, with levels of expenditure below that required to maintain the value of the city's capital stock (CUASA 1992). If we examine the changing pattern of capital investment in water supply illustrated in Figure 4, we can identify marked fluctuations over the last 25 years. During the early 1970s, in the years preceding the 1975 fiscal crisis, we find higher levels of investment than in any subsequent period, marked by a predominance of federal and state sources of funding. In the wake of the 1975 fiscal crisis, there was a virtual collapse in capital investment followed, in the early 1980s, by a modest recovery in capital investment aided by a new input of federal funding. By the mid-1980s, however, the level of capital investment had again begun to falter, with increasingly tight restrictions on federal expenditure. Since the end of the 1980s, there has been a major increase in capital investment from city sources; the renewed levels of investment in the 1990s have arisen from a fundamental reconfiguration in the arrangements for capital funding through an increased reliance on the municipal bond markets. Yet, despite the increased level of capital investment, the city has

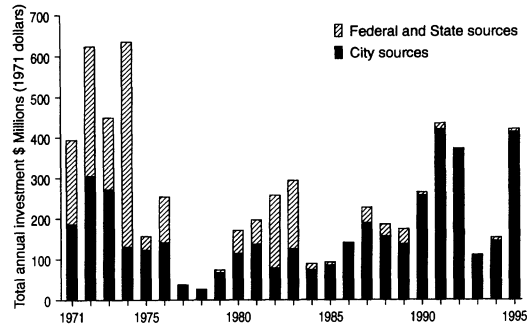


Figure 4 Changing levels and sources of capital investment in the New York City water and sewerage system, 1971–95

Source: New York City Record, New York City Office of the Comptroller and New York City Office of Management and Budget

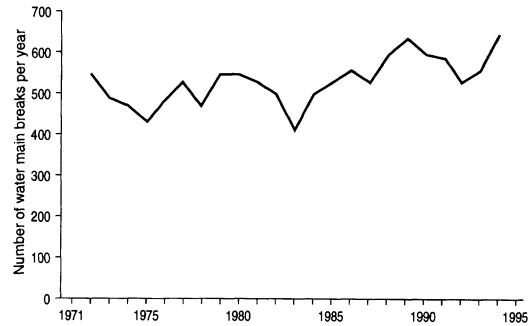


Figure 5 The number of water main breaks, 1972–94

Source: New York City Office of the Comptroller, with additional data adapted from Cropp (1989)

still not reached the level of investment of the pre-fiscal crisis era. Furthermore, current levels of investment are not adequate to prevent a further deterioration in the city's infrastructure. The median age of water mains and sewers continues to rise, resulting in a gradual yet inexorable trend towards increasing numbers of water main breaks (Fig. 5). Some 52 per cent of the city's 5773 miles of water mains consist of unlined cast iron laid before 1930, whereas only 9 per cent is comprised of more flexible ductile iron laid after 1970 which is less likely to crack under stress. By the year 2020 more than 35 per cent of the city's water mains will be over 100 years old and the city will face severe difficulty in maintaining its water and sewerage infrastructure without punitive increases in water and sewer fees (CUASA 1991). The consequences

of dilapidated infrastructure are that some 4.7 per cent of the city's water supply is estimated to be lost through leaks, thereby undermining efforts to conserve water, and the city is repeatedly faced with expensive pipe failures, in some instances involving substantial flooding of the subway system and extensive road collapses costing many millions of dollars to repair (*New York Newsday* 1994; *New York Times* 1995g, 1996).¹⁵ The extensive delapidation of the city's pipes is also thought to be a contributory factor in the presence of bacterial contamination of water supplies (see below).

With the sharp decline in federal and state aid for water supply (primarily channelled into the upgrading of waste water treatment), the city has become increasingly reliant on just two sources of funding: consumer charges for water and sewer services; and the issue of municipal bonds specifically for the water and sewer system. The increasing reliance on revenue financing from water and sewer fees to support capital investment mirrors developments in a number of larger US cities including Boston, Chicago, Philadelphia and Detroit. Reluctance to raise property taxes since the 1970s has led inevitably to rising water and sewer fees, with annual increases of 23.2 per cent in 1990 and 22.9 per cent in 1991 alone. The background to this change can be traced to the administrative changes of 1985, with the creation of two quasi-autonomous city agencies – the New York City Municipal Water Finance Authority and New York City Water Board – by the Koch administration in order to relieve some pressure on the city's capital budget. The Municipal Water Finance Authority borrows money authorized by the City Administration and City Council for capital projects by selling bonds backed by water and sewer fees. The Water Board then sets water and sewer rates at whatever level is necessary to pay back the bonds and pay for the operating expenses of the water supply system (NYCOC 1991). In addition to political pressures to hold down property taxes, a number of other factors have contributed towards the sharp rise in water and sewer fees since the late 1980s: the increasing operating costs of the water supply system; declining contributions of state and federal funding (especially since the second Reagan administration); the unwillingness of state voters to approve additional construction bond issues (with a heavily defeated proposal for an environmental bond issue in 1989); and increasing

debt service on newly issued revenue bonds. This shift in funding arrangements for water has proved increasingly socially regressive. In poorer parts of the city, high water charges have begun to threaten the economic viability of low-cost housing, in some instances leading to charges greater than mortgage repayments in the multi-occupancy privately rented sector.¹⁶

In 1993, the city's new Republican administration under mayor Rudolph W Giuliani marked a decisive move towards greater fiscal austerity and instituted a range of cuts for social and environmental services. In May 1995, Mayor Giuliani announced his intention to sell off the entire water system to a quasi-autonomous agency, the New York City Water Board, which currently leases the system from the city. Under the proposed deal, the city would receive US\$2.3 billion from the Water Board in exchange for the ownership of the entire water and sewer system. This transaction would allow the city to pay off old bonds (to allow new borrowing), write off delinquent tax receivables, and release US\$1 billion over the next four years for urgent capital projects, so enabling it to exceed its current borrowing limit. The sale would be funded by US\$2.5 billion new water and sewer bonds with a debt service of some US\$2 billion (US\$65 million a year over a 30-year period). There has been fierce competition among Wall Street bond underwriters to win the US\$1.5 million in fees for managing the sale of the city's water assets (*New York Newsday* 1995b). However, this attempt to find a short-term solution to the city's growing budget deficit has been blocked by the city comptroller Alan Hevesi, thereby exposing deep divisions in city water policy.¹⁷ Comptroller Hevesi, a Democrat with strong links to environmentalist groups, has rejected the proposed sale of valuable city assets in order to reduce the current budget deficit as a 'fiscal gimmick' with deleterious long-term consequences for the city (*New York Times* 1995b, 1995d, 1995e, 1995f). The loss of the water and sewer system would accelerate the erosion of the city's control of its watershed by making it easier for the New York State governor to change the composition of the city's Water Board in favour of up-state development interests (the seven members are currently appointed by the city's mayor). This would make the need for water filtration more likely in the Catskill-Delaware system and thus prove financially punitive for the city in the long term (see below).

The fiscal dimension to water policy reveals how New York can be increasingly portrayed as a 'dual city' marked by a divergence between its private and public spheres (Castells 1989; Christopherson 1994; Mollenkopf and Castells 1991). New York has seen not only a polarization of incomes since the late 1970s but also an emerging mismatch between the needs of the regional and global economy where the newer financial service industries serving global markets lie trapped within the infrastructural shell of a Fordist regional economy centred around manufacturing and public sector services (see Harvey 1989; Markusen and Gwiasda 1994; Sassen 1991). This spatial mismatch is relevant to the maintenance of environmental quality in urban areas through the inability of the local state to modernize its infrastructure leading to a steady decline in long-term capital investment in facilities such as water mains and sewers (as well as roads, bridges, public transit systems and the maintenance of public space). The selling of the water system would institute an important diminution in the role of the local state in the provision of environmental services, leading to declining political autonomy for the city in the determination of its water policy and long-term socially regressive and financially punitive consequences for its citizens. Above all, the fiscal incapacity of the state to take an effective role in water policy is leading to a radically reduced role for city government in the management of its water supply – a development which serves to undermine its primary responsibility in maintaining long-term water quality.

The declining legitimacy of environmental regulation

The most distinctive feature of New York's water supply system has been its high-quality unfiltered supply linked by the most elaborate system of aqueducts in the US to a vast mountainous watershed. When the water supply system was originally constructed, these were remote and sparsely populated areas, yet the build-up of up-state development pressures has thrown the long-term security of the city's water system into doubt. Water quality in the Croton system, supplying 10 per cent of the city's water, has been steadily deteriorating since the early 1960s (NYCDEP 1993, 1994; NYCMITF 1992). Figure 6 shows how the concentration of the indicator pollutant chloride has risen from 8.8 mg/l in 1960 to 33.2 mg/l in

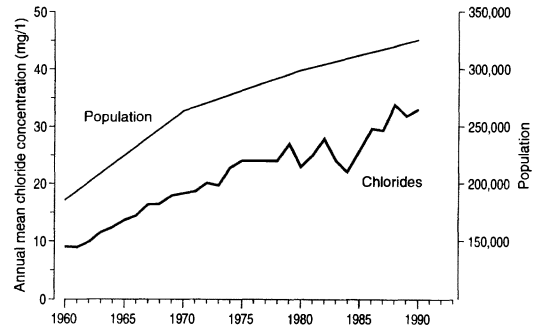


Figure 6 Changes in mean annual chloride concentration and population in the Croton watershed system, 1960–90

Source: New York City Department of Environmental Protection

1990, an increase of 265 per cent, in comparison with average concentrations of 8.5 mg/l in 1990 in the more distant and sparsely populated Catskill–Delaware system (NYCDEP 1995).¹⁸ Another key indicator of declining water quality is the presence of the coliform bacterium *Escherichia coli* which was detected in the summer of 1993 in the Chelsea and the Lower East Side districts of Manhattan served by part of the Croton system. In the ensuing public health alert (Fig. 7), the city advised households in affected areas of the city to boil their water whilst sales of bottled water grew by between 15 and 300 per cent at stores throughout the city (*New York Newsday* 1995c; *New York Times* 1995a). Bottled water consumption has grown rapidly in response to skilful marketing of mineral waters as part of the rise of 'health consumerism' coupled with increased anxiety over water quality in the 1990s (*New York* 1995). But these trends are not explicable simply in terms of elite marketing and bio-consumerism alone: water quality has entered the wider arena of risk and uncertainty in public policy discourse emanating from the erosion of trust between citizens and the executive authorities of the state.¹⁹ Earlier literature on flexible production systems tended to treat changing markets as an exogenous variable and neglected to provide an adequate treatment of the linkages between changes in production and consumption. In this case, we can identify an interconnection between the deregulative processes in the city's watershed leading to declining water quality and the socio-economic polarization of incomes and lifestyles contributing towards the diversification of elite consumer goods. The idea of a 'dual welfare



Figure 7 The Giuliani Administration has been periodically overwhelmed by the city's water crisis

Source: *The Village Voice* 11 July 1995. Reproduced courtesy of Steve Brodner

system' (Stoker 1989) is useful here in emphasizing the simultaneous operation of a degraded public water supply system in combination with increasing access to private sources of drinking water by the better-off. In considering water supply as more than simply an issue of sectoral change in production, we can show how emerging disparities in water consumption are related to broader shifts in the context for public policy.

Nine of the Croton system's twelve reservoirs are now overloaded with phosphates from inadequate sewer and septic systems and, since 1990, the entire Croton system has been repeatedly closed as a result of summer algal growth (NYCDEP 1994).²⁰ Non-epidemic strains of cholera as well as *Giardia lamblia* and *Cryptosporidium* spp. have also been detected. The presence of *Cryptosporidium* spp. and other pathogens has caused alarm in New York's gay community since some of these organisms are known to cause potentially fatal illnesses in immuno-suppressed individuals as well as presenting a threat to children and the elderly (*New York Newsday* 1995d).

Yet the picture of declining water quality is not as straightforward as it may appear: the increasing sophistication of environmental monitoring over the last twenty years has revealed the extent of previously undetected and largely unknown threats to public health, such as new chemical compounds, *Cryptosporidium* spp. and other pathogenic organisms at the limit of detection. The threat of cryptosporidiosis raises three particularly perplexing issues for environmental regulation: the health uncertainties form part of wider sense of public unease which is undermining relations between city authorities and its citizens; the risk lies at the edge of scientific knowledge (the organism was not recognized as a cause of human disease before the mid-1970s); and the contamination cannot be prevented simply by technological means through the filtering of public water supplies.²¹

The background to the current escalation in political conflict over water quality can be traced to a tightening in federal water quality standards under the Surface Water Treatment Rule of 1989.²² As a result of these new water quality standards, the federal Environmental Protection Agency has presented the city with a deadline to prevent further deterioration in water quality in the Catskill-Delaware system by December 1999 or be forced to undertake filtration at a cost of some US\$4.5 to 8 billion. Lobbying by major engineering companies is already underway for this lucrative contract which marks a significant extension to potential investment opportunities in municipal service provision for the private sector. The most immediate dilemma facing New York's water policy is whether filtration can be avoided for the Catskill-Delaware system and whether the watershed can be protected without undermining regional development for some of the poorest communities in up-state New York. As for the Croton watershed, the political prospects of regulating what is now an affluent commuter belt have steadily deteriorated with new pro-development groups emerging such as the Alliance for Watershed and Water Development seeking an end to current watershed regulations and promoting filtration for the city's water.²³ Putnam County, located just 50 km north of the city in the heart of the Croton watershed, is now the fastest growing county in the state with a stream of new developments for luxury homes, golf courses, offices, hotels and shopping malls underway. A number of these pro-development groups were significant

contributors to the 1994 campaign fund for state governor George Pataki, who has emerged as the most powerful political player in the drafting of the new regulations for development in the city's watershed (*New York Times* 1995c). Given the rapid deterioration of water quality in the Croton system, the city agreed in 1990 to state-mandated demands for filtration and the focus of attention is now shifting towards the other 90 per cent of the water supply derived from the Catskill-Delaware system.

The 1990s have seen an intensification of efforts by the city to protect its watershed but the logistical problems appear to be insurmountable in the face of available resources. For much of this period rarely more than 30 enforcement officers have been assigned to guard 2000 square miles of watershed with some 120 000 septic systems and a variety of other potential sources of pollution (Gordon and Kennedy 1991; *New York Daily News* 1994a). In 1990, the recognition of deteriorating water quality and uncontrolled development led to the first comprehensive revision of the city's watershed rules since 1953. These new watershed protection rules addressed new threats such as pesticides, herbicides and other toxins absent from the earlier regulations. However, the rules have been greatly weakened under political pressure from up-state interests and the Republican-controlled state assembly in Albany. A particular barrier to effective regulation of water quality is that the city owns only 3.8 per cent of the land areas in its watershed, far lower than cities such as Boston and Portland which also rely on unfiltered water supplies. The 1993 proposal by the city to buy 80 000 acres of watershed land in order to protect its water supply has run into repeated political and fiscal obstacles (*New York Newsday* 1995a). The period since 1993 has seen a stark polarization between the city and up-state interests. The perceived regulatory interference in the watershed being met by a growing mobilization of property rights activists (with links to well-established groups in the Adirondacks further north) and increasingly sophisticated anti-regulation lobbies such as the Coalition of Watershed Towns, with close political links to the Pataki-led Republican State Administration. The possibilities for environmental regulation have been undermined by a deep-rooted and spatially differentiated ideological and cultural divide between urban environmental activists and rural up-state communities resenting outside interfer-

ence in land-use planning and economic activity. Since the early 1990s, the regulatory role of the local state has come under sustained political attack both from the up-state communities and development interests in the watershed who demand less regulation, and from the increasingly well-organized and vociferous city-based environmental groups who demand greater regulation and control.

Under a watershed protection plan finally agreed in January 1997, the city has been forced to finance extensive economic development programmes for the watershed towns over a period of fifteen years in exchange for greater cooperation in the prevention of water pollution (*New York Times* 1995h, 1995i).²⁴ A new pattern of environmental regulation has emerged with the creation of a new institutional structure in the form of a Watershed Council representing both city and up-state interests to oversee the protection of water quality. This new forum has supplanted significant features in the existing policy structures. In the place of a relatively centralized, ossified and non-participatory regulatory system, the watershed is now overseen by a complex and dynamic jigsaw of many different pieces. Participation extends to a myriad of different actors and interest groups ranging from up-state lumber companies to city-based ecologists. Yet behind this apparent opening out of environmental discourse, a more fundamental shift has occurred: the local state – a powerful arbiter on behalf of urban water policy – has found its power diminished in relation to a broad-based coalition of forces ranging from agricultural interests to speculative real estate with a common interest in relaxing land-use controls in the city's watershed. The diverse fractions of capital represented in the Watershed Council have successfully coalesced around a regional anti-regulatory agenda capable of dominating political discourse over the future of the city's water supply. New patterns of governance at a regional level, mediated through the practical needs of the political manageability of complex policy problems in combination with new institutional innovations, have led to a historical shift in power away from the local state and a diminution in the city-based technically orientated discourses of 'municipal managerialism'.²⁵ We can conclude that the city's watershed forms a geographically distinct biophysical region which lies caught in a radical reconfiguration of state authority, whereby the regional and long-term

dimensions to regulatory planning have become successively displaced by the 'hollowing out' of the state, the decentralization and dismantling of state authority and the upsurge of grass-roots property rights activism. A variety of piecemeal, *ad hoc* and experimental interventions has emerged from the disintegration of a relatively stable mode of environmental regulation which had dominated regional water resources management since the nineteenth century.

Conclusions

The transformation of the policy discourse surrounding New York's water supply involves developments far beyond the more narrowly defined functionalist readings of socio-economic restructuring in western societies prevalent in some teleological post-Fordist and 'ecological modernization' literature. The narrower conceptions of socio-economic change which emphasize technological and managerial innovations in the labour process serve to obscure the underlying contradictions between capital accumulation and environmental protection, and effectively depoliticize and dehistoricize our analysis. Where emphasis is placed on the environmental benefits of a post-Fordist technological paradigm, there is a danger of confusing greater efficiency in specific sectors with an overall environmental improvement, since advances in pollution abatement technology, such as water filtration systems, are invariably an 'end of pipe' response to a preventable environmental deterioration, such as the declining water quality from watershed development pressures described in this paper. Drawing on Mandel's (1978) emphasis on the overaccumulation of capital, the investment in environmental management technologies such as water filtration programmes can be interpreted as a new investment opportunity for surplus capital and as an instance of the interaction between the processes of regulation and accumulation at a sub-national scale (an area which remains relatively unexplored in the existing literature). In particular, investment in the physical infrastructure of water supply can be conceived as an example of switching between different circuits of capital investment in the built environment in order to allow continued accumulation to occur during a period of lower profitability (see Beauregard 1994; Harvey 1996). We need to move analysis beyond the evaluation of different tech-

nologies towards a greater understanding of the social and political context for changes in environmental regulation and their relationship with changes in the role of the state in the provision of environmental services. Regulation theory (supplemented by insights drawn from the literature on governance) may provide an important means by which to develop structuralist accounts of environmental crisis by explicitly linking the changing role of the state in environmental regulation to the recapitalization of western economies and the restructuring of the fiscal capacity and ideological legitimacy of the local state. Perhaps it is preferable to conceive of 'a failure of Fordism and a multitude of nationally and locally *politically* mediated crises of Fordism' (Hay 1995, 391, original emphasis). Within this more contextual framework, the future of New York's water supply can be interpreted as a local manifestation of a broader crisis in the regulation of the ecological contradictions of capital.

The conventional historical periodization from Fordism to post-Fordism does not satisfactorily correspond to the experience of New York: the period between the construction of the Croton Aqueduct in the 1840s and the contemporary decline of the public sector role in water supply marks a distinctive period, notable not for its discontinuities but for its remarkable stability. We can consider this extended period to be a relatively stable regime of 'environmental' governance. The term 'municipal managerialism' can be used to identify a particular phase or regime of local governance marked by extensive state intervention in combination with specific technical and scientific discourses conducive to the rationalization of urban space. This is best conceived as an historically located and discursively constructed phase rather than simply as an economically determined moment in capitalist urbanization. It is the period since the 1970s which marks a clear disjuncture, both in terms of declining water quality and a changing role for the local state in water supply. Within this period, we can differentiate between the mid-1970s and the early 1990s, when fiscal pressures were temporarily resolved by the extension of the municipal bond market for water supply, and the recent attempts to give up fiscal and political responsibility for water in the face of spiralling and socially regressive water and sewer fees and intractable regulatory problems in maintaining water quality. An important question now is whether the city could protect its water

quality in the face of the national shift towards environmental deregulation even if there was the political will to do so. In legislative terms, decisive intervention is possible only at the level of the nation-state, which underlines the potential impact of current attempts to dismantle the postwar federal legislative framework for environmental protection now being pursued in the Republican-controlled Senate and Congress with strong backing from property rights activists, mining and timber industries, as well as a plethora of other business interests. A paradoxical situation emerges here: the rhetoric of government downsizing, decentralization and deregulation is occurring in the midst of a radical weakening of state authority at every level, yet neo-federalist rhetoric demands a greater role by successively lower tiers of state authority in public policy. In the field of environmental regulation, this is proving unworkable, yet the impetus for the dissolution of the public sphere enjoys bipartisan support in the face of fractious and largely impotent sources of opposition.

What we are seeing in New York is a protracted process of reshaping the role of the local state in municipal water supply. In effect, a 'hollowing out' of the state arising from a combination of fiscal and ideological pressures is leading to a polarization in the public policy debate between demands for water quality protection advanced by environmental groups in the city and a coalition of anti-regulation up-state interests, whose rhetoric is rooted in a legacy of land-use conflict in the city's watershed (see Pfeffer and Stycos 1994; Stave 1995). We can argue that the future form of environmental management is emerging as a politically contested reconfiguration of public policy, in this instance centred on a redefinition of the administrative powers of city government. At the heart of the debate over environmental management lies a tension between capitalist development and the administrative jurisdiction of the state. State-led policy agendas under the auspices of technological modernism have often had deleterious environmental consequences as the highway-spliced inner-city neighbourhoods of postwar New York attest. Yet to dispense with the role of the state altogether as part of an ecological critique of the institutional and philosophical basis to western modernity risks the effective abandonment of any practical means for implementing environmental regulation; a dilemma which is heightened by the global dimensions to environ-

mental change (see Gandy 1996). The most promising solution to environmental degradation may lie in the development of a more sophisticated public sphere through which new forms of democratic decision-making can emerge in preference to any lurch towards the 'ecological Hobbesianism' of greater control which may prove in any case to be fiscally and ideologically untenable (Dryzek 1992). A commitment to improving the legitimacy of public policy through the development of communicative and democratic structures may well offer the most practical means of mediating conflict at a local and regional level but it still leaves unresolved the underlying dynamics of capital restructuring and the associated diminution of the fiscal and ideological strength of the public realm. The disintegration of the regulatory state (and the public sphere) is undermining the possibilities for the articulation (and enforcement) of a public interest founded in a conception of rationality divergent from that of capital (see Gandy 1997; Lash *et al.* 1996). The role of strong advocacy groups and an informed and active citizenry emerge as crucial in any effort to protect the environmental advances of the last 30 years. Yet the post New Deal US environmentalist agenda harbours innate weaknesses: its individualist and consumer rights-based orientation serves to deflect attention away from more widely conceived regulatory goals in the public interest which extend to the sphere of production as well as consumption. Similarly, the antipathy held by city-based water quality advocacy groups towards the economic viability of low-income, up-state rural communities beyond the affluent commuter belt is testament to wider ideological tensions in the US environmental movement which serve to strengthen the hand of capital in the dismantling of the public sphere.

If we disentangle the local contextual peculiarities of the New York case, we can begin to draw out some broader themes of potentially wider applicability. The crisis of Fordism in the 1970s is widely viewed as stemming from the development of a mismatch between economy and society. This has made the notion of post-Fordism or 'flexible accumulation' as an inevitable resolution to the crisis in western economies since the early 1970s appear plausible, especially when research is restricted to technological and managerial innovations in specific sectors of the economy. If we extend our conception of Fordist crisis to embody a mismatch between economy, society and nature,

then it is clear that, far from solving the contradictions of Fordism, the deregulative momentum of the post-Fordist era is exacerbating the ecological contradictions of capital. In the case of New York's water supply, deregulation is leading to spiralling socio-economic inequalities in the sphere of consumption through a combination of higher water and sewer fees, declining water quality and widespread 'buying out' by better-off citizens through a dual market for drinking water split between deteriorating public supplies and private suppliers of bottled water. For over 140 years New York City successfully provided cheap, plentiful and high-quality water to its citizens. This historic achievement is now thrown into doubt by the outcome of socio-economic restructuring at a global level beyond the reach of any regulatory or democratic structures yet devised. Regimes of accumulation and modes of social regulation exist at different levels of theoretical abstraction and at different geographical scales: the protracted negotiations between the city and its rural watershed in the context of global forces affecting the fiscal viability and legitimacy of environmental regulation reflect this complex and historically constituted relationship between economy and society. Urban water supply systems combine these multifarious elements into a system which is both discursively constituted yet rooted in a biophysical reality extending from the exigencies of public health to the geography of the city's mountainous up-state watershed. The challenge for interdisciplinary environmental research is to differentiate at an epistemological level between these different elements and to recognize the intersections between nature and history which have underpinned the transformation of urban space.

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Notes

- 1 There is a large literature on the restructuring of the local state and the emergence of new patterns of urban governance since the late 1980s. Important examples include Amin (1994); Burrows and Loader (1994); Esser and Hirsch (1989); Florida and Jonas (1991); Geddes (1988); Goodwin *et al.* (1993); Hambleton (1993); Hirsch (1991); Hoggett (1987, 1991); Jessop (1995); Painter (1991); Painter and Goodwin (1995); Pinch (1989); Stoker (1989, 1991); and Judge *et al.* (1995).
- 2 The ecological dimensions to socio-economic restructuring are explored in Altvater (1993); Drummond and Marsden (1995); Gibbs and Jenkins (1991); Leyshon (1992); Lipietz (1992); and Ossenbrügge (1991). The most extensive empirical applications of regulation theory in environmental research have thus far been largely confined to the study of rural change (see, for example, Cloke and Goodwin 1992; Goodwin *et al.* 1995; Marsden *et al.* 1990; Ward *et al.* 1995).
- 3 In recent years, the study of water supply systems have developed a variety of more theoretically and historically grounded modes of analysis. Examples include Feldman (1991); Gottlieb and Fitzsimmons (1991); Goubert (1989); Guillaume (1988); Harris and Wilson (1993); Heilman *et al.* (1994); Swyngedouw (1995, 1997); Worster (1985).
- 4 Bob Jessop (1992) notes that there is a marked analytical asymmetry between Fordism and post-Fordism to the extent that the use of post-Fordist typologies may confuse analysis by placing a series of developments together with no clearly specified causal relationships under a simplistic teleological trajectory. Jessop argues that we can, however, identify at least four uses of the concept 'post-Fordism' in the literature. First, the term 'post-Fordism' has been used to refer to changes in the labour process and to a variety of technological, organizational and managerial innovations that have been identified in production systems within manufacturing sectors in developed economies. Secondly, the term is extended to denote a specific accumulation regime or mode of macro-economic growth based around a shift from the autocentric, nationally based Fordist models of economic development towards an integrated global economy marked by divergent regional economies and market-led polarization of incomes. Thirdly, the concept is extended to

- encompass a specific mode of regulation, illustrated by the neo-liberal challenge to the Keynesian welfare state and the attempt to restore profitability to private capital. Finally, 'post-Fordism' has been used to refer to a distinctive historical epoch marked by ever-greater social fragmentation and heterogeneity, radically distinct from earlier periods.
- 5 There is a conceptual tension in the post-Fordist literature between a narrow focus on the labour process in contrast with broader analyses of the growing structural mismatch between the economy and society since the early 1970s. This broader approach to socio-economic restructuring with a distinctively national focus is often linked with the influential regulationist perspective pioneered in the work of Michel Aglietta and Robert Boyer, and more recently developed by de Vroey (1984); Lipietz (1987); Duménil and Lévy (1989); Dunford (1990); and Jessop (1990, 1995). Regulation theory is an extremely diverse body of literature. Bob Jessop (1992) distinguishes between seven different schools of thought covering literature from France, Holland, Germany, the Nordic countries and North America. For recent overviews, see Boyer (1990); Brenner and Glick (1991); Jessop (1995); and Tickell and Peck (1995).
 - 6 See, for example, Angerer (1992); Graham and Marvin (1995); Speth (1989); and Tylecote and van der Straaten (1995).
 - 7 Biophysical systems are not easily subsumed under a discursively constituted analytical framework, yet the sheer complexity of attempting to rationalize and control environmental systems is amenable to a Foucauldian analytical slant in as much as environmental regulation has its own historical lineage within the rationalization of urban space (see Boyer 1983; Burchell *et al.* 1992; Hunt and Wickham 1994).
 - 8 See Boyer (1983); Galishoff (1981); Kirby *et al.* (1956); Merritt (1969); and Spann (1981).
 - 9 The only exception to reliance on the municipal water supply system in New York is for 463 000 water users in the Borough of Queens who have been served by the private Jamaica Water Supply Company since 1920 (see Fig. 2). This company has recently been subject to city litigation over its high water rates and poor-quality water derived from polluted aquifers in Long Island.
 - 10 The marked fluctuations in water consumption within the overall trend illustrated in Figure 3 can be attributed to the impact of increasingly frequent droughts, notably in 1961–7, 1980–1, 1985, 1989 and 1993. In the late 1980s, the city began to introduce universal metering, involving a computerized automated reading and billing system, along with a range of proposals to promote water conservation, such as the installation of water-saving plumbing devices, modifications to building specifications and water audits for large users. As a consequence of the stabilization of growth in demand for water, current policy debate over the capacity of the water supply system may well shift towards the long-term management of climatic uncertainty (see Major 1992).
 - 11 See Beauregard (1993); Florida and Jonas (1991); Jackson (1985); and Walker (1981).
 - 12 See Juhl (1994); Moutal and Bowen (1991); Moutal *et al.* (1992); and NYCDEP (1988).
 - 13 Interview with Frank Oliveri, senior manager in the Bureau of Waste Water Treatment, New York City Department of Environmental Protection, on 7 July 1995. For greater detail on the recent restructuring of New York City's public sector workforce, see Mollenkopf (1992).
 - 14 For overviews of the causes and consequences of New York's fiscal crisis, see Fuchs (1992) and Lichten (1986).
 - 15 Interviews with Clark Wieman, Senior Research Fellow, Cooper Union for the Advancement of Science and the Arts, New York, 22 March 1995, and David A Golub, Press Office, New York City Department of Environmental Protection, on 7 July 1995. The public health issues associated with under-investment in water supply infrastructure are examined in NRDC (1994).
 - 16 Interview with Mark Izeman, Project Attorney, Natural Resources Defense Council, New York, on 26 June 1995.
 - 17 The comptroller is the most senior financial post in New York City's government and is responsible for auditing all financial transactions.
 - 18 The technical aspects to the water quality debate are focused on a series of indicators, principally the concentration of the *Escherichia coli* bacterium (a key faecal coliform indicating contamination with sewerage and the possible presence of other more dangerous pathogens such as Hepatitis A, intestinal parasites and *Salmonella*), the level of turbidity (cloudiness from particulate matter), the level of trihalomethanes (THMs) (by-products of chlorine interacting with organic matter during the disinfection process) and the presence of pathogens, notably *Cryptosporidium* spp., *Giardia lamblia* and enteric viruses.
 - 19 A contributory factor in the breakdown of trust between the public and regulatory agencies has been a series of testing scandals in the mid-1990s where former city employees alleged that levels of *E. coli* and other contaminants were deliberately altered to avoid a public health crisis (*New York Newsday* 1995c).
 - 20 Filtration of the Croton system has begun with a pilot filtration plant at the Jerome Park Reservoir (the first water filtration ever undertaken by the

- city) and full-scale filtration is expected to be completed by the year 2000 at a cost of around US\$600 million.
- 21 The use of sophisticated filtration technologies does not guarantee water quality. A striking recent example is in Milwaukee, Wisconsin, where the presence of *Cryptosporidium* in a filtered public water supply led to over 400 000 people becoming ill and the death of over a hundred mainly elderly or immunosuppressed people. For greater detail on cryptosporidiosis, a disease not recognized to be caused by a protozoan organism until the mid-1970s, see LeChavallier *et al.* (1991) and MacKenzie (1994).
- 22 A paradoxical outcome of the tightening of federal water quality standards for New York is that fiscal pressures are forcing a trade-off between different environmental goals. As Edward Scheader (1991) notes, a federal Surface Water Treatment Rule primarily concerned with biological safety compels improving disinfection efficiency and increasing chlorine levels; a Lead and Copper Rule compels increasing water pH to reduce corrosivity, a step that will have the two-fold effect of increasing trihalomethane production and reducing disinfection efficiency; along with a Disinfection By-Products Rule that will severely limit the use of chlorine as a primary disinfecting agent.
- 23 Interview with Simon Gruber, Gaia Institute of the Cathedral of St John the Divine, New York, on 21 March 1995. In November 1991, the city submitted an application to the federal Environmental Protection Agency for filtration avoidance and, in January 1993, the EPA responded with a list of some 66 different conditions which it required the city to meet, covering virtually all aspects of its water policy. Environmental groups complain that, despite over half of the region's 102 sewage treatment plants violating their permits, the city had never prosecuted a watershed polluter before 1990.
- 24 Interview with Simon Gruber, Gaia Institute of the Cathedral of St John the Divine, New York, on 15 June 1995. Additional data taken from field notes at the meeting of the Ad Hoc Forestry Task Force held in Liberty, New York, on 22 June 1995. An important difficulty with watershed protection regulation is the lack of basic waste water infrastructure in many of the more remote up-state communities. Many small, low-income towns in the Catskill-Delaware system, such as Bedford and Katanah, have no central sewer (Prendergast 1992). In the Catskill-Delaware watershed, 21 of the 38 towns in the region lack zoning ordinances, the most rudimentary of development control (Gordon and Kennedy 1991).
- 25 Interview with Simon Gruber, Gaia Institute of the Cathedral of St John the Divine, New York, on 24 April 1996. Other new institutional forums which

have emerged include the Watershed Agricultural Council which has links with city-based, state-based and federal regulatory agencies as well as national research institutions underlying both the complexity and experimental nature of many new initiatives (NYCDEP 1996). Bob Jessop (1995) notes the close affinity between the regulationist approach and theories of governance at the empirical level where there are potential areas of fruitful and complementary interaction between these largely separate bodies of scholarship. In this respect, the Watershed Council is a useful example of what he describes as a 'shift from the centrality of government to more decentralized forms of governance' (*ibid.*, 324).

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